

An aerial, high-angle view of the London skyline, featuring The Shard on the left, the River Thames in the center, and various other skyscrapers and buildings. The image is overlaid with a semi-transparent blue filter.

Whirlwind tour through the HTTP2 spec

PHP UK 2016 — 19.02.2016 — Ole Michaelis (Jimdo)

QUICK FAQ



IS IT REALLY
DONE?

YES!

IS SSL
MANDATORY?

No! But...

IS HTTP/2 MADE
BY GOOGLE?

No!

BUT WHAT'S
SPDY THEN?

Another Protocol!

IS HTTP/2
PLAIN TEXT?

No!

ARE HEADERS
COMPRESSED?

YES!

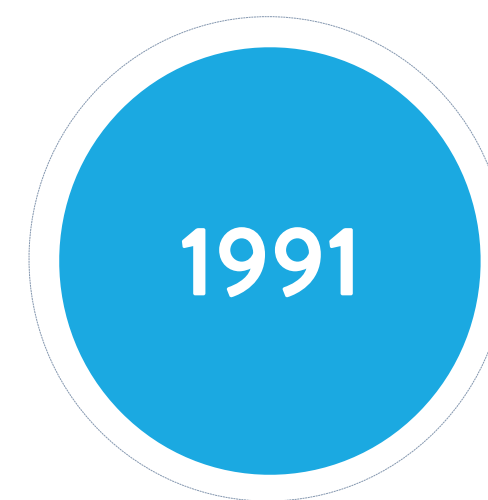
WILL HTTP/1.1
STILL WORK?

YES!

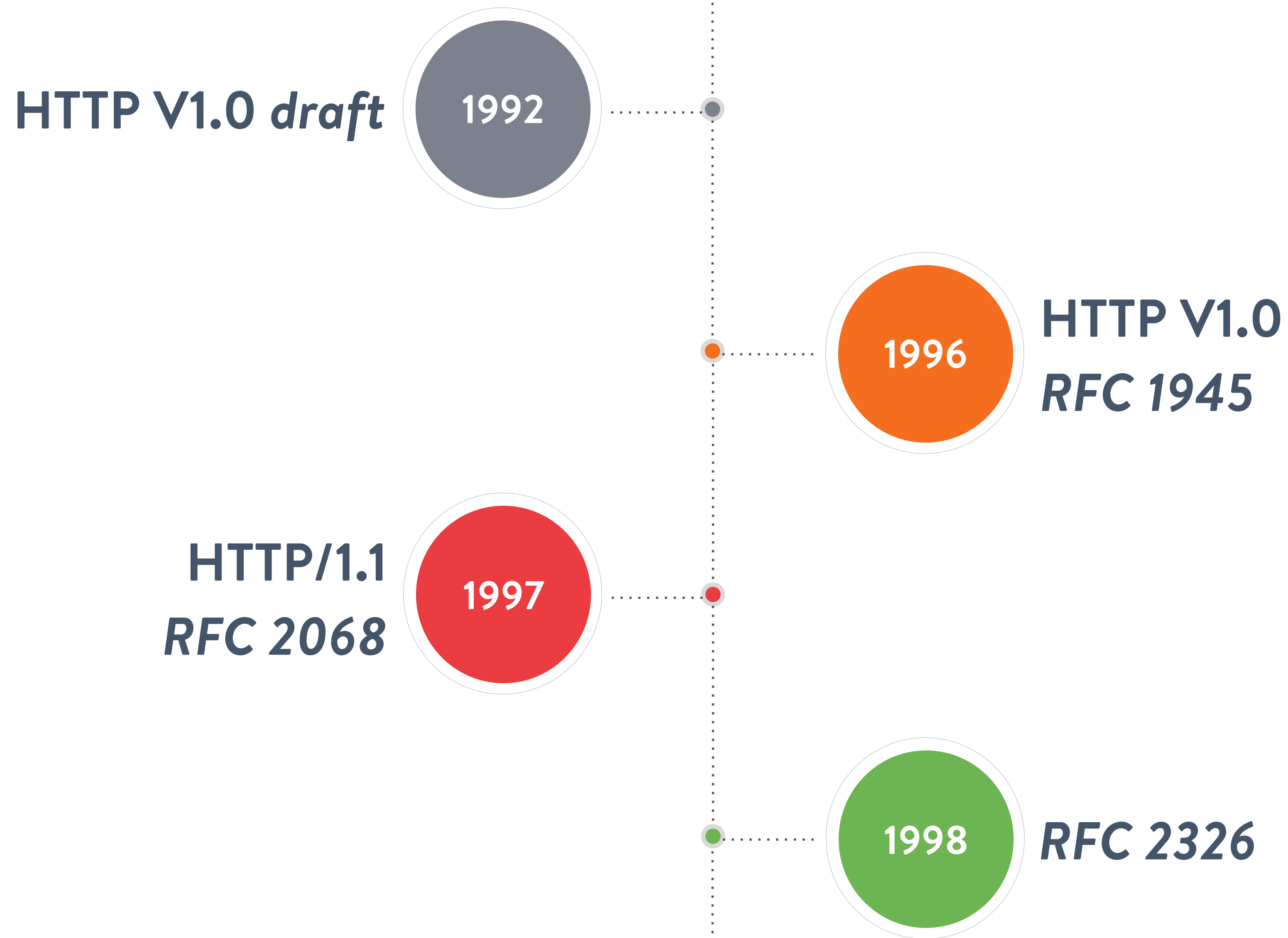


A BRIEF HISTORY

Sir Tim Berners-Lee's World Wide Web



HTTP V0.9



HTTP/1.1
RFC 2616

1999

2007

IETF forms ✨
HTTPbis WG

Call for Proposals
for HTTP/2

early
2012

Nov.
2012

First HTTP/2 draft based
on Google's SPDY

**HTTP/1.1
split**

2014

RFC 7230

Message Syntax & Routing

RFC 7231

Semantics and Content

RFC 7232

Conditional Requests

RFC 7233

Range Requests

RFC 7234

Caching

RFC 7235

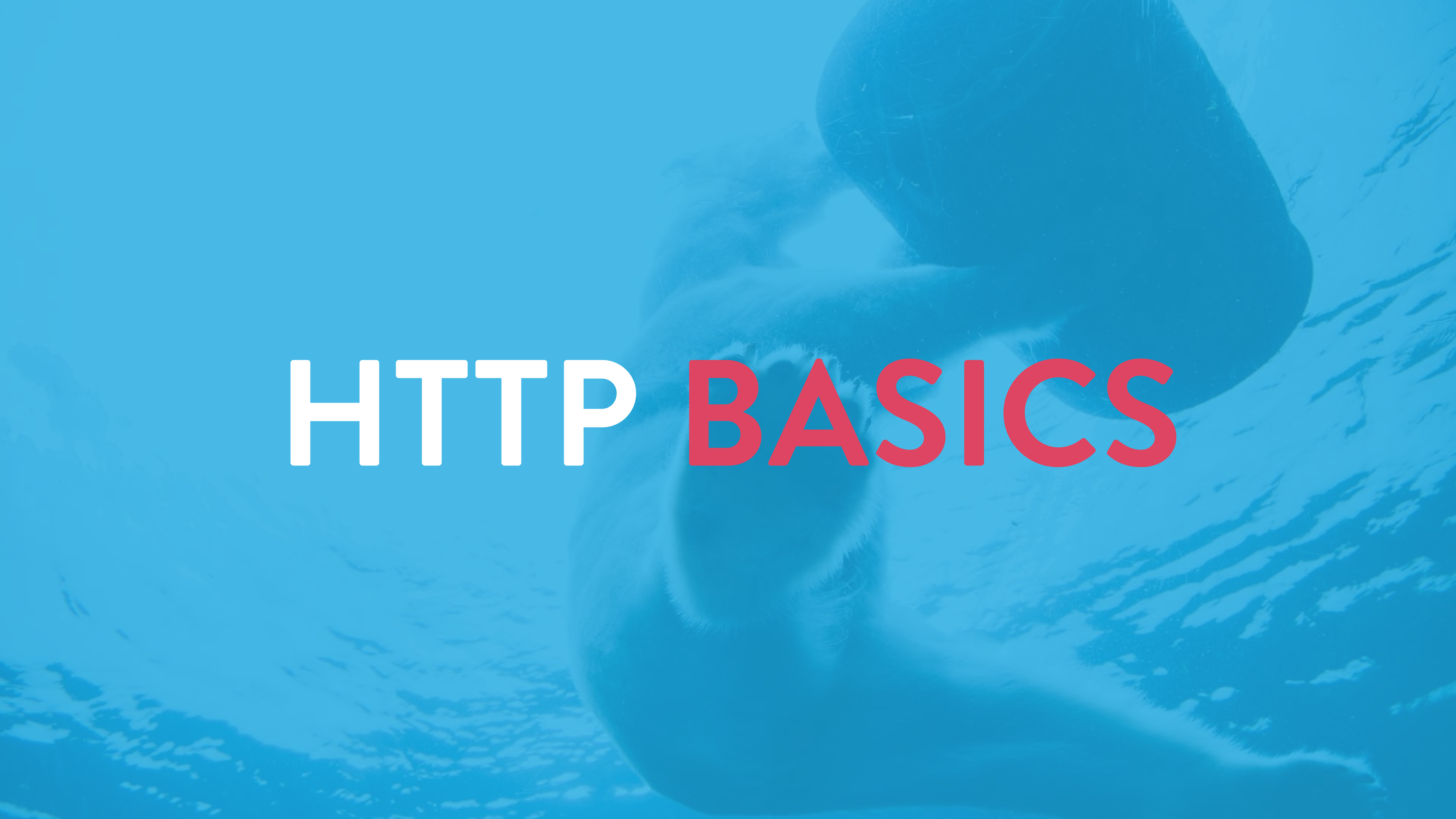
Authentication

May
2015

**HTTP/2
RFC 7540**

End of 2015:

22% of all Internet Traffic is HTTP/2



HTTP BASICS

PLAIN TEXT

👉 ~ telnet google.com 80

Trying 173.194.39.2...

Connected to google.com.

Escape character is '^]'.

GET / HTTP/1.1

Host: google.com

HTTP/1.1 302 Found

Cache-Control: private

Content-Type: text/html; charset=UTF-8

Location: <http://www.google.de/>?

STATELESS

SUPER FLEXIBLE

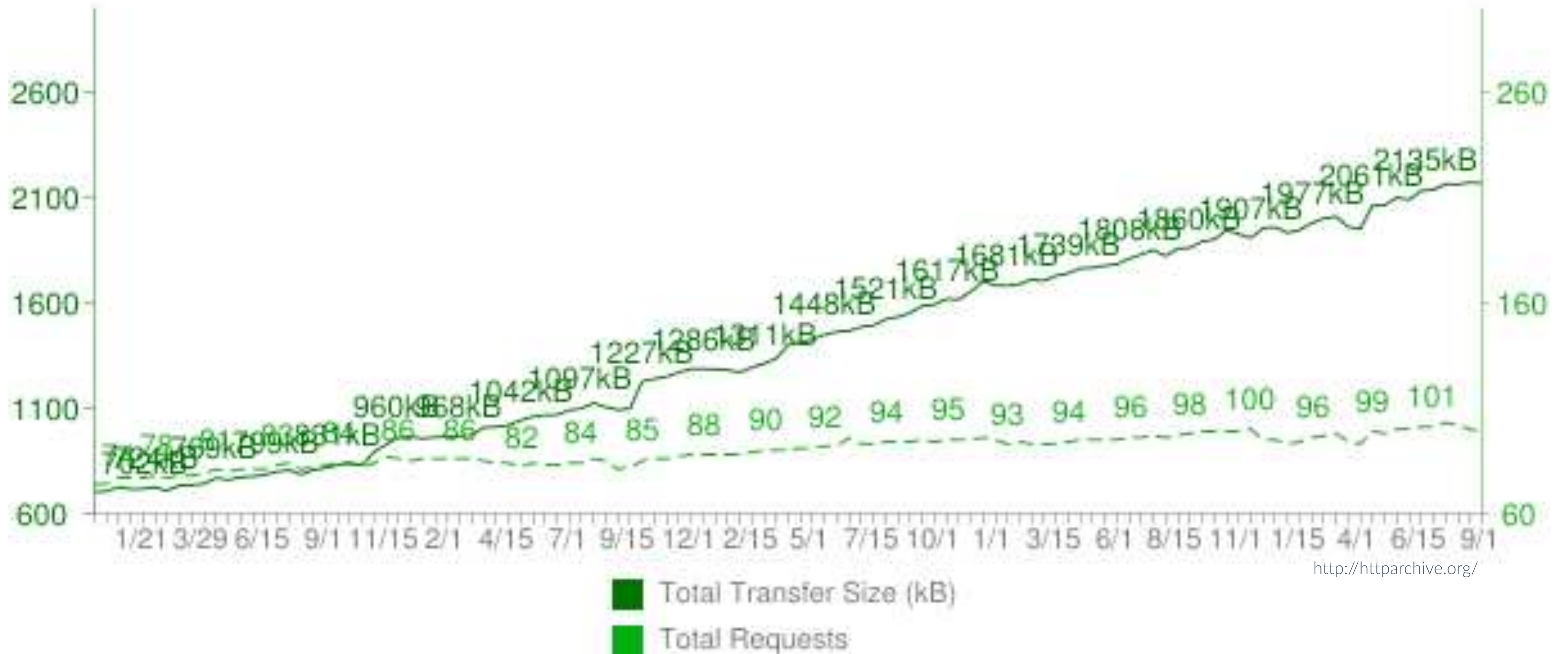
The background of the slide features a photograph of a sea turtle resting on a sandy beach. The entire image is covered with a semi-transparent green overlay. The text is centered on the slide.

HTTP/1.1

PROBLEMS

THE WEB MATURED

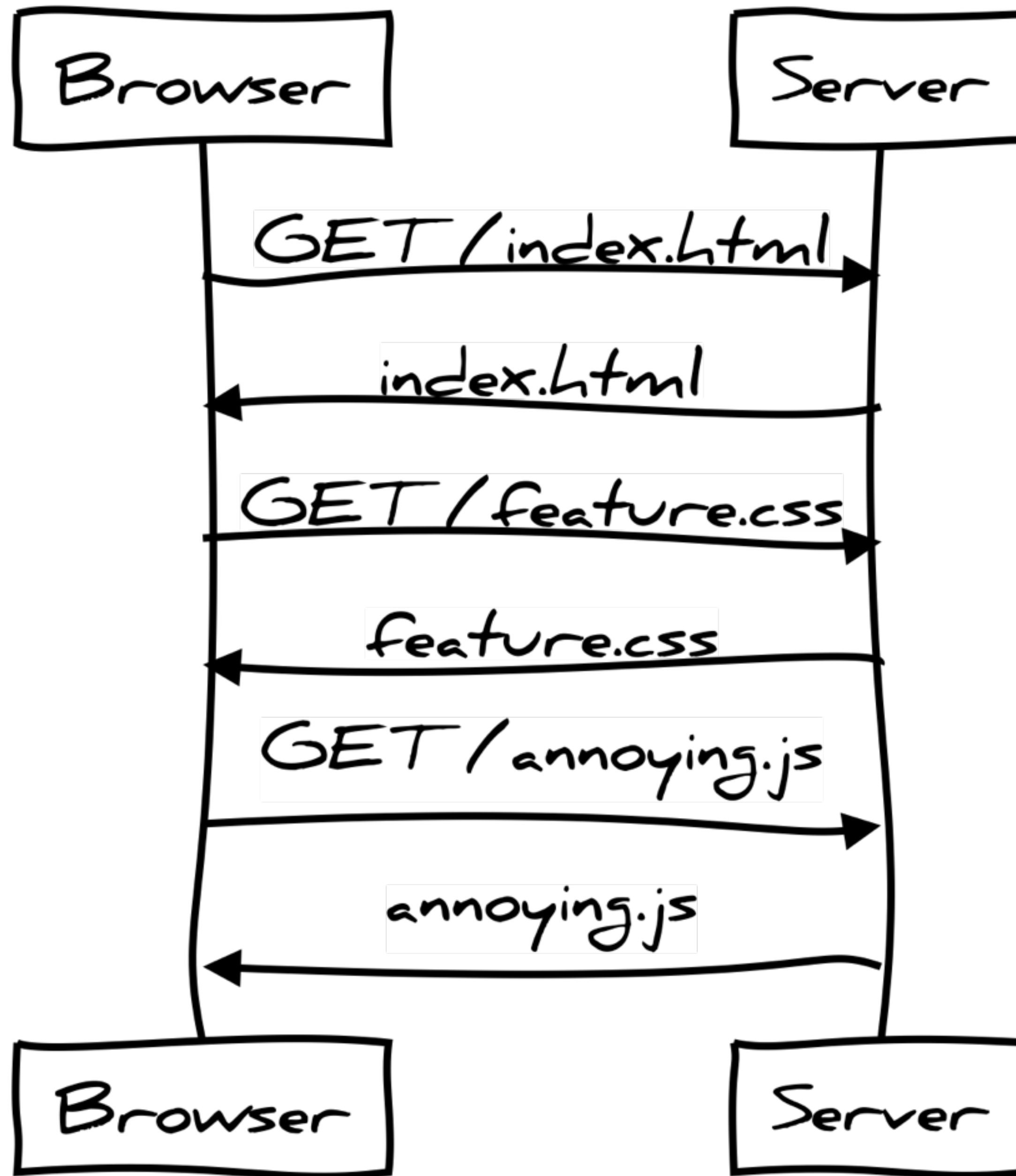
Total Transfer Size & Total Requests



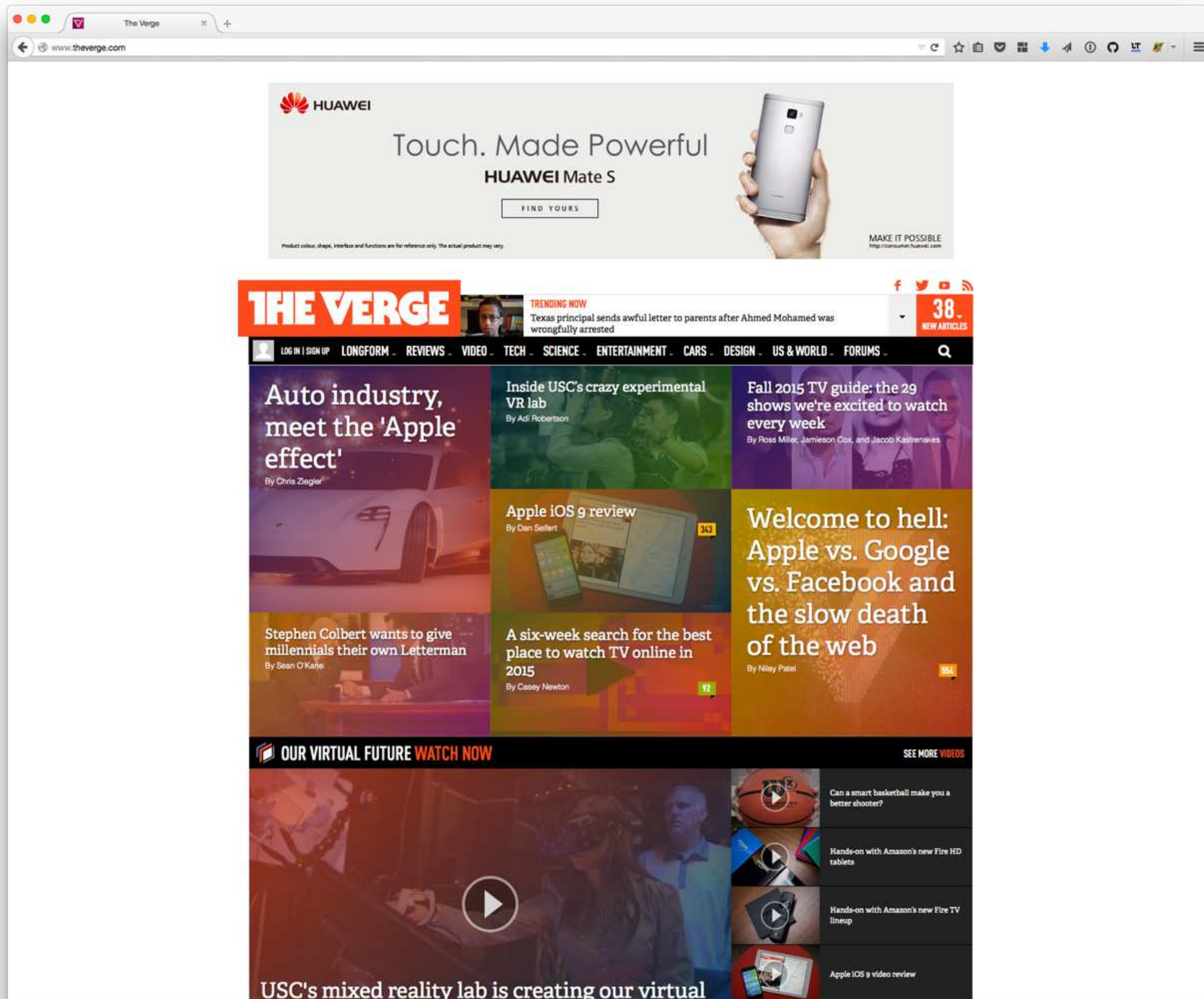
<http://httparchive.org/>

CONNECTIONS
38 PER
PAGE

REQUEST BONANZA



LATENCY!



ElementsNetworkSourcesTimelineProfilesResourcesAuditsConsole

View:

Preserve log

Disable cache

DSL (2 Mbps 5ms RT

Filter

Hide data URLs

All

XHR

JS

CSS

Img

Media

Font

Doc

WS

Other

Recording frames...

50 ms100 ms150 ms200 ms250 ms300 ms350 ms400 ms450 ms500 ms550 ms600 ms650 ms700 ms750 ms800 ms850 ms900 ms950 ms1000 ms

Name	Method	Status	Protocol	Type	Initiator	Size	Time	Cache-Control	Timeline - Start Time
------	--------	--------	----------	------	-----------	------	------	---------------	-----------------------

No requests captured. Reload the page to see detailed information on the network activity.

ConsoleSearchEmulationRendering

<top frame>

Preserve log

Filter

Regex

Hide network messages

All

Errors

Warnings

Info

Logs

Debug

Handled

'webkitMovementX' is deprecated. Please use 'movementX' instead.

'webkitMovementY' is deprecated. Please use 'movementY' instead.

Failed to load resource: net::ERR_SSL_PROTOCOL_ERROR

Failed to clear temp storage: It was determined that certain files are unsafe for access within a Web application, or that too many calls are being made on file resources, SecurityError

libraries.vc262b07aa2474684.js:2

libraries.vc262b07aa2474684.js:2

https://sc.iasds01.com:80/dtc7asid=4767e789-5d95-11e5-b038-00259086cc10&second_pass=1

> |

The image is a screenshot of the Chrome DevTools interface, specifically the Network and Console panels. The top bar shows the 'Network' tab is active. Below it, the 'View' section includes 'Preserve log' (unchecked), 'Disable cache' (checked), and a dropdown menu showing 'DSL (2 Mbps 5ms RT)'. The 'Filter' section shows 'All' selected, with other filters like 'XHR', 'JS', 'CSS', 'Img', 'Media', 'Font', 'Doc', 'WS', and 'Other' available. The main area of the Network panel is a timeline showing 'Recording frames...' with a scale from 0 to 1000 ms. Below the timeline is a table with columns: Name, Method, Status, Protocol, Type, Initiator, Size, Time, Cache-Control, and Timeline - Start Time. The table is currently empty. The bottom panel is the Console, which shows several error messages. The first two are deprecation warnings for 'webkitMovementX' and 'webkitMovementY'. The third is a 'Failed to load resource' error with a status of 'net::ERR_SSL_PROTOCOL_ERROR'. The fourth is a 'Failed to clear temp storage' error with a status of 'SecurityError'. The console also shows a search bar, 'Emulation' and 'Rendering' tabs, and a 'Filter' section with 'All' selected and other filters like 'Errors', 'Warnings', 'Info', 'Logs', 'Debug', and 'Handled'.



Ole Michaelis

@CodeStars

I think @verge is my absolute favourite example of how fucked up web performance is 120 reqs / ~10s before “load” event

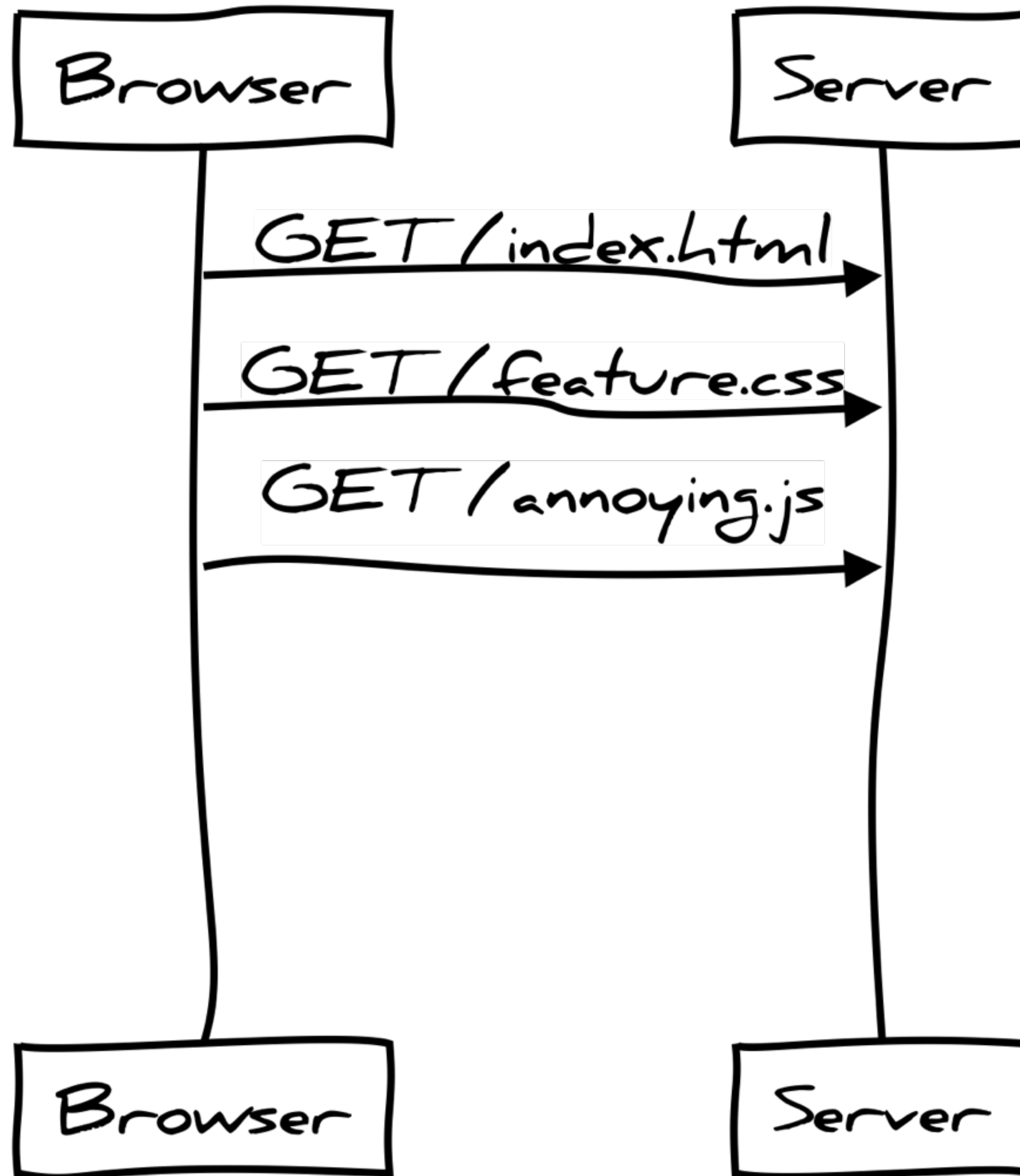
1:34 AM - 18 Sep 2015

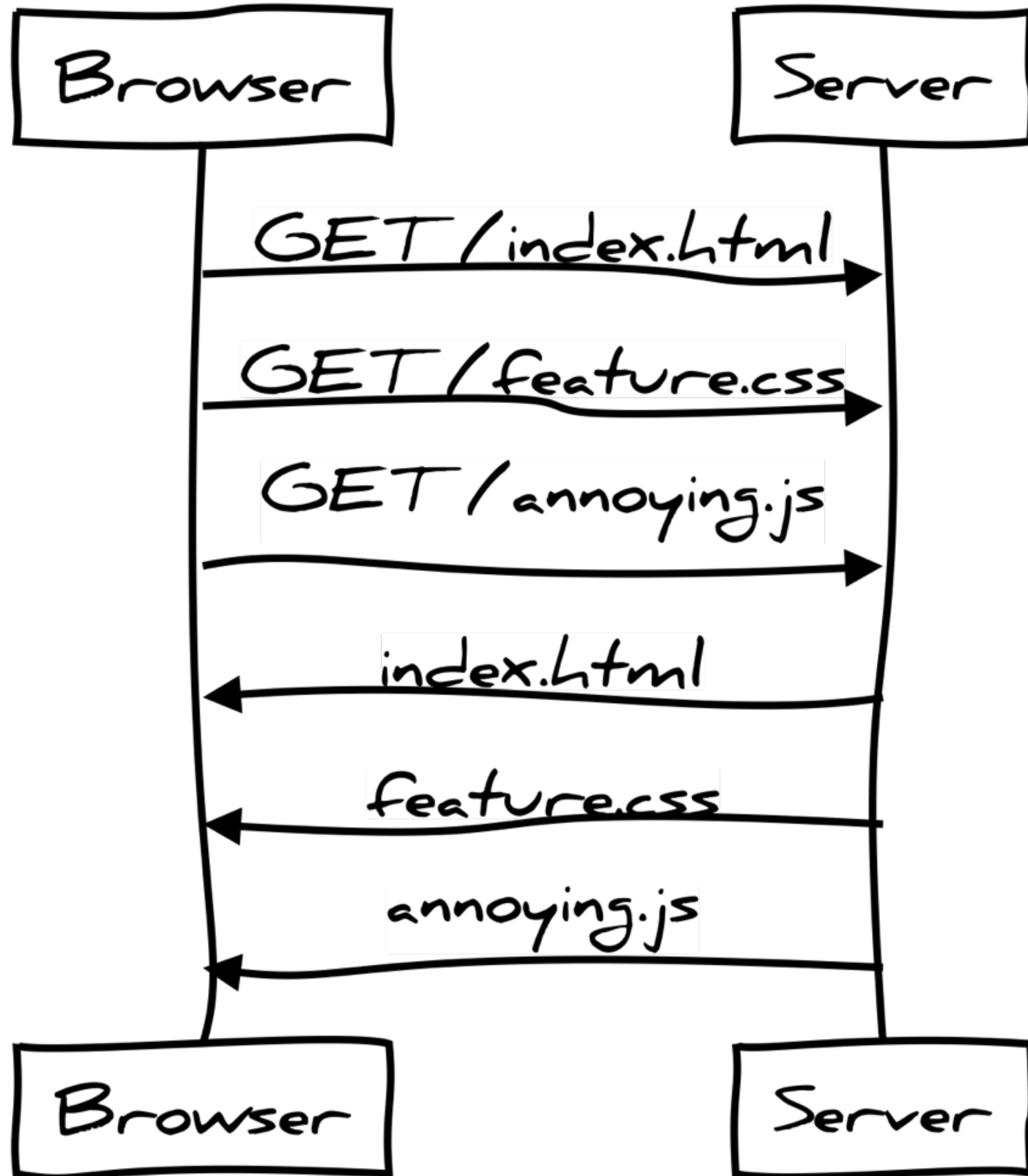
📍 Bahrenfeld, Hamburg



HOL* BLOCKING!

***Head of Line**





HOL* BLOCKING

RECAP

ORDER MATTERS!

HOL* BLOCKING

RECAP

SLOWEST BLOCKS!

HOL* BLOCKING

RECAP

NO WORKAROUND!

HOL* BLOCKING

RECAP

OFTEN UNUSED!



WE
ENDEAVORED

SPRITING

CONCATENATING

DOMAIN SHARDING

INLINING

PRELOADING HACKS!

COOKIE FREE
DOMAINS*



HTTP/2 TO THE RESCUE



COMPATIBLE

UPGRADE FROM HTTP/1.1

Non Secure HTTP

UPGRADE HEADER

GET / HTTP/1.1

Host: server.example.com

Connection: Upgrade, HTTP2-Settings

Upgrade: h2c

HTTP2-Settings: *<base64url encoding of HTTP/
2 SETTINGS payload>*

HTTP/1.1 101 Switching Protocols

Connection: Upgrade

Upgrade: h2c

[HTTP/2 connection ...

HTTPS

TLS-ALPN

RFC 7301

Client

Server

ClientHello

----->

ServerHello

(ALPN extension &
list of protocols)

(ALPN extension &
selected protocol)

Certificate*

ServerKeyExchange*

CertificateRequest*

ServerHelloDone

<-----

Certificate*

ClientKeyExchange

CertificateVerify*

[ChangeCipherSpec]

Finished

----->

[ChangeCipherSpec]

Finished

<-----

Application Data

<----->

Application Data

HEADSUP:

h2 vs. h2c

MULTIPLYED

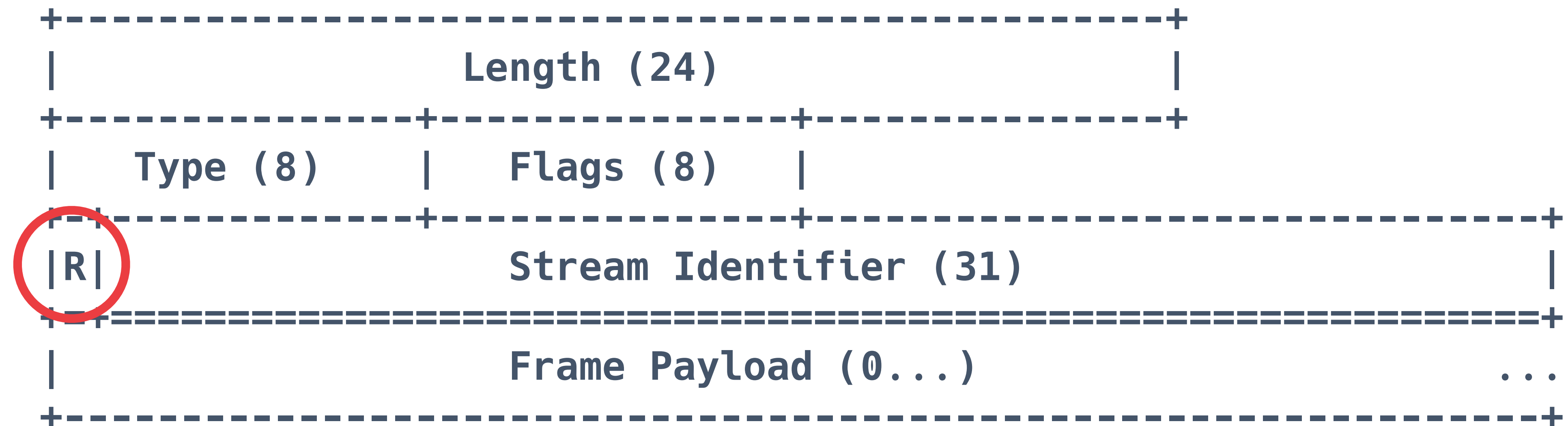
HTTP/2 CONNECTIONS

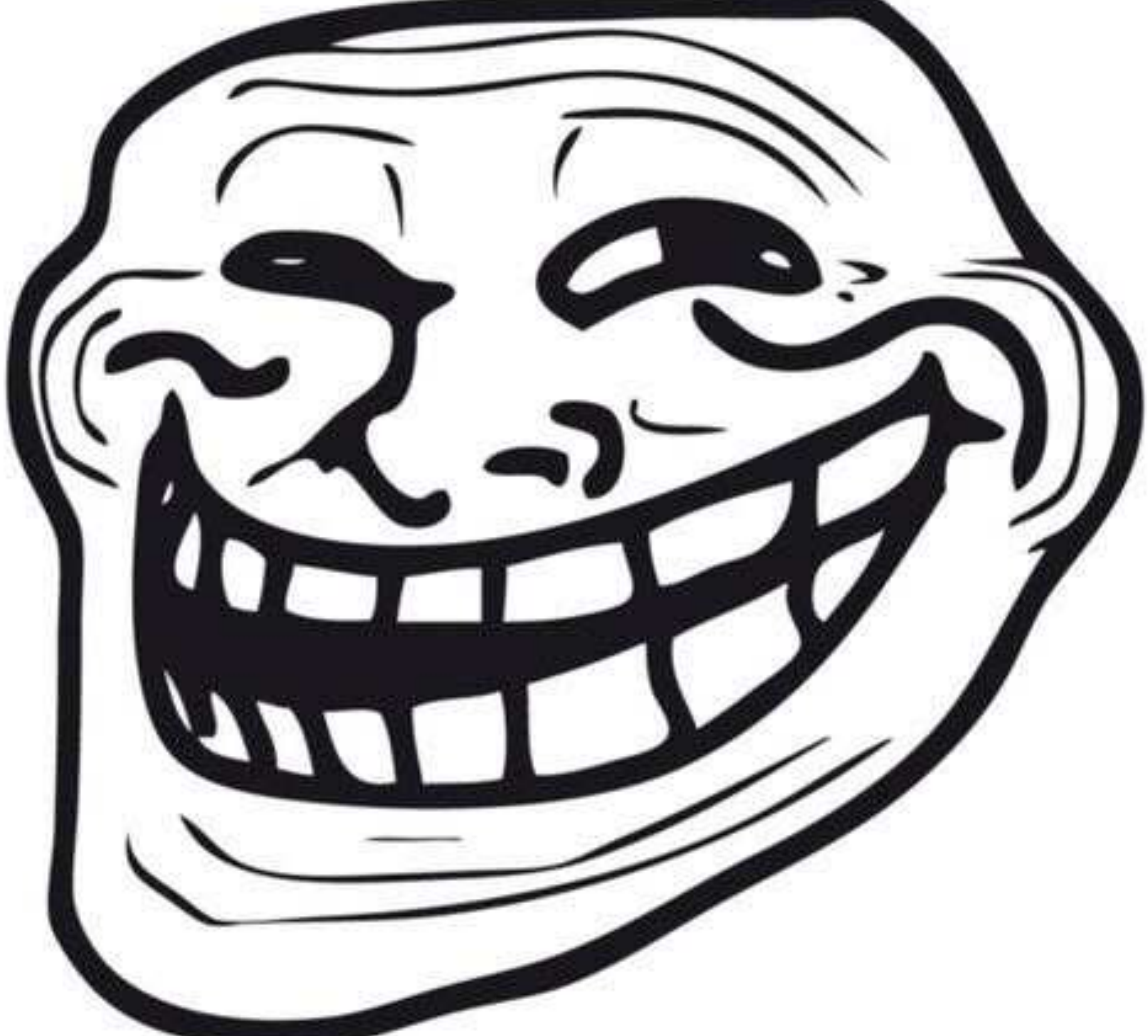


FRAMES

BINARY

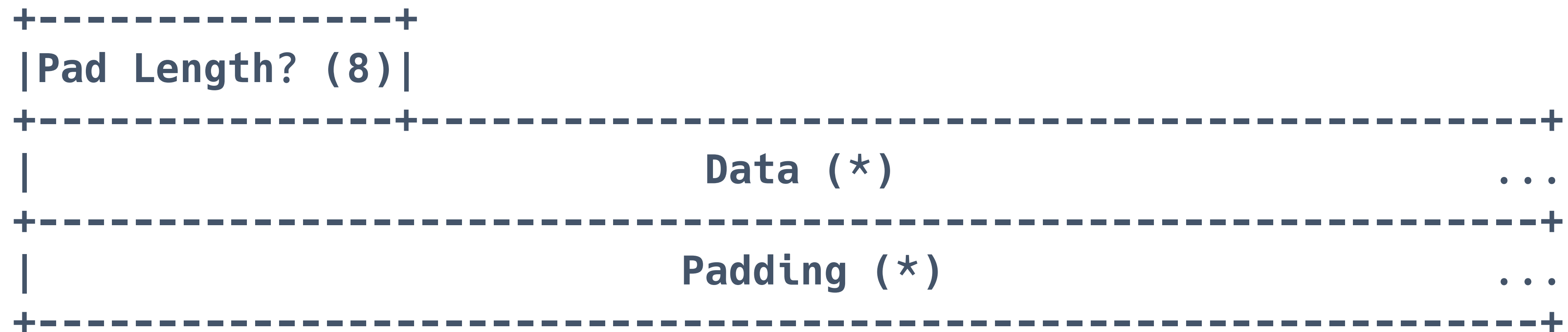
FRAME LAYOUT





TYPES

DATA 0x0



PRIORITY 0x2



RST_STREAM 0x3

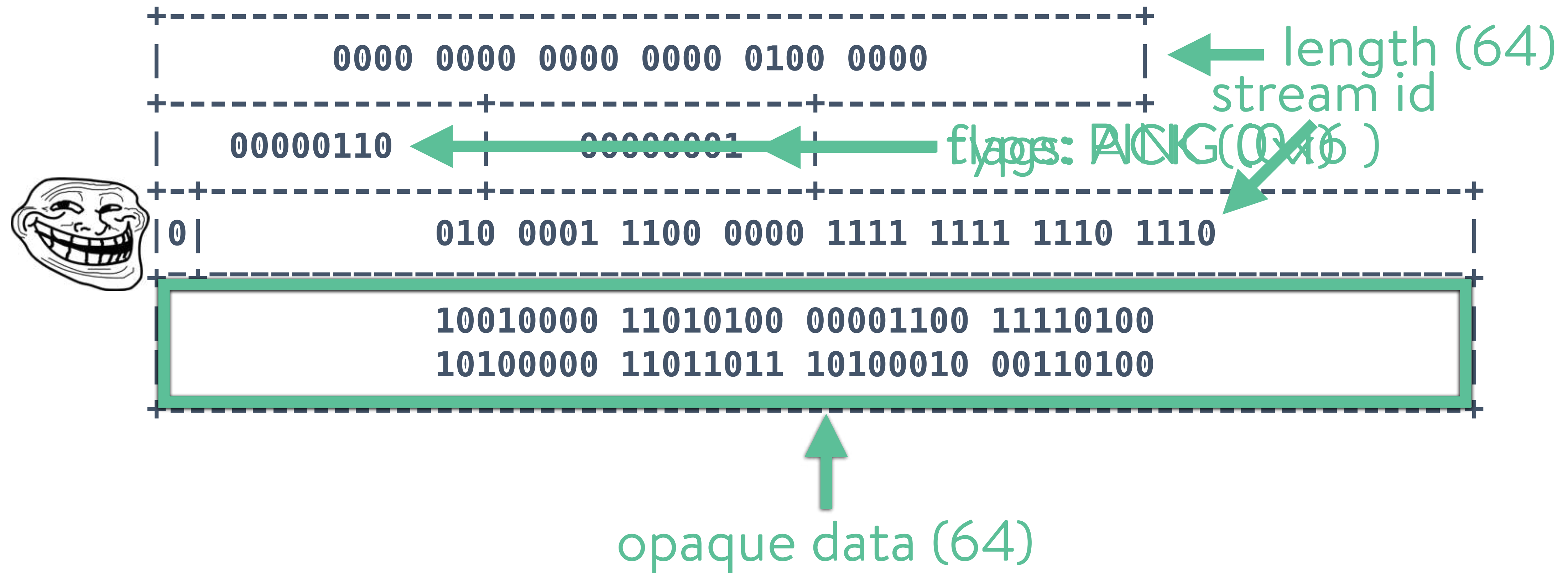


SETTINGS 0x4



a bunch more...

PING 0x6 /w ACK





HTTP/2

FEATURES

SERVER PUSH!

PUSH_PROMISE 0x5



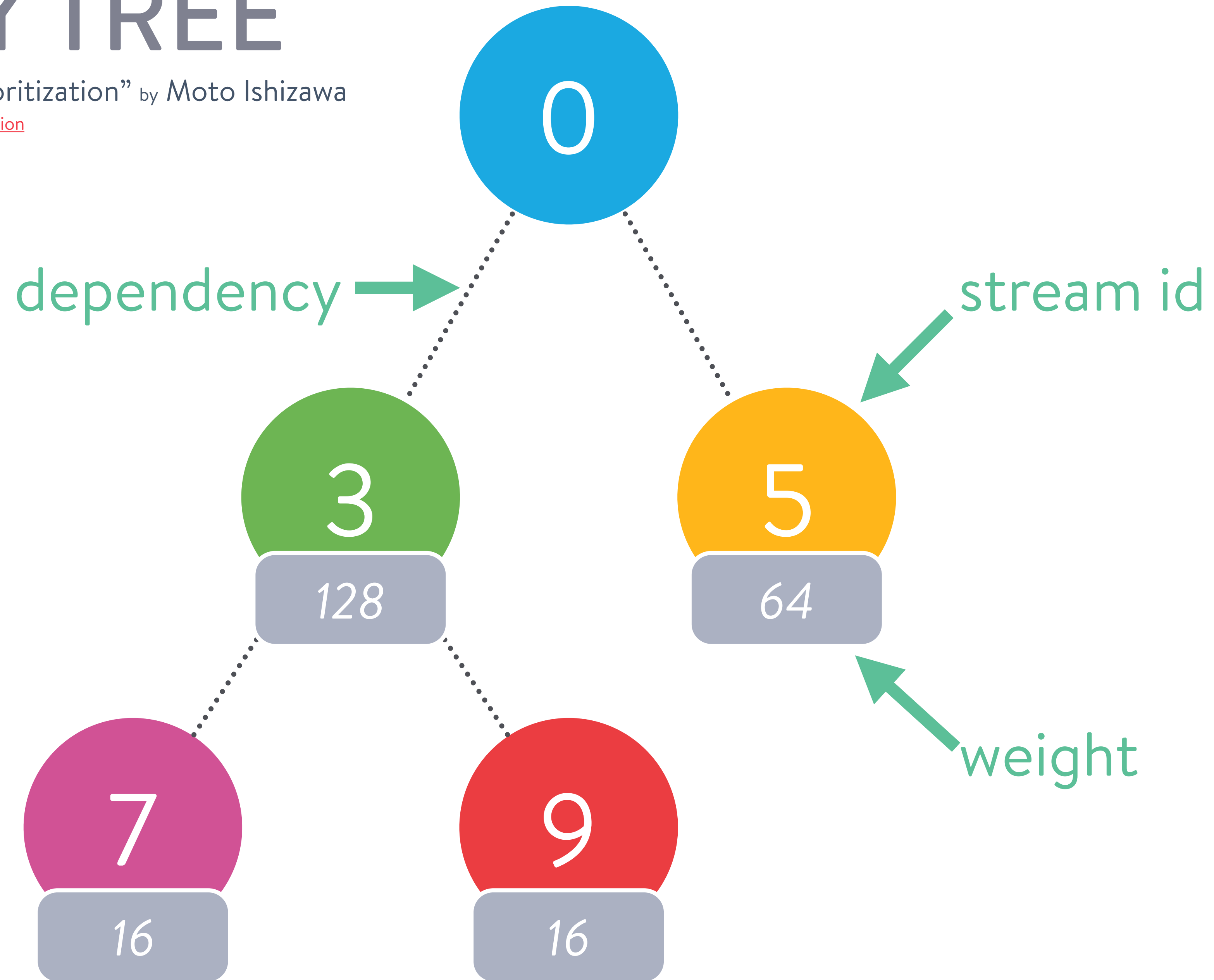
FLOW CONTROL

WEIGHTED DEPENDENCIES

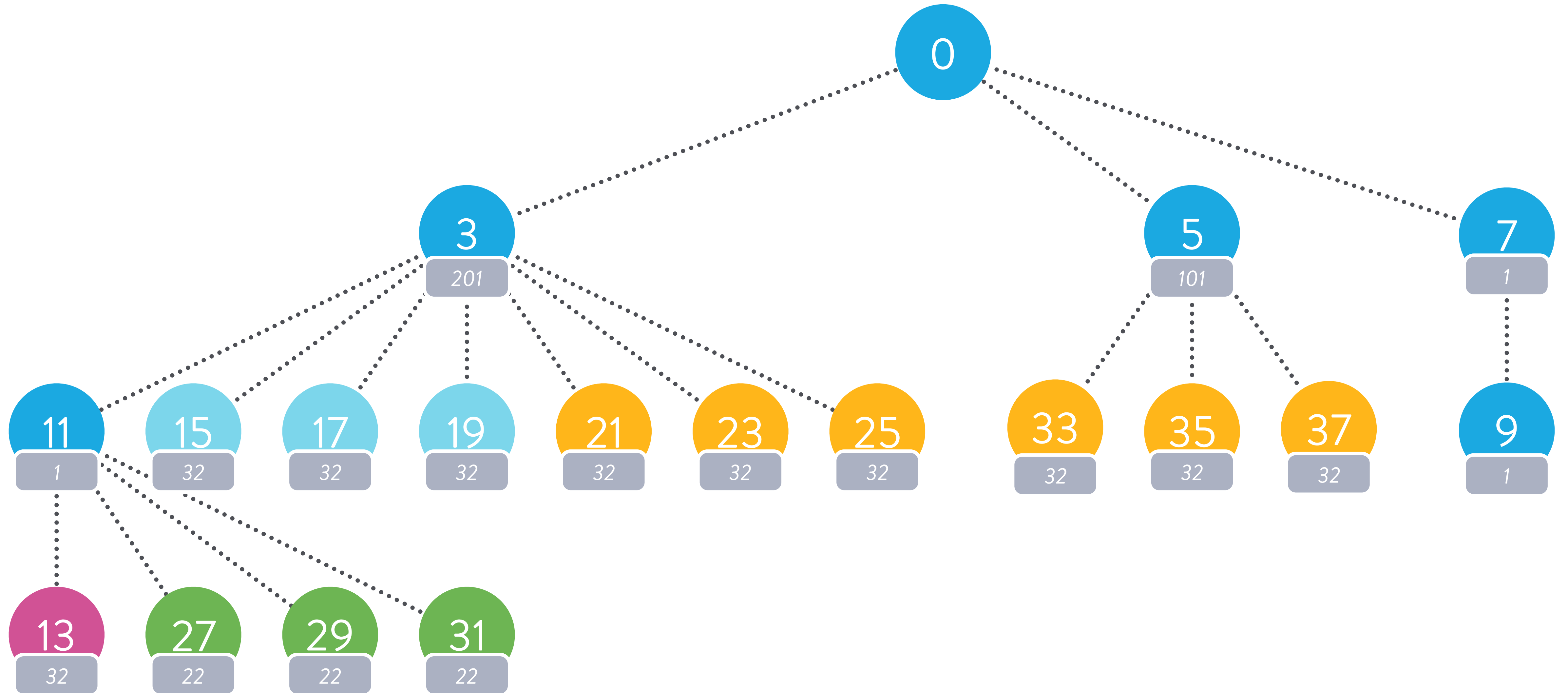
PRIORITY TREE

from “Understanding HTTP/2 prioritization” by Moto Ishizawa

<https://speakerdeck.com/summerwind/2-prioritization>

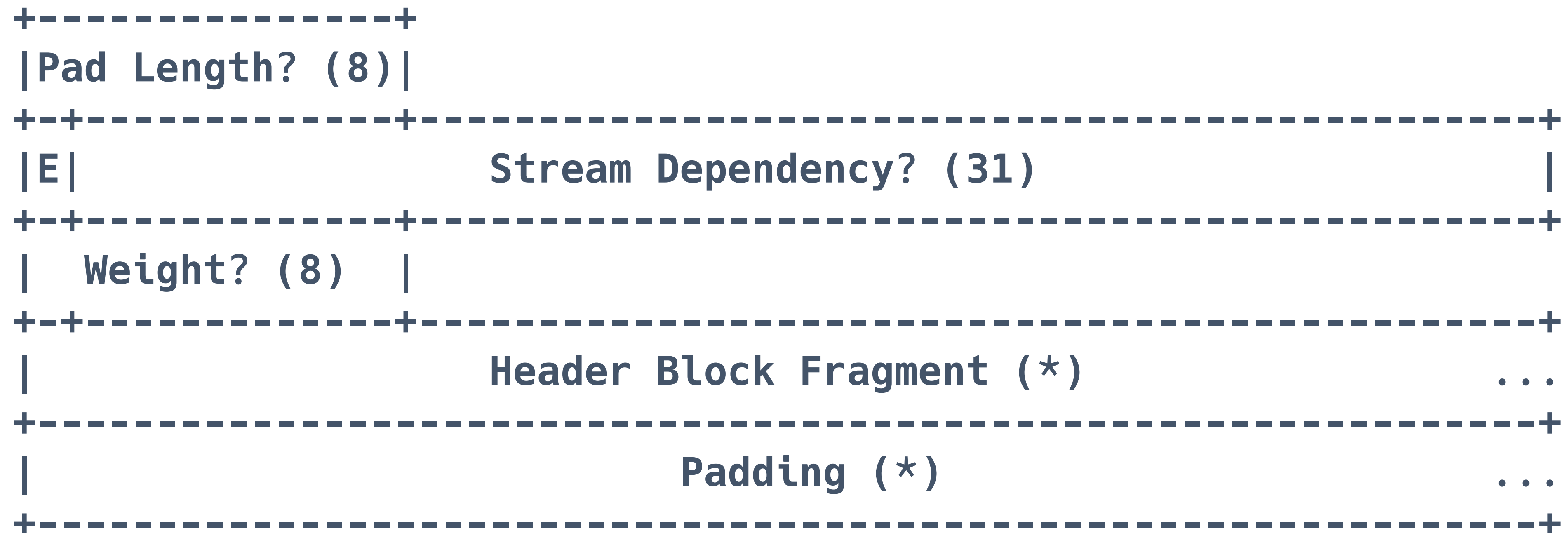


FIREFOX DEPENDENCY TREE



COMPRESSED HEADERS

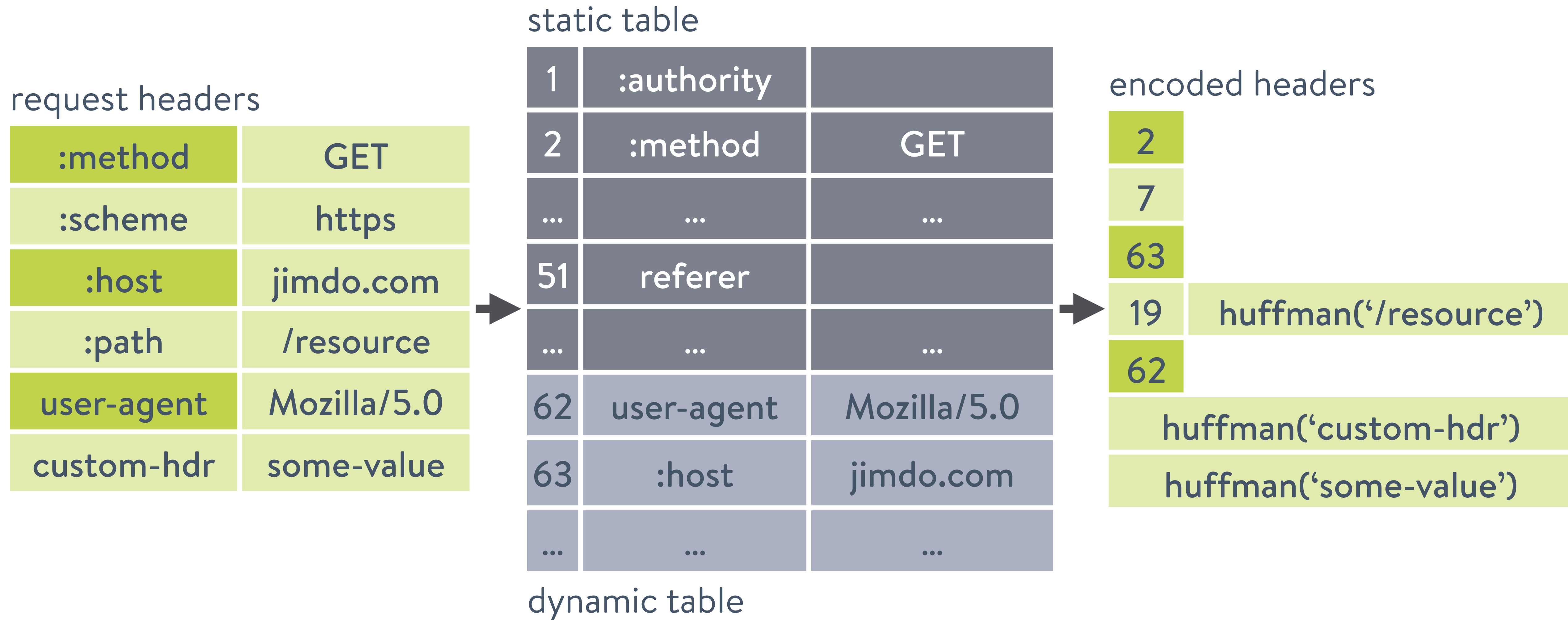
HEADERS 0x1



HPACK

RFC 7541

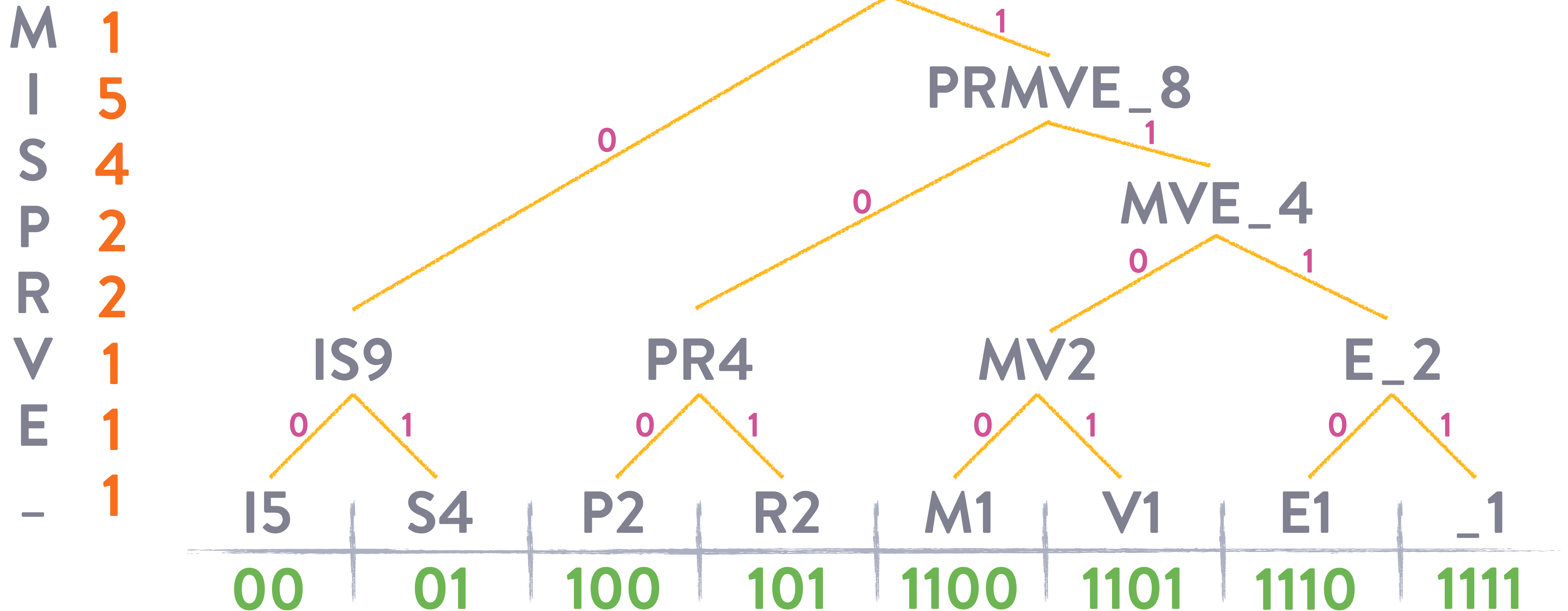
HEADER COMPRESSION TABLE



HUFFMAN

IN 1 MINUTE

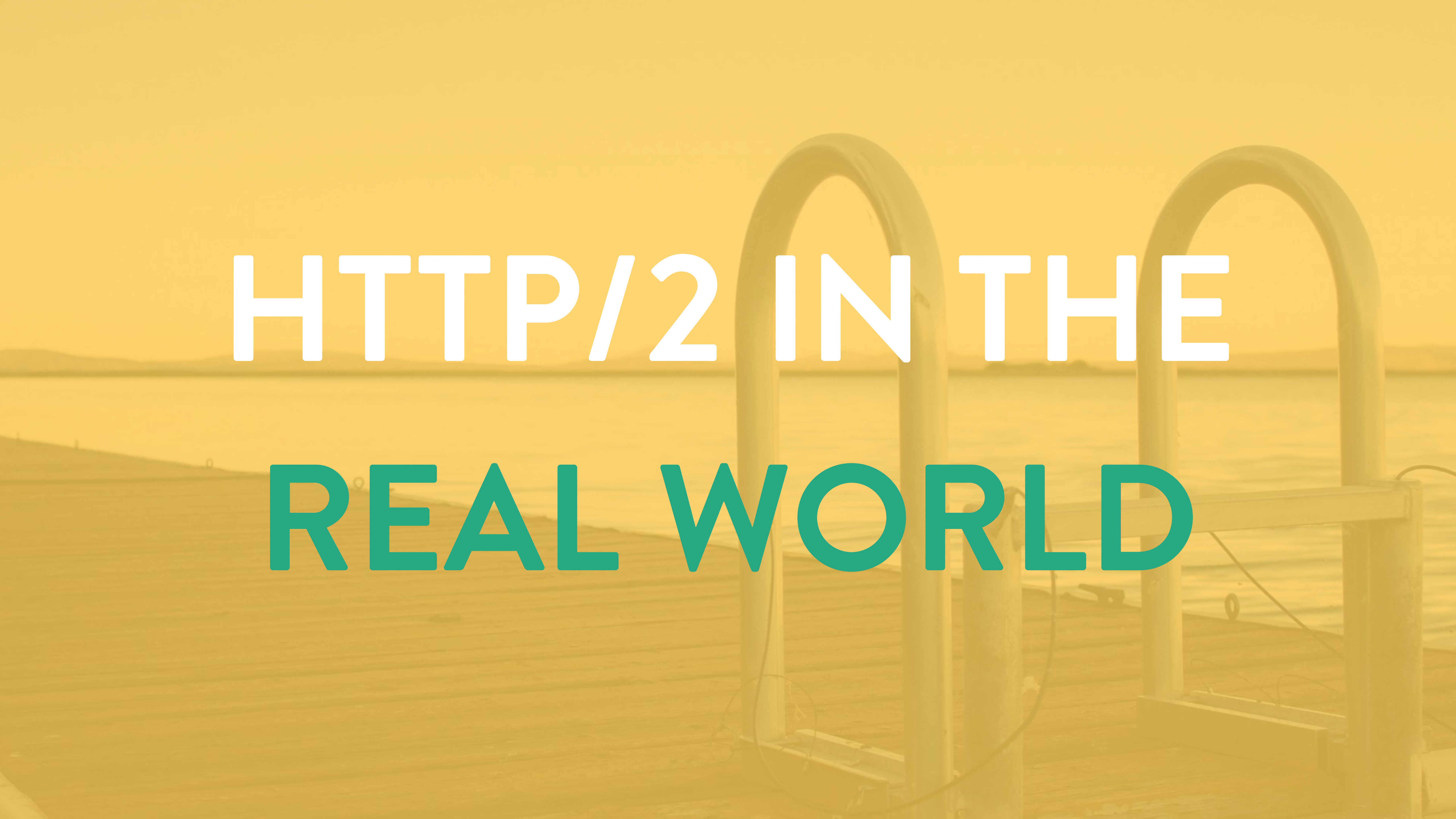
MISSISSIPPI RIVER = 17 chars * 8 bit = 136 bits



COMPRESSION

TABLE

I5	S4	P2	R2	M1	V1	E1	_1
00	01	100	101	1100	1101	1110	1111



HTTP/2 IN THE REAL WORLD

IT'S HERE
ALREADY

demo time

IMPLEMENTATIONS

BROWSER

HTTP/2 protocol - OTHER

Networking protocol for low-latency transport of content over the web. Originally started out from the SPDY protocol, now standardized as HTTP version 2.

Germany73.49% + 11.47% = 84.96%

Global63.24% + 7.89% = 71.14%

Current aligned

Usage relative

Show all

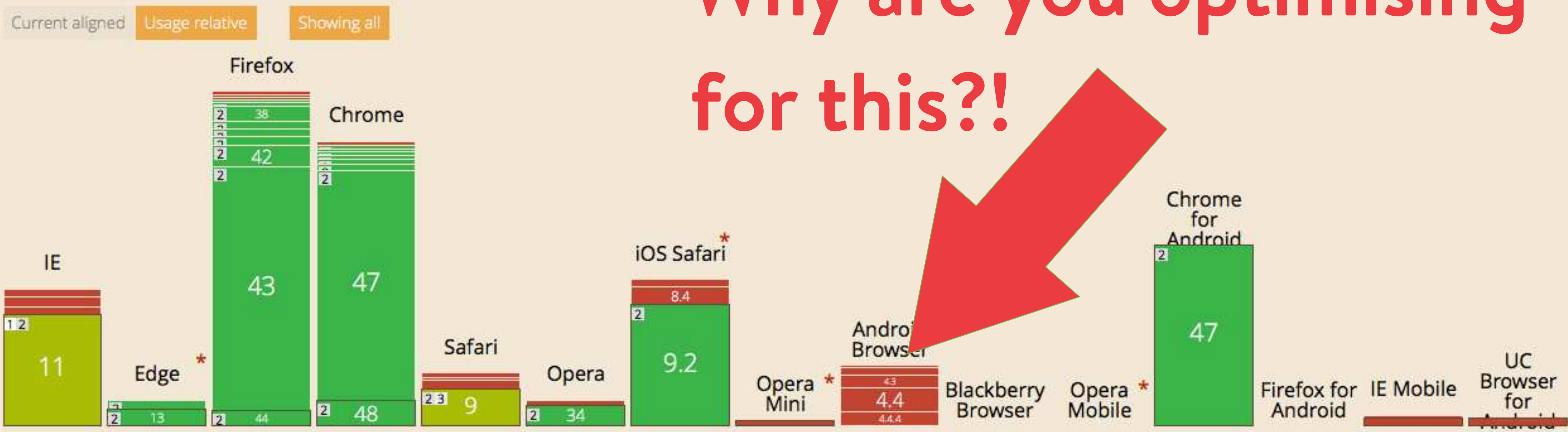
IE	Edge	Firefox	Chrome	Safari	Opera	iOS Safari	Opera Mini	Android Browser	Chrome for Android
		238							
		240							
8		241						4.3	
9		242						4.4	
10	212	243	247	8		8.4		4.4.4	
1 211	213	244	248	2 39	234	29.2	8	47	247
	214	245	249	2 39.1	235	29.3			
		246	250		236				
		247	251						

HTTP/2 protocol - OTHER

Networking protocol for low-latency transport of content over the web. Originally started out from the SPDY protocol, now standardized as HTTP version 2.

Germany	73.49%	+ 11.47%	= 84.96%
Global	63.24%	+ 7.89%	= 71.14%

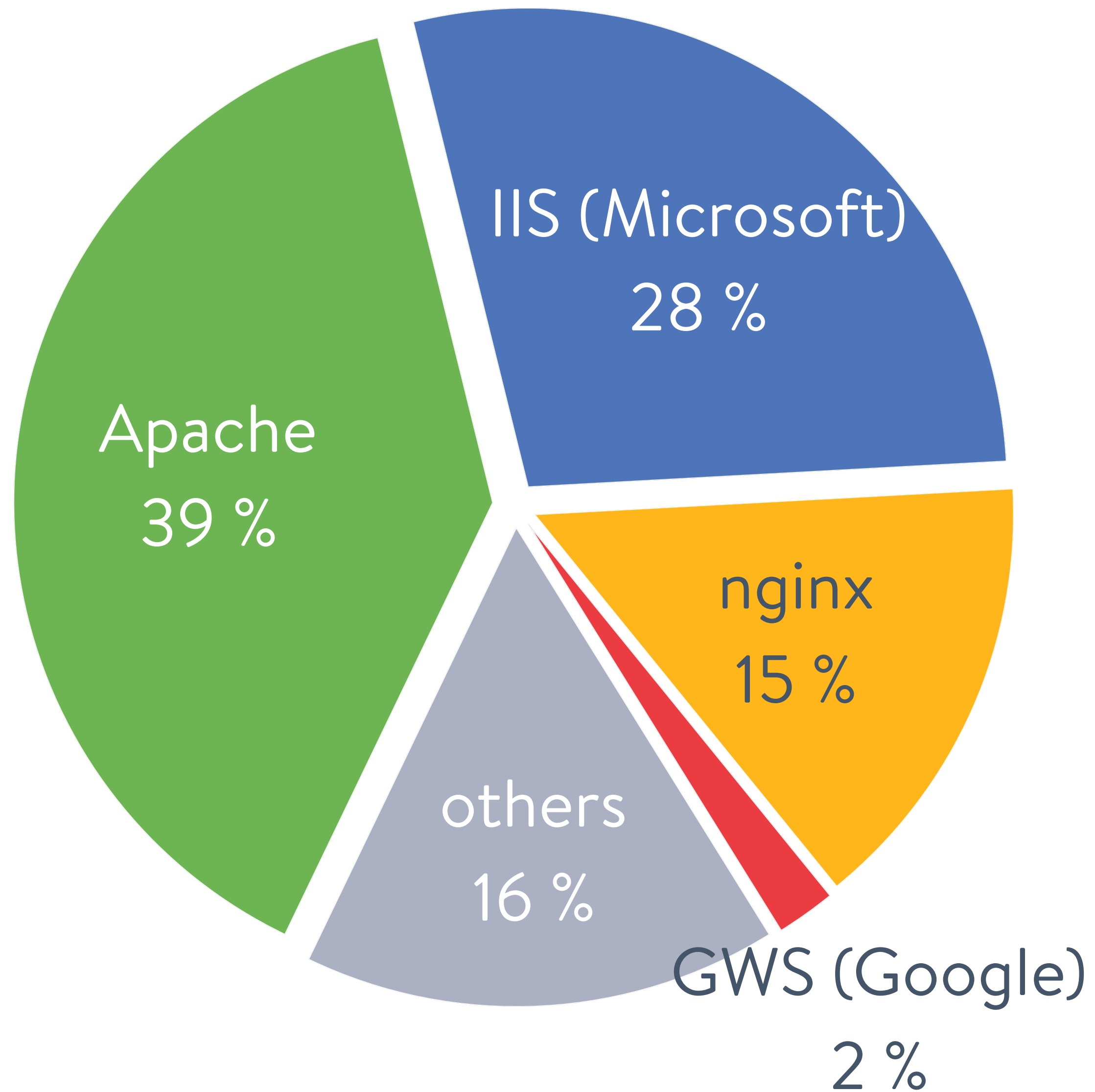
Why are you optimising for this?!



<http://caniuse.com/#search=http2>

SERVER

MARKET SHARE & HTTP/2 SUPPORT



GWS

unknown — Chrome

dropped SPDY in Feb 2015

Apache

since 2.4.12 — Jul 2015

nginx

since 1.9.5 — 22 Sep 2015

IIS

Win 10 / Server 2016

It is super easy!

Apache

```
# this needs to be somewhere
```

```
LoadModule http2_module modules/mod_http2.so
```

```
# this is already optional
```

```
<IfModule http2_module>
```

```
    LogLevel http2:info
```

```
</IfModule>
```

NGINX

```
server {  
    listen 443 ssl http2 default_server;  
  
    ssl_certificate      server.crt;  
    ssl_certificate_key  server.key;  
    ...  
}
```




YOU ARE
HOLDING IT
WRONG

STOP

STOP

CONCATENATING

STOP

SPRITING

STOP

DOMAIN SHARDING

TRASH

THE ASSET PIPELINE



START USING HTTP/2

JINDO

OLE MICHAELIS

 CodeStars

 nesQuick

 codestars.eu



A group of people are shown from behind, hugging each other in a line. They are outdoors at night, with a string of warm-toned lights hanging above them. The scene is overlaid with a semi-transparent green filter. The text 'THANKYOU' is centered over the group, with 'THANK' in white and 'YOU' in orange.

THANKYOU



CodeStars



<https://joind.in/talk/dda32>

RESSOURCES

🐦 @bagder @igrigorik @tatsuhiro_t @mnot

<https://http2.github.io/http2-spec/>

<http://daniel.haxx.se/http2/>

<http://daniel.haxx.se/blog/2015/05/07/http2-for-tcpip-geeks/>

<http://www.slideshare.net/peychevi/http2-and-quick-protocols-optimizing-the-web-stack>

<https://ma.ttias.be/architecting-websites-http2-era/>

<https://benramsey.com/talks/2015/05/phptek-http2/>

<https://speakerdeck.com/summerwind/2-prioritization>

http://chimera.labs.oreilly.com/books/1230000000545/ch12.html#HTTP2_HEADER_COMPRESSION

<http://tools.ietf.org/html/rfc6585>

<http://httparchive.org>

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

<https://github.com/igrigorik/http-2>

<https://aprescott.com/posts/spdy-colon-headers>

<https://tools.ietf.org/html/draft-ietf-httpbis-header-compression-12>

<https://www.youtube.com/watch?v=ZdooBTdW5bM>

<https://github.com/supertinou/huffman>

<http://daniel.haxx.se/blog/2015/03/06/tls-in-http2/>

<http://news.netcraft.com/archives/2015/06/25/june-2015-web-server-survey.html>

<http://isthewebhttp2yet.com/>

Thanks to all the
people who helped
me with this deck!