

Magento2 on HTTP2





Branko Toić



CIO - Plus Hosting

DevelopersParadise

2016 / Opatija / Croatia



TL;DR

PERFORMANCE!

If you have the ability, use it!



History of HTTP

- HTTP/0.9 was first standard adopted in 1991
- Web of documents (simple formatting, links to other documents)
- Basic methods (GET, POST, HEAD)

HTTP/0.9

1991

HTTP/1.0

1996

HTTP/1.1

1997

SPDY/2

2012

HTTP/2

2015



History of HTTP

- Defined in RFC1945 as upgrade to previous version
- Backwards compatible
- Adding additional headers
- Adding methods (PUT, DELETE, LINK, UNLINK)

HTTP/0.9

1991

HTTP/1.0

1996

HTTP/1.1

1997

SPDY/2

2012

HTTP/2

2015



History of HTTP

- Defined in RFC2068, later augmented by RFC2616
- Fixes issues in HTTP/1.0 by adding extra features
- Additional methods (OPTIONS, PATCH, TRACE)
- Keep alive, host header

HTTP/0.9

1991

HTTP/1.0

1996

HTTP/1.1

1997

SPDY/2

2012

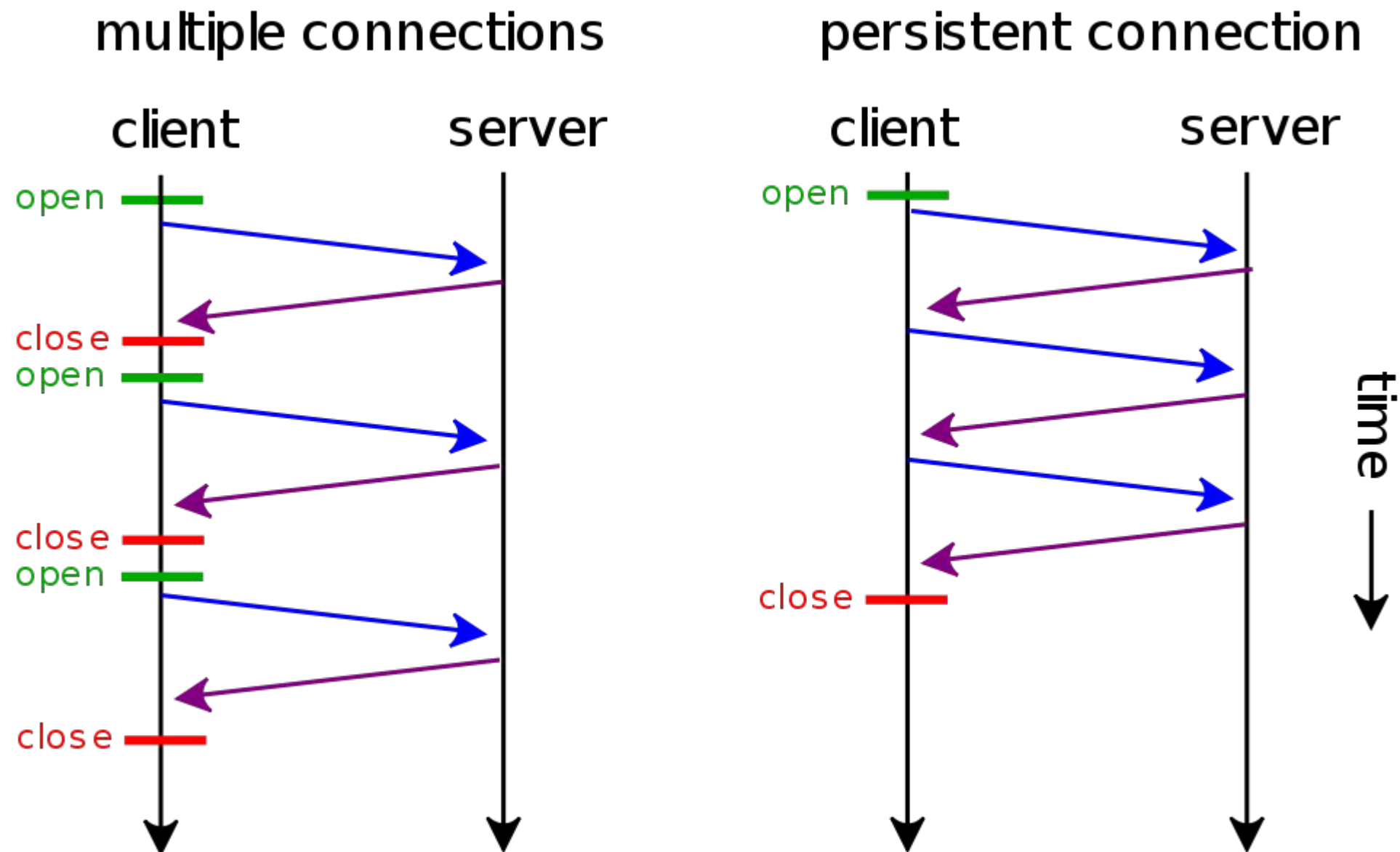
HTTP/2

2015



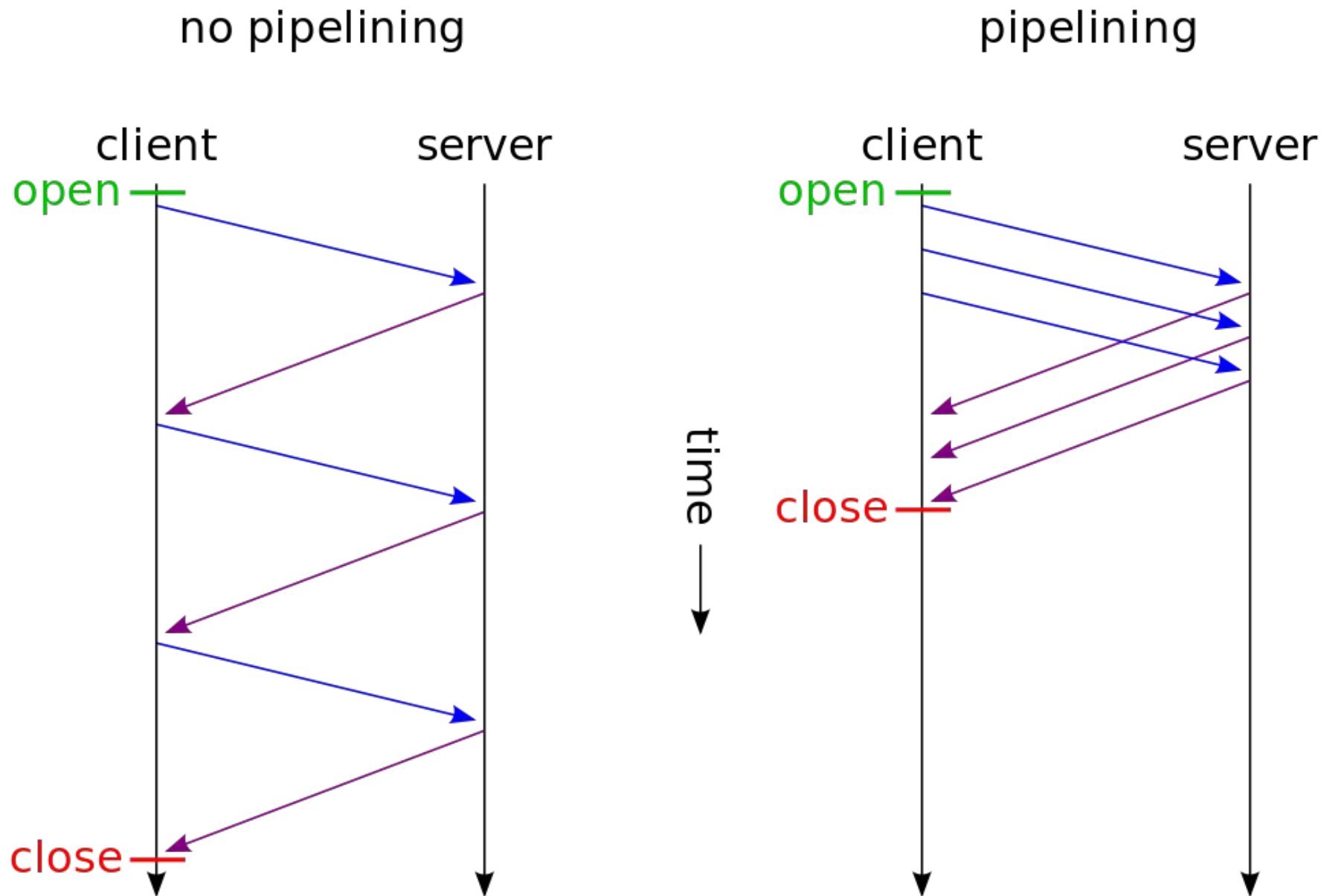
"Flaws" addressed in HTTP/1.1

Keep Alive for connection reuse



"Flaws" addressed in HTTP/1.1

HTTP Pipelining



HTTP/1.x Best practices

Actually workarounds:

- Sprites
- Concatenating
- Minifying
- Inlining
- Sharding
- ...

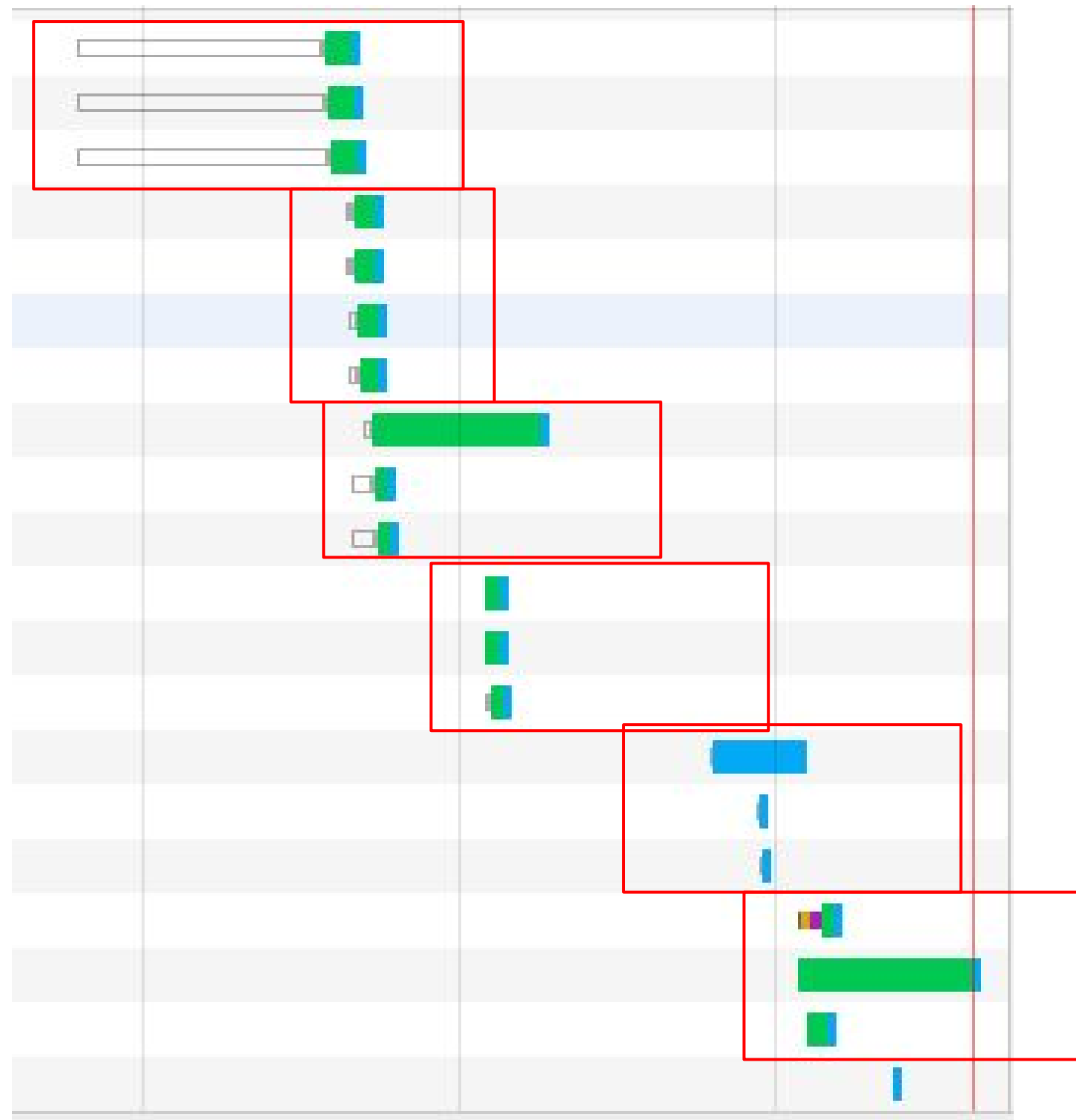


HTTP/1.x #1 issue: **HOL Blocking**

One resource at the time



HOL Blocking



HTTP/1.x #2 issue: **Metadata**

- **Stateless**
- **Duplicate content**
- **No compression?**



History of HTTP

- At this point web is beyond HTTP/1.x
- SPDY/2 started as a base for HTTP/2



Welcome to HTTP/2



What is HTTP/2

- Still based on REQUEST -> RESPONSE
- Solves previous protocol flaws
- Protocol upgrade
- Fully compatible with previous version



HTTP/2 Protocol upgrade

```
[branko@blap:~]$ nghttp -nv -u http://magento2.plus.hr/
[ 0.027] Connected
[ 0.027] HTTP Upgrade request
GET /http2/test.txt HTTP/1.1
host: magento2.plus.hr
connection: Upgrade, HTTP2-Settings
upgrade: h2c
http2-settings: AAMAAABkAAQAAP__
accept: */*
user-agent: nghttp2/1.8.0

[ 0.043] HTTP Upgrade response
HTTP/1.1 200 OK
Date: Fri, 01 Apr 2016 08:18:53 GMT
Server: Apache/2.4.18
Last-Modified: Fri, 01 Apr 2016 08:18:47 GMT
ETag: "0-52f6807310clf"
Accept-Ranges: bytes
Content-Length: 0
Cache-Control: max-age=172800
Expires: Sun, 03 Apr 2016 08:18:53 GMT
X-Frame-Options: sameorigin
X-Content-Type-Options: nosniff
X-XSS-Protection: 1; mode=block
Content-Type: text/plain

[ERROR] HTTP Upgrade failed
```



HTTP/2 Protocol upgrade

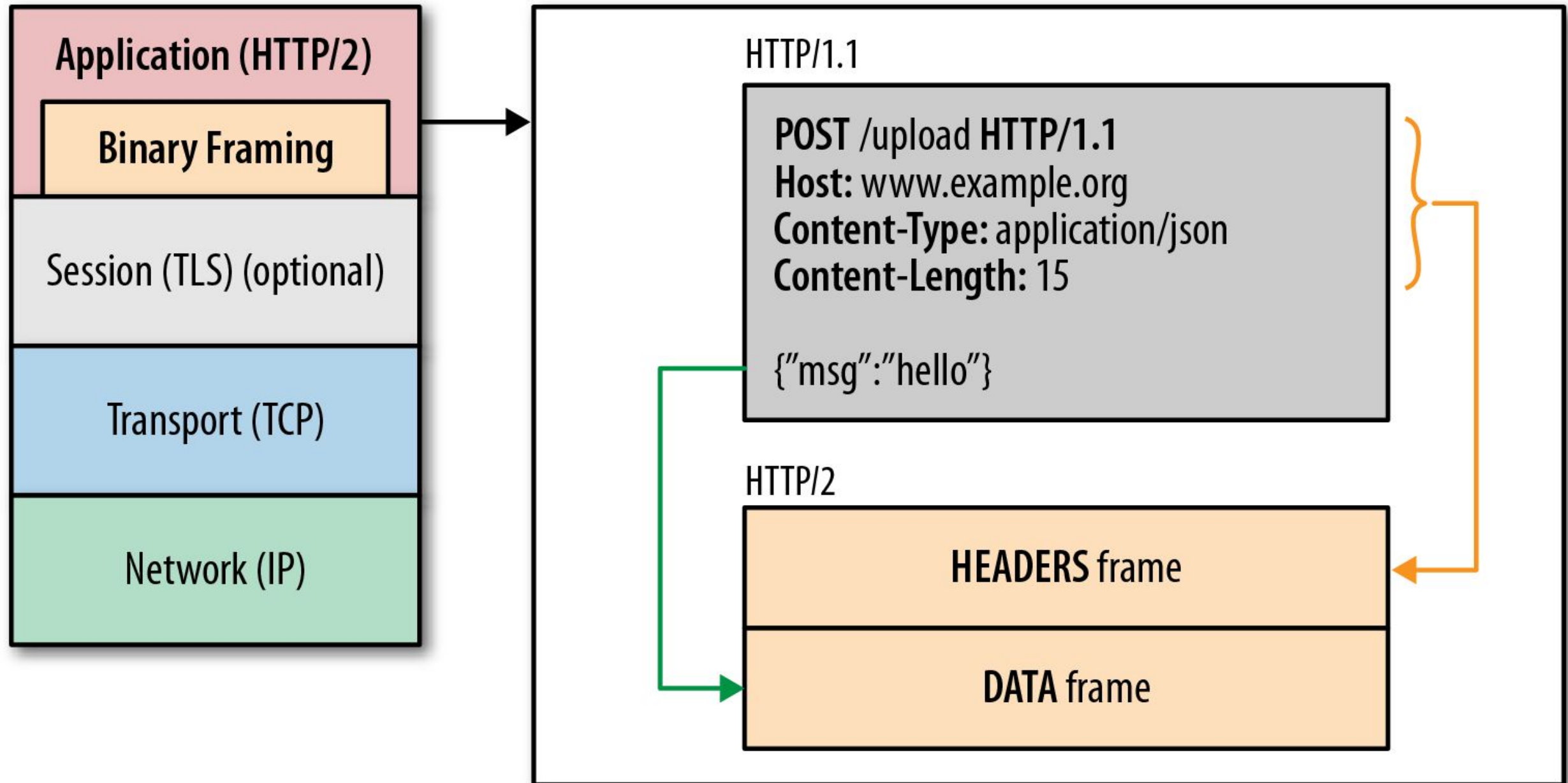
```
[branko@blap:~]$ nghttp -nv -u http://magento2.plus.hr/
[ 0.031] Connected
[ 0.031] HTTP Upgrade request
GET /http2/test.txt HTTP/1.1
host: magento2.plus.hr
connection: Upgrade, HTTP2-Settings
upgrade: h2c
http2-settings: AAMAAABkAAQAAP__
accept: */*
user-agent: nghttp2/1.8.0

[ 0.047] HTTP Upgrade response
HTTP/1.1 101 Switching Protocols
Upgrade: h2c
Connection: Upgrade

[ 0.047] HTTP Upgrade success
[ 0.047] send SETTINGS frame <length=12, flags=0x00, s
(niv=2)
[SETTINGS_MAX_CONCURRENT_STREAMS(0x03):100]
[SETTINGS_INITIAL_WINDOW_SIZE(0x04):65535]
```

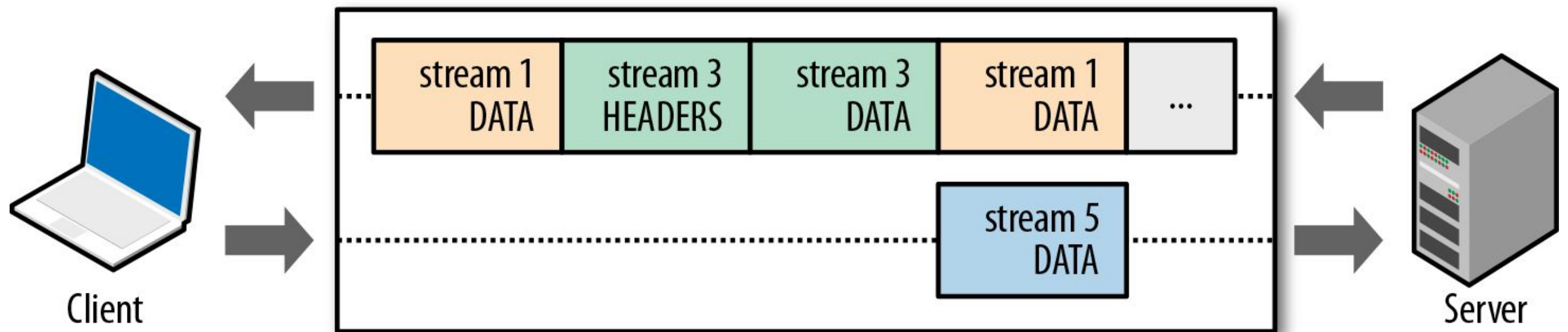


HTTP/2 binary framing



HTTP/2 multiplexing

HTTP/2 connection



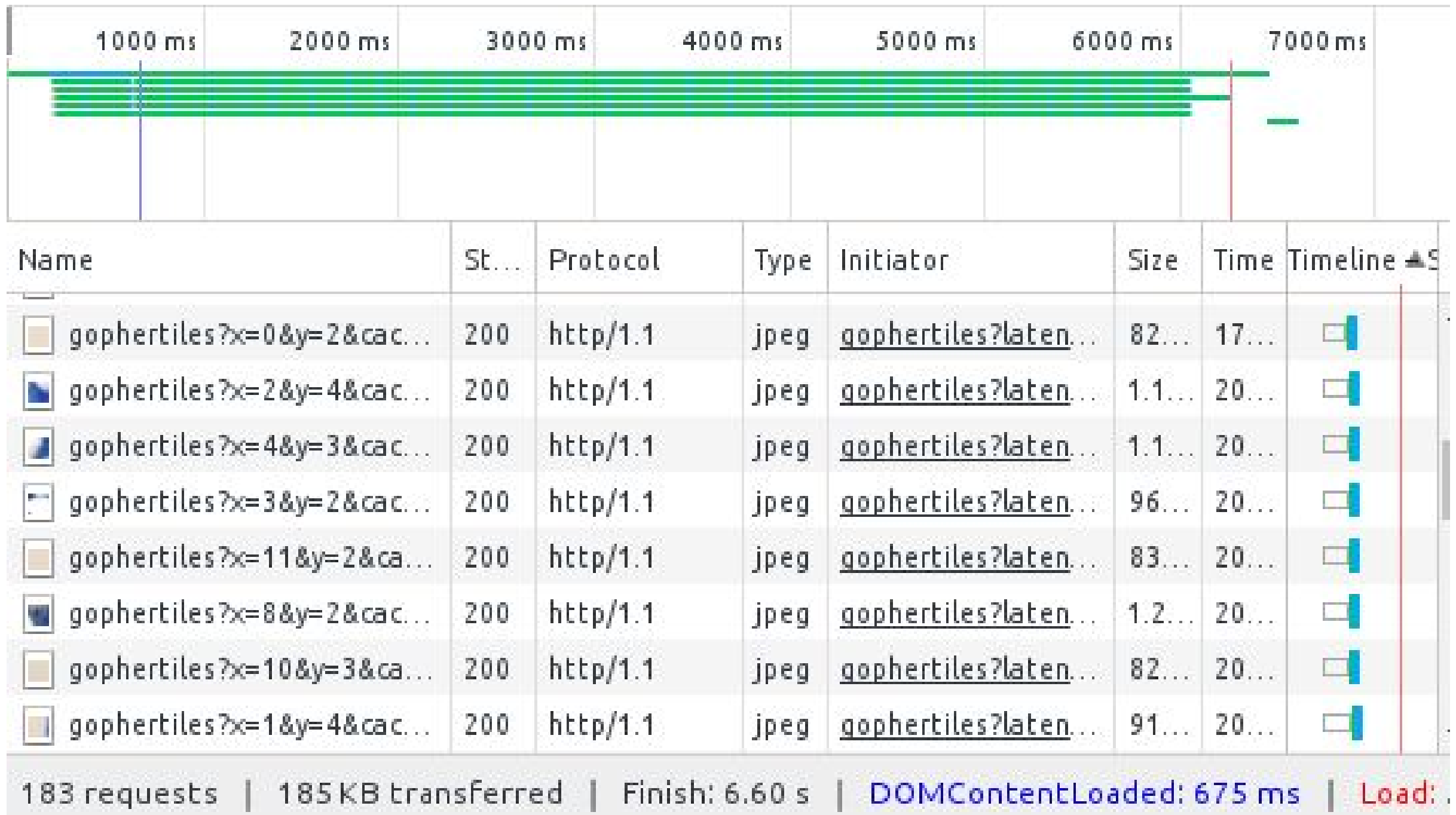
Example



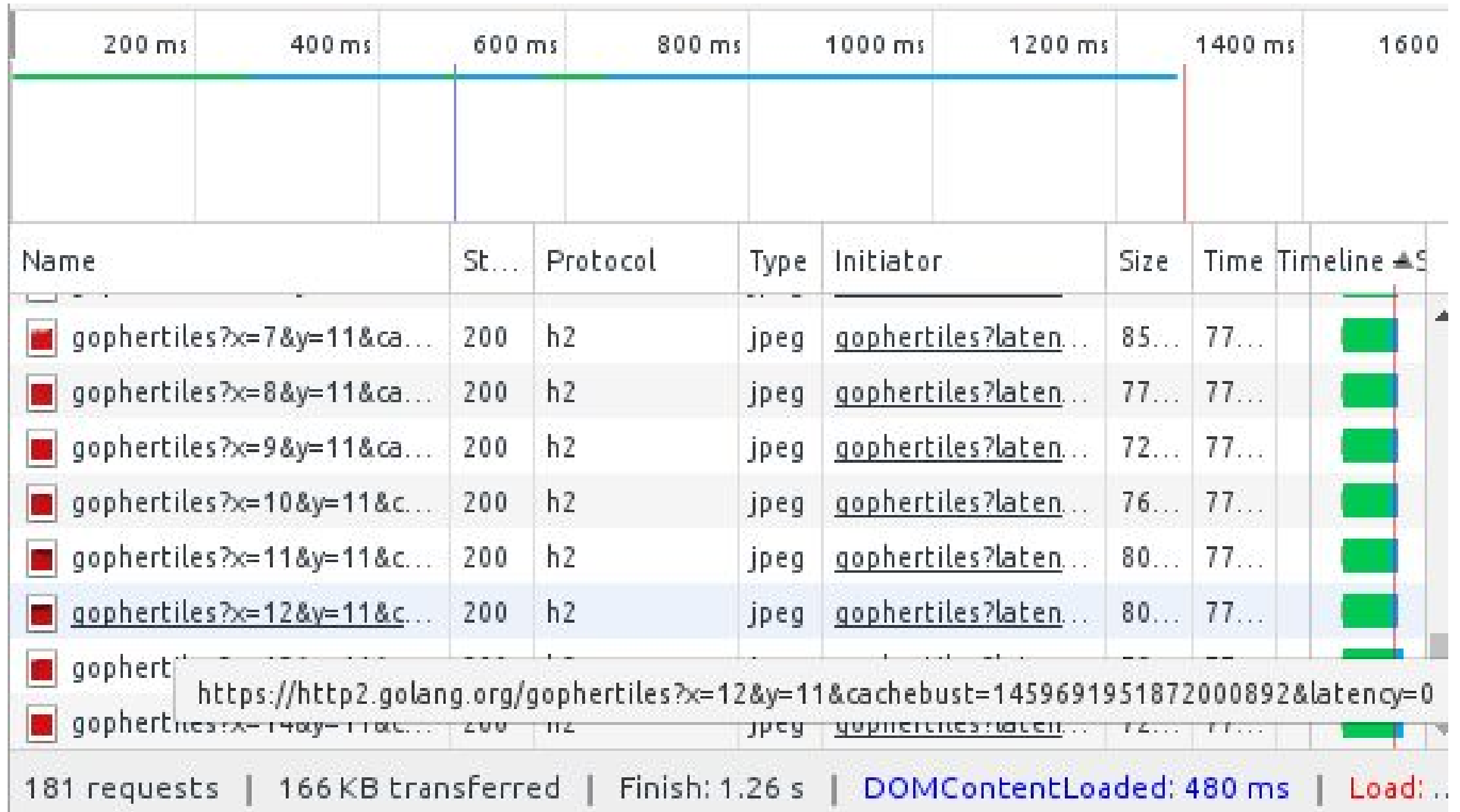
<https://http2.golang.org/gophertiles>



Example HTTP/1.x



Example HTTP/2



HTTP/2 - HPACK

Request headers

:method	GET
:scheme	https
:host	example.com
:path	/resource
user-agent	Mozilla/5.0 ...
custom-hdr	some-value

Static table

1	:authority	
2	:method	GET
...
51	referer	
...
62	user-agent	Mozilla/5.0 ...
63	:host	example.com
...

Dynamic table

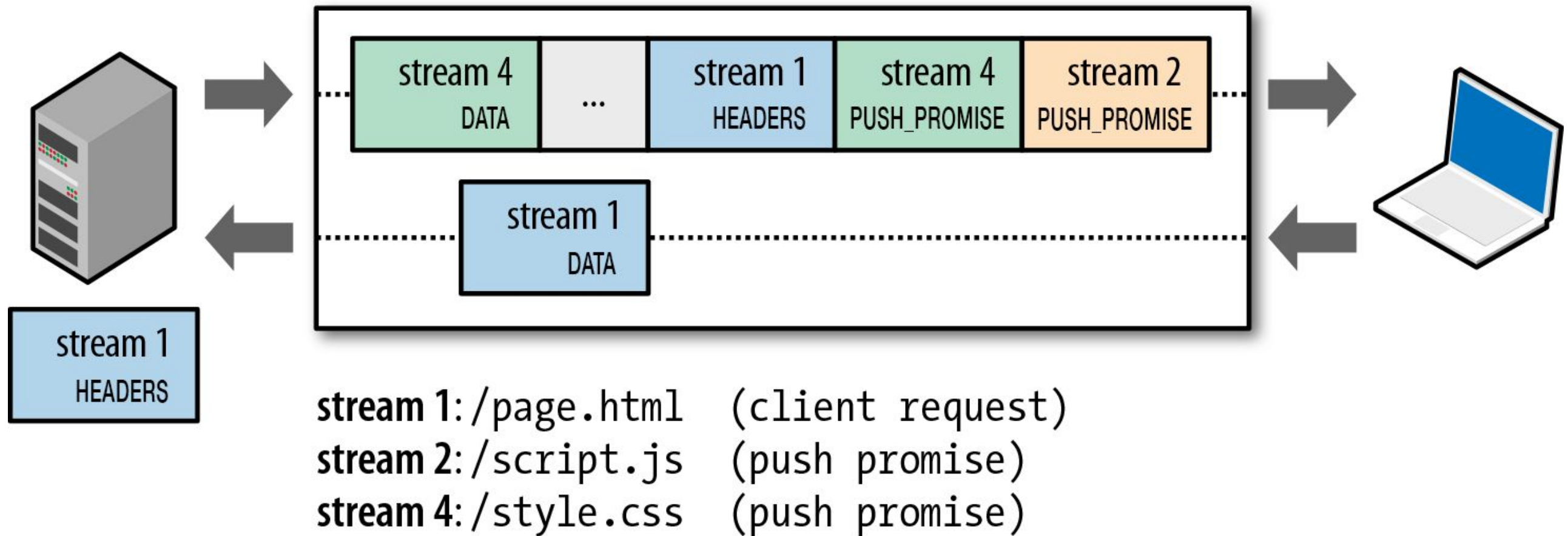
Encoded headers

2	
7	
63	
19	Huffman("/resource")
62	
	Huffman("custom-hdr")
	Huffman("some-value")



HTTP/2 - PUSH

HTTP/2 connection



HTTP/2 - PUSH

Like inlining, but with additional performance benefits:

- Pushed resources can be cached by the client
- Pushed resources can be reused across different pages
- Pushed resources can be multiplexed alongside other resources
- Pushed resources can be prioritized by the server
- Pushed resources can be declined by the client

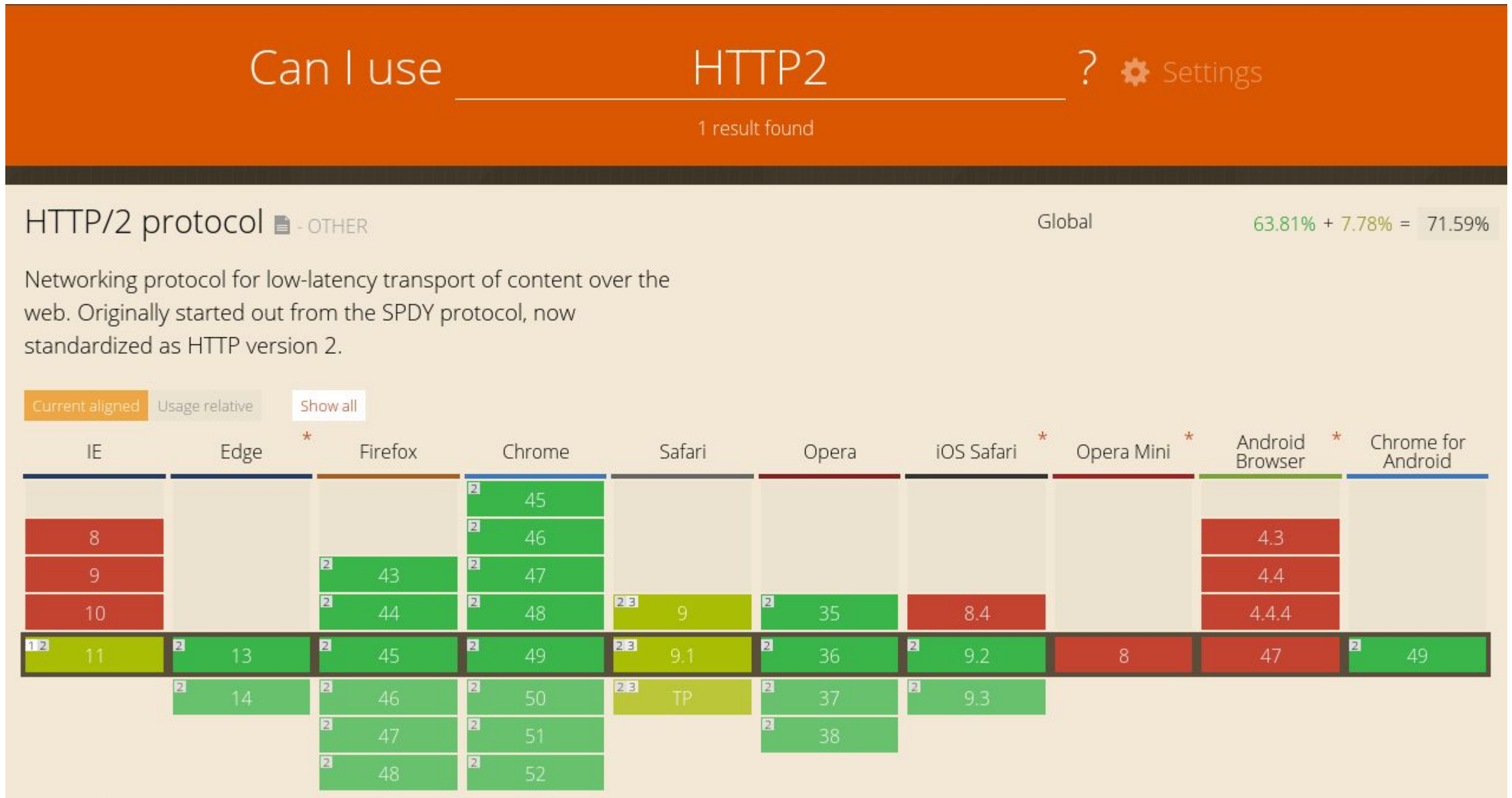


What is still a good practice?

- **GZIP** (Save the bandwidth)
- **Rendering time** (First impression counts)
- **CDN** (Locally distributed content, over h2)
- **Cache Control** (Save the bandwidth)



HTTP/2 Support



HTTP/2 Support



Apache

NGINX

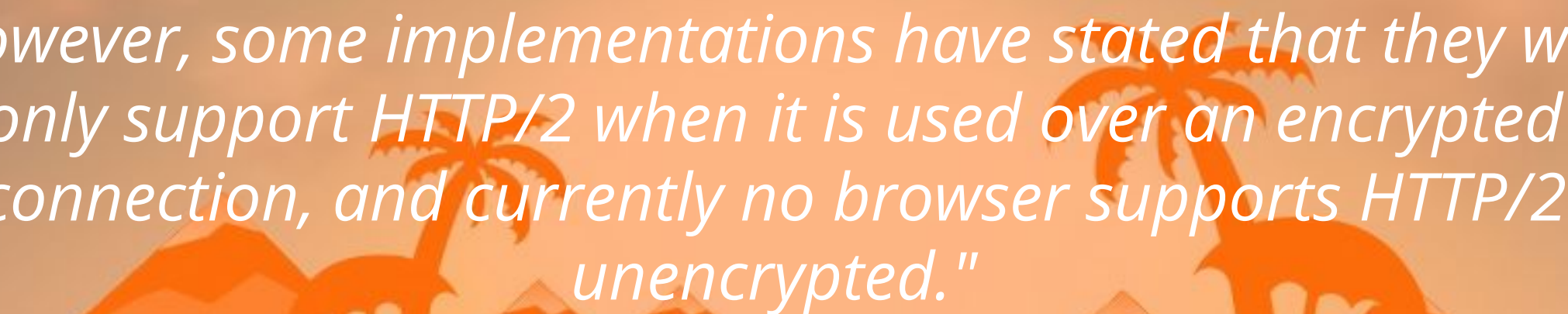
<https://github.com/http2/http2-spec/wiki/Implementations>



Does HTTP/2 require encryption?

"No. After extensive discussion, the Working Group did not have consensus to require the use of encryption (e.g., TLS) for the new protocol."

However, some implementations have stated that they will only support HTTP/2 when it is used over an encrypted connection, and currently no browser supports HTTP/2 unencrypted."



TLS and ALPN

- **Currently only supported method for protocol upgrade in browsers**
- **Requires OpenSSL \geq 1.0.2**
- **Most servers do not support it out of the box**



HTTP/2 Adoption

H2 enabled CDN

- Easy
- Fast
- Local content distribution



HTTP/2 Adoption

H2 enabled Proxy

- Requires h2 capable proxy server
- Backend does not need to talk h2
- No connection limits on backend
- Medium difficulty



HTTP/2 Adoption

H2 Full

- Full support on web server
- Enables PUSH
- More control
- Hard to implement for some



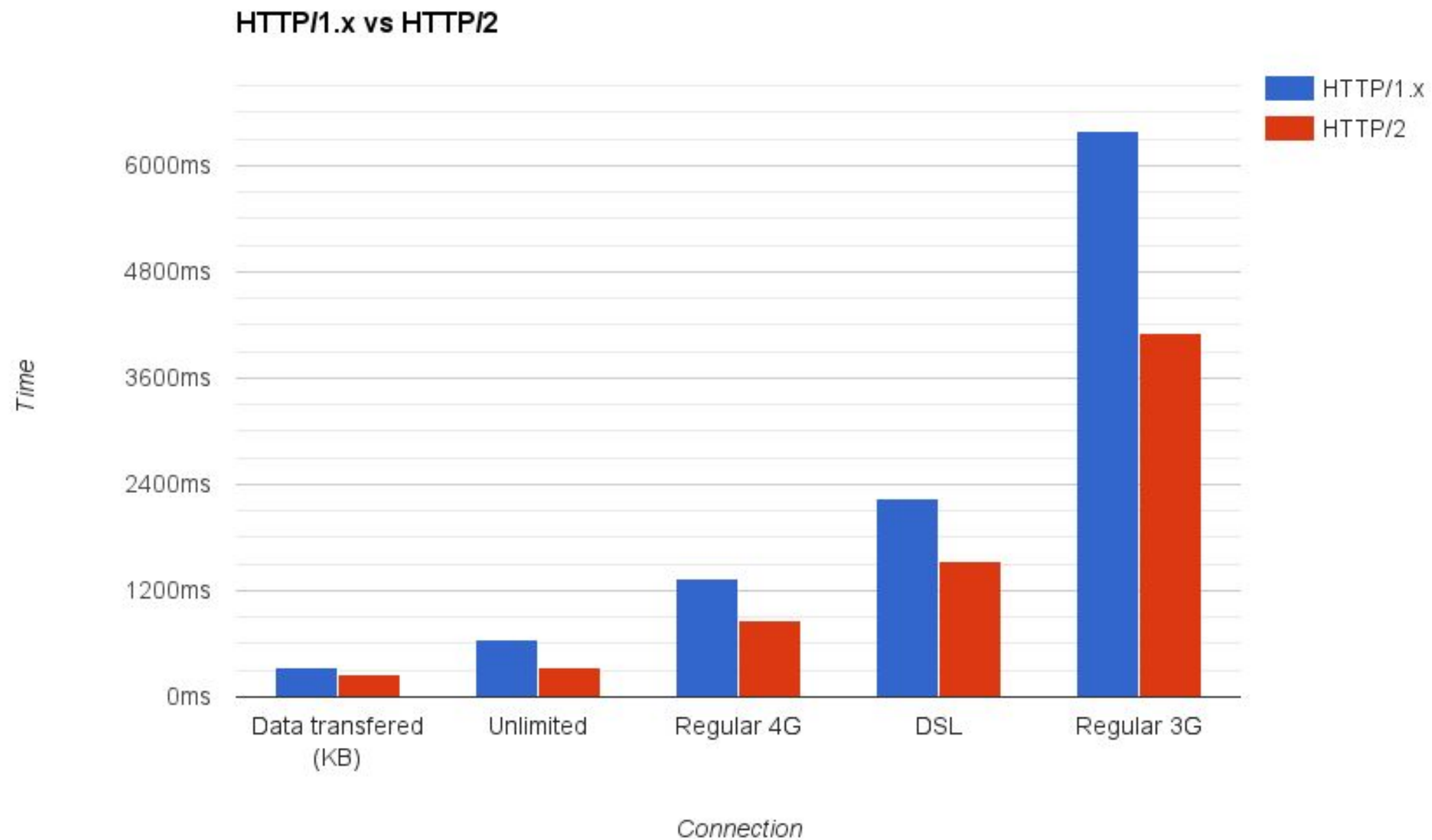
HTTP/2 Tests

- 3 test cases
- 5 iterations each
- High performance isolated test hosts
- Base tests for comparison
 - (<https://magento2.plus.hr/http2>)



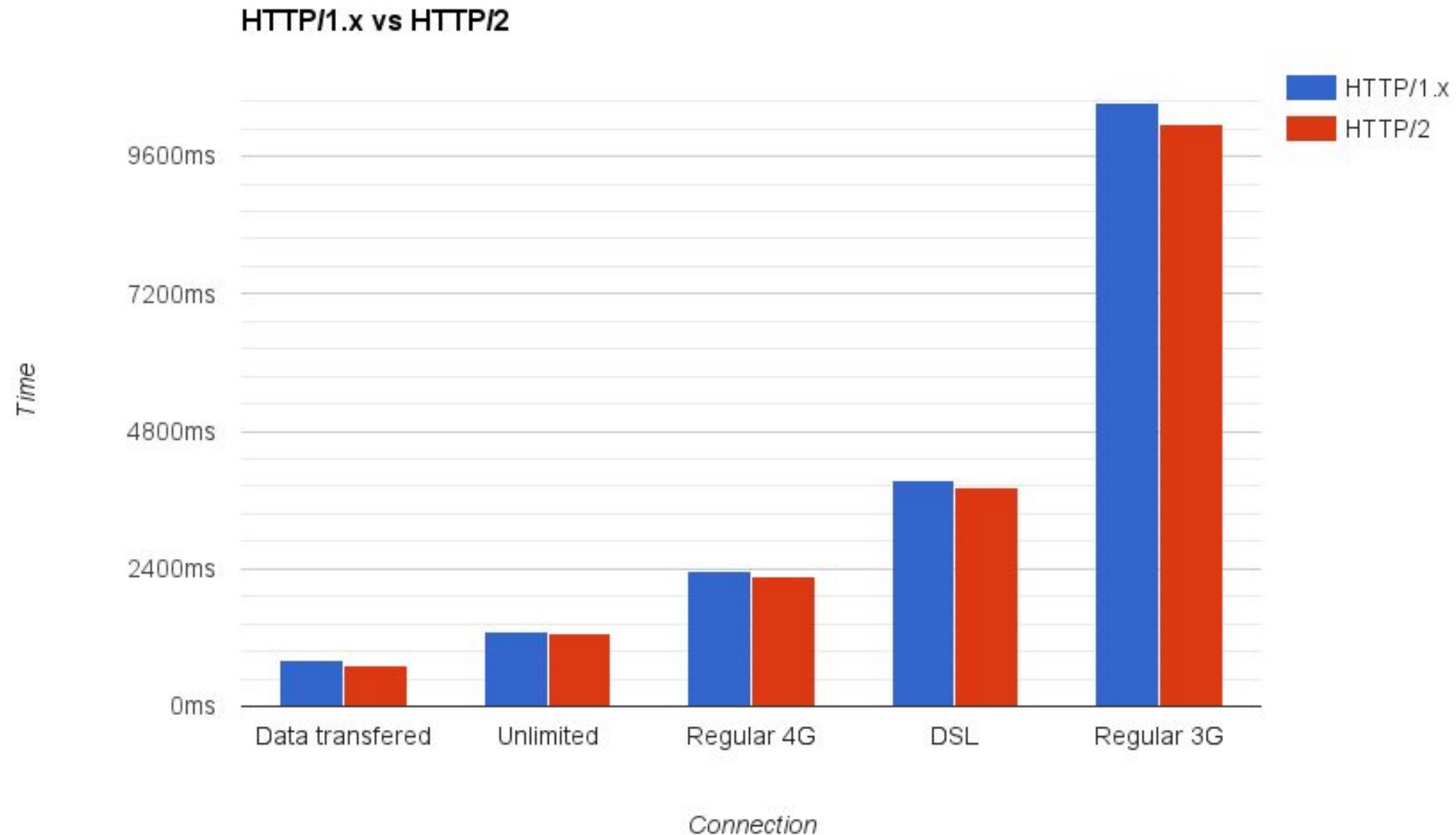
HTTP/2

Base reference



HTTP/2 & Magento2

Magento homepage



What's the **problem** then?



**"My team has created a very innovative solution,
but we're still looking for a problem to go with it."**



HTTP/2 & Magento2

<https://magento2.plus.hr/>

- Come and test it out!
- Require.js XHR requests are counter productive
- Merging JS is "broken" on another level





















HTTP/2 & PUSH?

- Don't do it through .htaccess
- Avoid duplicate headers
- Watch out for endless streams

header("Link: </pub/media/styles.css>;rel=preload");



















HTTP/2 NO PUSH

Name	St...	P...	Type	Size	Time	Timeline – Start Time
 magento2.plus.hr	200	h2	document	8.3 KB	192 ms	
 80f06aa0a25c8c71129972d0e29ca151....	200	h2	stylesheet	39.7 KB	102 ms	
 styles-l.min.css	200	h2	stylesheet	12.3 KB	123 ms	
 require.min.js	200	h2	script	7.5 KB	205 ms	
 print.min.css	200	h2	stylesheet	610 B	207 ms	
 requirejs-min-resolver.min.js	200	h2	script	242 B	103 ms	
 mixins.min.js	200	h2	script	1.2 KB	203 ms	
 requirejs-config.min.js	200	h2	script	2.0 KB	205 ms	
 styles.css	200	h2	stylesheet	3.8 KB	101 ms	



HTTP/2 PUSH

Name	St...	P...	Type	Size	Time	Timeline - Start Time	400.00 ms	600.00 ms
 magento2.plus.hr	200	h2	document	9.7 KB	435 ms			
 80f06aa0a25c8c71129972d0e29ca151....	200	h2	stylesheet	282 KB	355 ms			
 styles-l.min.css	200	h2	stylesheet	12.3 KB	361 ms			
 require.min.js	200	h2	script	24.7 KB	30 ms			
 requirejs-min-resolver.min.js	200	h2	script	338 B	22 ms			
 mixins.min.js	200	h2	script	1.2 KB	358 ms			
 styles.css	200	h2	stylesheet	36.4 KB	36 ms			
 print.min.css	200	h2	stylesheet	610 B	358 ms			

Connection Setup

TIME

Queueing



1.19 ms

Stalled



16.72 ms

Request/Response

TIME

Request sent



3.30 ms

Waiting (TTFB)



0.19 ms

Content Download



9.32 ms

Explanation





30.73 ms



Page load times?



HTTP/2 Debugging

Name	Status	Protocol	Type	Initiator
 magento2.plus.hr	200	h2	document	Other
 80f06aa0a25c8c71129972d0e...	200	h2	stylesheet	<u>(index):17</u>
 styles-l.min.css	200	h2	stylesheet	<u>(index):18</u>
 require.min.js	200	h2	script	<u>(index):22</u>

_SERVER["REMOTE_PORT"]	33143
_SERVER["GATEWAY_INTERFACE"]	CGI/1.1
_SERVER["SERVER_PROTOCOL"]	HTTP/2
_SERVER["REQUEST_METHOD"]	GET
_SERVER["QUERY_STRING"]	<i>no value</i>
_SERVER["REQUEST_URI"]	/info.php



HTTP/2 Debugging

- <chrome://net-internals/#http2>

```
222012: HTTP2_SESSION
magento2.plus.hr:443 (DIRECT)
Start Time: 2016-04-03 16:14:20.256

t=1415 [st= 0] +HTTP2_SESSION [dt=?]
--> host = "magento2.plus.hr:443"
--> proxy = "DIRECT"
t=1415 [st= 0] HTTP2_SESSION_INITIALIZED
--> protocol = "h2"
--> source_dependency = 222011 (SOCKET)
t=1415 [st= 0] HTTP2_SESSION_SEND_SETTINGS
--> settings = [{"id:3 flags:0 value:1000"}, {"id:4 flags:0 value:6291456}]
t=1415 [st= 0] HTTP2_STREAM_UPDATE_RECV_WINDOW
--> delta = 15663105
--> window_size = 15728640
t=1415 [st= 0] HTTP2_SESSION_SENT_WINDOW_UPDATE_FRAME
--> delta = 15663105
--> stream_id = 0
t=1415 [st= 0] HTTP2_SESSION_SEND_HEADERS
--> fin = true
--> :method: GET
--> :authority: magento2.plus.hr
--> :scheme: https
--> :path: /
--> accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/w
--> upgrade-insecure-requests: 1
--> user-agent: Mozilla/5.0 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML
--> accept-encoding: gzip, deflate, sdch
--> accept-language: en-US,en;q=0.8,hr;q=0.6,sr;q=0.4,sv;q=0.2
--> priority = 0
--> stream_id = 1
--> unidirectional = false
t=1430 [st= 15] HTTP2_SESSION_RECV_SETTINGS
--> clear_persisted = false
--> host = "magento2.plus.hr:443"
t=1430 [st= 15] HTTP2_SESSION_RECV_SETTING
--> flags = 0
--> id = 3
--> value = 100
t=1430 [st= 15] HTTP2_SESSION_RECEIVED_WINDOW_UPDATE_FRAME
--> delta = 2147418112
--> stream_id = 0
```



Thank You!



DevelopersParadise

2016 / Opatija / Croatia