HTTP Basics

HTTP Request & HTTP Response

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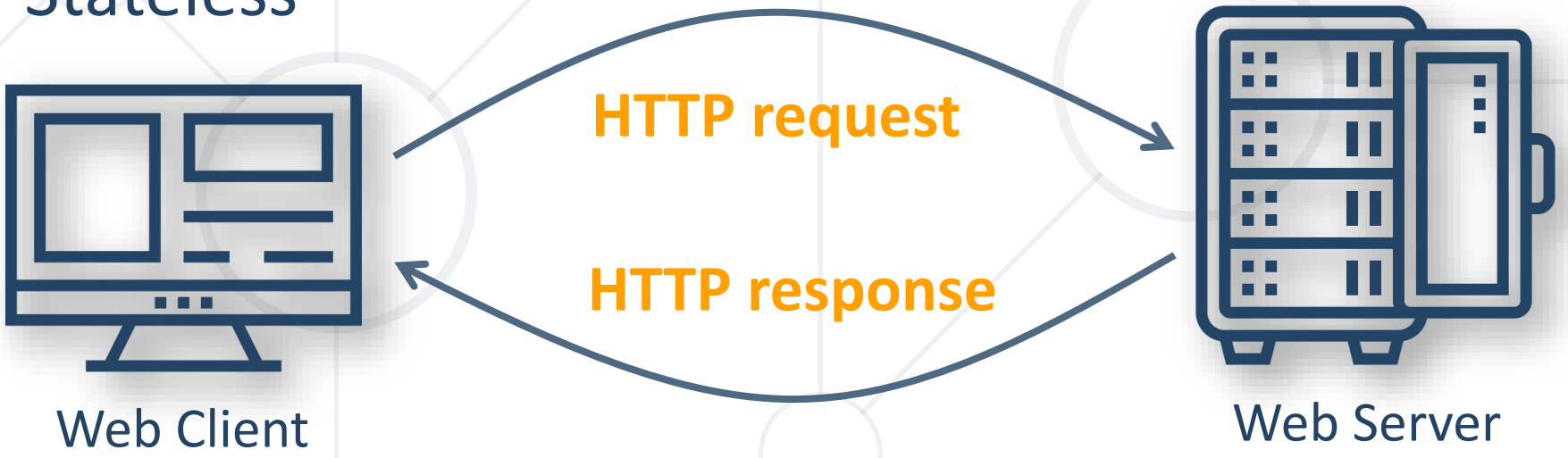
HTTP Protocol – Basics

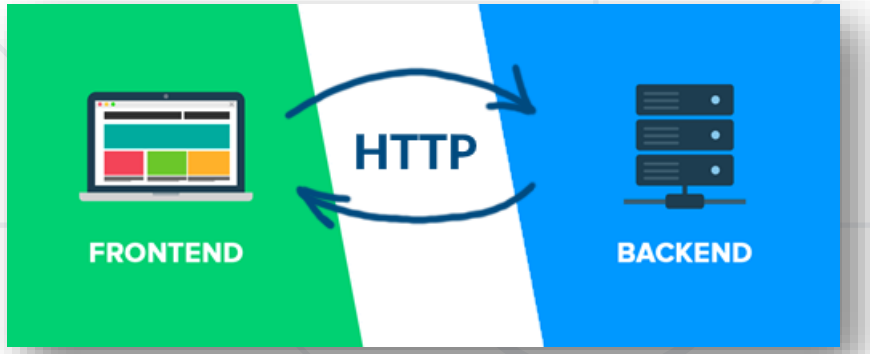
HTTP Basics

- **HTTP** (**H**yperText **T**ransfer **P**rotocol)
  - Text-based client-server protocol for the Internet
  - For transferring Web resources (HTML files, images, styles, etc.)
  - Request-response based, relies on URLs (like https://softuni.org)
  - Stateless



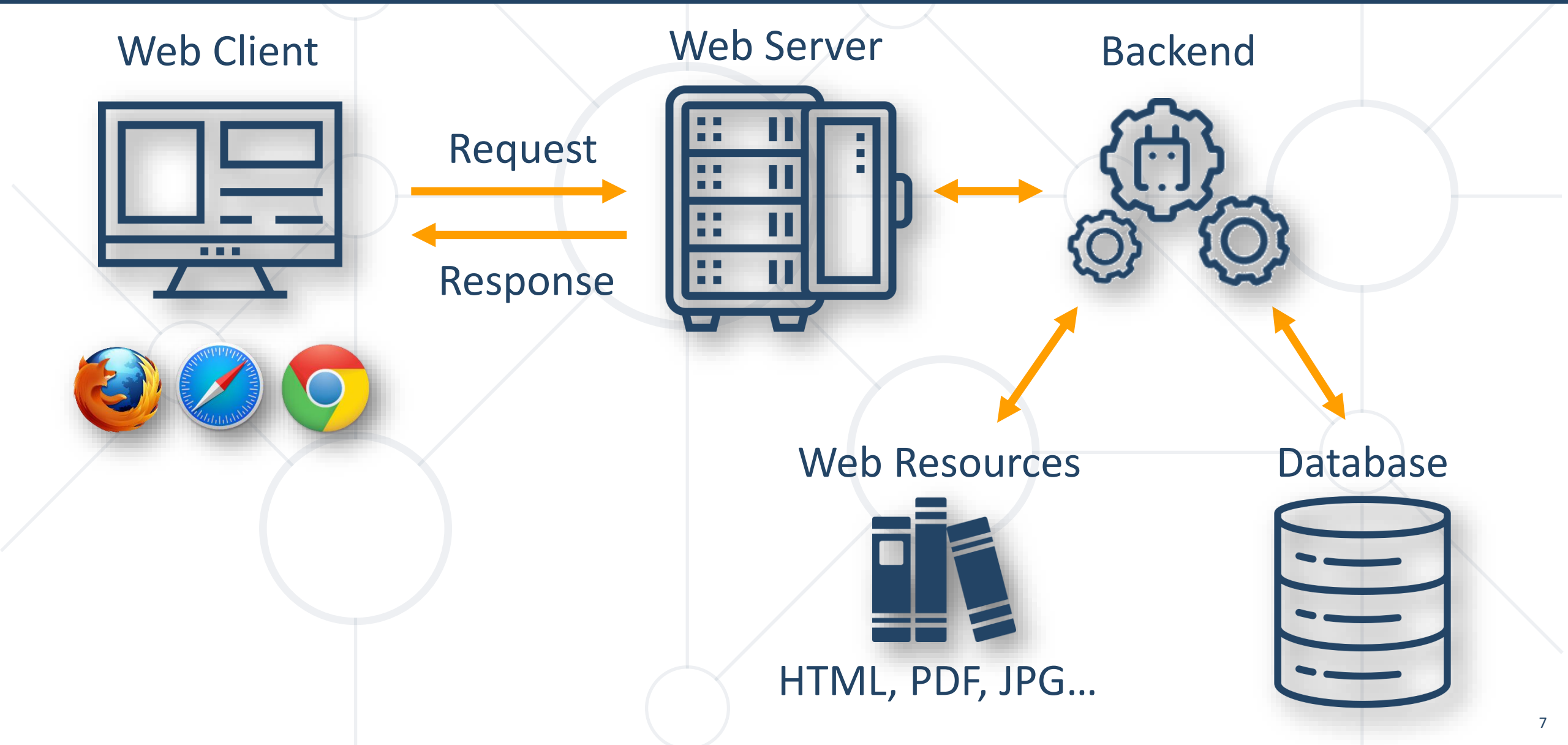
Front-End and Back-End

- **Front-end** and **back-end** separates the modern apps into **client-side** (UI) and **server-side** (data) components
- **Front-end** == client-side components (presentation layer), e.g., React app
  - Implement the **user interface** (UI)
- **Back-end** == server-side components (business logic APIs), e.g., ASP.NET Core
  - Provide **data storage and processing**

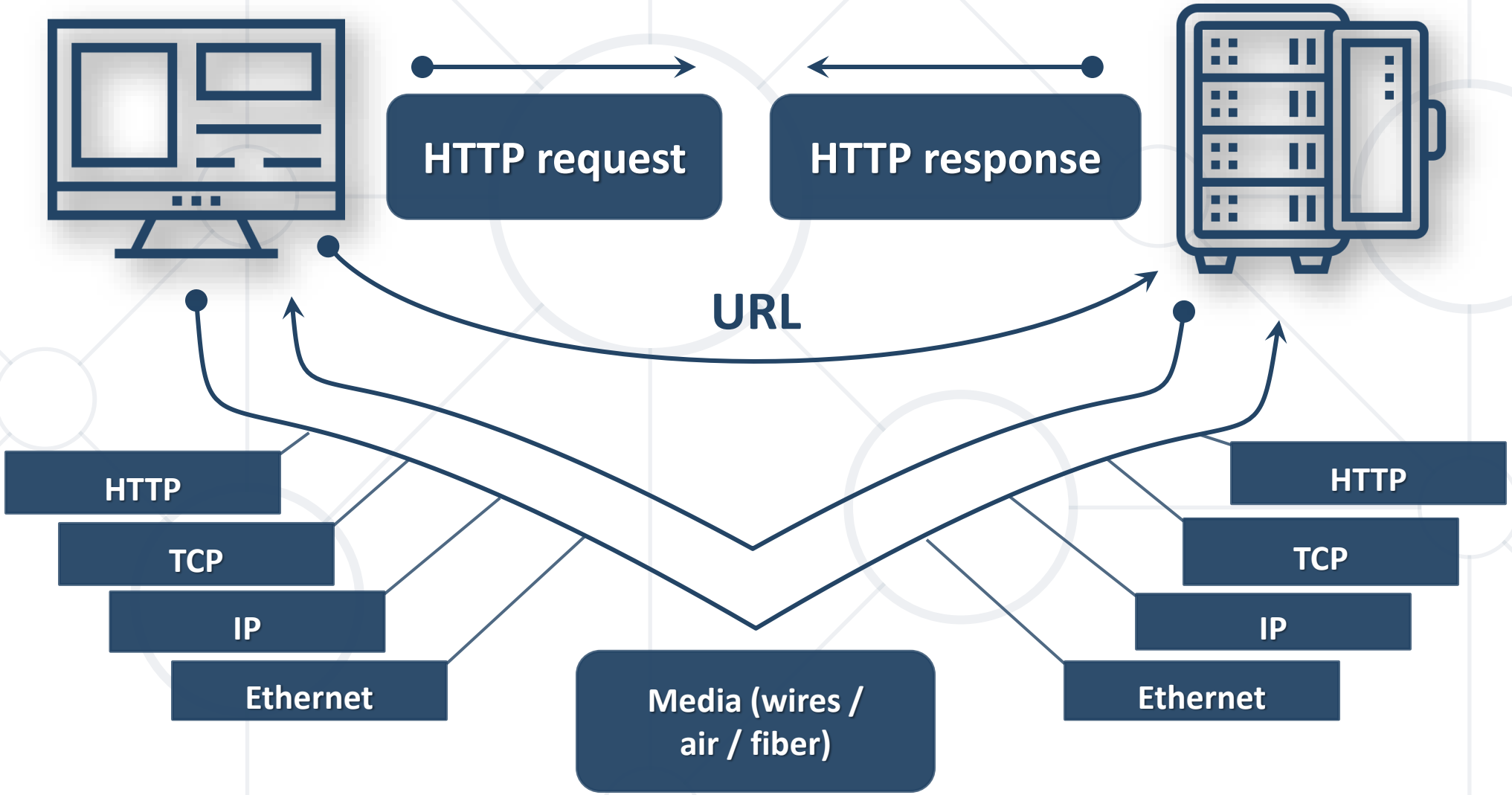


- **HTTP** connects front-end with back-end

The Client-Server Model in Web Apps

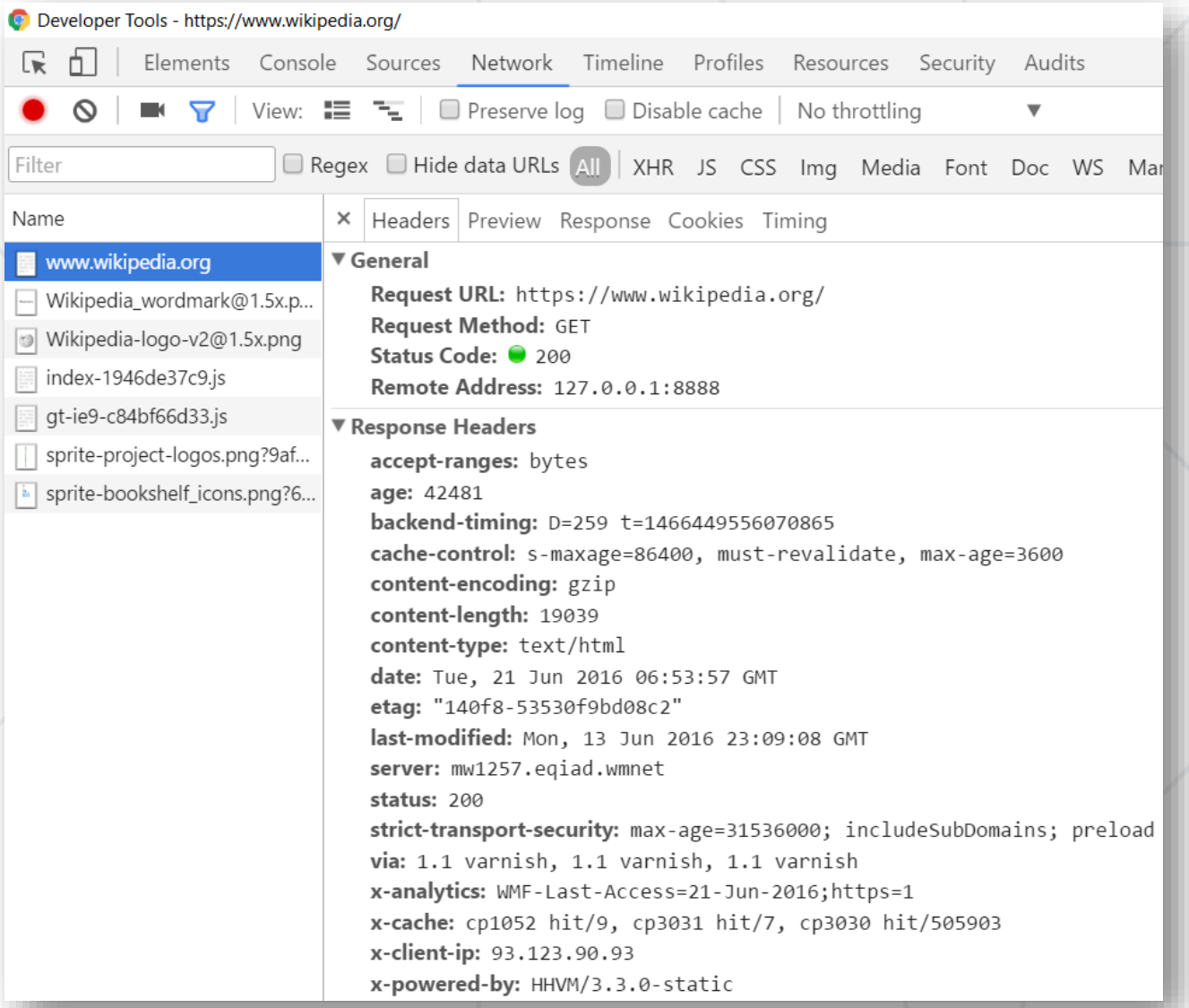


Network Layers and HTTP



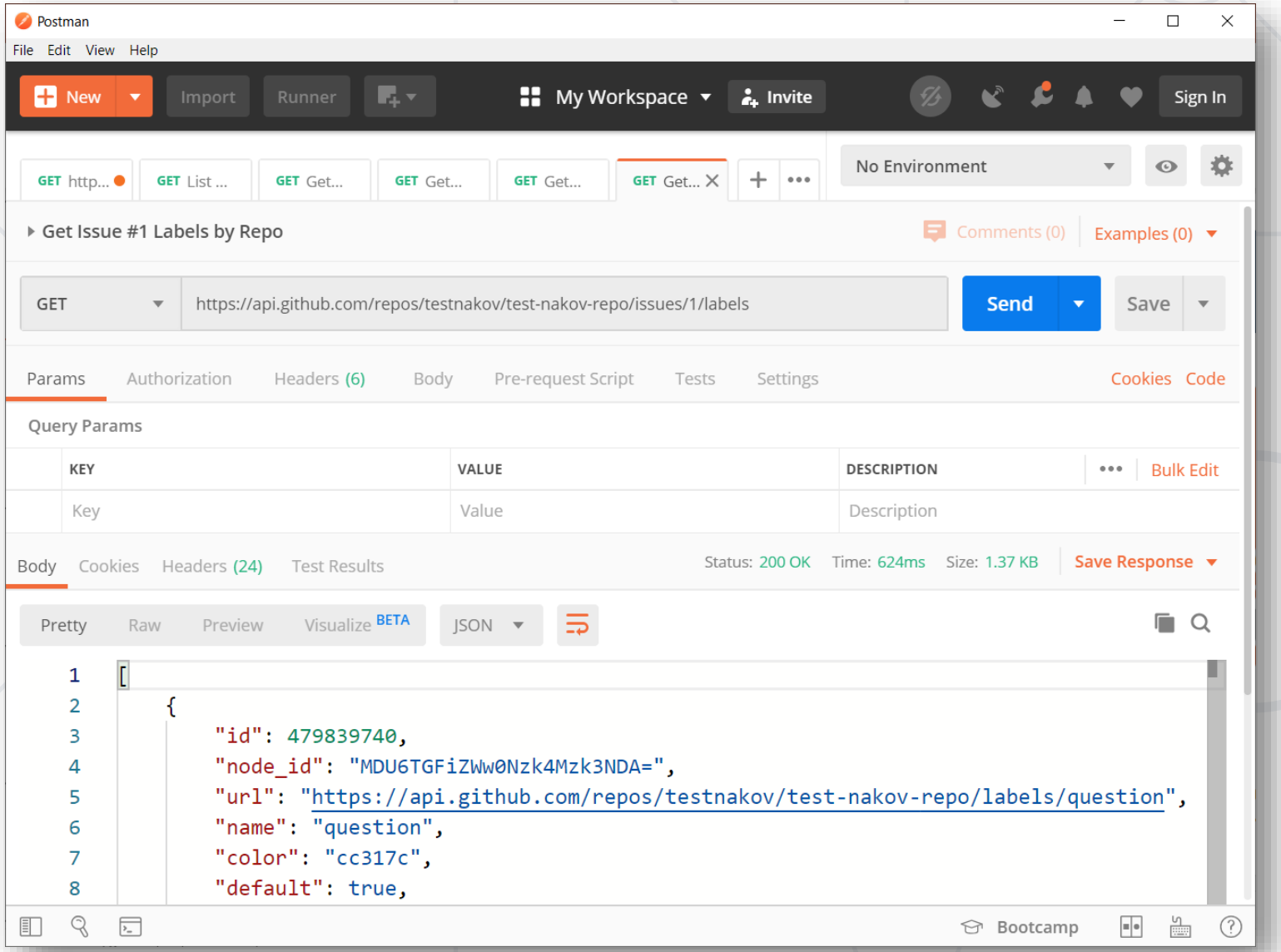
HTTP Dev Tools

HTTP Developer Tools: Network Inspector



- Chrome Developer Tools
  - Press **[F12]** in Chrome
  - Open the [Network] tab
  - Inspect the HTTP traffic

HTTP Developer Tools: HTTP Client Tools



Postman

- HTTP client tool for developers
- Compose and send HTTP requests
- Insomnia Core
- Hoppscotch

HTML Forms

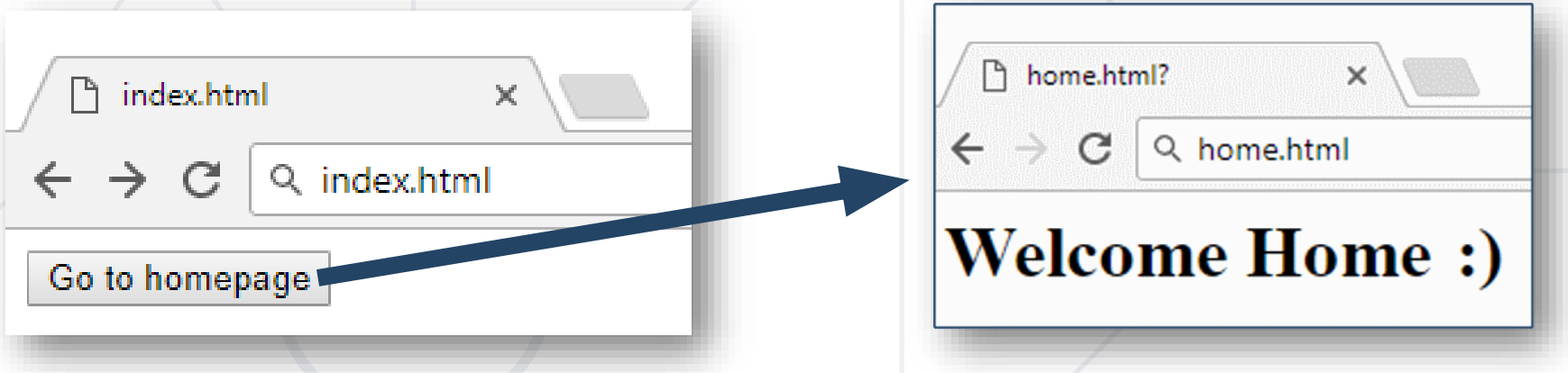
Form Submission: GET and POST

HTML Forms: Action

- The "**action**" attribute defines where to submit the form data

```
<form action="home.html">
  <input type="submit" value="Go to homepage"/>
</form>
```

Relative or full URL

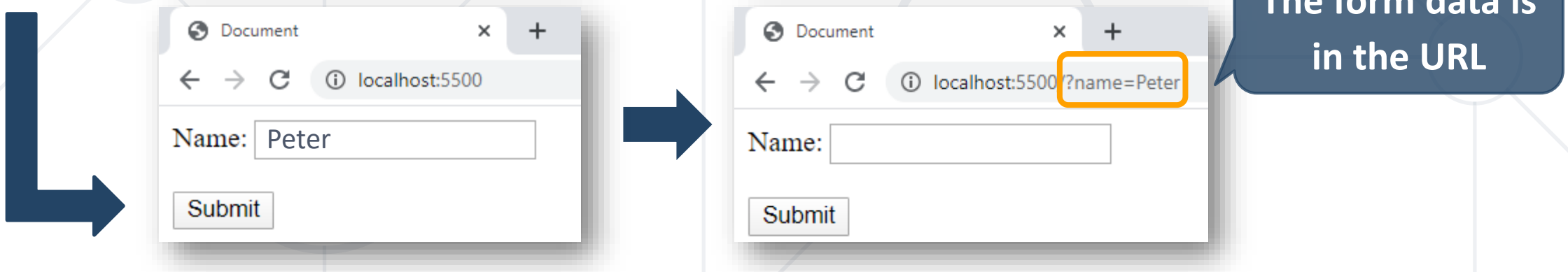


Example: *https://repl.it/@nakov/http-form-example*

HTML Forms: Method GET

- Forms can specify the **HTTP method** for sending the form data

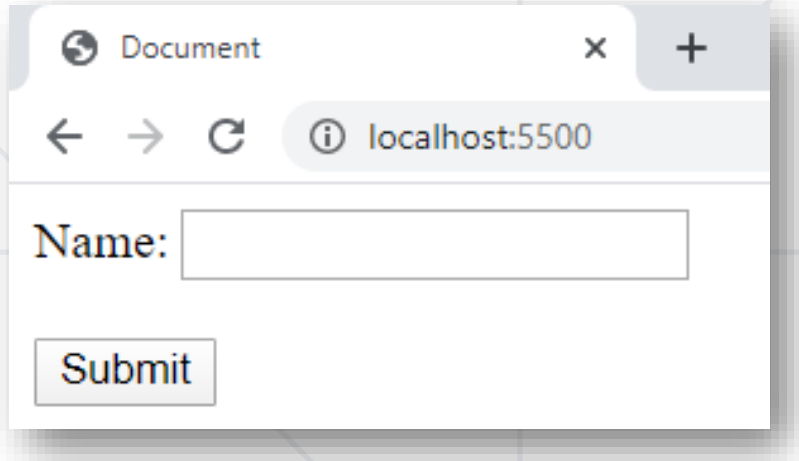
```
<form method="get">
  Name: <input type="text" name="name">
  <br /><br />
  <input type="submit" value="Submit">
</form>
```



Example: *https://repl.it/@nakov/http-get-example*

HTML Forms: Method POST

```
<form method="post">
  Name: <input type="text" name="name">
  <br /><br />
  <input type="submit" value="Submit">
</form>
```



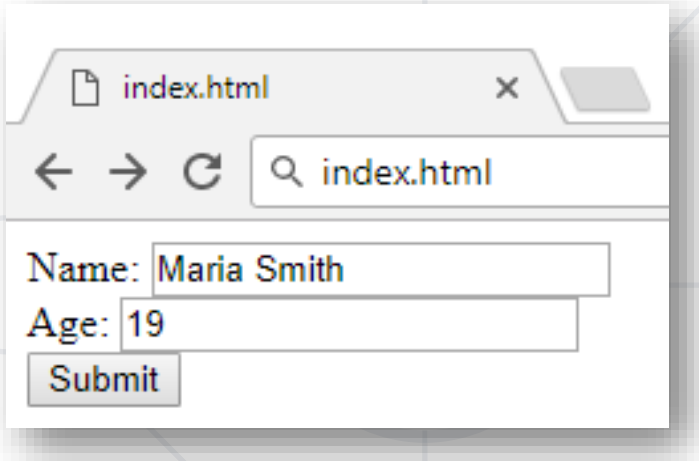

```
POST /index.html HTTP/1.1
Host: localhost
Content-Type: application/x-www-form-urlencoded
Content-Length: 10

name=Peter
```

The HTTP request body holds the submitted form data

Example: *https://repl.it/@nakov/http-post-example*

URL Encoded Form Data – Example

```
<form method="post">
  Name: <input type="text" name="name"/> <br/>
  Age: <input type="text" name="age"/> <br/>
  <input type="submit" />
</form>
```

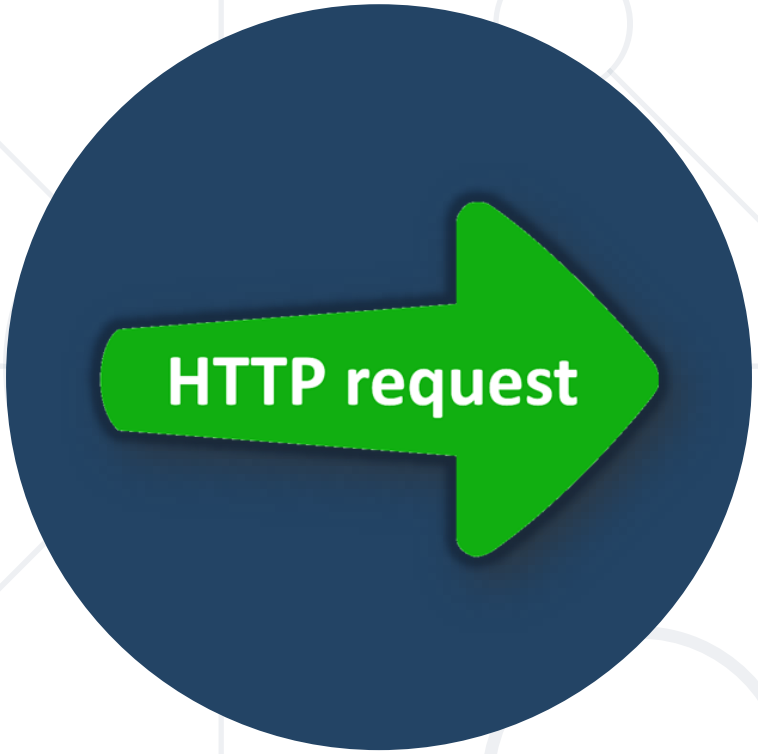



```
POST /index.html HTTP/1.1
Host: localhost
Content-Type: application/x-www-form-urlencoded
Content-Length: 23

name=Maria+Smith&age=19
```

URL-encoded form data

File upload fields are not supported (unless multipart encoding is set)

Example: *https://repl.it/@nakov/http-post-example-name-age*



HTTP Request

Request Method, Headers, Body

HTTP Request Methods

- **HTTP** defines **methods** to indicate the desired action to be performed on the identified resource

Method	Description
GET 	Retrieve a resource
POST 	Create / store a resource
PUT 	Update (replace) a resource
DELETE 	Delete (remove) a resource
PATCH 	Update resource partially (modify)
HEAD 	Retrieve the resource's headers

CRUD == the four main functions of persistent storage

Method
CONNECT
OPTIONS
TRACE

HTTP GET Request – Example

```
GET /users/SoftUni-Tech-Module/repos HTTP/1.1
Host: api.github.com
Accept: */*
Accept-Language: en
Accept-Encoding: gzip, deflate
User-Agent: Mozilla/5.0 (Windows NT 10.0; WOW64)
 AppleWebKit/537.36 (KHTML, like Gecko)
 Chrome/54.0.2840.71 Safari/537.36
Connection: keep-alive
Cache-Control: no-cache
<CRLF>
```

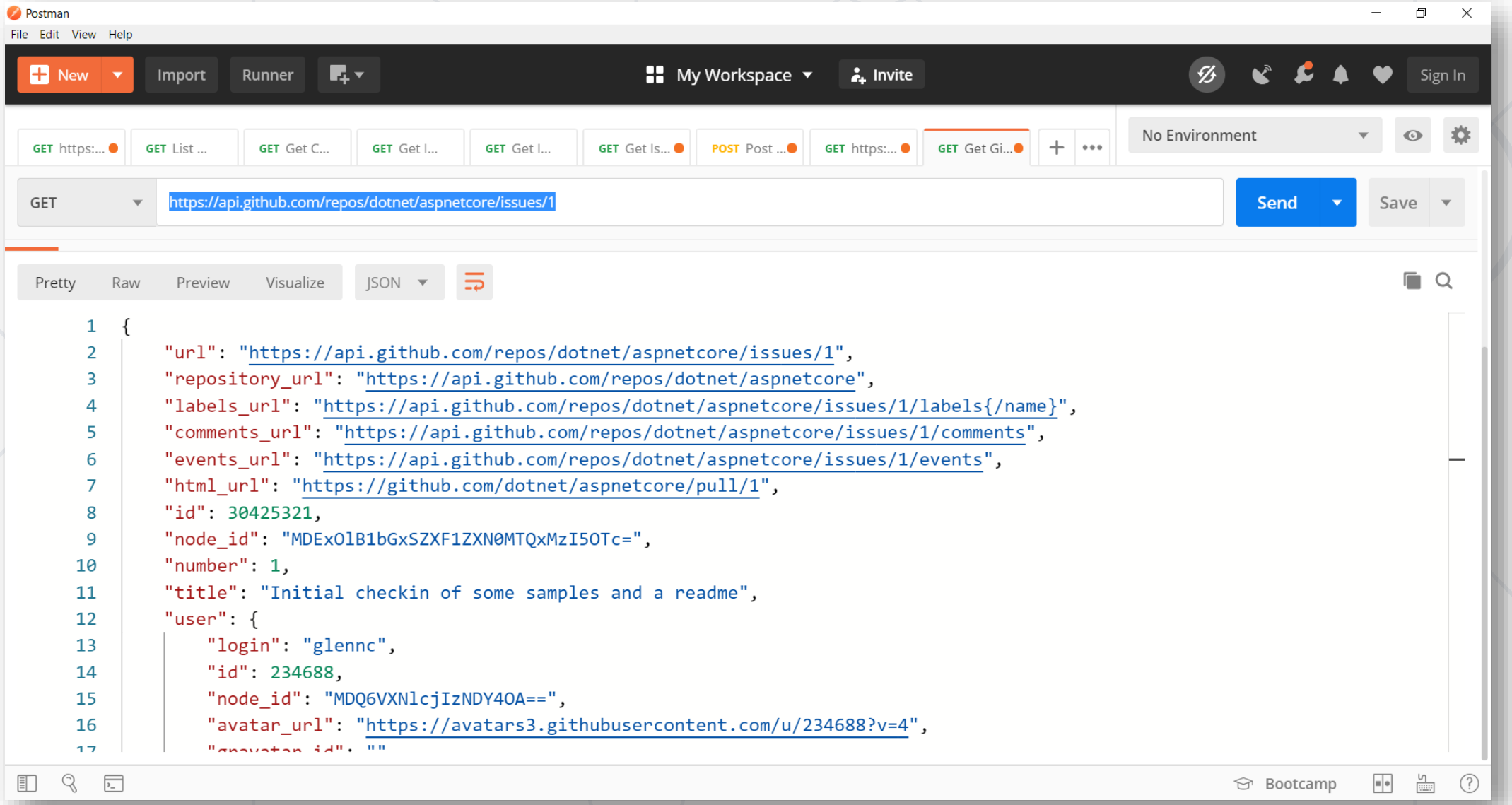
Realtive URI, not full URL

HTTP request line

HTTP headers

The request body is empty

HTTP GET – Example with Postman



HTTP POST Request – Example

```
POST /post HTTP/1.1
Host: postman-echo.com
Accept: */*
Accept-Encoding: gzip, deflate
Content-Type: application/json
Connection: keep-alive
Content-Length: 95
<CRLF>
{"title":"Found a bug",
 "body":"I'm having a problem with this.",
 "labels":["bug","minor"]}
<CRLF>
```

HTTP request line

URL: https://postman-echo.com/post

HTTP headers

The request body holds the submitted data

HTTP POST – Example with Postman

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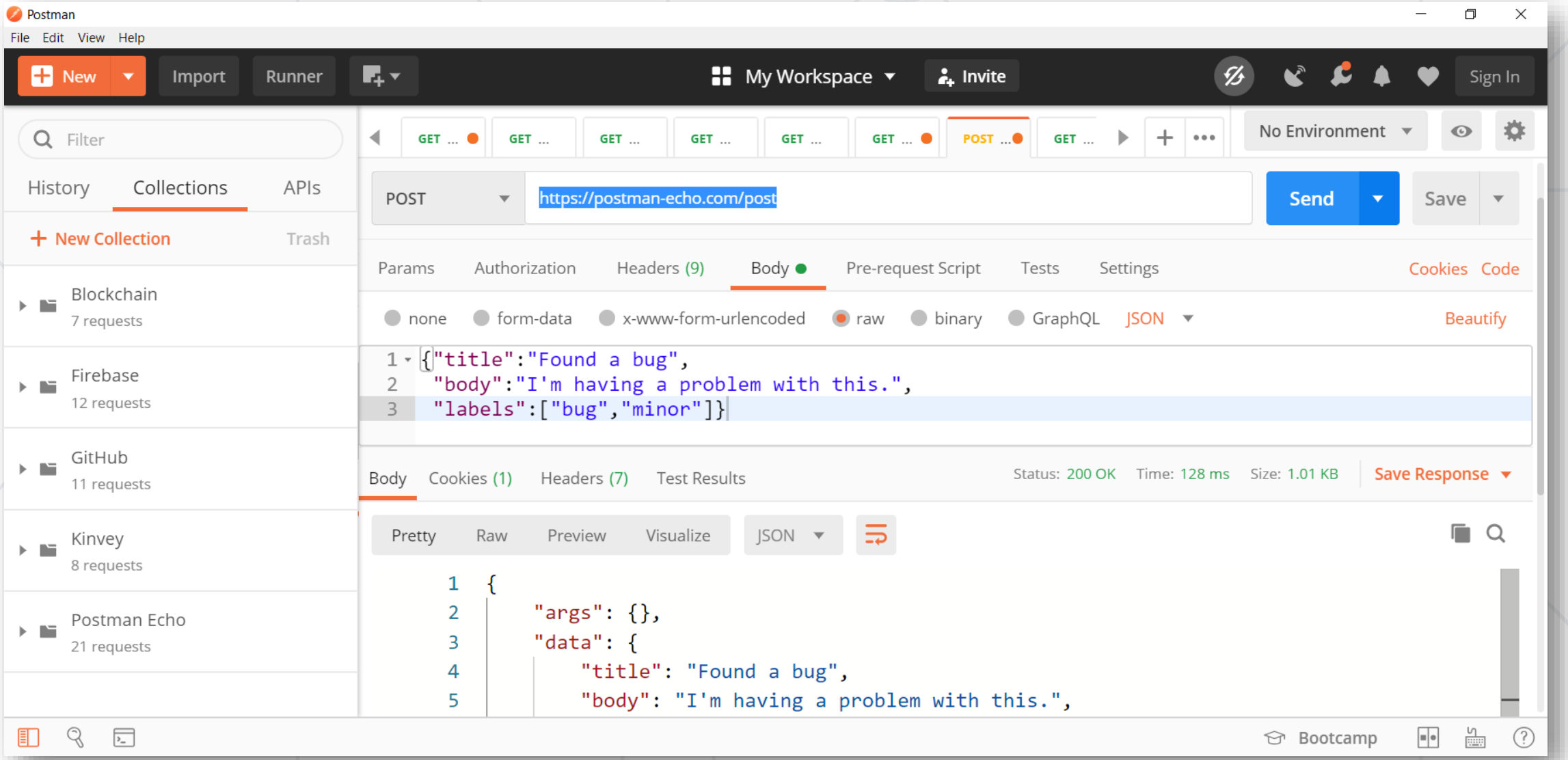

HTTP Response

Response Status, Headers, Body

HTTP Response – Example

```
HTTP/1.1 200 OK
Date: Fri, 11 Nov 2016 16:09:18 GMT+2
Server: Apache/2.2.14 (Linux)
Accept-Ranges: bytes
Content-Length: 84
Content-Type: text/html
<CRLF>
<html>
  <head><title>Test</title></head>
  <body>Test HTML page.</body>
</html>
```

HTTP response status line

HTTP response headers

HTTP response body

HTTP Response Status Codes

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Status Code	Action	Description
200	OK	Successfully retrieved resource
201	Created	A new resource was created
204	No Content	Request has nothing to return
301 / 302	Moved	Moved to another location (redirect)
400	Bad Request	Invalid request / syntax error
401 / 403	Unauthorized	Authentication failed / Access denied
404	Not Found	Invalid resource was requested
409	Conflict	Conflict was detected, e.g. duplicated email
500 / 503	Server Error	Internal server error / Service unavailable

Content-Type and Disposition

- The `Content-Type` / `Content-Disposition` headers specify how to process the HTTP request / response body

```
Content-Type: application/json
```

JSON-encoded data

```
Content-Type: text/html; charset=utf-8
```

UTF-8 encoded HTML page

```
Content-Type: application/pdf
Content-Disposition: attachment;
filename="Financial-Report-2020.pdf"
```

Download a PDF file

- Standard media types: *https://iana.org/assignments/media-types*

HTTP Conversation: Example

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

HTTP Request

```
HTTP/1.1 200 OK
Date: Tue, 16 May 2020 15:13:41 GMT
Server: Microsoft-HTTPAPI/2.0
Last-Modified: Tue, 16 Jan 2018 15:13:42 GMT
Content-Length: 18586
<CRLF>
<html><title>Get a Tech Degree from…
</title>
```

HTTP Response

URL

Protocol, Host, Path, Query String

Uniform Resource Locator (URL)

- **Network protocol** (http, ftp, https...) – HTTP in most cases
- **Host** or **IP** address (softuni.org, gmail.com, 127.0.0.1, web)
- **Port** (the default port is **80**) – integer in the range [0…65535]
- **Path** (/forum, /path/index.php)
- **Query string** (?id=27&lang=en)
- **Fragment** (#slides) – navigate to some section in the page

Query String

- Query string contains data that is **not part** of the path structure

```
http://example.com/path/to/page?name=tom&color=purple
```

- Commonly used in searches and dynamic pages
- It is the part of the URL after the question mark (**?**) symbol
- Parameters have **name=value** format
- Multiple parameters are separated by the **&** delimiter

URL Encoding

- URLs are encoded according to **RFC 1738**
  - Normal URL characters – have no special meaning

```
[0-9a-zA-Z]
```

  - Reserved URL characters – have a **special meaning**

```
!  *  '  (  )  ;  :  @  &  =  +  $  /  ,  ?  #  [  ]
```

  - Reserved characters are **escaped** by **percent encoding**

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

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

URL Encoding – Examples

- All other characters are escaped by **% hex code**, e.g.,

Char	URL Encoding
space	%20
"	%22
#	%23
$	%24

Char	URL Encoding
%	%25
&	%26
щ	%D1%89
爱	%E7%88%B1

- Example

```
Наков-爱-SoftUni
```

Each char is converted to its UTF-8 bytes, represented as hex digits

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

Valid and Invalid URLs – Examples

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- Some valid URLs

```
http://www.google.bg/search?sourceid=navclient&ie=UTF-
8&rlz=1T4GGLL_enBG369BG369&q=http+get+vs+post
```

```
http://bg.wikipedia.org/wiki/%D0%A1%D0%BE%D1%84%D1%82%D1%83%D0%B5%D1
%80%D0%BD%D0%B0_%D0%B0%D0%BA%D0%B0%D0%B4%D0%B5%D0%BC%D0%B8%D1%8F
```

- Some invalid URLs

```
http://google.com/search?&q=C# .NET 4.0
```

Should be: C%23+.NET+4.0

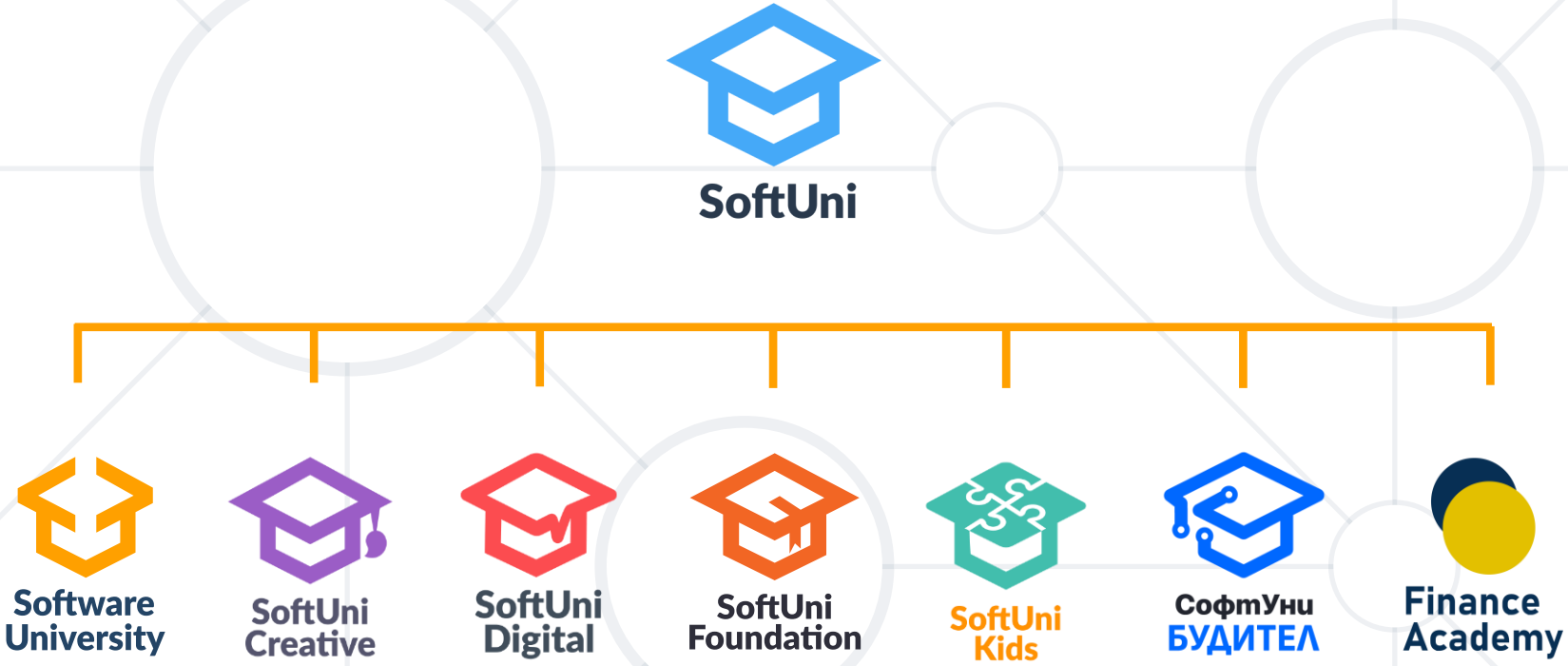
```
http://google.com/search?&q=код
```

Should be: %D0%BA%D0%BE%D0%B4

Summary

- HyperText Transfer Protocol
  - Text-based client-server protocol for the Internet
  - Works with message pairs
    - Request: method + headers + body
    - Response: status + headers + body
- The URL parts: protocol, host, port, path, query string and fragment

Questions?



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