The Handshake and Upgrade Headers

4 min

Where do these persistent WebSocket connections come from? Don’t worry, the answer doesn’t involve storks. WebSockets actually originate from our old friend, HTTP, and something called a *handshake*.

The handshake is essentially an agreement between the client and the server to establish a persistent WebSocket connection and is initiated using a plain old HTTP request! In the header of the request, the client must communicate to the server that it wants to *upgrade* the connection from HTTP to WebSockets. It does so using an HTTP GET request to a ws:// URI along with a set of specific headers like in the following example:

```
GET ws://example.com:8080/ HTTP/1.1
Host: localhost:8080
Connection: Upgrade
Upgrade: websocket
Sec-WebSocket-Version: 13
Sec-WebSocket-Key: q4xkcO32u266gldTuKaSOw==
```

The request from the client will include the following required headers:

- The Connection header controls whether or not the network connection stays open after the current transaction finishes. A value of Upgrade signals that we want to upgrade the connection to a new protocol.

- The Upgrade header specifies the protocol that the client wants to

Preview: Docs Loading link description

switch

to. In this case, the protocol websocket is specified.

- The Sec-WebSocket-Key header is a one-time random value generated by the client and is used by the server to prove that it received a valid WebSocket opening handshake.

- The Sec-WebSocket-Version: 13 header specifies the WebSocket protocol version the client wishes to use. The most recent (as of 2021) and only accepted version of the WebSocket protocol is 13.

Note: *When you visit a website that is built using WebSockets, you will still enter http:// into your browser to make the initial handshake request – the ws:// protocol is used to establish a WebSocket connection after the initial http:// request is made.*

Once the server receives this request, it can complete the WebSocket handshake by sending a response to the client like so:

```
HTTP/1.1 101 Switching Protocols
Upgrade: websocket
Connection: Upgrade
Sec-WebSocket-Accept: fA9dggdnMPU79lJgAE3W4TRnyDM=
```

Let’s break down each of these response headers:

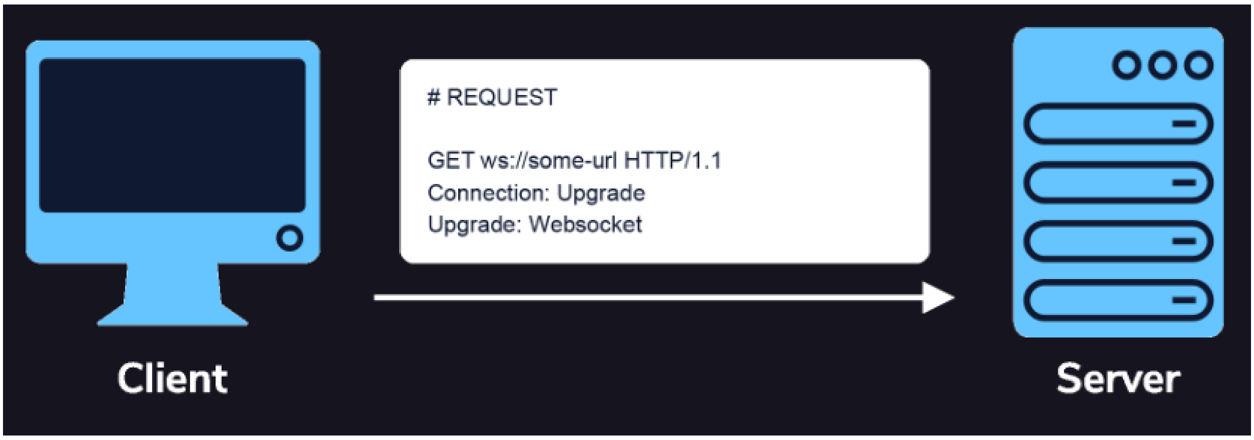
- The HTTP/1.1 101 Switching Protocols header indicates that the server is switching to the protocol that the client requested in its Upgrade request header
- The Connection: Upgrade header confirms that the connection has been upgraded.
- The Upgrade: websocket header confirms that the protocol is being upgraded from HTTP to WebSocket
- The Sec-WebSocket-Accept: fA9dggdnMPU79lJgAE3W4TRnyDM= header is a key generated based on the Sec-WebSocket-Key header in the request and is used to authenticate the handshake.

After the client receives the server response, the HTTP connection is replaced by a WebSocket connection and data can begin flowing freely. An application can now benefit from transferring as much data as desired without:

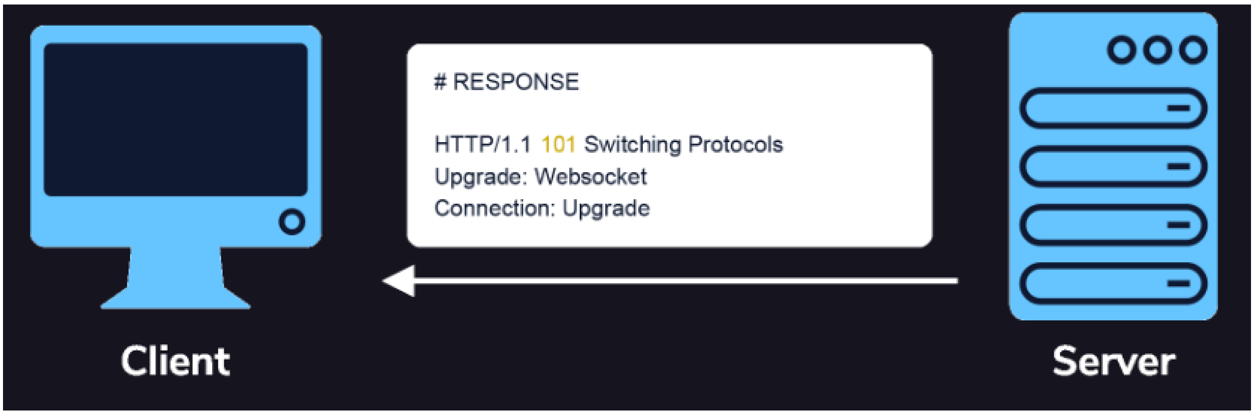
- Incurring the overhead associated with each client-to-server message having an HTTP header.
- Having to open up a new underlying TCP connection for each client-to-server message.

Instructions

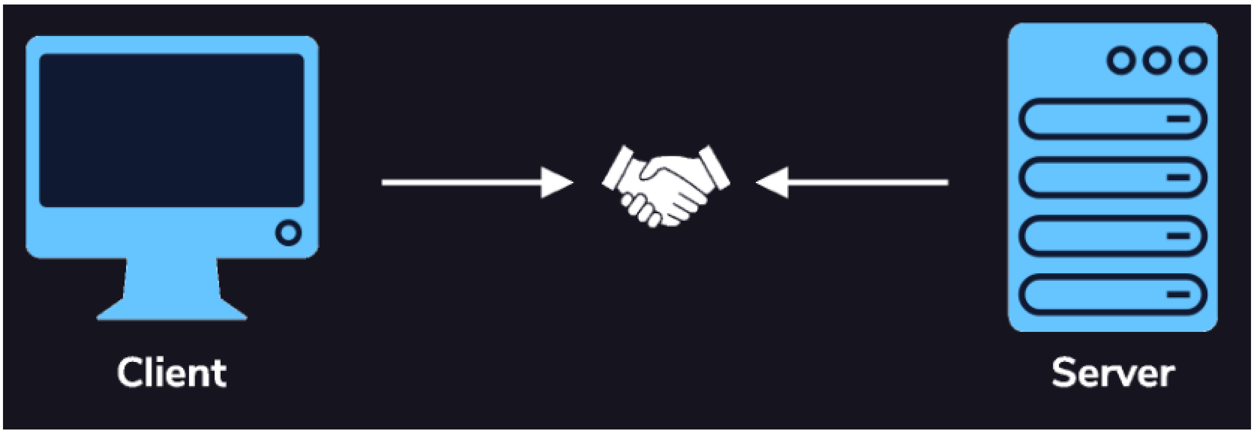
Take a look at the upgrade headers passed between client and server to initiate a handshake. Once this handshake takes place, data can flow freely between the two.



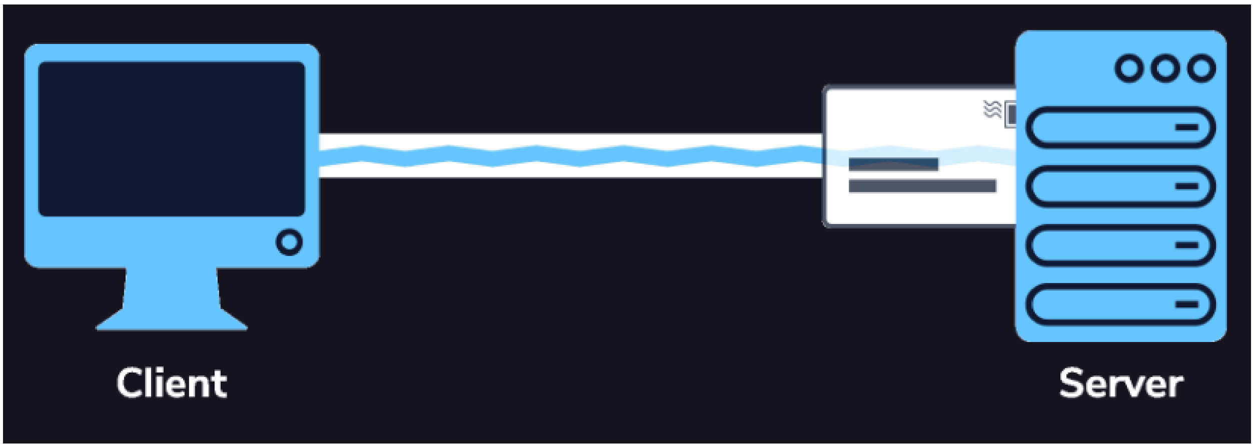
```
# REQUEST

GET ws://some-url HTTP/1.1
Connection: Upgrade
Upgrade: Websocket
```



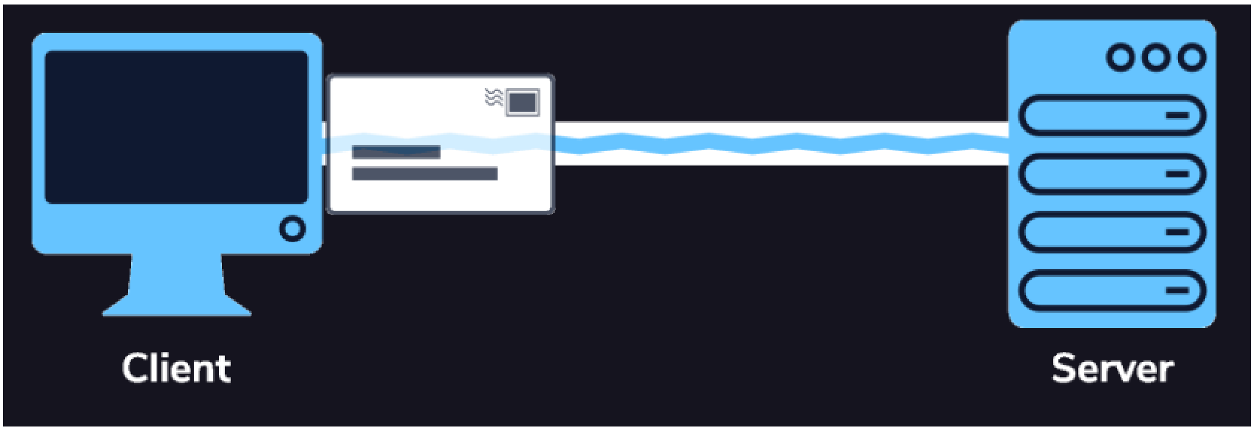
```
# RESPONSE

HTTP/1.1 101 Switching Protocols
Upgrade: Websocket
Connection: Upgrade
```



Client
Server



Client
Server



Client
Server