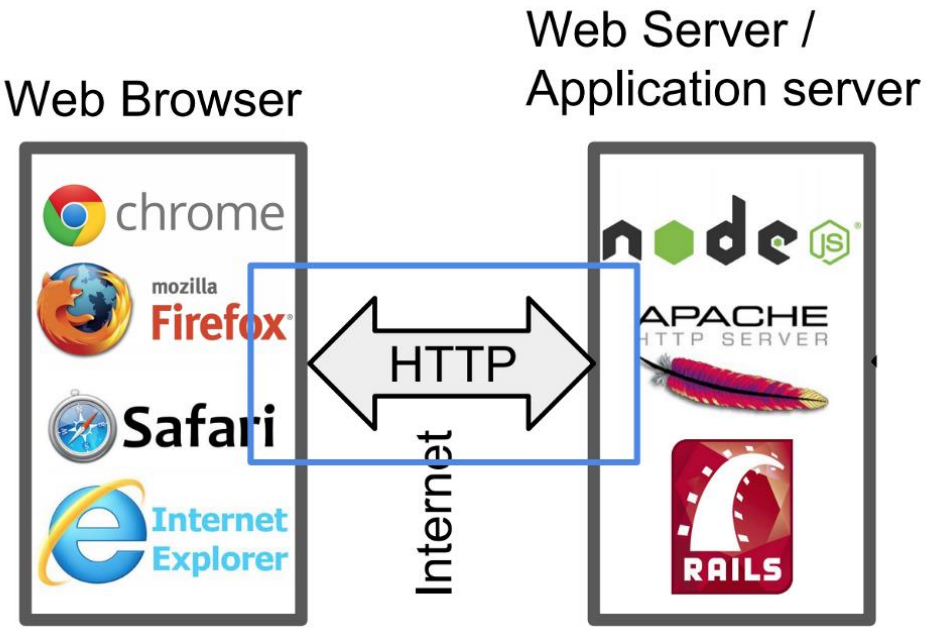
HTTP Server Design and Implementation from Scratch

HTTP Server: Introduction

- An HTTP Server is software that understands URLs (web addresses) and HTTP (the protocol browser uses to view pages).
- An HTTP Server can be accessed through the domain names of the websites it stores and it delivers the content of these hosted websites to the end user's device.



HTTP Server: Introduction

- Lets have a look at the interaction between Server and Web Browser.

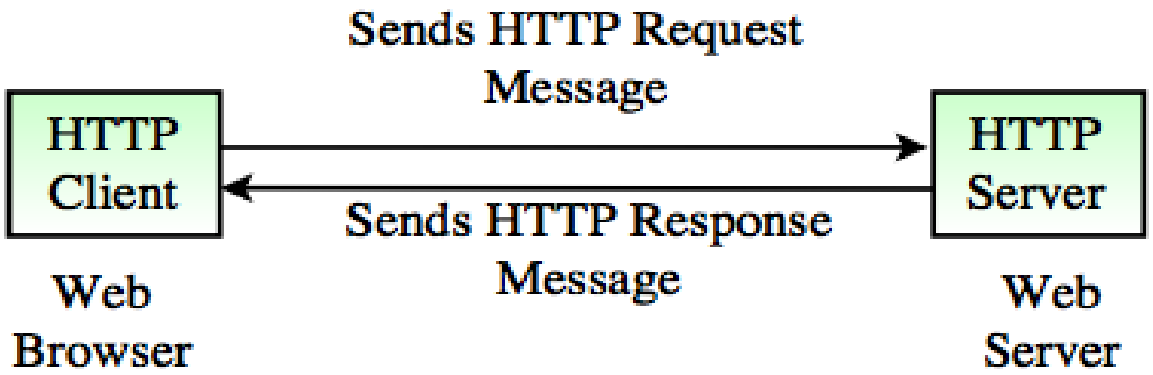


Fig. HTTP Protocol

Outline of client-server interaction

HTTP Client Request

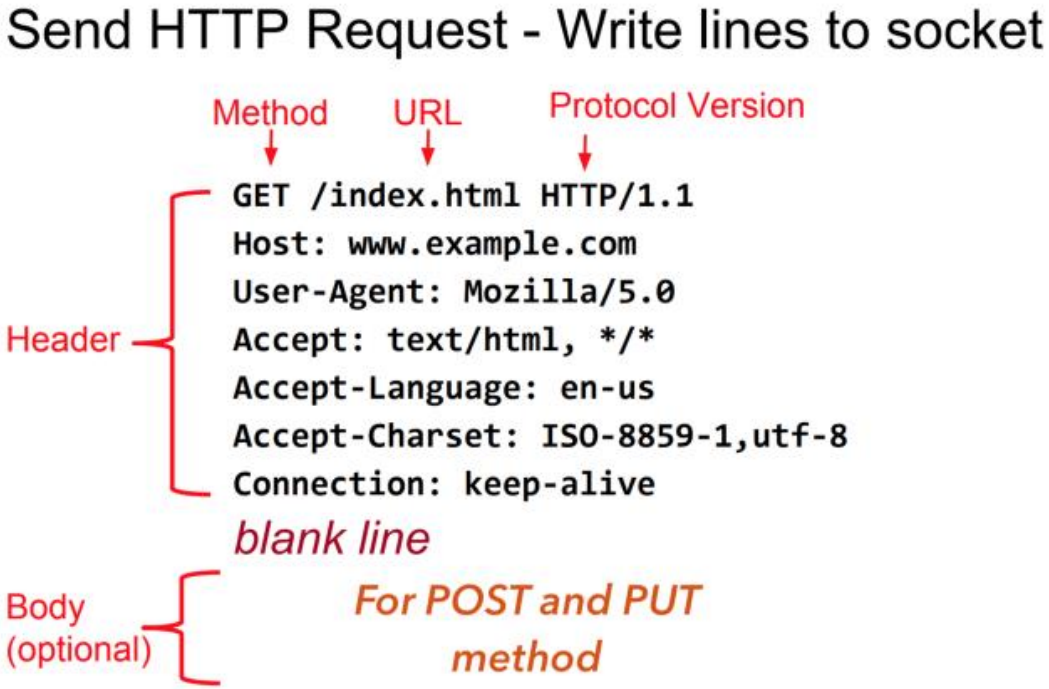
- Client needs to connect to the server every time.
- When we want to connect to the server, we type some URL/Address of the website in the browser
- To display the page, browser fetches the file index.html from a web server.
- For example, www.example.com (Defaults: port 80, file index.html, http protocol).
- On entering link www.example.com in the web browser, the web browser re-constructs the URL/Address as:

  http://www.example.com:80

- This reconstructed URL web-browsers send to the servers every time we navigate the internet pages.
- If the server is configured to certain default pages. Like, server has a default web page, it is displayed when we visit a website on that server.
- That web page is decided by the name of the file. Some servers have **public.html** and some will have **index.html**.

HTTP Client Request

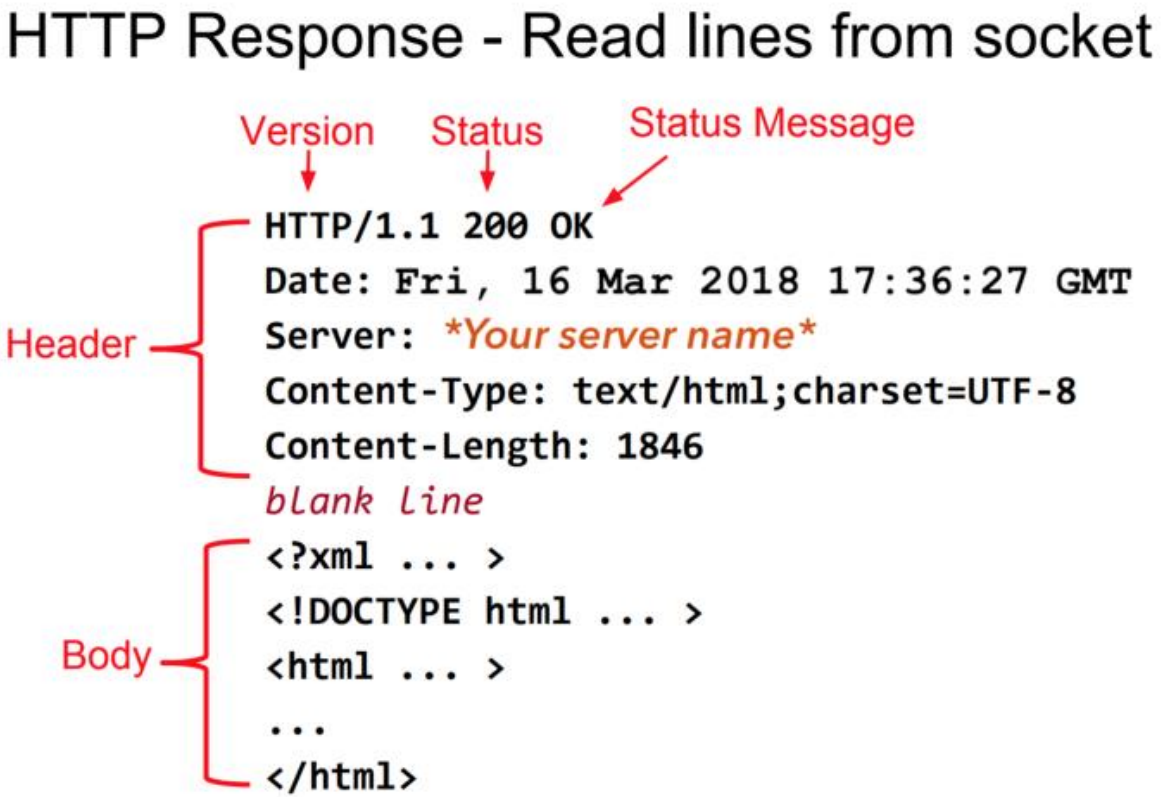
- Lets consider **index.html** as default page.
- When browser Sends HTTP request to server, a HTTP header is sent.



- This HTTP Request is received at Server's end, which is processed by the server

HTTP Server Response

- The client sent some headers to HTTP server and expects same in-return.
- This is the HTTP response format the web-browser is expecting from Server



HTTP Server Using Socket Programming

Step 1: Creating socket file descriptor

```
 if ((server_fd = socket(AF_INET, SOCK_STREAM, 0)) == 0)
{
    perror("In socket");
    exit(EXIT_FAILURE);
}
```

// This is a TCP socket

HTTP Server Using Socket Programming

Step 2: Create a struct sockaddr_in address;

#define PORT 80 //define with header files

address.sin_family = AF_INET;

address.sin_addr.s_addr = INADDR_ANY;

address.sin_port = htons(PORT);

HTTP Server Using Socket Programming

Step 3: Bind *server_fd* and *address*

```
if (bind(server_fd, (struct sockaddr *)&address,
sizeof(address) ) <0)
    {
        perror("In bind");
        exit(EXIT_FAILURE);
    }
```

HTTP Server Using Socket Programming

Step 4: Listen on *server_fd*

```
if (listen(server_fd, 10) < 0)
   {
      perror("In listen");
      exit(EXIT_FAILURE);
   }
```

- *Here 10 is* ***queue_limit,*** *i.e.* number of active participants that can “wait” for a connection

HTTP Server Using Socket Programming

Step 5: Accept client request using *accept()*

```
int addrlen = sizeof(address);

 while(1) // infinite while loop for accepting request of different clients
{
if ((new_socket = accept(server_fd, (struct sockaddr *)&address,
(socklen_t*)&addrlen))<0)
      {
         perror("In accept");
         exit(EXIT_FAILURE);
      }

} //end while(1)
```

- *Note that "new_socket " will be used for further communication*

HTTP Server Using Socket Programming

Step 6: Read and Print data received from client

```
 while(1)
{
if ((new_socket = accept(server_fd,……
……..

char buffer[30000] = {0};
 valread = read( new_socket , buffer, 30000);
 printf("%s\n",buffer );

} //end while(1)
```

HTTP Server Using Socket Programming

Step 7: Create HTTP Response in a String

char *server_response = "HTTP/1.1 200 OK\nContent-Type: text/html\nContent-Length: 72\n\n <!DOCTYPE HTML><HTML><body><h1>Hello Thapar Institute</h1></body></HTML>";

while(1)

{

……..

}

- Here, we are sending HTTP response header appended with HTML content <html><body><h1>Hello Thapar Institute</h2></body></html>

HTTP Server Using Socket Programming

Step 7: Send the Response to client and close new_socket

```
char *server_response =  "HTTP/1.1 200 OK\nContent-Type: text/html\nContent-Length: 72\n\n <!DOCTYPE HTML><HTML><body><h1>Hello Thapar Institute </h1></body></HTML>";
while(1)
{
……accept()……..
…….print client data….
 write(new_socket , server_response , strlen(server_response));
 printf("-------Response sent to client---------\n");
 close(new_socket);
}//end while(1)
```