<WA1/>

2020

HTTP

The Protocol of the Web

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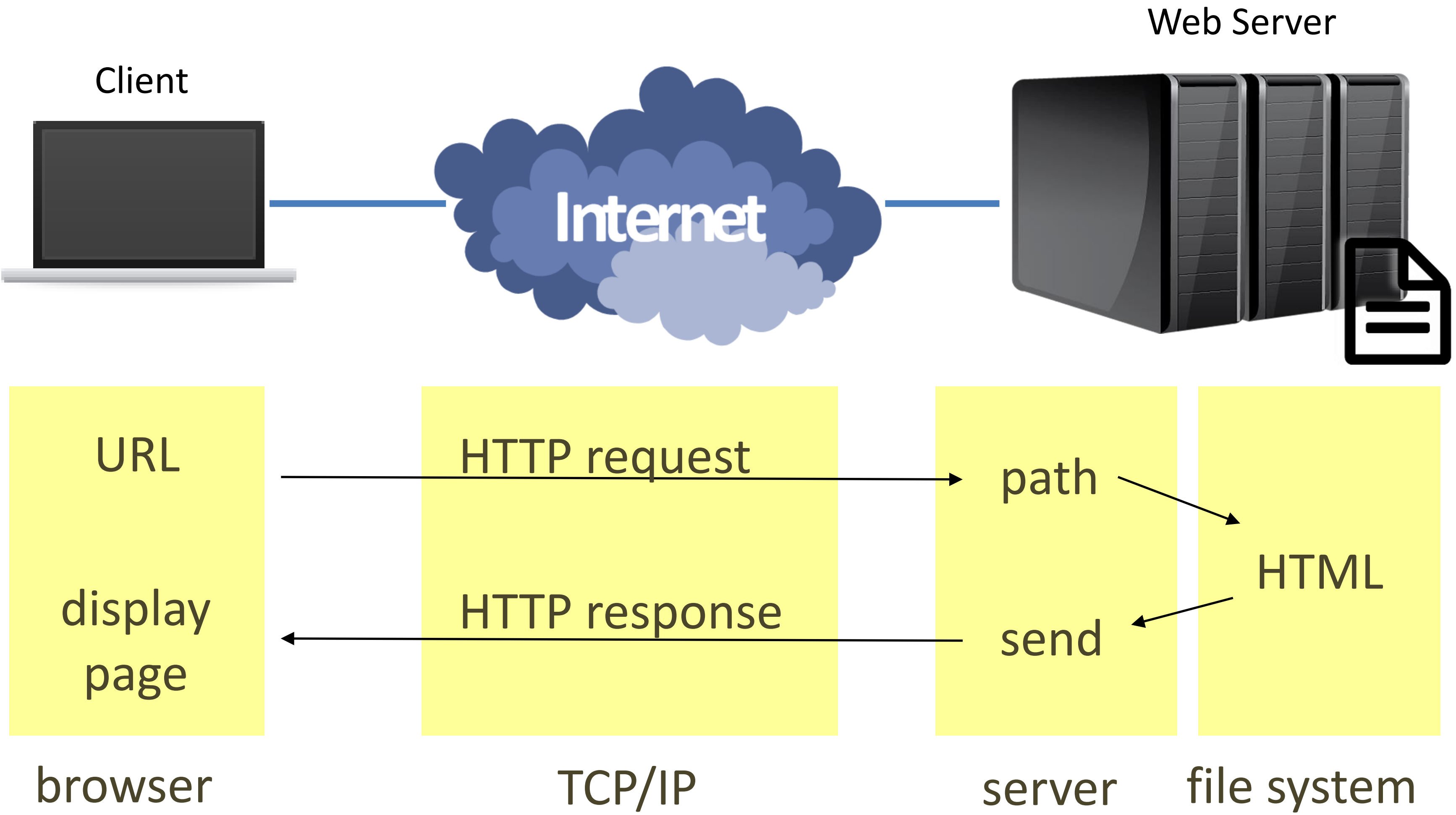
HTTP: Hypertext Transfer Protocol



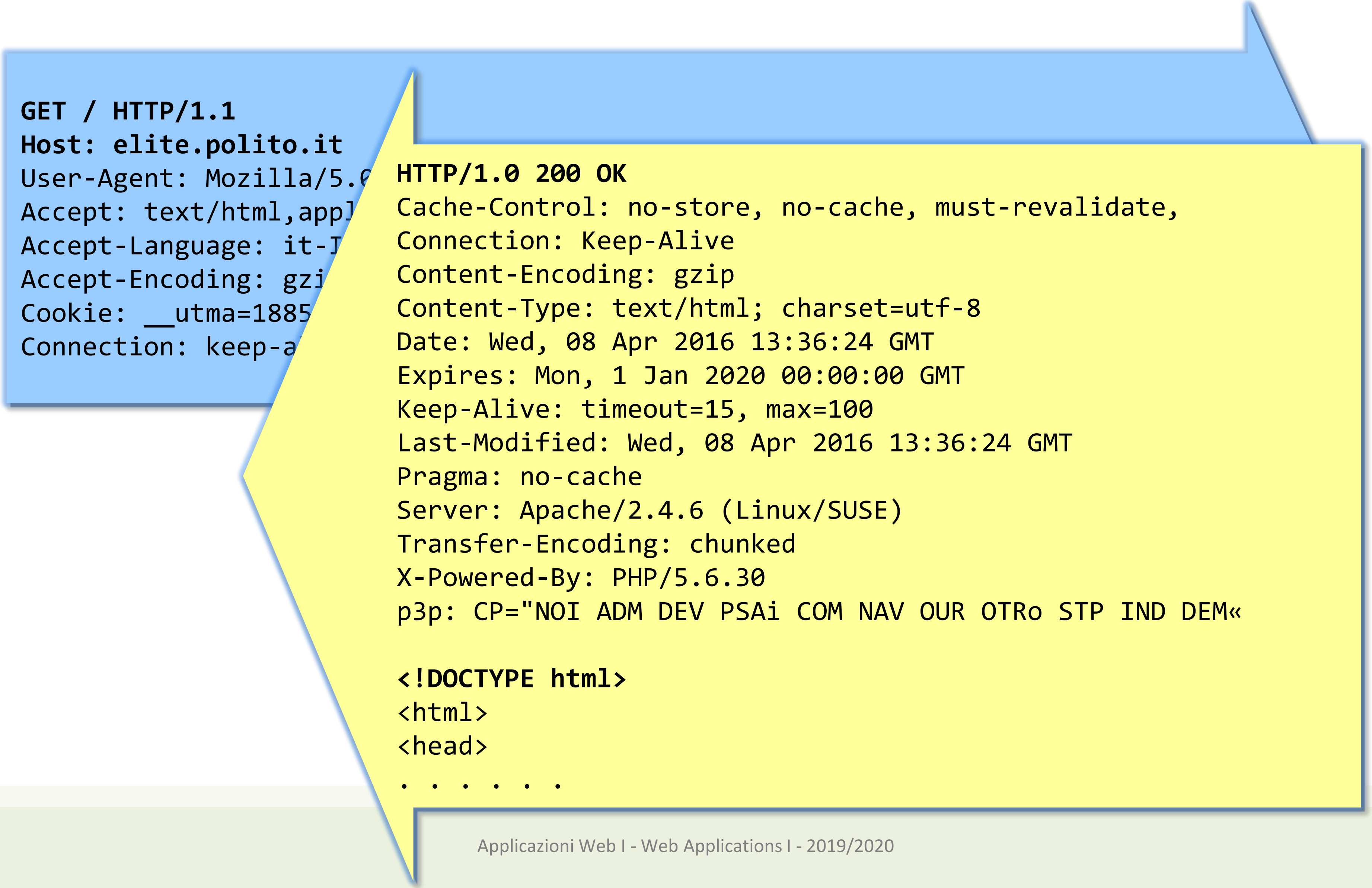
HTTP protocol

https://tools.ietf.org/html/rfc7230
https://tools.ietf.org/html/rfc7231

```
GET / HTTP/1.1
Host: elite.polito.it
User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64; rv:37.0) Gecko/20100101 Firefox/37.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: it-IT,it;q=0.8,en-US;q=0.5,en;q=0.3
Accept-Encoding: gzip, deflate
Cookie: __utma=18858605.1512105954.1382561222.1428481384.1428499850.353;
Connection: keep-alive
```

HTTP protocol

https://tools.ietf.org/html/rfc7230
https://tools.ietf.org/html/rfc7231



```
GET / HTTP/1.1
Host: elite.polito.it
User-Agent: Mozilla/5.0
Accept: text/html,appl
Accept-Language: it-I
Accept-Encoding: gzi
Cookie: __utma=1885
Connection: keep-a
```

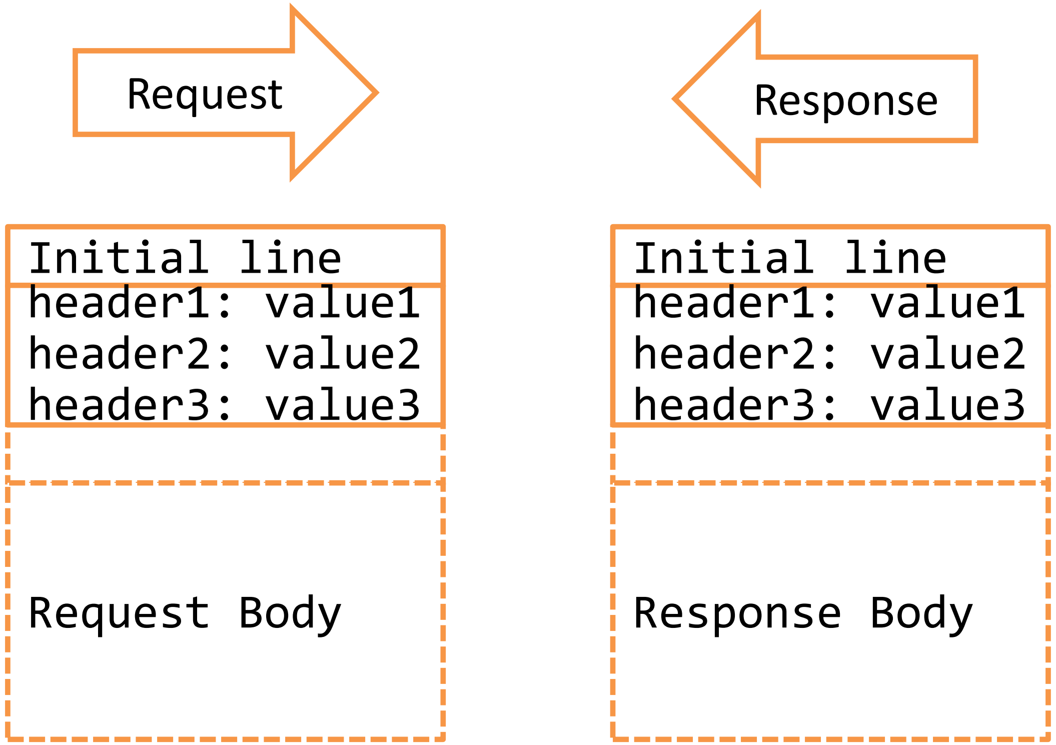
```
HTTP/1.0 200 OK
Cache-Control: no-store, no-cache, must-revalidate,
Connection: Keep-Alive
Content-Encoding: gzip
Content-Type: text/html; charset=utf-8
Date: Wed, 08 Apr 2016 13:36:24 GMT
Expires: Mon, 1 Jan 2020 00:00:00 GMT
Keep-Alive: timeout=15, max=100
Last-Modified: Wed, 08 Apr 2016 13:36:24 GMT
Pragma: no-cache
Server: Apache/2.4.6 (Linux/SUSE)
Transfer-Encoding: chunked
X-Powered-By: PHP/5.6.30
p3p: CP="NOI ADM DEV PSAi COM NAV OUR OTRo STP IND DEM«

<!DOCTYPE html>
<html>
<head>
. . . . . .
```

HTTP 1.1 vs HTTP 2

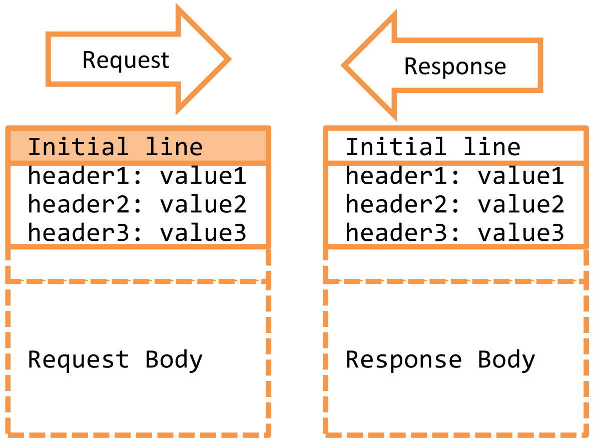
- Changes do not require any changes to how existing web applications work, but new applications can take advantage of new features for increased speed. HTTP/2 leaves all of HTTP 1.1's high-level semantics, such as methods, status codes, header fields, and URIs, the same. What is new is how the data is framed and transported between the client and the server.
  https://en.wikipedia.org/wiki/HTTP/2
- We will study the application-level aspect of the protocol, and for our purposes 1.1 and 2 are interchangeable.

HTTP messages

- An initial line
- Zero or more header lines
- A blank line (CRLF)
- An optional message body



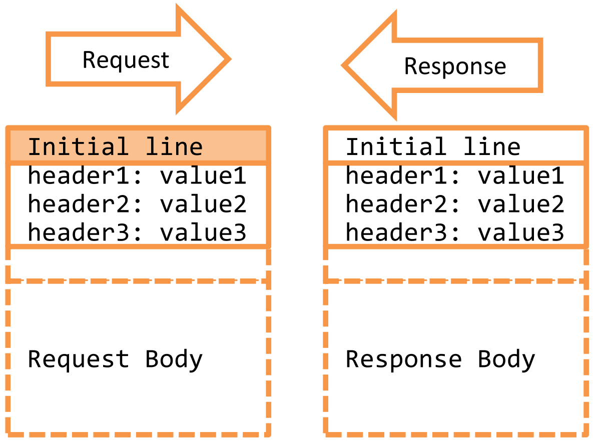
Request – initial line



- A **request** initial line has three parts separated by white spaces:
  - Method name
  - Local path of the requested resource
  - Version of HTTP being used

- `GET /path/to/file/index.html HTTP/1.0`

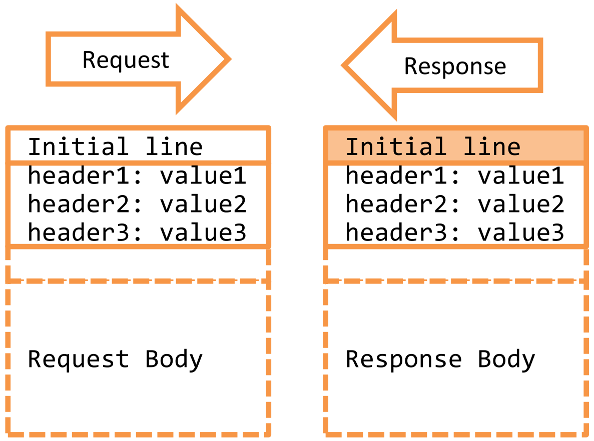
HTTP Methods



GET	Requests a representation of the specified resource. Should only retrieve data.
HEAD	Asks for a response identical to GET, but without the response body
POST	Submit an entity to the specified resource, often causing a change in state or side effects on the server
PUT	Replaces current representations of the target resource with the request payload
DELETE	Deletes the specified resource
TRACE	Message loop-back test along the path to the target resource
OPTIONS	Describe the communication options for the target resource
CONNECT	Establish a tunnel to the server identified by the target resource
PATCH	Apply partial modifications to a resource

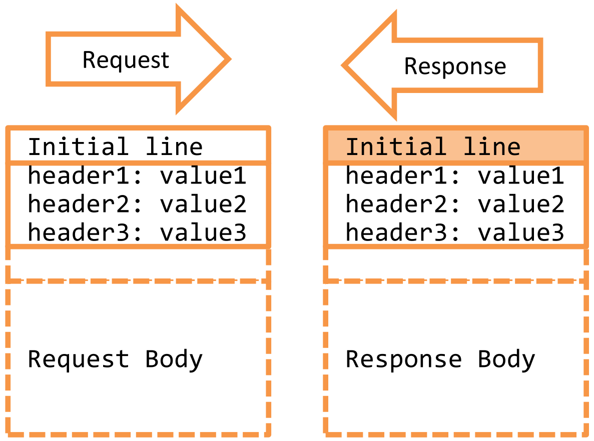
https://tools.ietf.org/html/rfc7231#section-4.3

Response – initial line



- A status line
- 3 parts separated by spaces:
  - The HTTP version
  - The response status code
  - An English phrase describing the status code
- Example:
  - `HTTP/1.0 200 OK`
  - `HTTP/1.0 404 Not Found`

Response Status Codes

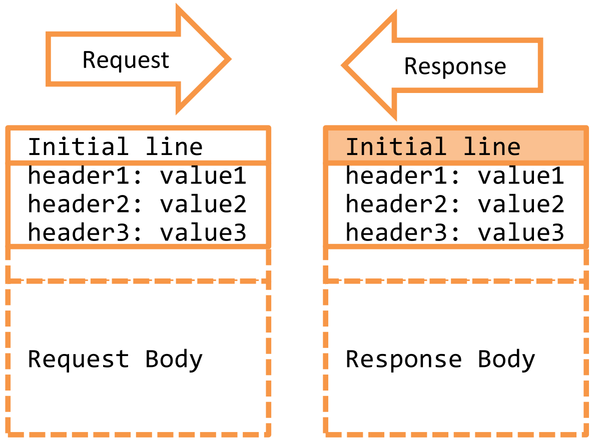


- 1xx – Informational
- 2xx – Success
- 3xx – Redirection
- 4xx – Client Error
- 5xx – Server Error

Response Status Codes

- 1xx – Informational
- 2xx – Success
- 3xx – Redirection
- 4xx – Client Error
- 5xx – Server Error

- 100 Continue
- 101 Switching Protocols
- **200 OK**
- 201 Created
- 202 Accepted
- 203 Non-Authoritative Information
- 204 No Content
- 205 Reset Content
- 300 Multiple Choices
- **301 Moved Permanently**
- 302 Found
- 303 See Other
- 305 Use Proxy
- **307 Temporary Redirect**
- 400 Bad Request
- 402 Payment Required
- 403 Forbidden
- **404 Not Found**
- 405 Method Not Allowed
- 406 Not Acceptable
- 408 Request Timeout
- 410 Gone
- 411 Length Required
- 413 Payload Too Large
- 414 URI Too Long
- 415 Unsupported Media Type
- 417 Expectation Failed
- 426 Upgrade Required
- **500 Internal Server Error**
- 501 Not Implemented
- 502 Bad Gateway
- 503 Service Unavailable
- 504 Gateway Timeout
- 505 HTTP Version Not Supported



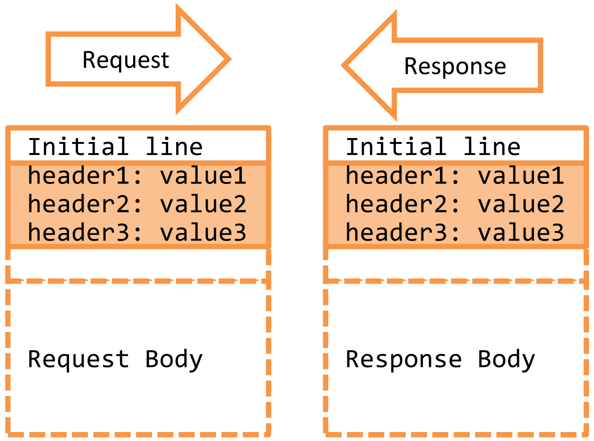
Request

```
Initial line
header1: value1
header2: value2
header3: value3

Request Body
```

Response

```
Initial line
header1: value1
header2: value2
header3: value3

Response Body
```

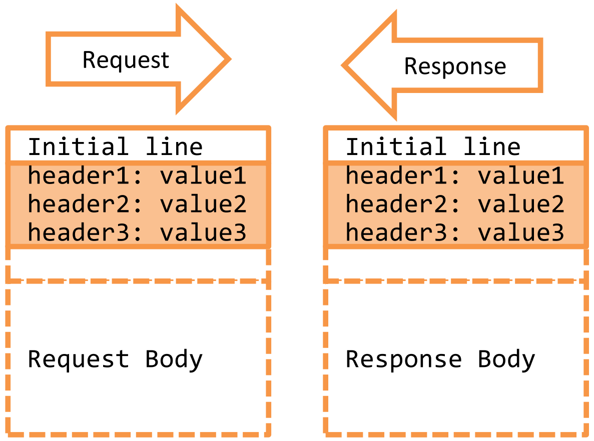
Header lines



- Information about the request/response
- Information about the object sent in the message body
- One line per header
- `Header-Name: header-value`
- HTTP/1.1 defines 46 headers. Only 1 is mandatory in all requests:
  - `Host:`

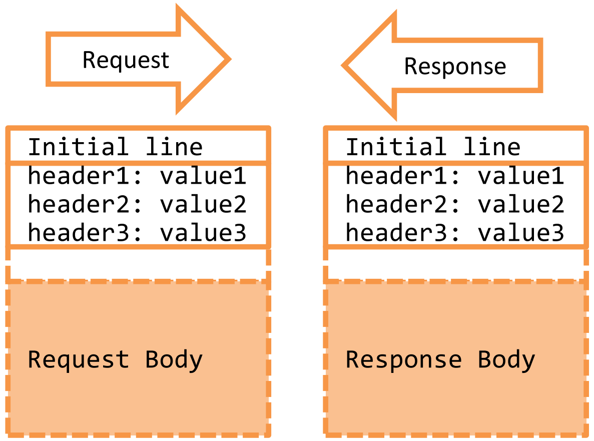
https://developer.mozilla.org/en-US/docs/Web/HTTP/Headers

Header lines



- Main categories
  - Authentication, Caching, Client hints, Conditionals, Connection management, Content negotiation, Controls, **Cookies**, **CORS**, Do Not Track, Downloads, **Message body information**, Proxies, **Redirects**, Request context, Response context, Range requests, Security, Server-sent events, Transfer coding, WebSockets, …
- Full list: https://developer.mozilla.org/en-US/docs/Web/HTTP/Headers

Message body



Request

Initial line
header1: value1
header2: value2
header3: value3

Request Body

Response

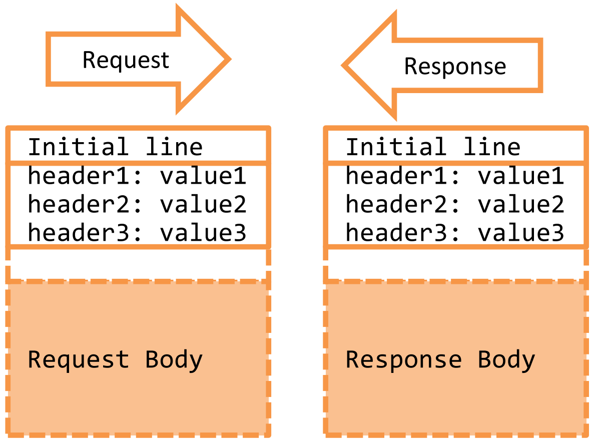
Initial line
header1: value1
header2: value2
header3: value3

Response Body

- Data sent after the header lines
  - **Request:** data entered in a form, a file to upload, …
  - **Response:** the resource returned to the client
    - Images
    - text/plain, text/html
    - …
- `Content-Type` indicates the media type of the resource
  - `Content-Type: text/html; charset=UTF-8`
  - `Content-Type: application/json`
  - `Content-Type: multipart/form-data; boundary=something`
  - `Content-Type: application/x-www-form-urlencoded`
- `Content-Encoding:` the compression (e.g., `gzip`) applied to the body

Content-Type Examples

Content-Type	Body
text/plain	Plain text
text/xml	XML
text/html	**HTML**
image/png	PNG image
audio/basic	Wave audio
audio/mpeg	MPEG audio (MP3)
video/quicktime	Quicktime Video
application/pdf	Adobe PDF document
application/javascript	JavaScript
application/vnd.ms-powerpoint	PowerPoint file
application/json	**JSON**

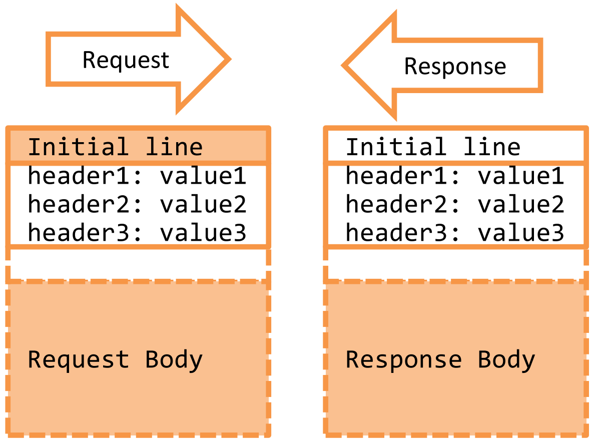


```
Initial line
header1: value1
header2: value2
header3: value3

Request Body
```

```
Initial line
header1: value1
header2: value2
header3: value3

Response Body
```

https://developer.mozilla.org/en-US/docs/Web/HTTP/Basics_of_HTTP/MIME_types

HTTP Methods



```
Initial line
header1: value1
header2: value2
header3: value3
```

```
Initial line
header1: value1
header2: value2
header3: value3
```

Method	Request Body	Response Body	Idempotent	HTML Forms
GET	No	Yes – resource content	Yes	Yes
HEAD	No	No	Yes	No
POST	Yes – form data or application data	Yes (usually modification results)	No	Yes
PUT	Yes – application data	Yes	Yes	No
DELETE	May	May	Yes	No

https://developer.mozilla.org/en-US/docs/Web/HTTP/Methods

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