Internet and HTTP

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sli.do

#python-web

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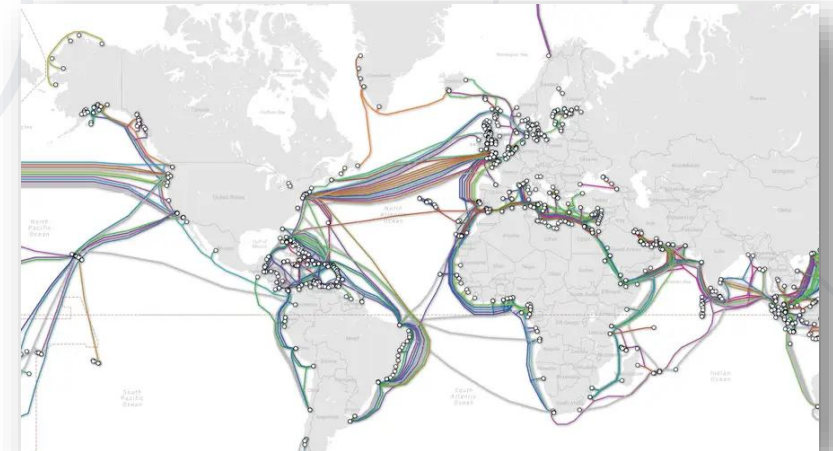5. **MIME**

6. **HTTP Request** and **HTTP Response**

Introduction

An Introduction to the Internet

What is the Internet?

- **Vast network** that connects billions of devices together all over the globe

- Through **fiber optics**, **copper**, **satellites** or **cell phone network**

- We get indirectly **connected** through **ISP**s (**I**nternet **S**ervice **P**roviders)

Networks and Internet

- **Network** is a group of **two or more devices** that can communicate

- **The internet** is made of hundreds of thousands of **networks**

- These different systems **connect to each other**, **communicate with each other**, and **work together** because of standards for how data is sent

Web Server Work Model

Web Client

Web Server

Technology

Request

Response

Web Resources
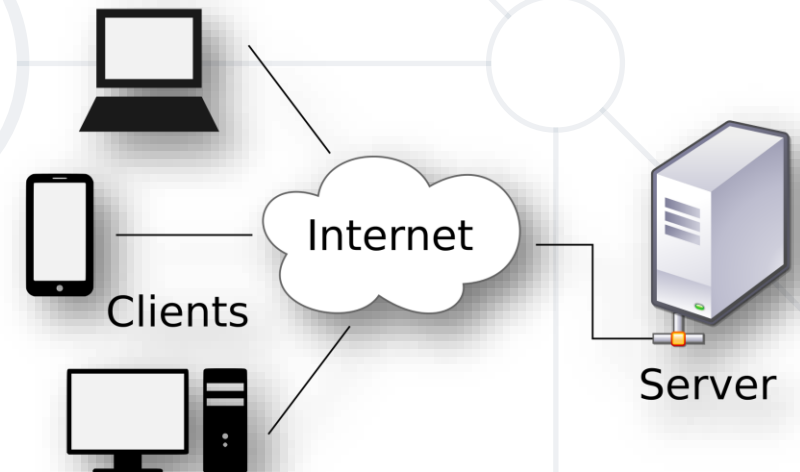
HTML, PDF, JPG...

Database

Important Definitions

Servers and Clients

- **Servers** are the machines that provide services to other machines

- **Clients** are the machines that are used to connect to those services

Network Protocol

- Set of **rules** and **standards**, that allow communication between network devices

- Include **mechanisms** for devices to **identify** and make **connections** with each other

- Example for standard network protocols:
  - TCP, UDP, IP, ARP
  - HTTP, FTP, TFTP, SMTP, SSH

Packets

- Every message, file or stream of information **sent over computer networks** is broken down into small chunks called **packets**

- Each packet contains **important information** inside of it called a **header**:

    - Contents

    - Origin

    - Destination

From: 123.45.67.89

Internet Protocol (IP)

- All the devices on the Internet have **IP Addresses**

- Each IP address is **unique** to each computer or device at the edge of the network

IP Address:
192.168.10.5

IP Address:
192.168.0.1

IP Address

- An **IP Address** has many parts, organized in a hierarchy

Subnetworks

192.168.14.120

Device address

- This version of IP Addressing is called **IPv4**
  - Provides more than 4 billion **32 bits** unique addresses

Domain Name Server

- The **domain name** is a human way to access IP addresses for devices and websites around the world

- When a domain name is entered in the browser, a request is made to the **DNS**

IP Address	Domains
216.58.214.46	Google.com
217.174.159.195	Softuni.bg

HTTP Basics

Web Communication Explained

Hyper Text Transfer Protocol

Request

Response

HTTP

TCP

IP

Ethernet

Media (wires / air / fiber)

HTTP

TCP

IP

Ethernet
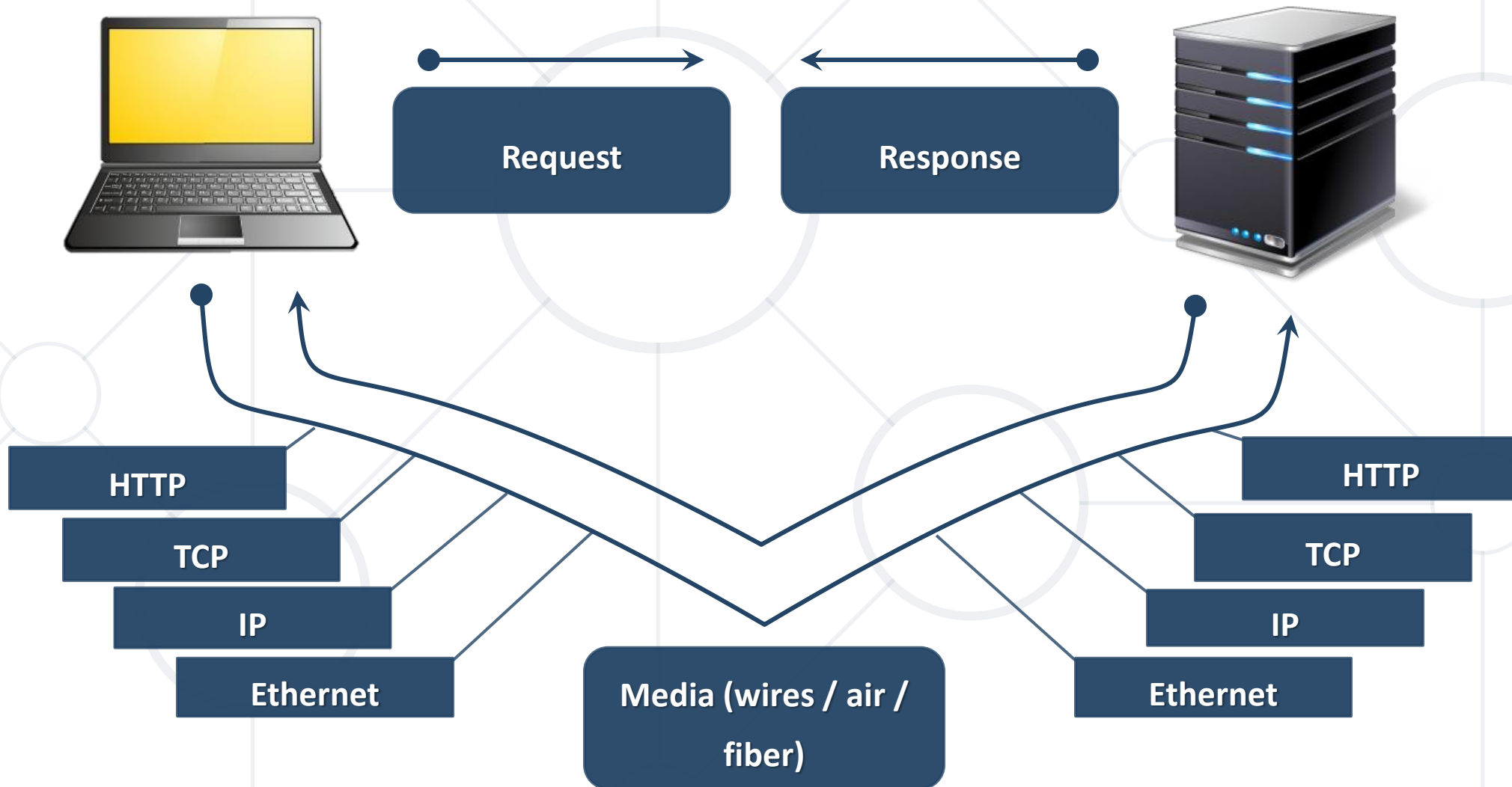
HTTP Request Methods

Method	Description
POST	Create / store a resource
GET	Read / retrieve a resource
PUT	Update / modify a resource
DELETE	Delete / remove a resource

The four basic functions of persistent storage

Other HTTP Methods
CONNECT
HEAD
OPTIONS
TRACE

HTTP Conversation: Example

- HTTP **request**:

```
GET /courses/python HTTP/1.1
Host: softuni.bg
User-Agent: Mozilla/5.0
<CRLF>
```

The empty line denotes the end of the request headers

- HTTP **response**:

```
HTTP/1.1 200 OK
Date: Mon, 12 Jul 2024 13:09:03 GMT
Server: Microsoft-HTTPAPI/2.0
Last-Modified: Mon, 11 Jul 2024 15:33:23 GMT
Content-Length: 54
<CRLF>
<html><title>Hello</title>
Welcome to our site</html>
```

The empty line denotes the end of the response headers

URL

Uniform Resource Locator

Uniform Resource Locator (URL)

- A **URL** is a reference to a web resource that specifies its location on a network and a mechanism for retrieving it

- A URL is a specific type of URI (**Uniform Resource Identifier**)

`http://localhost:8080/demo/index.html?id=27&lang=en#lecture`

| Protocol | Host | Port | Path | Query String | Fragment |

URL Encoding

- URLs are encoded according RFC 1738:
  - Safe URL characters: **[0-9a-zA-Z]**, **$**, **-**, **_**, **.**, **+**, *****, **'**, **(**, **)**, **,**, **!**

- All other characters are escaped by:

```
%[character hex code]
```

  - Space is encoded as "**+**" or "**%20**"

```
Наков-爱-SoftUni
```

  - URL-encoded string:

```
%D0%9D%D0%B0%D0%BA%D0%BE%D0%B2-%E7%88%B1-SoftUni
```

Char	URL Encoding
space	%20
щ	%D1%89
"	%22
#	%23
$	%24
%	%25
&	%26

Tools for Developers

Dev Tools

Tools for Developers – Browser Dev Tools
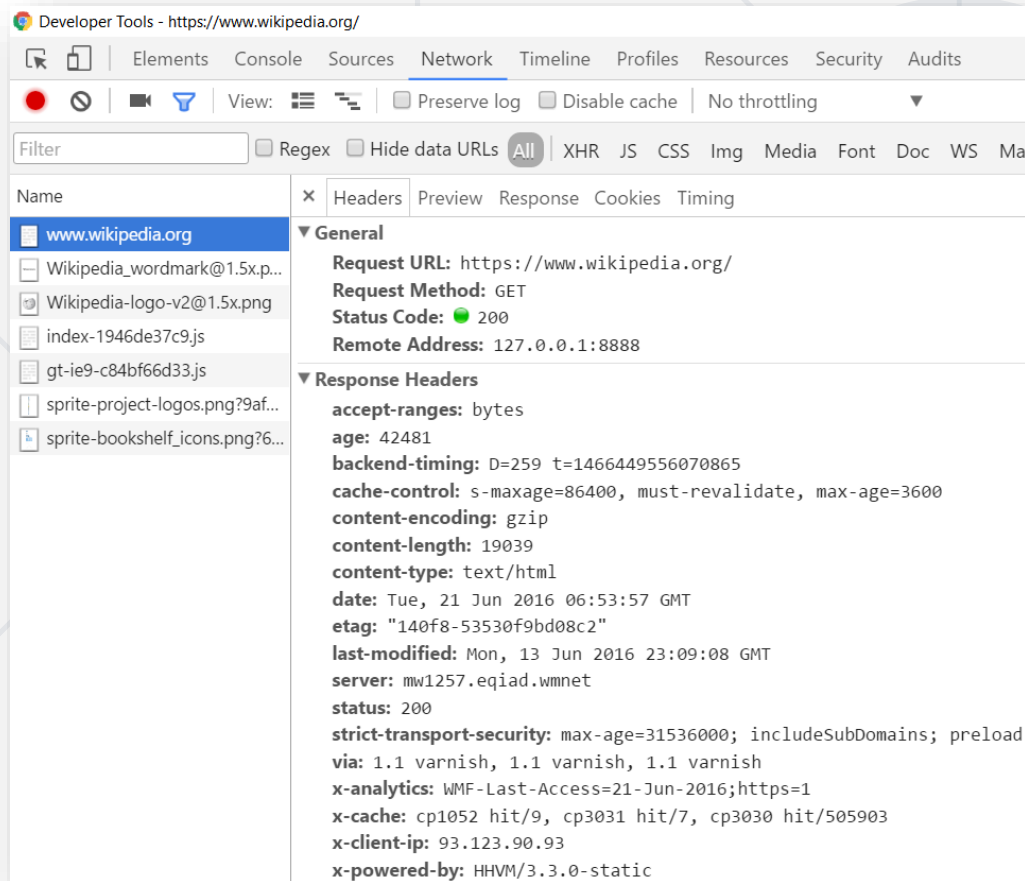
Chrome Developer Tools
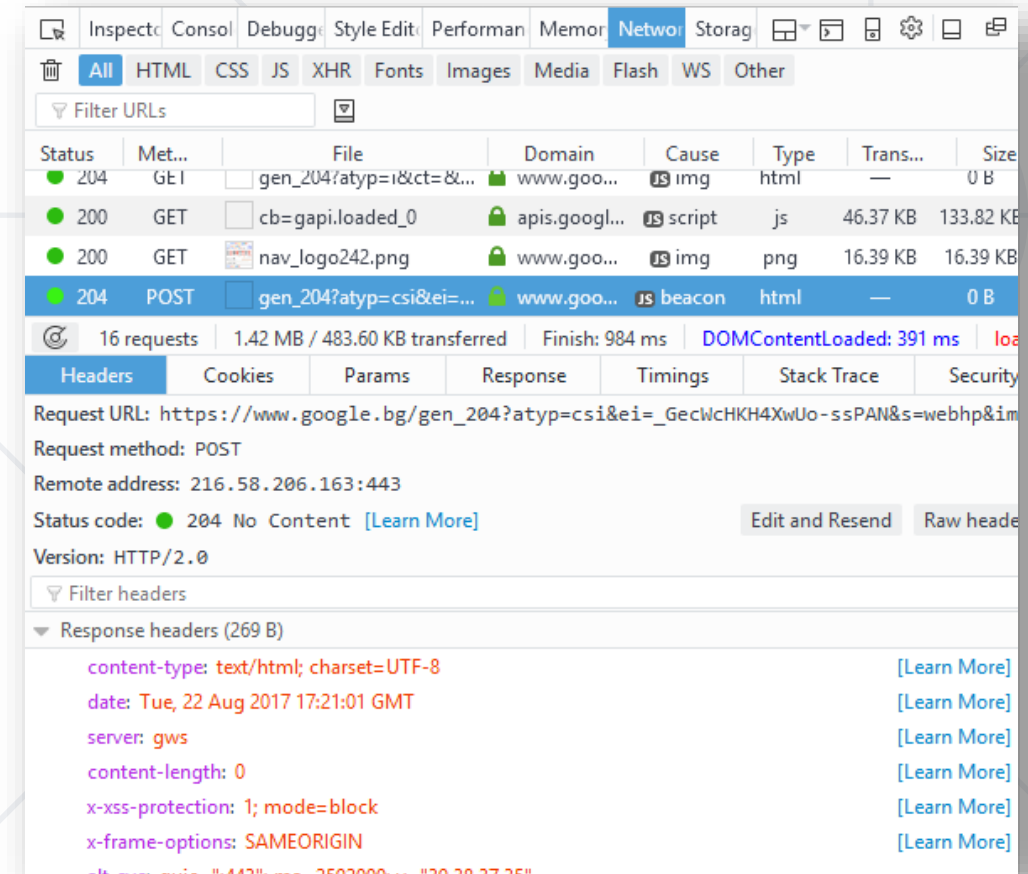
Mozilla Developer Tools

Tools for Developers

Postman – API platform

Rested – Firefox add-on

Postman - Register an Account
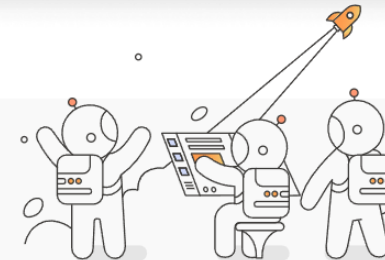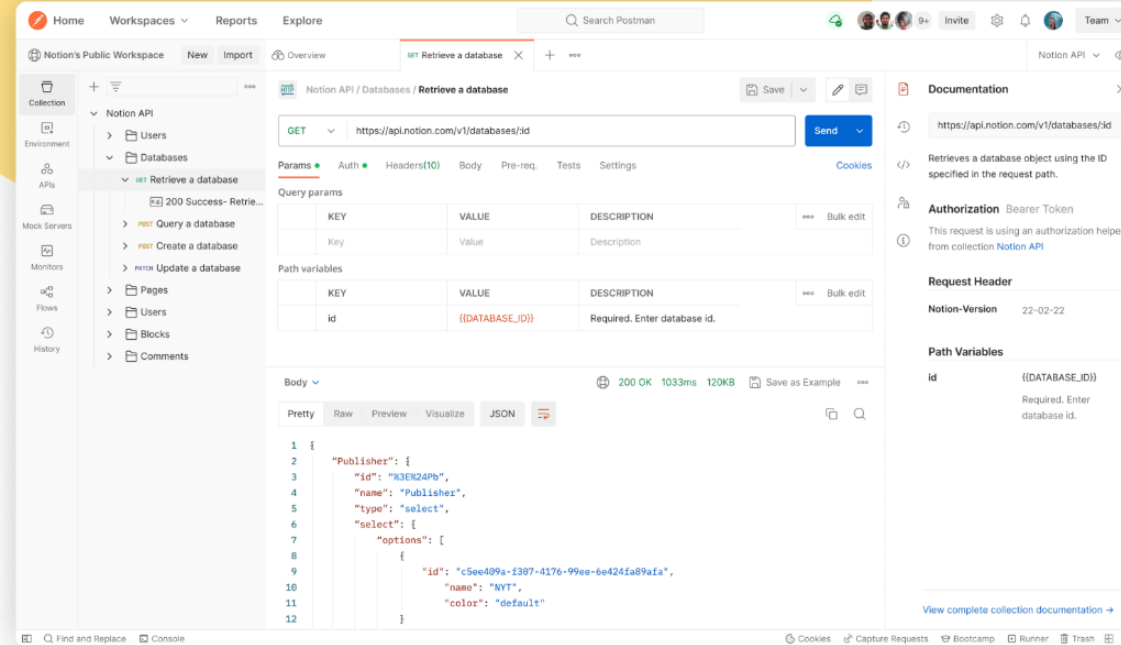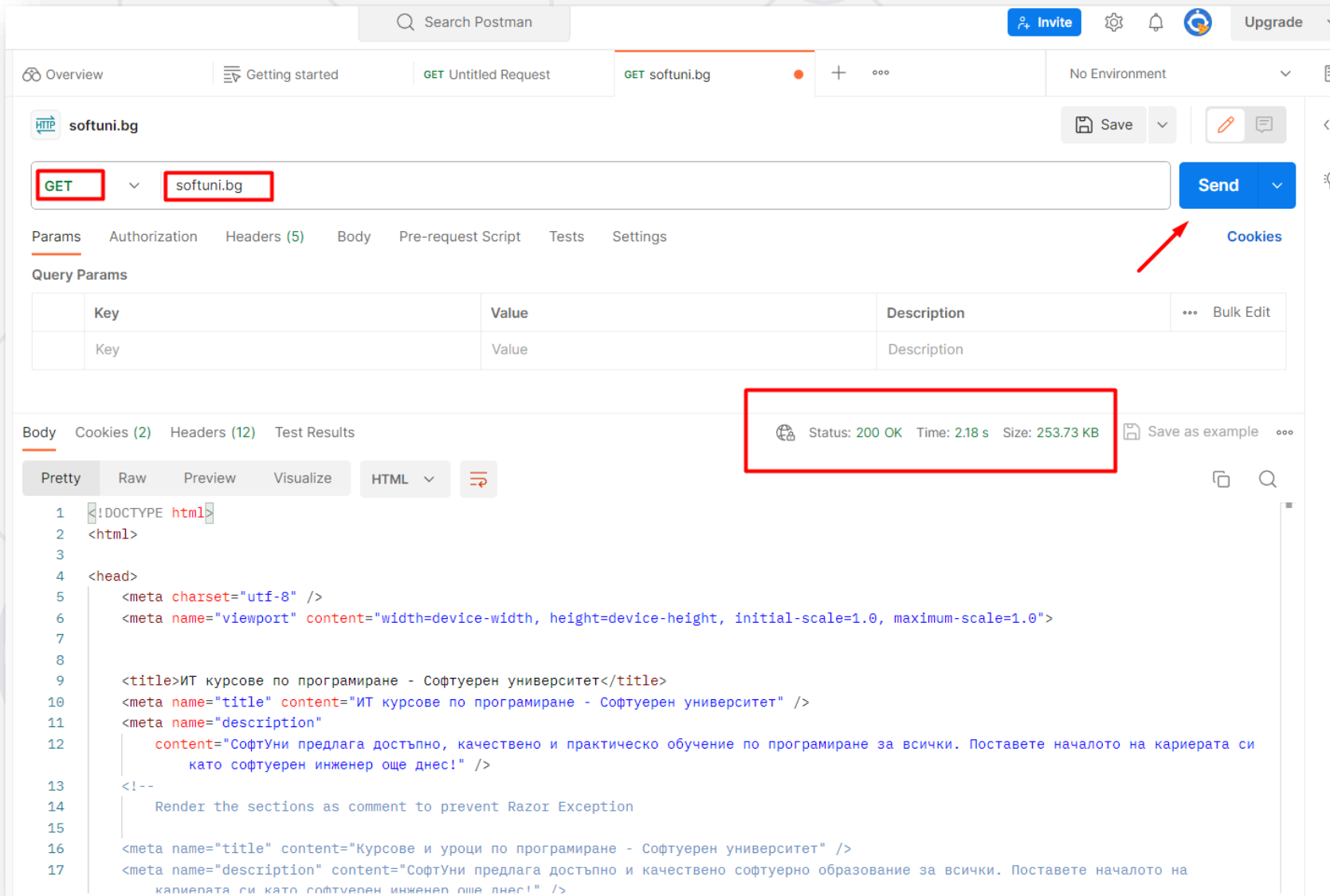
Postman - Usage

Postman - GET Request

Multi-Purpose Internet Mail Extensions

MIME and Media Types

What is MIME?

- **MIME** == Multi-Purpose Internet Mail Extensions

  - Internet standard for encoding resources

  - Originally developed for email attachments

  - Used in many Internet protocols like HTTP and SMTP
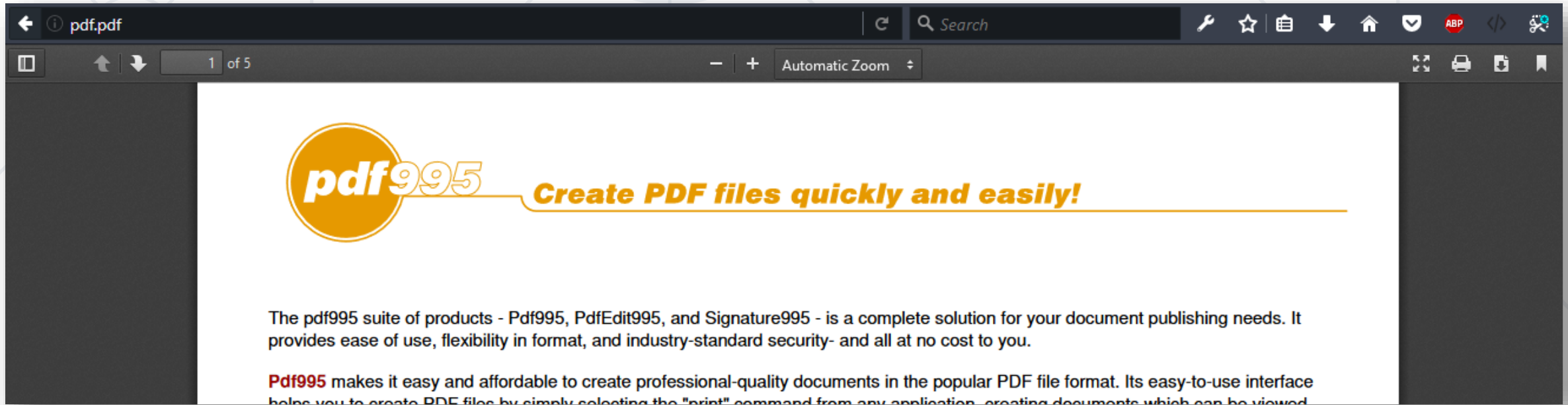
Common MIME Media Types

MIME Type / Subtype	Description
application/json	JSON data
image/png	PNG image
image/gif	GIF image
text/html	HTML
text/plain	Text
text/xml	XML
video/mp4	MP4 video
application/pdf	PDF document

HTTP Request / HTTP Response

HTTP Request Message

- Request message sent by a client consists of:

  - HTTP **request line**

    - Request **method** (GET / POST / PUT / DELETE / …)

    - Resource **URI** (URL)

    - Protocol **version**

  - HTTP **request headers**

    - Additional parameters

  - HTTP **request body** – optional data e.g., posted form fields

```
<method> <resource> HTTP/<version>
<headers>
(empty line)
<body>
```

```
<form method="get" action="/my-action">
    Name: <input type="text" name="name" />
    Age: <input type="text" name="age" />
    <button>Submit</button>
</form>
```

```
GET /my-action? HTTP/1.1
Host: localhost
<CRLF>

```

HTTP request line

HTTP request headers

The request body is empty

POST Request Method - Example

- The **POST** method transfers data in the HTTP body

- **POST** can send text and binary data e.g., upload files

```
POST /login HTTP/1.1
Host: localhost
Content-Length: 59
<CRLF>
username=test&password=top*secret!
<CRLF>
```

HTTP request line

HTTP request headers

The request body holds the submitted form data

HTTP Response Message

- The **response message** sent by the HTTP server consists of:

  - HTTP response **status line**

    - Protocol version

    - Status code

    - Status text

  - Response **headers**

    - Provide meta data about the returned resource

  - Response **body**

    - The content of the HTTP response (data)

```
HTTP/<version> <status code> <status text>
<headers>
<CRLF>
<response body – the requested resource>
```

HTTP Response Codes

- HTTP response code classes
  - **1xx**: informational (e.g., "**100 Continue**")
  - **2xx**: successful (e.g., "**200 OK**", "**201 Created**")
  - **3xx**: redirection (e.g., "**304 Not Modified**", "**301 Moved Permanently**", "**302 Found**")
  - **4xx**: client error (e.g., "**400 Bad Request**", "**404 Not Found**", "**401 Unauthorized**", "**409 Conflict**")
  - **5xx**: server error (e.g., "**500 Internal Server Error**", "**503 Service Unavailable**")

HTTP Response – Example

- Example of **HTTP response** from the Web server:

```
HTTP/1.1 200 OK
```

HTTP response **status line**

```
Date: Fri, 19 Jul 2024 16:09:18 GMT+2
Server: Apache/2.2.14 (Linux)
Accept-Ranges: bytes
Content-Length: 84
Content-Type: text/html
```

HTTP response **headers**

```
<CRLF>
```

```
<html>
  <head><title>Test</title></head>
  <body>Test HTML page.</body>
</html>
```

HTTP response **body**

HTTP Response – Example

- Example of **HTTP response** with **error** result:

```
HTTP/1.1 404 Not Found
```
HTTP response status line

```
Date: Fri, 19 Jul 2024 16:09:18 GMT+2
Server: Apache/2.2.14 (Linux)
Connection: close
Content-Type: text/html
```
HTTP response headers

<CRLF>

```
<html><head><title>404 Not Found</title></head>
<body>
<h1>Not Found</h1>
<p>The requested URL /img/logo.gif was not found on this server.</p>
<hr><address>Apache/2.2.14 Server at Port 80</address>
</body></html>
```
The HTTP response body

Browser Redirection

- HTTP **GET requesting** a moved URL:

```
GET / HTTP/1.1
Host: http://softuni.org
User-Agent: Gecko/20100115 Firefox/3.6
<CRLF>
```
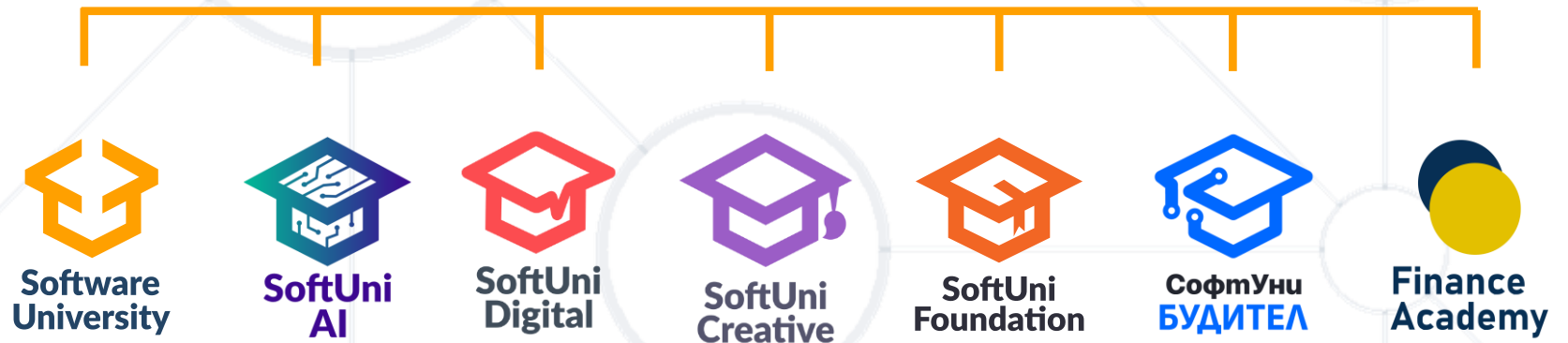
- The following HTTP response (**301 Moved Permanently**) tells the browser to request another URL:

```
HTTP/1.1 301 Moved Permanently
Location: http://softuni.bg
...
```

Summary

- **Internet**, Definitions of Internet
- What is **HTTP**
- What is **URL**
- Browser **Tools** for **Developers**
- **Postman** API Platform
- What is **MIME**

Questions?

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