[Websockets]

↳ Full duplex connection protocol but how?

Let's talk about (HTTP)

↳ Application layer protocol on top of (TCP) in transport layer

HTTP 1.0

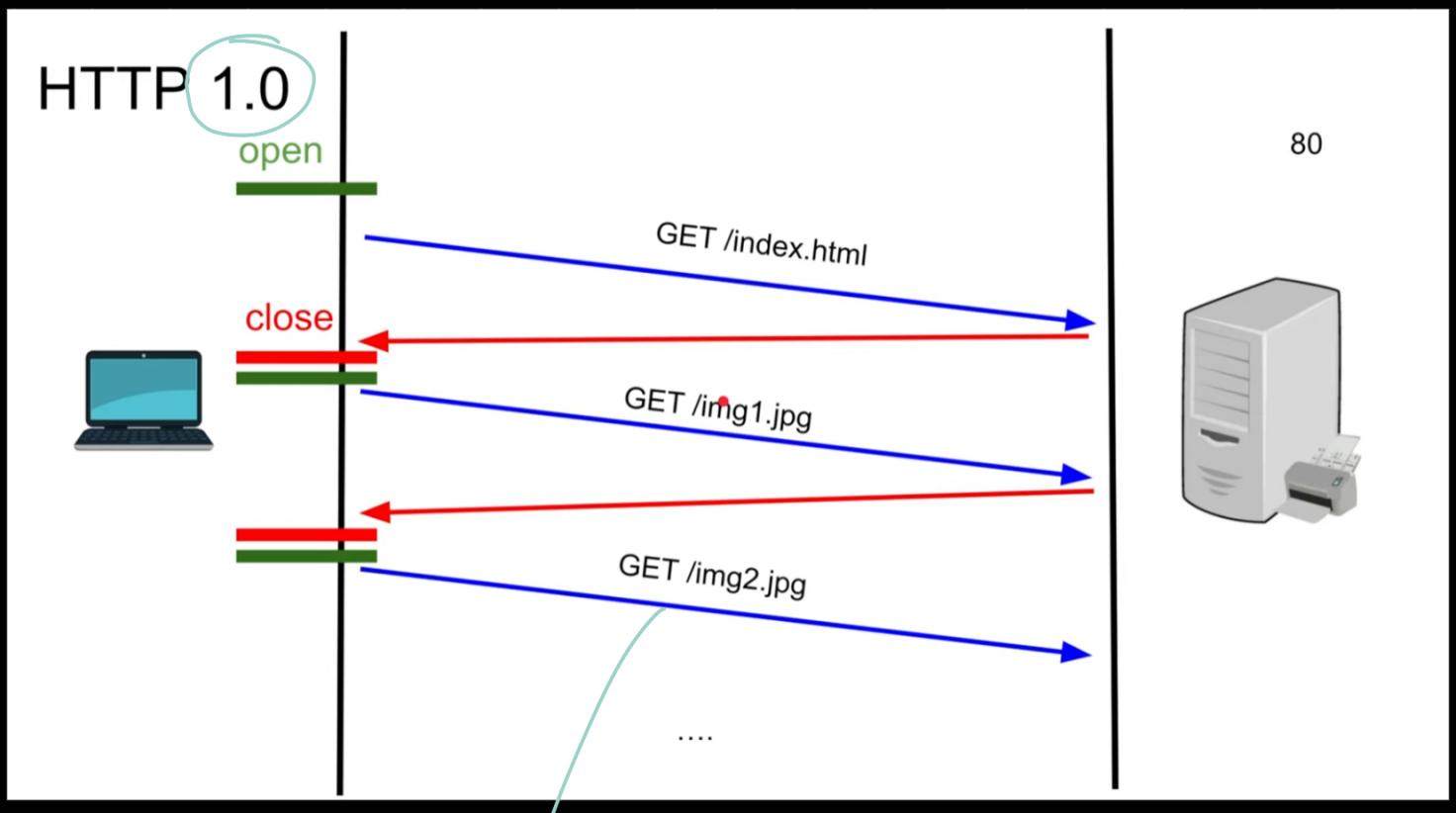
↳ http is req-response which means 3 steps.

① 3-way handshake using TCP

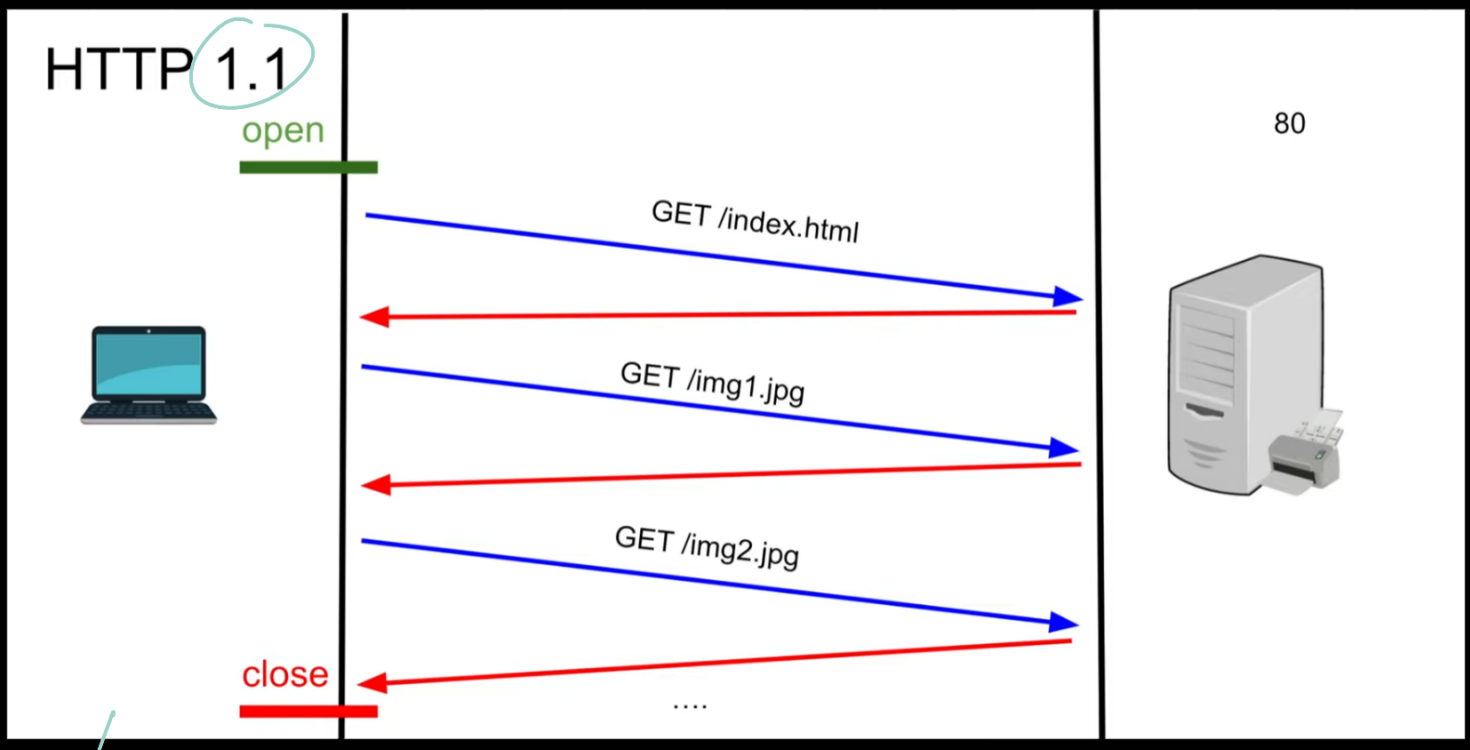
② Data transfer

③ Connection close

* So, for http resources like RAM reserved on client and server, once data is transferred, connection is closed/timeout



Each image have different TCP connection
↳ very slow



↳ All images from same server under same TCP Connection

Websockets is extension of http 1.1

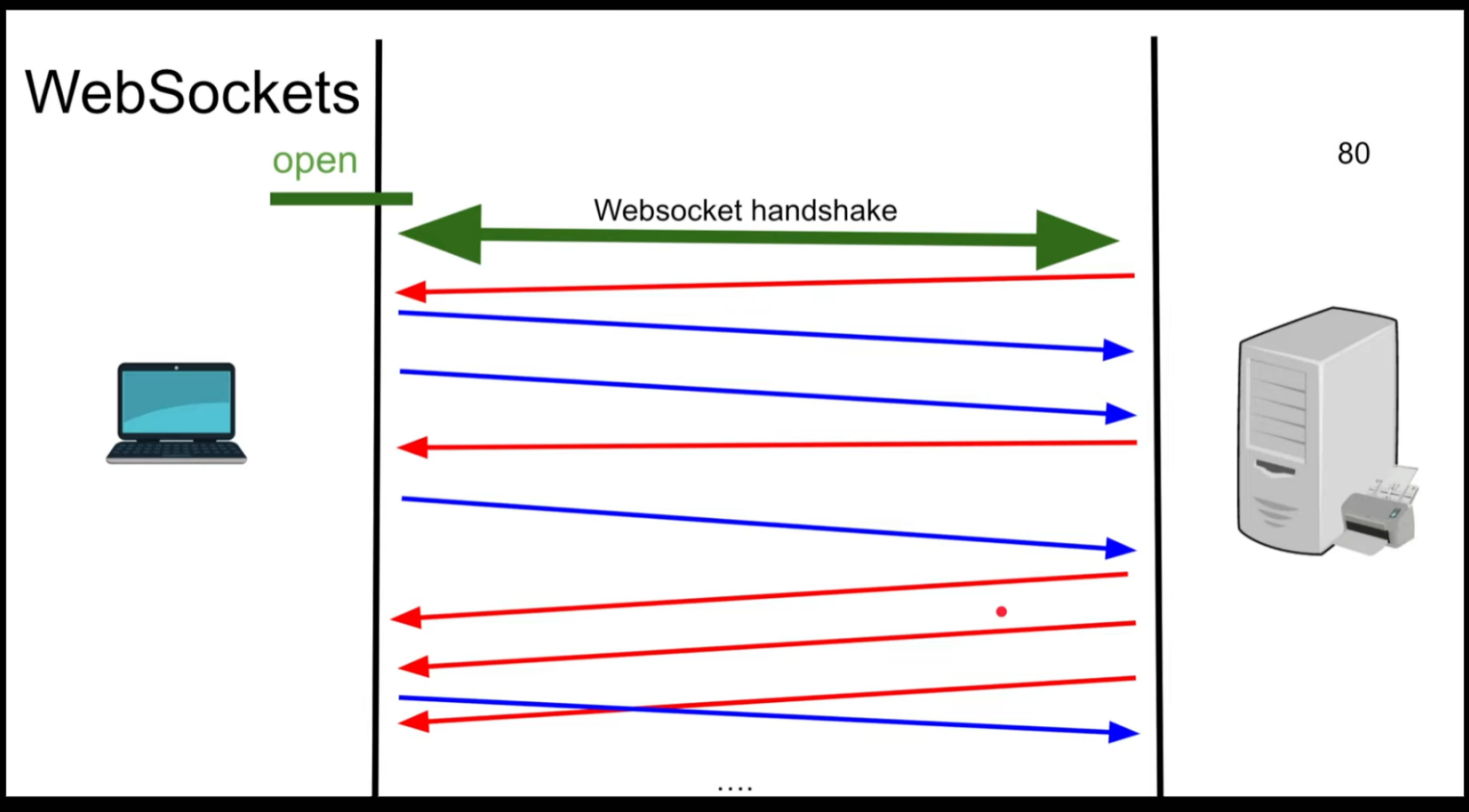
* In websocket, the socket and all Data structure present in RAM on client and server after TCP connection remains there until the connection is closed explicitly.

How WebSockets Work

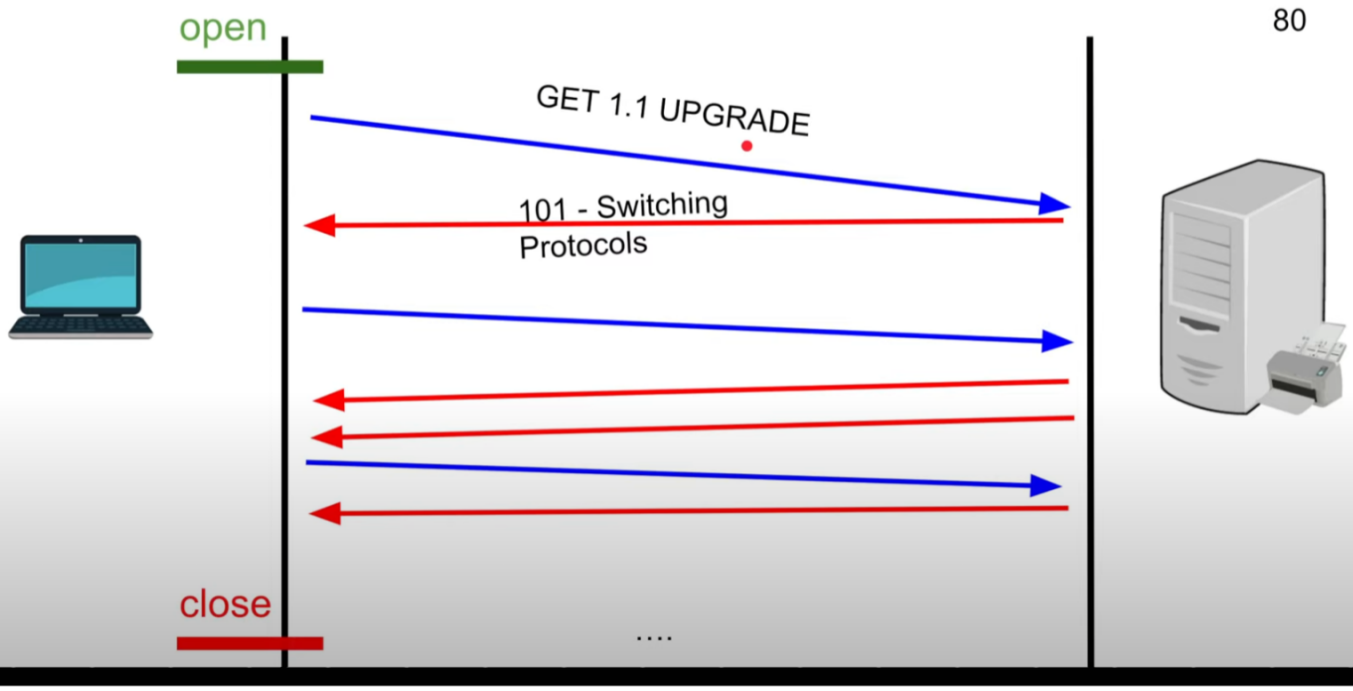
1. **Handshake:**
   - Initiated via an HTTP request with an `Upgrade` header.
   - Example:

```http
GET /chat HTTP/1.1
Host: example.com
Upgrade: websocket
Connection: Upgrade
```

   - If the server supports WebSockets, it responds with a `101 Switching Protocols` status and upgrades the connection.
2. **Persistent Connection:**
   - Once established, the connection stays open allowing data to flow in both directions.
3. **Data Exchange:**
   - Messages are exchanged as frames.
   - Frames are lightweight compared to HTTP messages, reducing overhead.
4. **Closure:**
   - Either the client or the server can close the connection gracefully.



WebSockets Handshake ws:// or wss://



WebSocket Handshake

Client

```
GET /chat HTTP/1.1
Host: server.example.com
Upgrade: websocket
Connection: Upgrade
Sec-WebSocket-Key: x3JJHMbDL1EzLkh9GBhXDw==
Sec-WebSocket-Protocol: chat, superchat
Sec-WebSocket-Version: 13
Origin: http://example.com
```

Server

```
HTTP/1.1 101 Switching Protocols
Upgrade: websocket
Connection: Upgrade
Sec-WebSocket-Accept: HSmrc0sMlYUkAGmm5OPpG2HaGWk=
Sec-WebSocket-Protocol: chat
```

WebSockets Pros and Cons

Pros

- Full-duplex (no polling)
- HTTP compatible
- Firewall friendly (standard)

Cons

- Proxying is tricky
- L7 L/B challenging (timeouts)
- Stateful, difficult to horizontally scale