

# HTTP Protocol

## Handling Requests, Constructing Responses, HTTP/2



**SoftUni Team**  
Technical Trainers  
Software University  
<http://softuni.bg>



*Java Web  
Dev Basics*



# Table of Contents

A thumbnail for a slide titled "HTTP Basics: Request and Responses". It features a large blue button with the text "http://".

**HTTP Basics**  
Request and Responses

A thumbnail for a slide titled "HTML Forms: Form Method and Action". It features icons for a form, the number 5, and an HTTP request.

**HTML Forms**  
Form Method and Action

A thumbnail for a slide titled "URL: Uniform Resource Locator". It features a globe icon and the word "URL".

**URL**  
Uniform Resource Locator

A thumbnail for a slide titled "Web Server". It features an illustration of a computer monitor, a server tower, and books.

**Web Server**

A thumbnail for a slide titled "HTTP Request: What is a HTTP Request?". It features an icon of a hand holding a bell.

**HTTP Request**  
What is a HTTP Request?

A thumbnail for a slide titled "HTTP Response: What is a HTTP Response?". It features a speech bubble icon with a circular arrow.

**HTTP Response**  
What is a HTTP Response?

# Questions



sli.do

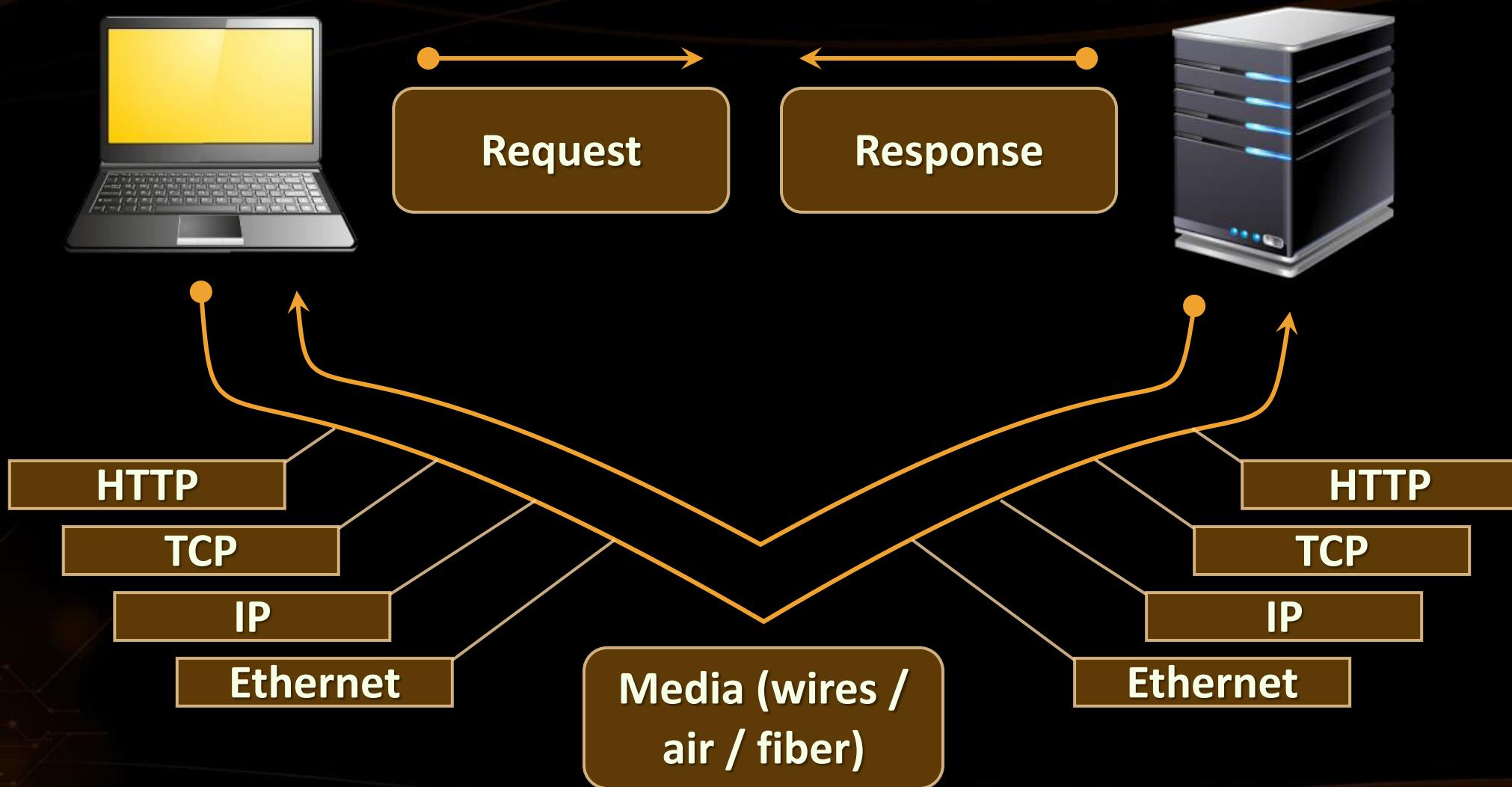
#java-web

http://

# HTTP Basics

## Request and Responses

# Hyper Text Transfer Protocol



# HTTP Request Methods

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

Method	Description
GET	Retrieve / load a resource
POST	Create / store a resource
PUT	Update a resource
DELETE	Remove a resource

# HTTP Conversation: Example

- HTTP request:

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

The empty line denotes the end of the request header

- HTTP response:

```
HTTP/1.1 200 OK
Date: Mon, 5 Jul 2010 13:09:03 GMT
Server: Microsoft-HTTPAPI/2.0
Last-Modified: Mon, 12 Jul 2014 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 header



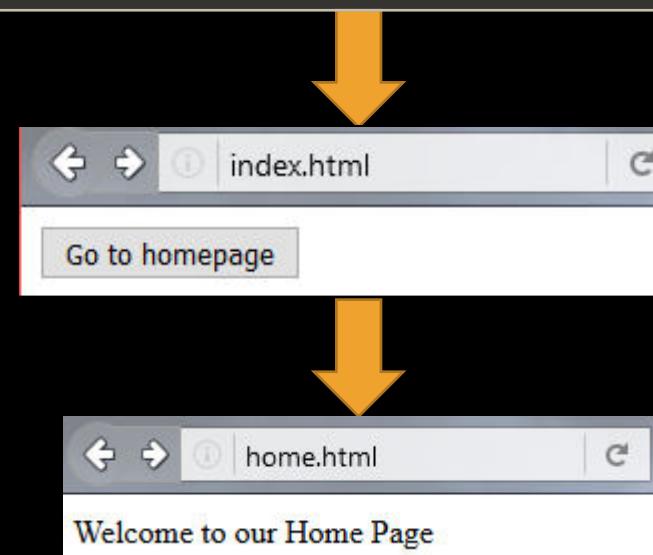
# HTML Forms

Form Method and Action

# HTML Forms - Action Attribute

- Defines where to submit the form data:

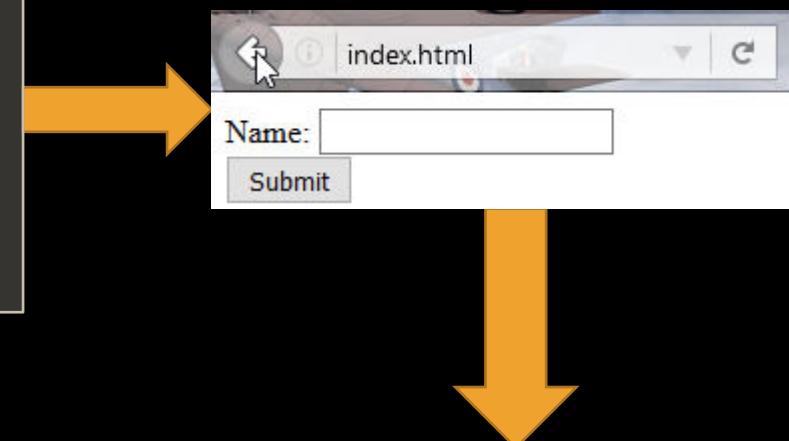
```
<form action="home.html">  
    <input type="submit" value="Go to homepage"/>  
</form>
```



# HTML Forms – Method Attribute

- Specifies the HTTP method to use when sending form-data

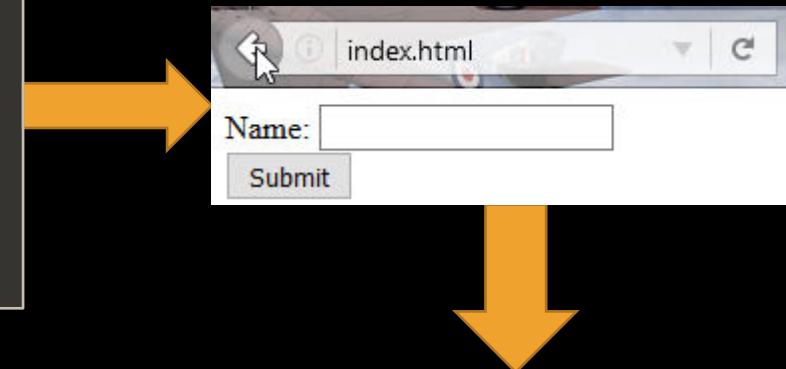
```
<form method="get">  
    Name: <input type="text" name="name">  
    <br>  
    <input type="submit" value="Submit">  
</form>
```



The form data  
is in the URL

# HTML Forms – Method Attribute (2)

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



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

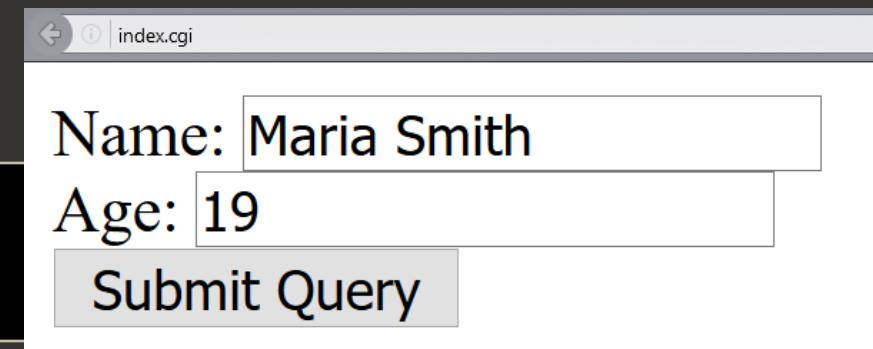
name=Pesho

HTTP request body  
holds the form data

Headers will be  
explained later

# 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 http://localhost/cgi-bin/index.cgi HTTP/1.1
```

```
Host: localhost
```

```
Content-Type: application/x-www-form-urlencoded
```

```
Content-Length: 23
```

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



File uploads are  
not supported



# URL

## Uniform Resource Locator

# Uniform Resource Locator (URL)



- URL is a formatted string, consisting of:
  - Protocol for communicating (**http**, **ftp**, **https**...) – HTTP in most cases
  - Host or IP address (**www.softuni.bg**, **gmail.com**, **127.0.0.1**, **web**)
  - Port (the default port is **80**) – a number in range [0...65535]
  - Path (**/forum**, **/path/index.php**)
  - Query string (**?id=27&lang=en**)
  - Fragment (**#lectures**) – used on the client to navigate to some section

# 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"
  - Example: **Наков-爰-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

# Valid and Invalid URLs – Examples

- 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:

Should be:

?q=C%23+.NET+4.0

```
http://www.google.bg/search?q=C# .NET 4.0
```

```
http://www.google.bg/search?q=бира
```

Should be: ?q=%D0%B1  
%D0%B8%D1%80%D0%B0



# HTTP

## Tools for Developers

# HTTP Tools for Developers - Browser

Developer Tools - https://www.wikipedia.org/

Elements Console Sources Network Timeline Profiles Resources Security Audits

View: Preserve log Disable cache No throttling

Filter Regex Hide data URLs All XHR JS CSS Img Media Font Doc WS Map

Name	Headers	Preview	Response	Cookies	Timing
www.wikipedia.org	<b>General</b> Request URL: https://www.wikipedia.org/ Request Method: GET Status Code: 200 Remote Address: 127.0.0.1:8888				
Wikipedia_wordmark@1.5x.p...					
Wikipedia-logo-v2@1.5x.png					
index-1946de37c9.js					
gt-ie9-c84bf66d33.js					
sprite-project-logos.png?9af...					
sprite-bookshelf_icons.png?6...					

accept-ranges: bytes  
age: 42481  
backend-timing: D=259 t=1466449556070865  
cache-control: s-maxage=86400, must-revalidate, max-age=3600  
content-encoding: gzip  
content-length: 19039  
content-type: text/html  
date: Tue, 21 Jun 2016 06:53:57 GMT  
etag: "140f8-53530f9bd08c2"  
last-modified: Mon, 13 Jun 2016 23:09:08 GMT  
server: mw1257.eqiad.wmnet  
status: 200  
strict-transport-security: max-age=31536000; includeSubDomains; preload  
via: 1.1 varnish, 1.1 varnish, 1.1 varnish  
x-analytics: WMF-Last-Access=21-Jun-2016;https=1  
x-cache: cp1052 hit/9, cp3031 hit/7, cp3030 hit/505903  
x-client-ip: 93.123.90.93  
x-powered-by: HHVM/3.3.0-static

Chrome Developer Tools

Net Cookies

URL Status Domain Size

GET softuni.bg 200 OK softuni.bg 17,4K

Headers Response HTML Cache Cookies

Response Headers view source

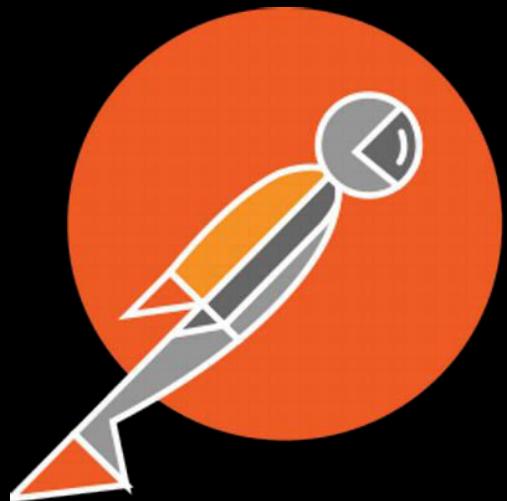
Cache-Control private  
Content-Encoding gzip  
Content-Length 17819  
Content-Type text/html; charset=utf-8  
Date Tue, 17 Jan 2017 14:09:56 GMT  
Set-Cookie language=bg; path=/; secure  
Vary Accept-Encoding  
X-Frame-Options SAMEORIGIN

Request Headers view source

Accept text/html,application/xhtml+xml,application/xml;q=0.9,\*/\*;q=0.8  
Accept-Encoding gzip, deflate, br  
Accept-Language en-US,en;q=0.5  
Cache-Control max-age=0  
Connection keep-alive  
Cookie cb-enabled=accepted; \_ga=GA1.2.240989729.1483973326; .auth.softuni=iZYSnIwmFlQP-Bx9XYYA\_6EvX5fEIJlzCcUbXkg91S2CLDIj-8GP09FXKyMCJ1T4BC9NbzKvxYFsRwHLLigWUHpYxwoKYYFLnz1trRNdpvWHeTLB1aPSHMCZXsktHJMrg2BdT54dwME81M9du0waJLdrfIp2D-x1Yu79oeGkXogN4Mv--au2ZR6nLlh7CnRQaOBst15J5dF\_QSScfN4F1V2ey6UvgUvlvvaX77bh\_ZM-dht2fA1SH78ZLoQvClpwmCraZuY6ZzSYkIzniLGFTgao9ksHvmpCeVxX5OrXM\_2b8PKmPBorYtpmPFMXVqK2QrF4VzNPnfKSGn\_E5kn7LcnFgSy6juwFcc5efqdIyldcLnldPdyUvs4su4wJb5EpSJQ2RcP1NsC0OBy1R0uBlu-4GBjFHErvEahvdzj14DQgy2vJMgedsTB8\_kKrRHW13z7qjmN-Fv17X4goU-N3fwGvBqdYIYxLkfFFNRo4i\_LPqTbgCnlcdx4wt92PmBNBkNKGjjOH2fjkwlVHsn1R1q3p2wHtOyuIrckOHmP6mYiHyxjoN\_1B9LCdDC1A9EkC7HfWm0HS1wjyibAXAvvH7FqCxn2fQ1QEENBZC6a84pT01dC07dVyVtESx-wuxW4oKBMG9uI9077iFTdzfqzDTxFKDS11E\_OzW2FwzJ0ubOU-Na\_rVrvUhxZ3Xg9LobpAsUYsKiKPA9ImFCKSwBGe7nAw-SkHifxHBK4-QYWdKZmK7unW0U1wjwUQ7Dkrh9KKnIevvbRAvcgh-uN36hvvf4XdIL0s-lblsnrMPz3ux8LTPUWGHXwWjWhbx39u2GSQQxsW68Tm6CB7uJYt0894uroFMYbIttY\_Gz2I6hTGN7CJWuUaUcudb30-chiwzKdpAzhBf9p1GHW1XQOiswCZRqqhfO1gSgXrLopCcb7HCpR1-10TCG-2-M\_BCCB0www1.DUH111-10-5-0-ON-N-0-U-7-1fEC1-20071-WD1-37

Firebug

# HTTP Tools for Developers - Browser (2)

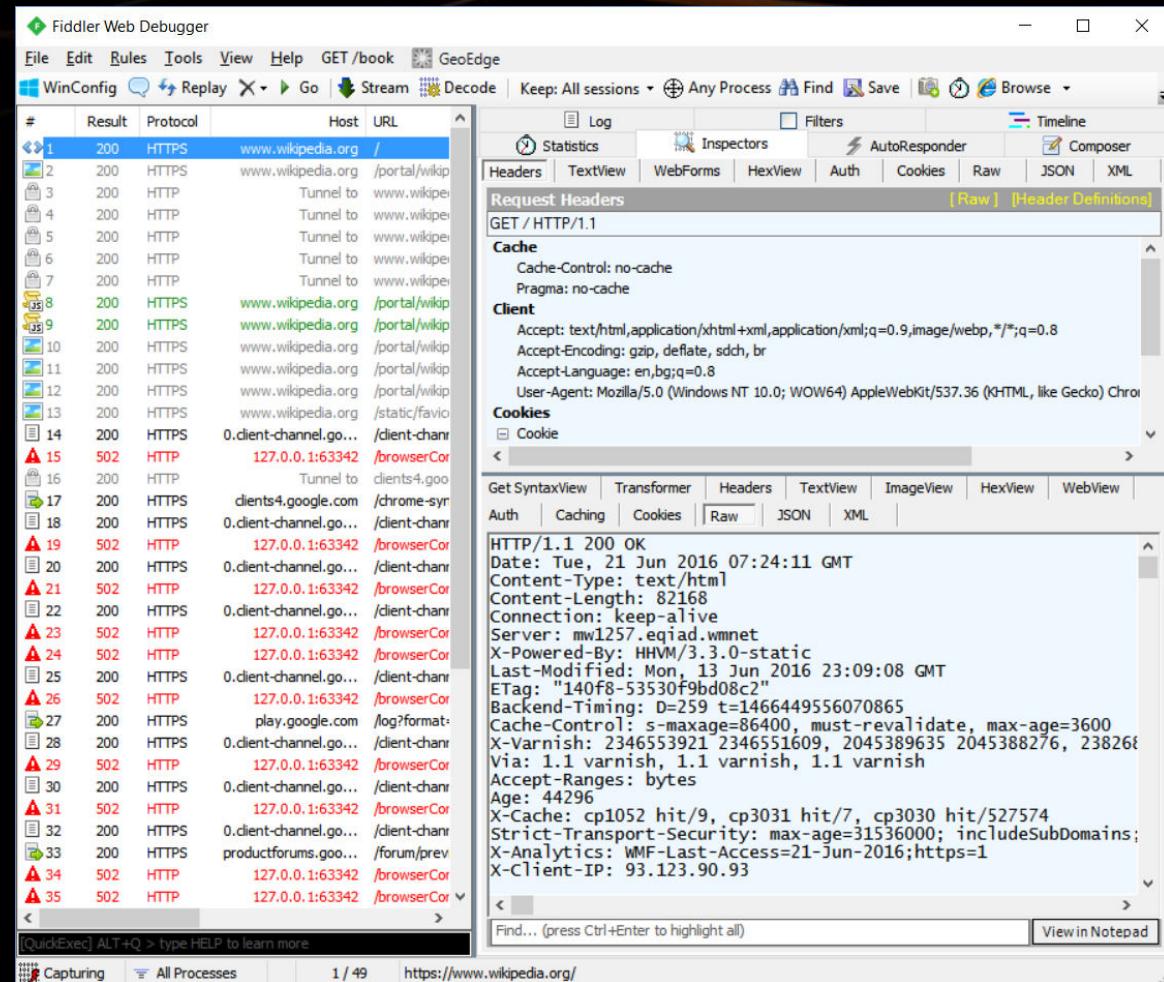


[Postman](#) - Chrome



[RESTClient](#) - Firefox

# HTTP Tools for Developers - Desktop



Fiddler

# Web Server



# What is a Web Server?

- Computer system that processes requests via **HTTP**, the basic network protocol

Web Client



Web Server



Communication

# Web Server Work Model

Web Client



Request

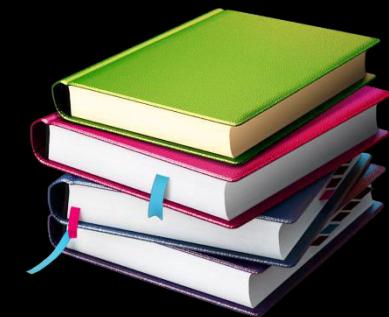
Protocol

Response

Web Server



Web Resources



HTML, PDF, JPG...



Protocols:

HTTP

FTP

WebSocket

Protocol

Host

Port

Resource

URL

`http://localhost:80/softuni.jpg`

# Web Server Work Model (2)

Web Client



Request

Protocol

Response

Web Server



Technology



Web Resources

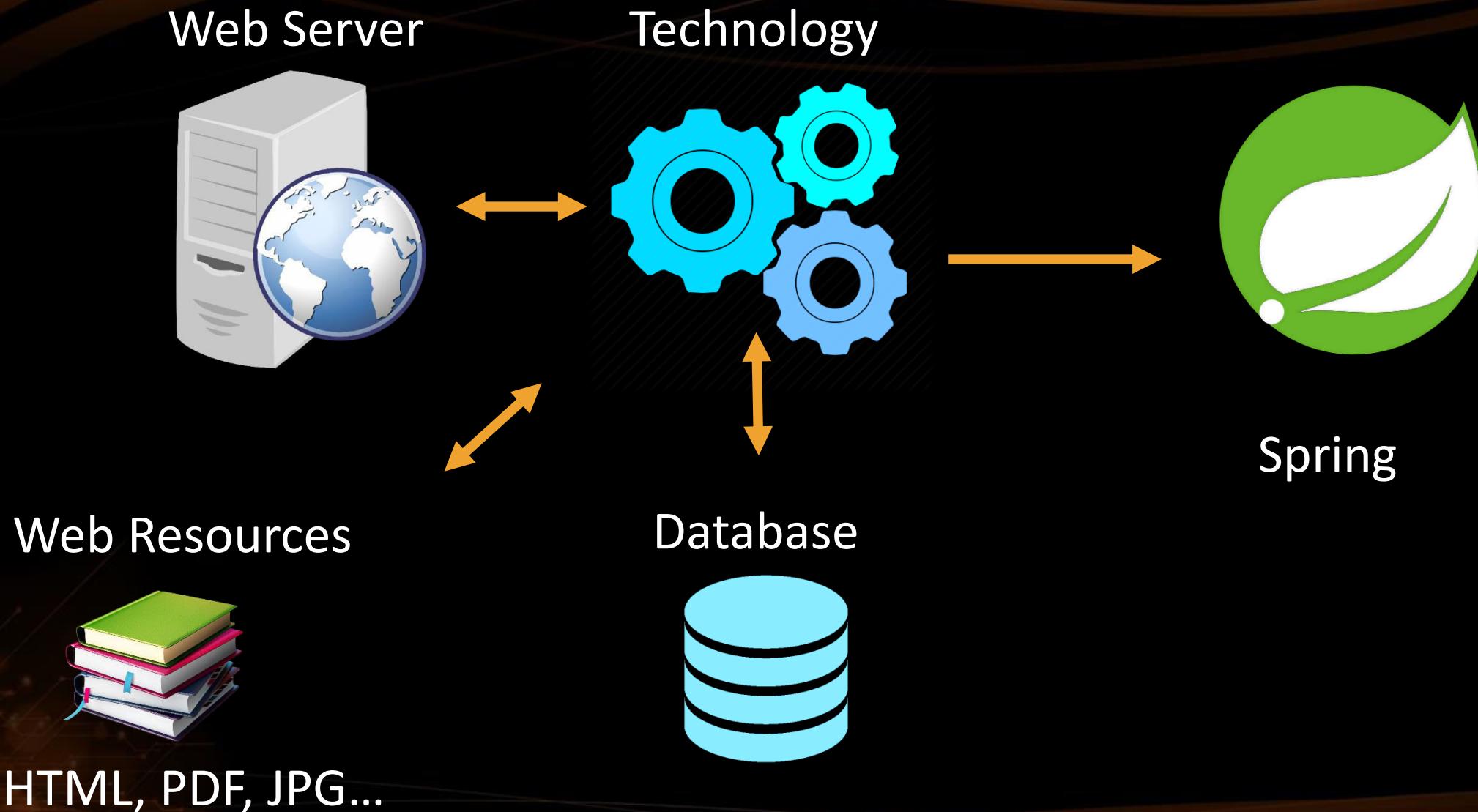


HTML, PDF, JPG...



Database

# Web Server Work Model (3)



# Most Popular Web Servers (W3Techs)

Product	Vendor	Percent
Apache	Apache	48.5%
nginx	NGINX, Inc.	35.4%
IIS	Microsoft	10.8%
LiteSpeed Web Server	LiteSpeed Technologies	2.9%
GWS	Google	1.1%



OCTOBER 2017

# Most Popular Web Servers (NetCraft)

Product	Vendor	January 2016	Percent	February 2016	Percent	Change
Apache	Apache	304,271,061	33.56%	306,292,557	32.80%	0.76
IIS	Microsoft	262,471,886	28.95%	278,593,041	29.83%	0.88
nginx	NGINX, Inc.	141,443,630	15.60%	137,459,391	16.61%	-0.88
GWS	Google	20,799,087	2.29%	20,640,058	2.21%	-0.08

Product	Vendor	January 2017	Percent	February 2017	Percent	Change	Chart color
IIS	Microsoft	821,905,283	45.66%	773,552,454	43.16%	-2.50	red
Apache	Apache	387,211,503	21.51%	374,297,080	20.89%	-0.63	black
nginx	NGINX, Inc.	317,398,317	17.63%	348,025,788	19.42%	1.79	green
GWS	Google	17,933,762	1.00%	18,438,702	1.03%	0.03	blue



# MIME and Media Types

Multi-Purpose Internet Mail Extensions

# 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
- MIME defines several concepts
  - **Content-Type**, e.g. **text/html**, **image/gif**, **application/pdf**
    - Content **charset**, e.g. **utf-8**, **ascii**, **windows-1251**
  - **Content-Disposition**, e.g. **attachment; filename=logo.jpg**
  - Multipart messages (multiple resources in a single document)

# 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

What is a HTTP Request?

# 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>
```

# HTTP POST Request – Example

- Example of HTTP **POST** request:

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

HTTP request line

HTTP request headers

The request body holds  
the submitted form data

# HTTP GET Request – Example

- Example of HTTP **GET** request:

```
GET /index.html HTTP/1.1
```

```
Host: localhost  
<CRLF>
```

HTTP request line

HTTP request headers

The request body is empty



# HTTP Response

What is a HTTP Response?

# HTTP Response Message

- The response message sent by the HTTP server consists of:
  - HTTP response status line
    - Protocol version
    - Status code
    - Status phrase
  - 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 – Example

- Example of HTTP response from the Web server:

```
HTTP/1.1 200 OK
```

HTTP response status line

```
Date: Fri, 17 Jul 2010 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  
headers

HTTP response  
body

- 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 with error result:

HTTP/1.1 404 Not Found

HTTP response status line

Date: Fri, 17 Nov 2014 16:09:18 GMT+2

Server: Apache/2.2.14 (Linux)

Connection: close

Content-Type: text/html

<CRLF>

HTTP response headers

<HTML><HEAD><TITLE>404 Not Found</TITLE></HEAD>

<BODY>

<H1>Not Found</H1>

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
...
```

# Content-Type and Disposition

- The **Content-Type** response header the server specifies how the output should be processed
- Examples:

UTF-8 encoded HTML page.  
Will be shown in the browser.

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

**Content-Type: application/pdf**

**Content-Disposition: attachment; filename="Report-April-2016.pdf"**

This will download a PDF file named  
**Report-April-2016.pdf**



# HTTP/2

What's new? What's better? What's HTTP/2

# What's HTTP/2

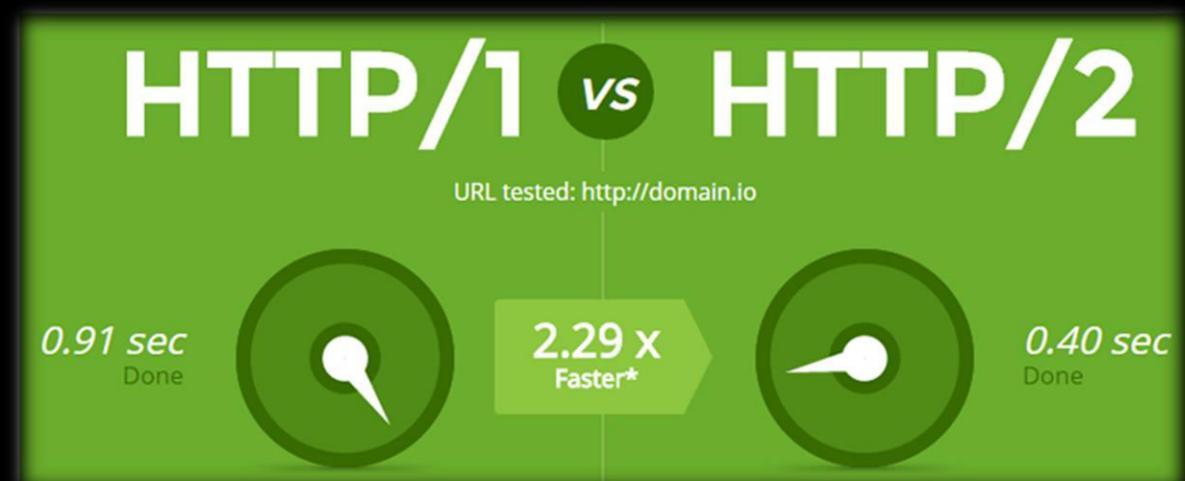
- **HTTP/2** (originally named **HTTP/2.0**) major revision of the **HTTP** network protocol used by the **World Wide Web**.
  - Supported by most of the popular web browsers (Chrome, Mozilla, Opera...)
- Fast & Optimized. Meets modern web usage requirements.
- Completely Backwards-Compatible.
- As of November 2017, **20.5%** of the top 10 million websites support **HTTP/2** (W3Techs statistics).



# What's new?

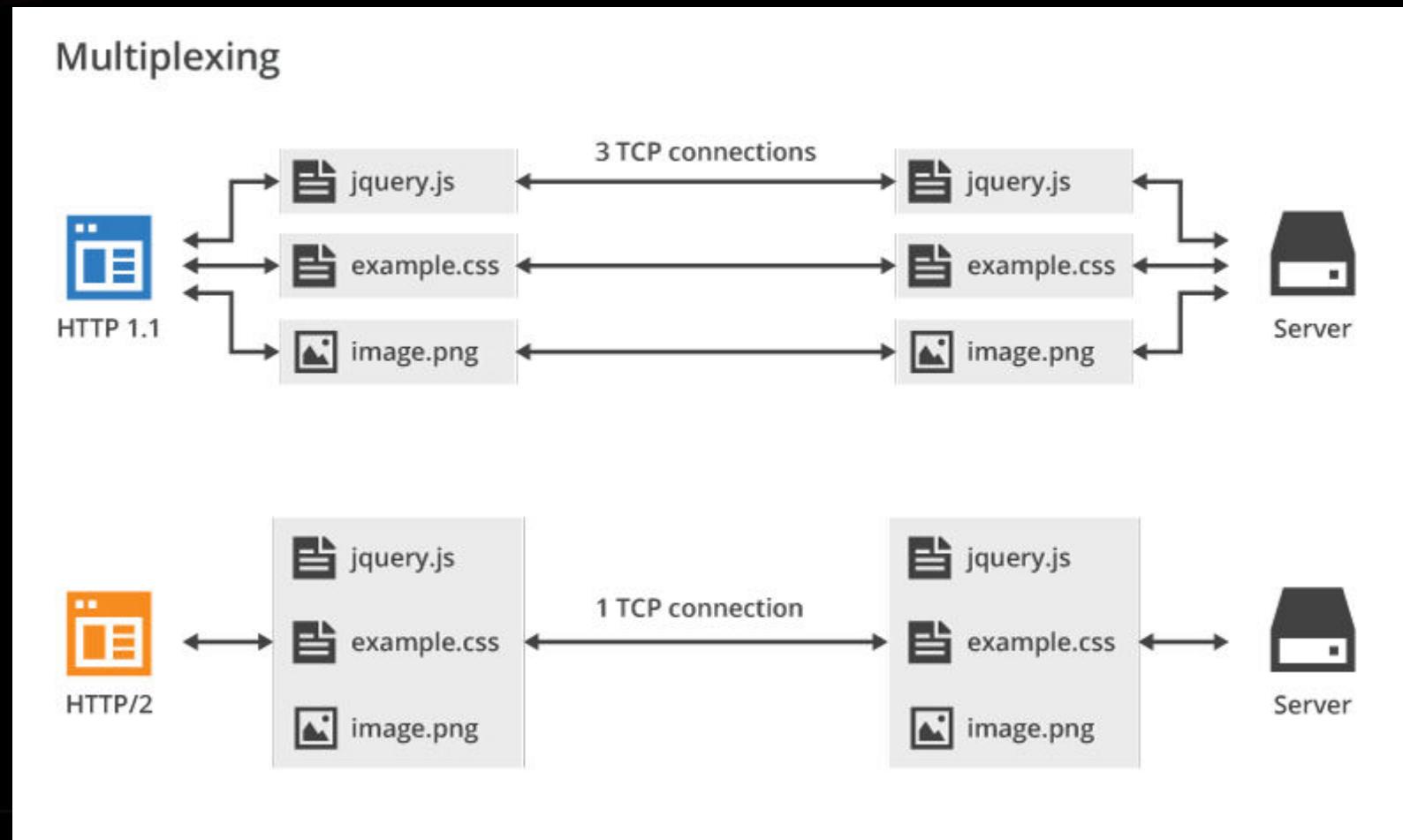
- **HTTP/2** is meant to erase the need of maintaining complex server infrastructures in order to perform well.
- **HTTP/2** communicates in binary data frames.
- **HTTP/2** introduces several new important elements:
  - **HTTP/2 Multiplexing**
  - **HTTP/2 Header Compression**
  - **HTTP/2 Server Push**

HTTP / 2



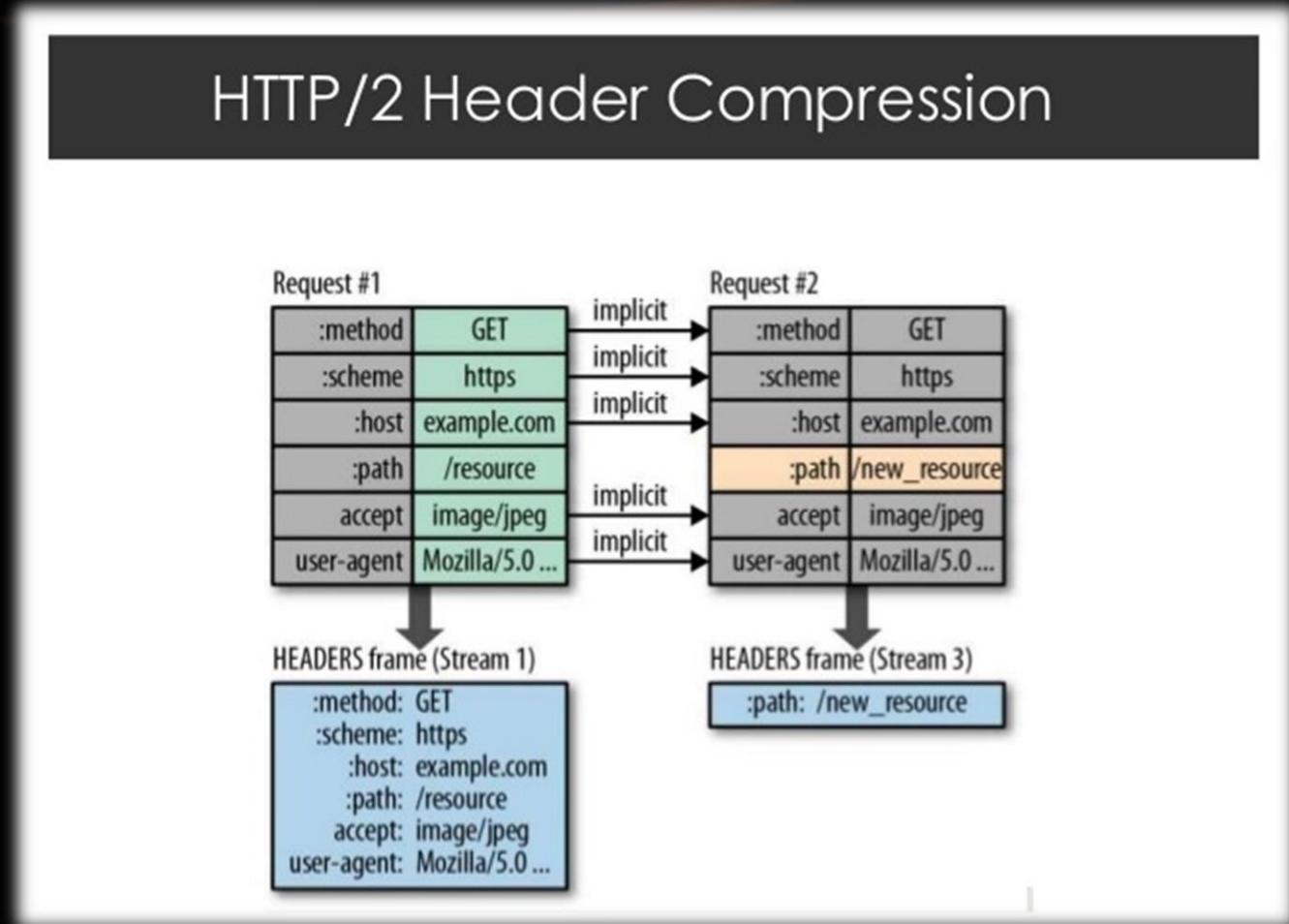
# HTTP/2 Multiplexing

- The art of handling multiple streams over a **single** TCP connection.



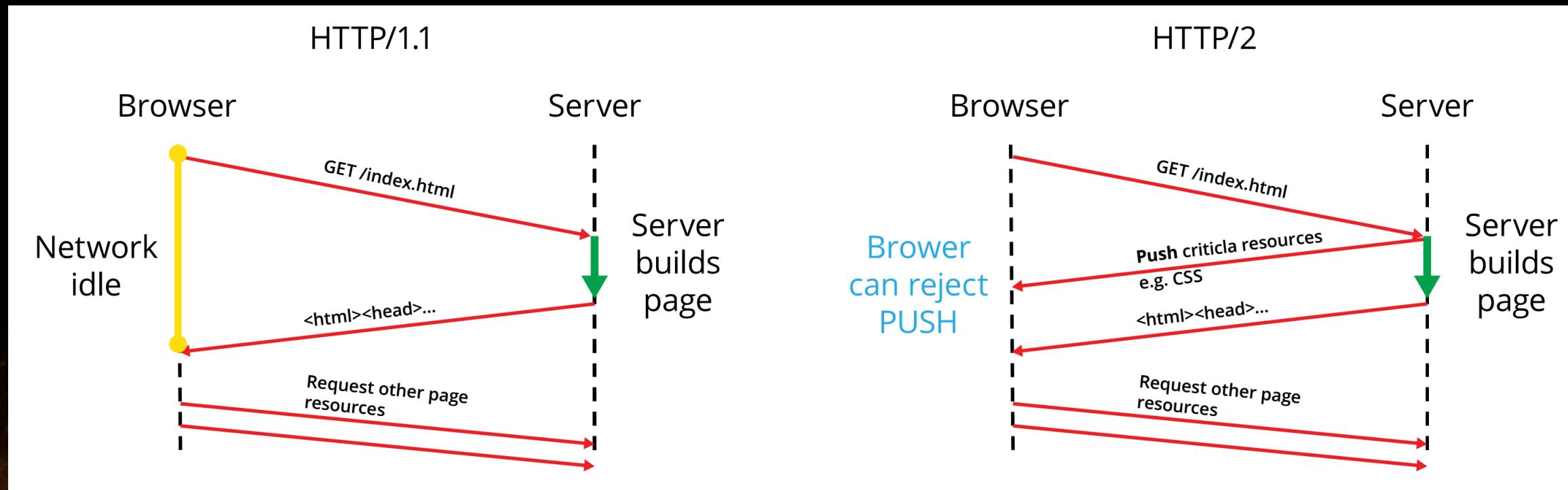
# HTTP/2 Header Compression

- **HTTP/2** maintains a **HTTP Header Table** across requests.
- Optimizes communication drastically.
- The process is essentially a **de-duplication**, rather than compression.



# HTTP/2 Server Push

- **HTTP/2 Server Push** is the process of sending resources to clients, without them having to ask for it.

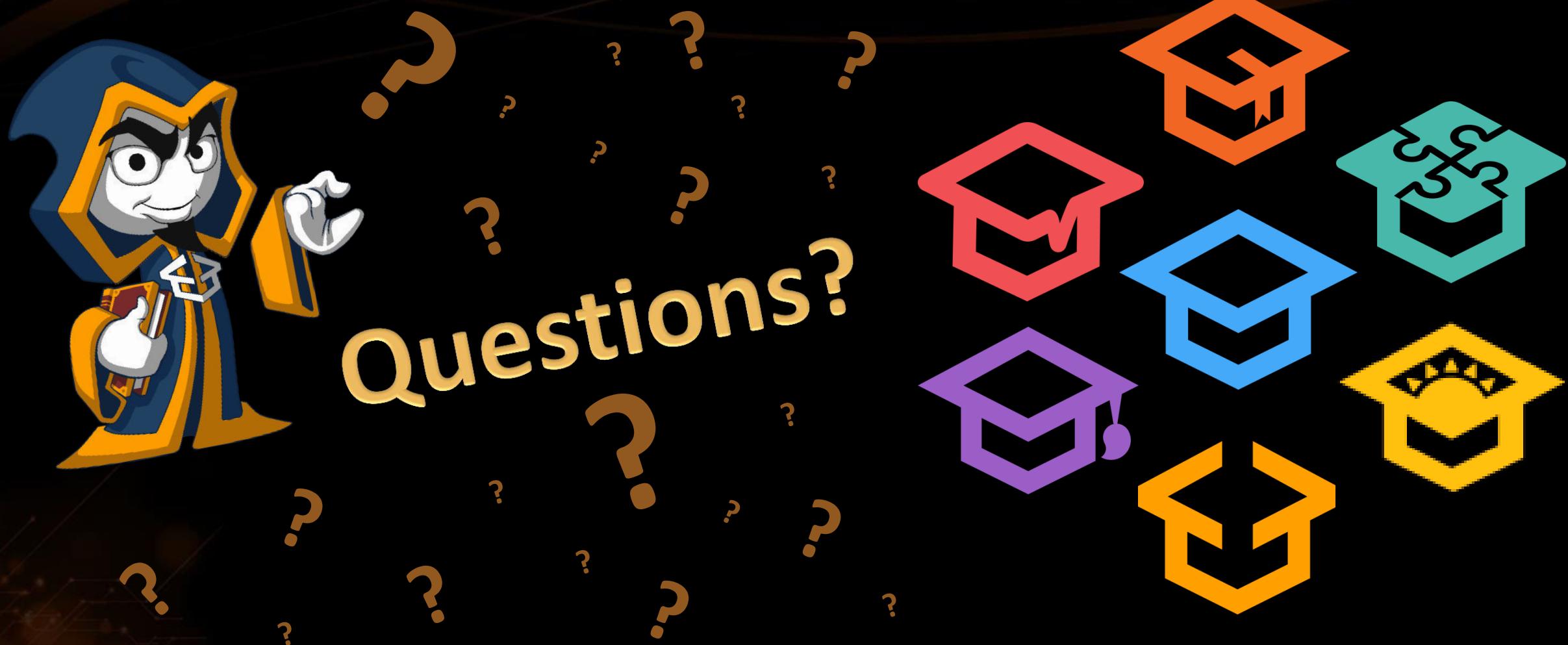


# Summary

- What is **HTTP**?
  - **HTML Forms & Actions.**
  - **URLs.**
- What is a **Web Server**?
  - Beneath the sheets of **Web Communication**.
- How to handle **HTTP Requests**?
- How to construct **HTTP Responses**?



# Java Web Dev Basics – HTTP Protocol



# SoftUni Diamond Partners



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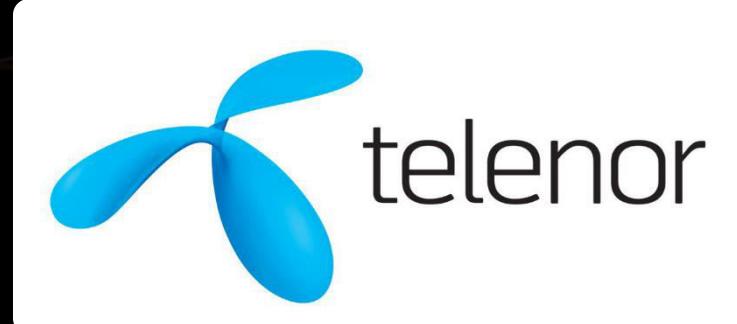
**SoftwareGroup**  
*doing it right*



**NETPEAK**  
SEO and PPC for Business

**SUPER  
HOSTING**  
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LIEBHERR



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  - <http://softuni.foundation/>
- Software University @ Facebook
  - [facebook.com/SoftwareUniversity](https://facebook.com/SoftwareUniversity)
- Software University Forums
  - [forum.softuni.bg](http://forum.softuni.bg)

