DARIAWAN

Spring →

Spring Boot + WebSocket Basic Example

WebSocket vs HTTP

WebSocket is a computer communications protocol, for two or more computers to communicate with each other at the same time (full-duplex) over a single TCP connection. Here some differences between HTTP (the most common protocol used for internet applications) and **WebSocket**:

	HTTP	**Web Socket**
Messaging Pattern	**Unidirectional**, client always initiates the request and server response	**Bi-directional**, either client or server can initiate sending a message
Duplex	**Half**, response occur after request	**Full**, client/server communication are independent
Service Push	Not natively supported. Client polling or streaming download techniques used	Core feature
Connections	**Multiple** TCP connections. For each request/response a new TCP session is needed	**Single** TCP connection. After initial connection using HTTP, the connection then upgraded to a socket based connection and used for all the future communication
Overhead	Moderate overhead per request/connection	Moderate overhead to establish & maintain the connection, then minimal overhead per message

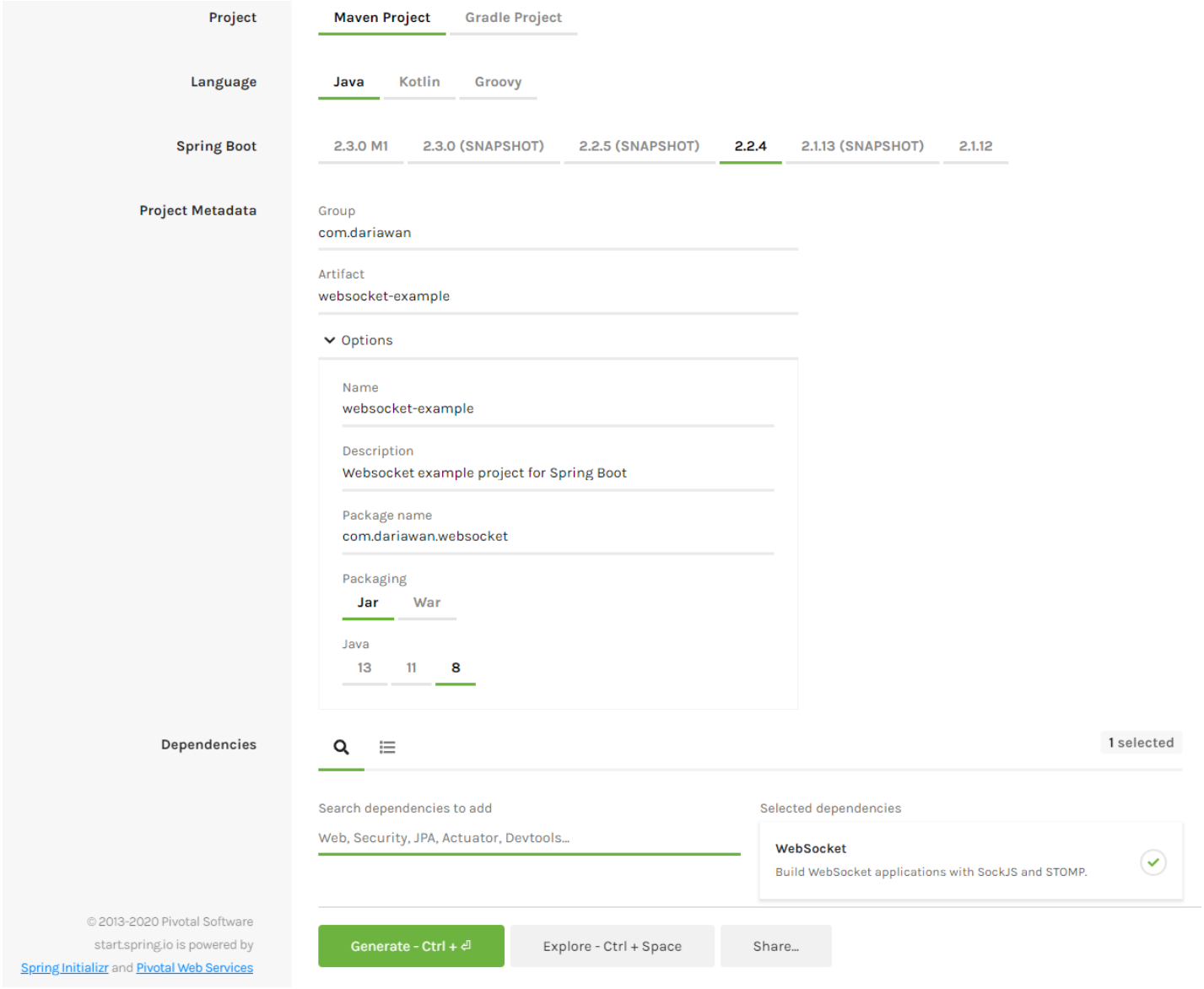
Caching	**Supported**. HTTP supports caching so that content can be stored locally by the browser and reused when required.	**Not possible**. Don't fit in the necessary scheme for caching, e.g. one requests which results in the same response every time
Supported clients	Broad support	Modern languages & clients

This article about Spring Boot and **WebSocket** means to be part of a series. In this post, we will learn to create a basic **WebSocket** application. The example in this article is a simple web application that broadcast messages using plain **WebSocket** connection.

Let's start by creating a new Spring Boot application.

Creating Spring Boot Application

Generate **Spring Boot** application we can use `Spring Initializr` (https://start.spring.io/) or `Spring Boot CLI` . For this tutorial, add **WebSocket** dependency:



Create Project in https://start.spring.io/

More dependencies needed to complete the application:

- Thymeleaf
- Webjars (Bootstrap and jQuery)
- Lombok

Since we are using maven, here `pom.xml` for this project:

pom.xml

```
1 <?xml version="1.0" encoding="UTF-8"?>
```

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLS
         xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 https://maven.apache.org/x
    <modelVersion>4.0.0</modelVersion>
    <parent>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-parent</artifactId>
        <version>2.2.4.RELEASE</version>
        <relativePath/> <!-- lookup parent from repository -->
    </parent>
    <groupId>com.dariawan</groupId>
    <artifactId>websocket-example</artifactId>
    <version>0.0.1-SNAPSHOT</version>
    <name>websocket-example</name>
    <description>Websocket example project for Spring Boot</description>

    <properties>
        <java.version>1.8</java.version>
    </properties>

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

        <dependency>
            <groupId>org.projectlombok</groupId>
            <artifactId>lombok</artifactId>
            <optional>true</optional>
        </dependency>
        <!-- https://mvnrepository.com/artifact/org.webjars/bootstrap -->
        <dependency>
            <groupId>org.webjars</groupId>
            <artifactId>bootstrap</artifactId>
            <version>4.4.1</version>
        </dependency>
```

```
        <!-- https://mvnrepository.com/artifact/org.webjars/jquery -->
        <dependency>
            <groupId>org.webjars</groupId>
            <artifactId>jquery</artifactId>
            <version>3.4.1</version>
        </dependency>


        <dependency>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-starter-test</artifactId>
            <scope>test</scope>
            <exclusions>
                <exclusion>
                    <groupId>org.junit.vintage</groupId>
                    <artifactId>junit-vintage-engine</artifactId>
                </exclusion>
            </exclusions>
        </dependency>
    </dependencies>

    <build>
        <plugins>
            <plugin>
                <groupId>org.springframework.boot</groupId>
                <artifactId>spring-boot-maven-plugin</artifactId>
            </plugin>
        </plugins>
    </build>
</project>
```

Spring Boot Application

`WebSocketExampleApplication` is the main entry point of our Spring Boot application:

WebSocketExampleApplication.java

```
package com.dariawan.websocket;

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

@SpringBootApplication
public class WebSocketExampleApplication {

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

Creating WebSocket Handler

In Spring we can create a customized handler by extends abstract class `AbstractWebSocketHandler` or one of it's subclass, either `TextWebSocketHandler` or `BinaryWebSocketHandler` :

- **TextWebSocketHandler**
  Base class for `WebSocketHandler` implementations that process text messages only.
- **BinaryWebSocketHandler**
  Base class for `WebSocketHandler` implementations that process binary messages only.

For our sample, since we need to handle only text so our class `MyTextWebSocketHandler` will extends `TextWebSocketHandler` .

MyTextWebSocketHandler.java

```
package com.dariawan.websocket.handler;

import java.io.IOException;
import java.util.List;
import java.util.concurrent.CopyOnWriteArrayList;
import org.slf4j.Logger;
import org.slf4j.LoggerFactory;
import org.springframework.web.socket.CloseStatus;
```

```
import org.springframework.web.socket.TextMessage;
import org.springframework.web.socket.WebSocketSession;
import org.springframework.web.socket.handler.TextWebSocketHandler;

public class MyTextWebSocketHandler extends TextWebSocketHandler {

    private static final Logger LOGGER = LoggerFactory.getLogger(MyTextWebSocketHandler.c

    private final List<WebSocketSession> sessions = new CopyOnWriteArrayList<>();

    @Override
    public void afterConnectionEstablished(WebSocketSession session) throws Exception {
        sessions.add(session);
        super.afterConnectionEstablished(session);
    }

    @Override
    public void afterConnectionClosed(WebSocketSession session, CloseStatus status) throw
        sessions.remove(session);
        super.afterConnectionClosed(session, status);
    }

    @Override
    protected void handleTextMessage(WebSocketSession session, TextMessage message) throw
        super.handleTextMessage(session, message);
        sessions.forEach(webSocketSession -> {
            try {
                webSocketSession.sendMessage(message);
            } catch (IOException e) {
                LOGGER.error("Error occurred.", e);
            }
        });
    }
}
```

Spring Web Socket Configuration

For Spring application to forward client requests to the endpoint , we need to register the handler. Class `WebSocketConfig` is a customized configuration class that implements interface `WebSocketConfigurer`. `WebSocketConfigurer` interface defines callback methods to configure the **WebSocket** request handling (example: adding **WebSocket** handler) via `@EnableWebSocket` annotation.

WebSocketConfig.java

```
1  package com.dariawan.websocket.config;
2
3  import com.dariawan.websocket.handler.MyTextWebSocketHandler;
4  import org.springframework.context.annotation.Configuration;
5  import org.springframework.web.socket.config.annotation.EnableWebSocket;
6  import org.springframework.web.socket.config.annotation.WebSocketConfigurer;
7  import org.springframework.web.socket.config.annotation.WebSocketHandlerRegistry;
8
9  @Configuration
10 @EnableWebSocket
11 public class WebSocketConfig implements WebSocketConfigurer {
12
13     @Override
14     public void registerWebSocketHandlers(WebSocketHandlerRegistry webSocketHandlerRegist
15         webSocketHandlerRegistry.addHandler(new MyTextWebSocketHandler(), "/web-socket");
16     }
17 }
```

Controller and HTML Template

Next, we create the UI part for establishing WebSocket and making the calls. Define the `WebSocketController` as follow:

WebSocketController.java

```
1  package com.dariawan.websocket.controller;
2
```

```
import org.springframework.stereotype.Controller;
import org.springframework.web.bind.annotation.RequestMapping;

@Controller
public class WebSocketController {

    @RequestMapping("/websocket")
    public String getWebSocket() {
        return "ws-broadcast";
    }
}
```

Function `getWebSocket()` returning the name of Thymeleaf template that will be used to render the response. The template that will be rendered in this function is `ws-broadcast.html`. Please refer to Adding Controller in Spring Boot + Thymeleaf CRUD Example.

ws-broadcast.html

```
<!DOCTYPE HTML>
<html xmlns:th="http://www.thymeleaf.org">
    <head>
        <title>Plain WebSocket Example</title>
        <th:block th:include="fragments/common.html :: headerfiles"></th:block>
    </head>
    <body>
        <div class="container">
            <div class="py-5 text-center">
                <h2>Basic Web socket</h2>
                <p class="lead">Sample of basic WebSocket broadcast - without STOMP & Soc
            </div>
            <div class="row">
                <div class="col-md-6">
                    <div class="row mb-3">
                        <div class="input-group">
                            Web socket connection: 
                            <div class="btn-group">
                                <button type="button" id="connect" class="btn btn-sm btn-
                            <button type="button" id="disconnect" class="btn btn-sm btn-o
                            </div>
```

```
                        </div>
                    </div>
                    <div class="row mb-3">
                        <div class="input-group" id="sendmessage" style="display: none;">
                            <input type="text" id="message" class="form-control" placehol
                            <div class="input-group-append">
                                <button id="send" class="btn btn-primary" onclick="send()
                            </div>
                        </div>
                    </div>
                </div>
                <div class="col-md-6">
                    <div id="content"></div>
                </div>
            </div>
        </div>

        <footer th:insert="fragments/common.html :: footer"></footer>

        <script>
            var ws;
            function setConnected(connected) {
                $("#connect").prop("disabled", connected);
                $("#disconnect").prop("disabled", !connected);
                if (connected) {
                    $("#sendmessage").show();
                } else {
                    $("#sendmessage").hide();
                }
            }

            function connect() {
                /*<![CDATA[*/
                var url = /*[['ws://'+${#httpServletRequest.serverName}+':'+${#httpServle
                /*]]>*/
                ws = new WebSocket(url);
                ws.onopen = function () {
                    showBroadcastMessage('<div class="alert alert-success">Connected to s
                };
                ws.onmessage = function (data) {
```

```
                    showBroadcastMessage(createTextNode(data.data));
                };
                setConnected(true);
            }

            function disconnect() {
                if (ws != null) {
                    ws.close();
                    showBroadcastMessage('<div class="alert alert-warning">Disconnected f
                }
                setConnected(false);
            }

            function send() {
                ws.send($("#message").val());
                $("#message").val("");
            }

            function createTextNode(msg) {
                return '<div class="alert alert-info">' + msg + '</div>';
            }

            function showBroadcastMessage(message) {
                $("#content").html($("#content").html() + message);
            }
        </script>
    </body>
</html>
```

We are using `th:include` and `th:insert` from Thymeleaf's page layout, and Webjars. We will not talk about these things in this article. For completeness of the example, here the content of `common.html` :

common.html

```
<!DOCTYPE HTML>
<html xmlns:th="http://www.thymeleaf.org">
```

```
    <head th:fragment="headerfiles">
        <meta charset="UTF-8">
        <meta name="viewport" content="width=device-width, initial-scale=1.0">
        <link rel="stylesheet" type="text/css" th:href="@{/webjars/bootstrap/4.4.1/css/bo
        <link rel="stylesheet" type="text/css" th:href="@{/css/main.css}"/>
        <script th:src="@{/webjars/jquery/3.4.1/jquery.js}" ></script>
    </head>
    <body>
        <footer th:fragment="footer" class="my-5 text-muted text-center text-small">
            <p class="mb-1">© 2020 Dariawan</p>
            <ul class="list-inline">
                <li class="list-inline-item"><a href="https://www.dariawan.com">Homepage<
                <li class="list-inline-item"><a href="#">Articles</a></li>
            </ul>
        </footer>
    </body>
</html>
```

Run Application

We can run our application from IDE, or from terminal. From terminal, go to the project's root directory and run:

```
$ mvn spring-boot:run
```

It'll run the main method in `WebSocketExampleApplication` class. Open browser and make request at http://localhost:8080/websocket.

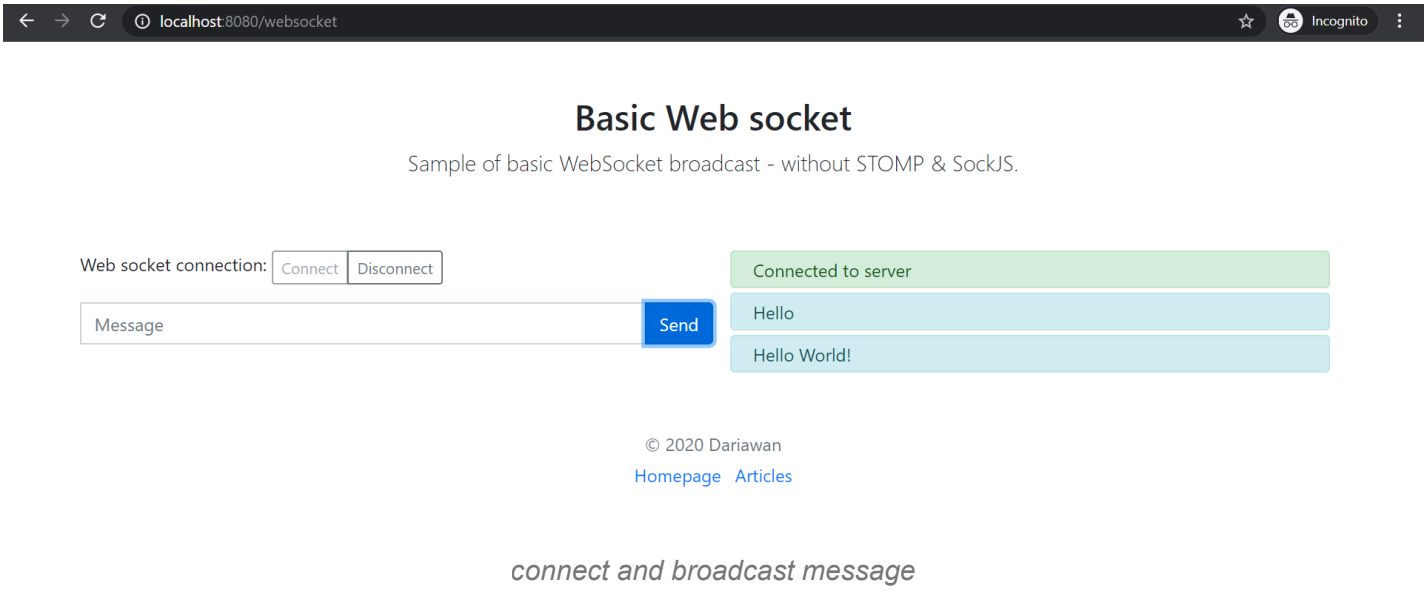
Create **WebSocket** connection by clicking "Connect" button. Here the request headers when make connection (truncated - with unnecessary information removed).

```
Host: localhost:8080
Origin: http://localhost:8080
Sec-WebSocket-Version: 13
Sec-WebSocket-Extensions: permessage-deflate
Sec-WebSocket-Key: PSfHzxFfZC1KVUUuC1fQHg==
Connection: keep-alive, Upgrade
Upgrade: websocket
```

And here response headers (also truncated)

```
HTTP/1.1 101
Upgrade: websocket
Connection: upgrade, keep-alive
Sec-WebSocket-Accept: to0bX/YSZHbE/Rtp2OOo5qXpR7I=
Sec-WebSocket-Extensions: permessage-deflate
```

After that, we can start broadcast the message. You can open multiple session of `http://localhost:8080/websocket`



connect and broadcast message

On clicking "Disconnect" the **WebSocket** connection will be closed.

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- Documenting Spring Boot REST API with Swagger
- Spring Boot + Thymeleaf CRUD Example
- Spring Boot + FreeMarker CRUD Example

- Spring Boot + Mustache CRUD Example
- Spring Boot + Groovy Templates CRUD Example

This article also part of following series:

- Build Spring WebSocket Application

← IllegalArgumentException: There is no PasswordEncoder mapped for the id "null"

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