Web Technologies

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HTTP

HyperText Transfer Protocol

HTTP

- Evolution of HTTP
- Uniform Resource Identifier (URI)
  - Uniform Resource Locator (URL)
  - Uniform Resource Names (URN)
- Basic operations
- Message Format and Status Codes

HTTP (HyperText Transfer Protocol)

- HTTP is a request/response standard of a client and a server
- Typically, an HTTP client initiates a request
- Resources to be accessed by HTTP are identified using Uniform Resource Identifiers (URIs)

Evolution of HTTP

HTTP/0.9 – The one-line protocol

- The initial version of HTTP had no version number
- HTTP/0.9 is extremely simple
- **Requests** consist of a single line and start with the only possible method **GET** followed by the **path** to the resource

```
1 | GET /mypage.html
```

HTTP/0.9 – The one-line protocol

- **Requests** consist of a single line and start with the only possible method **GET** followed by the **path** to the resource

```
1 | GET /mypage.html
```

- The **response** is extremely simple too: it only consisted of the file itself.

```
1 | <HTML>
2 | A very simple HTML page
3 | </HTML>
```

HTTP/0.9 – The one-line protocol

Request

```
1 | GET /mypage.html
```

Response

```
1 | <HTML>
2 | A very simple HTML page
3 | </HTML>
```

HTTP/0.9 is extremely simple:

- **no HTTP headers**, meaning that only HTML files could be transmitted, but no other type of documents.
- **no status or error codes:** in case of a problem, a specific HTML file was send back with the description of the problem contained in it, for human consumption.

HTTP/1.0 – Building extensibility

- **Versioning information** is now sent within each request
  - `HTTP/1.0`
- A **status code** line is also sent at the beginning of the response
- **HTTP headers** (request / response)
  - flexible and extensible
  - other documents than plain HTML files (`Content-Type` header).

```
GET /mypage.html HTTP/1.0
User-Agent: NCSA_Mosaic/2.0 (Windows 3.1)

200 OK
Date: Tue, 15 Nov 1994 08:12:31 GMT
Server: CERN/3.0 libwww/2.17
Content-Type: text/html
<HTML>
A page with an image
  <IMG SRC="/myimage.gif">
</HTML>
```

HTTP/1.0 – Building extensibility

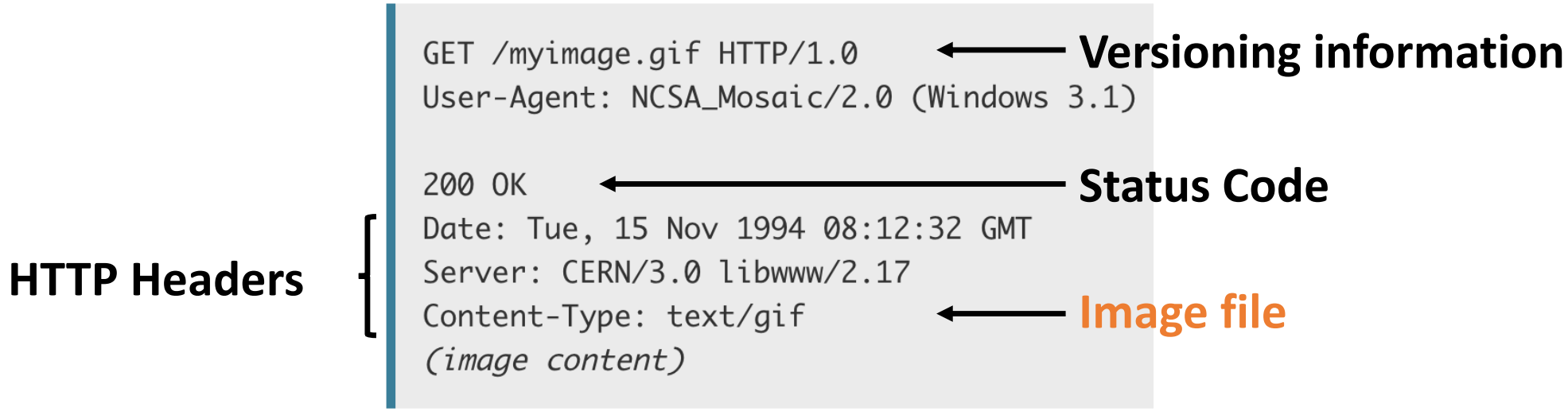
HTTP Headers

```
1  GET /mypage.html HTTP/1.0
2  User-Agent: NCSA_Mosaic/2.0 (Windows 3.1)
3
4  200 OK
5  Date: Tue, 15 Nov 1994 08:12:31 GMT
6  Server: CERN/3.0 libwww/2.17
7  Content-Type: text/html
8  <HTML>
9  A page with an image
10   <IMG SRC="/myimage.gif">
11 </HTML>
```

Versioning information

Status Code

HTTP/1.0 – Building extensibility



HTTP/1.0 – Building extensibility

- **try-and-see** approach (1991-1995)
- A lot of interoperability problems
- Definition of HTTP/1.0 (RFC 1945, Nov 1996)
  - RFC 1945: https://tools.ietf.org/html/rfc1945
  - No official standard.

HTTP/1.1 – The standardized protocol

- **First standardized version** of HTTP
  - HTTP/1.1 (January 1997)
  - RFC 2068 (https://tools.ietf.org/html/rfc2068)
- A **connection** can be **reused**
- **Pipelining** (allow to send a second request before the answer for the first one is fully transmitted)
- Chunked responses
- Cache control mechanisms
- Content negotiation

HTTP/1.1 – The standardized protocol

```
GET /en-US/docs/Glossary/Simple_header HTTP/1.1
Host: developer.mozilla.org
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.9; rv:50.0) Gecko/20100101 Firefox/50.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate, br
Referer: https://developer.mozilla.org/en-US/docs/Glossary/Simple_header

200 OK
Connection: Keep-Alive
Content-Encoding: gzip
Content-Type: text/html; charset=utf-8
Date: Wed, 20 Jul 2016 10:55:30 GMT
Etag: "547fa7e369ef56031dd3bff2ace9fc0832eb251a"
Keep-Alive: timeout=5, max=1000
Last-Modified: Tue, 19 Jul 2016 00:59:33 GMT
Server: Apache
Transfer-Encoding: chunked
Vary: Cookie, Accept-Encoding

(content)
```

HTTP/1.1 – The standardized protocol

Extensions (over 15 years):

- Using HTTP for secure transmissions
- Using HTTP for complex applications
  - WebDAV (1996)
  - Representational state transfer or REST (2000)

HTTP/2 – A protocol for greater performance

- **Binary protocol** (no longer be read and created manually)
- **Multiplexed protocol** (parallel requests can be handled)
- It compresses headers (remove duplication and overhead of data transmitted)
- Server push (It allows a server to populate data in a client cache)
- Officially standardized, in May 2015

URI

Uniform Resource Identifier

URL (Uniform Resource Locator)

- A URL is nothing more than the address of a given unique resource on the Web

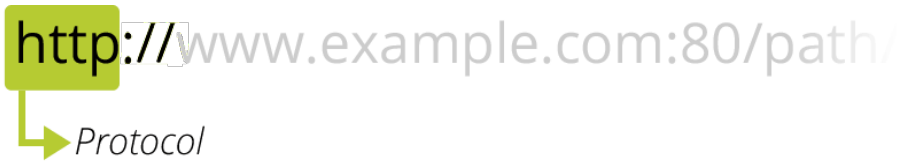
```
https://developer.mozilla.org
https://developer.mozilla.org/en-US/docs/Learn/
https://developer.mozilla.org/en-US/search?q=URL
```

URL Anatomy

- A URL is composed of different parts, some mandatory and others optional.

```
http://www.example.com:80/path/to/myfile.html?key1=value1&key2=value2#SomewhereInTheDocument
```

http://www.example.com:80/path/to/myfile.html?key1=value1&key2=value2#SomewhereInTheDocument

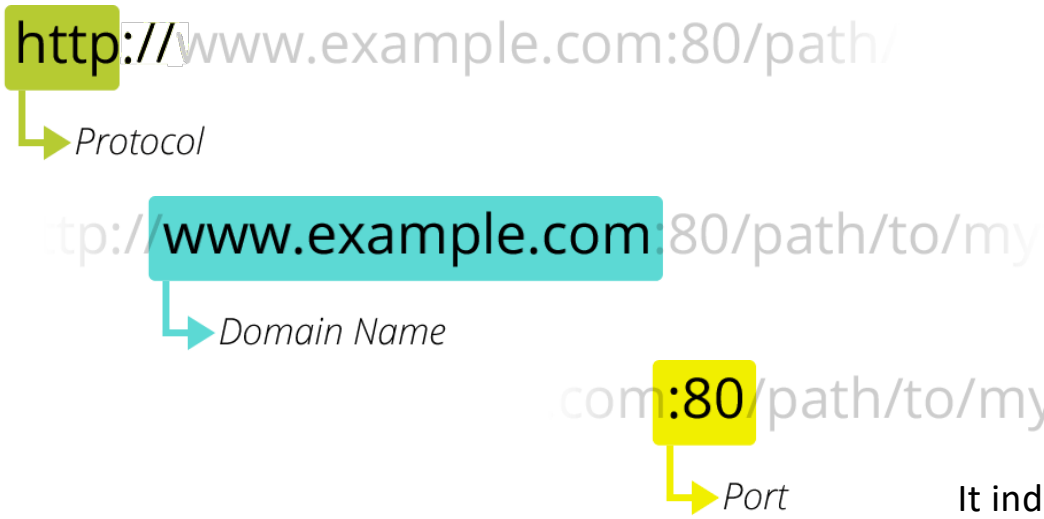


A protocol is a set method for exchanging or transferring data around a computer network, e.g http, https

http://www.example.com:80/path/to/myfile.html?key1=value1&key2=value2#SomewhereInTheDocument

It indicates which Web server is being requested

http://www.example.com:80/path/to/myfile.html?key1=value1&key2=value2#SomewhereInTheDocument

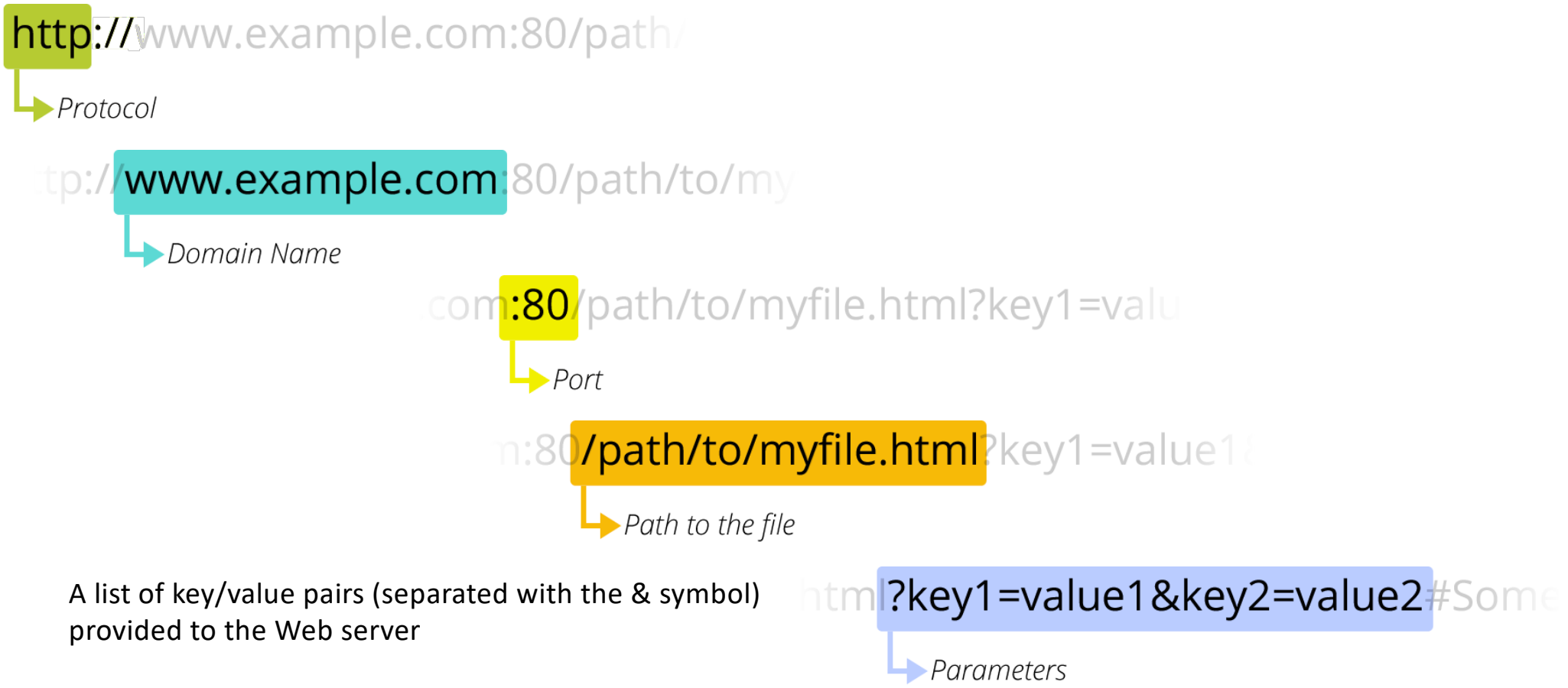


It indicates the technical "gate" used to access the resources on the web server.

http://www.example.com:80/path/to/myfile.html?key1=value1&key2=value2#SomewhereInTheDocument

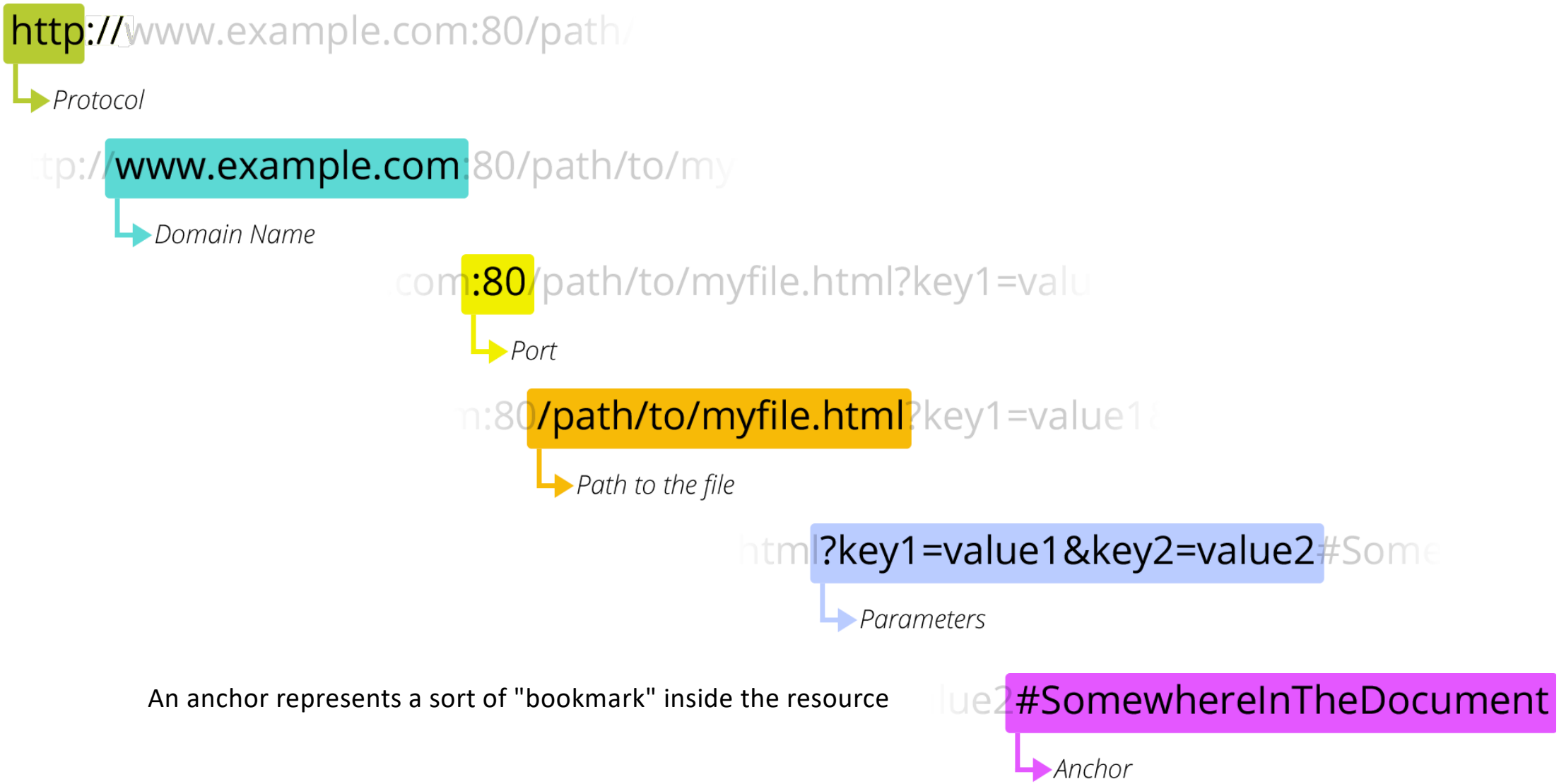
It is the path to the resource on the Web server

http://www.example.com:80/path/to/myfile.html?key1=value1&key2=value2#SomewhereInTheDocument

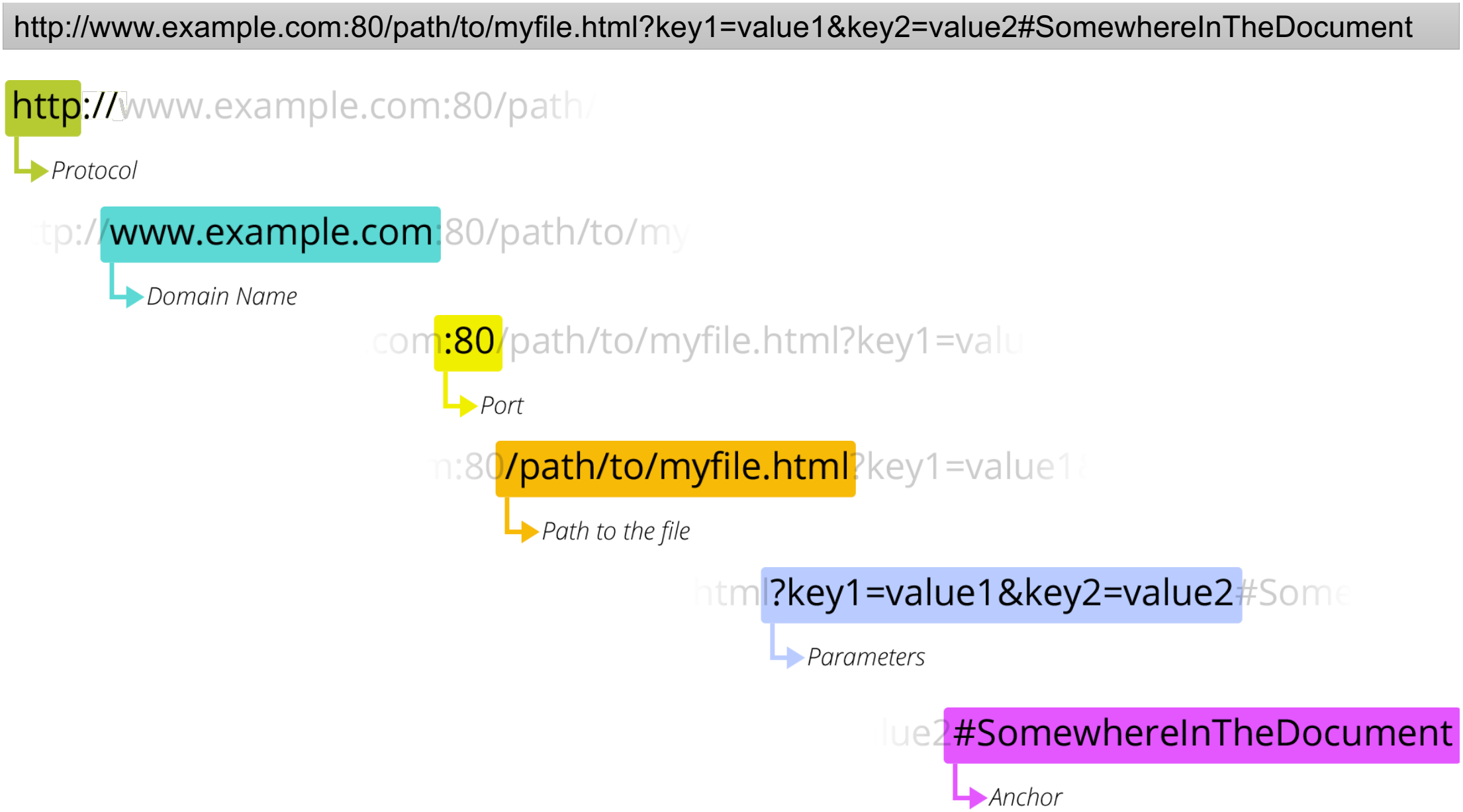


A list of key/value pairs (separated with the & symbol) provided to the Web server

http://www.example.com:80/path/to/myfile.html?key1=value1&key2=value2#SomewhereInTheDocument



An anchor represents a sort of "bookmark" inside the resource


http://www.example.com:80/path/to/myfile.html?key1=value1&key2=value2#SomewhereInTheDocument
http://
Protocol
www.example.com
Domain Name
:80
Port
/path/to/myfile.html
Path to the file
?key1=value1&key2=value2
Parameters
#SomewhereInTheDocument
Anchor

http://www.example.com:80/path/to/myfile.html?key1=value1&key2=value2#SomewhereInTheDocument

http:// — Protocol

postal service

www.example.com — Domain Name

City or town

:80 — Port

Zip code

Building

/path/to/myfile.html — Path to the file

Extra info (number apartment)

?key1=value1&key2=value2 — Parameters

Receiver

#SomewhereInTheDocument — Anchor

Request Methods

- HTTP defines methods (sometimes referred to as "verbs") indicating the desired action to be performed on the identified **resource**.
  - HEAD
  - **GET**
  - **POST**
  - PUT
  - DELETE
  - TRACE
  - OPTIONS
  - CONNECT
  - PATCH

Safe methods

- HEAD, GET, OPTIONS and TRACE are defined as safe (no side effects).
- POST, PUT and DELETE are intended for actions which may cause side effects either on the server.

Status codes

- The first line of the HTTP response is called the status line
- The way the user agent handles the response primarily depends on the code and secondarily on the response headers
  - Success: 2xx
  - Redirection: 3xx
  - Client-Side Error: 4xx
  - Server-Side Error: 5xx

Practice

Request the following resource using HTTP:

```
https://www.w3.org/History/19921103-hypertext/hypertext/WWW/TheProject.html
```

Check for:

- Method
- Versioning information
- Status code

HTTP session state

- HTTP is a stateless protocol.
- Hosts do not need to retain information
- about users between requests.
- Statelessness is a scalability property.
- For example, when a host needs to customize the content of a website for a user. Solution:
  - Cookies
  - Sessions
  - Hidden variables (when the current page is a form)
  - URL encoded parameters

Cookie

- Cookie is a small piece of text stored on a user's computer by a web browser.
- A cookie consists of one or more name- value pairs containing bits of information such as user preferences.
- A cookie can be used for:
  - authenticating,
  - session tracking, and
  - remembering specific information about users