

# **HTTP/2**

## **Introduction**



# **WARNING**

This talk contains too many technical details. Listen at your own risk.

# History

HTTP/0.9      HTTP/1.0      HTTP/1.1      SPDY/2      HTTP/2

1991

1995

1997

2012

2015



# HTTP/0.9

## World Wide Web

The WorldWideWeb (W3) is a wide-area [hypermedia](#) information retrieval initiative aiming to give universal access to a large universe of documents.

Everything there is online about W3 is linked directly or indirectly to this document, including an [executive summary](#) of the project, [Mailing lists](#) , [Policy](#) , November's [W3 news](#) , [Frequently Asked Questions](#) .

### What's out there?

Pointers to the world's online information, [subjects](#) , [W3 servers](#), etc.

### Help

on the browser you are using

### Software Products

A list of W3 project components and their current state. (e.g. [Line Mode](#) ,[X11 Viola](#) ,[NeXTStep](#) ,[Servers](#) ,[Tools](#) ,[Mail robot](#) ,[Library](#) )

### Technical

Details of protocols, formats, program internals etc

### Bibliography

Paper documentation on W3 and references.

### People

A list of some people involved in the project.

### History

A summary of the history of the project.

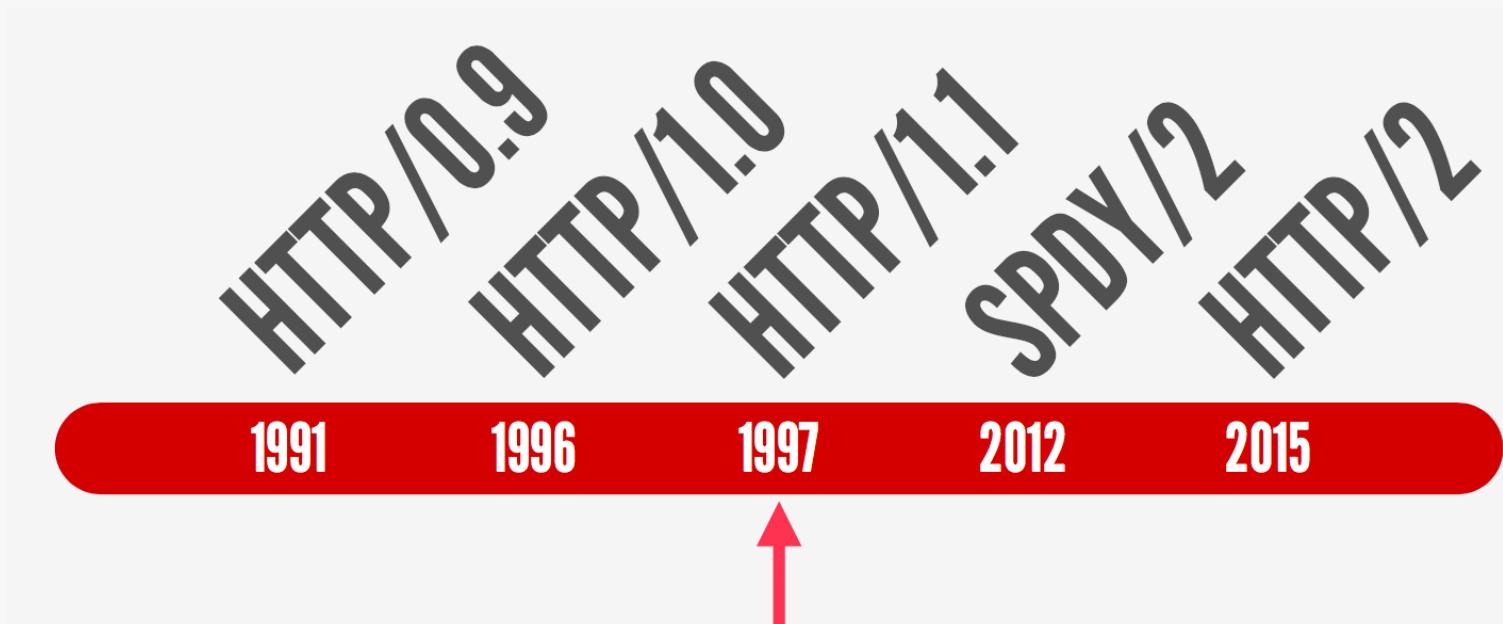
### How can I help ?

If you would like to support the web..

### Getting code

Getting the code by [anonymous FTP](#) , etc.

- HTTP/0.9 → HTTP/1.0
  - Add PUT, DELETE
- HTTP/1.0 → HTTP/1.1
  - Keep-alive
  - Add OPTION
  - cache-control



# Hyper-text → Hyper-media

Search Images Mail Drive Calendar Sites Groups Contacts More » surma@google.com | Account | Settings | Help | Sign out

The screenshot shows the Google Mail interface. At the top, there's a navigation bar with links for Search, Images, Mail, Drive, Calendar, Sites, Groups, Contacts, and More. On the right, it shows the user's email address and links for Account, Settings, Help, and Sign out. Below the navigation is a search bar with options to Search Mail or Search the Web, and links for Show search options and Create a filter. A blue sidebar on the left contains links for Compose Mail, Inbox (5), Starred (1), Sent Mail, Drafts (1), All Mail, Spam (2), and Trash. It also has sections for Contacts, Labels (GitHub 4329, Indef, IO2015, MDL 5, Notes), and Edit labels. The main area is the inbox, which lists 5 messages. The messages are:

<input type="checkbox"/>	Michael R. Bernstein	MDL Re: [material-design-lite] Material tabs shouldn't event.preventDefault(). (#1202) - —	2:16 pm
<input type="checkbox"/>	Michael R. Bernstein	MDL Re: [material-design-lite] Remove import of partials from components (#1475) - — Reply	2:15 pm
<input type="checkbox"/>	Michael R. Bernstein	MDL [material-design-lite] Implement creator and increase leak coverage (#1815) - This	2:14 pm
<input type="checkbox"/>	johnsonium	MDL [material-design-lite] Drawer Obfuscator Isn't in Sync with Drawer (#1883) - I built an	2:12 pm
<input type="checkbox"/>	Sarah Clark	Progressive Web Applications - After talking with Paul Kinlan, and working on the ND	12:44 pm
<input type="checkbox"/>	Jonathan, 'Addy, Mustafa (4)	Quick doc structure thoughts - I just am leaving home at like 1:30AM Monday morning to make my	6:10 am
<input type="checkbox"/>	Eng-Lon Elves (2)	PLEASE READ: London Engineering Christmas Party! - Sorry! Granting access rights to the site	4:24 am
<input type="checkbox"/>	Mustafa Kurtuldu	MDL [material-design-lite] Tool tips need a pointer cursor on hover (#1855) - Currently when you	Nov 6
<input type="checkbox"/>	Londovir (2)	MDL [material-design-lite] Scrollable Header Layout & IE11: Glitch with width calculations ...	Nov 5
<input type="checkbox"/>	Nicholas Jamieson	MDL [material-design-lite] Toggle components not fully upgraded for ripple effect (#1835) - When	Oct 31

At the bottom of the inbox view, there are buttons for Archive, Report Spam, Delete, More Actions..., Go, and Refresh. The page number "1 - 10 of 10" is also visible.

# HTTP/1.x

# ~~Best Practices~~ ~~Workarounds~~ Hacks

**Write it, concatenate it, minify it, inline it,  
sprite it, shard it, vulcanize it, gzip it**

# **Flaw #1: Head of Line Blocking**

# Flaw #2: Duplicate Metadata

```
GET /index.html
```

```
User-Agent: Mozilla/5.0...
```

```
Cookie: session_id=deadbeef
```

```
...
```

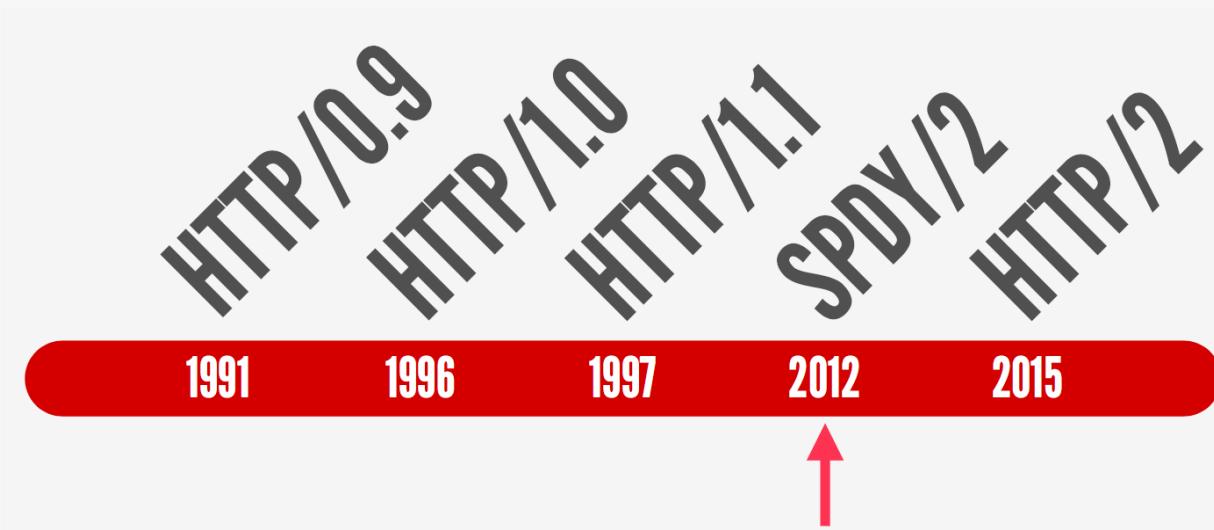
```
GET /script.js
```

```
User-Agent: Mozilla/5.0...
```

```
Cookie: session_id=deadbeef
```

```
...
```

# SPDY: An Experimental Protocol



“

*So far we have only tested SPDY in lab conditions. The initial results are very encouraging: when we download the top 25 websites over simulated home network connections, we see a significant improvement in performance—pages loaded up to 55% faster.*

*A 2x Faster Web, Chromium Blog*

# HTTP/2

- March 2012: Call for proposals for HTTP/2
- November 2012: First draft of HTTP/2 (**based on SPDY**)
- August 2014: HTTP/2 draft-17 and HPACK draft-12 are published
- August 2014: Working Group last call for HTTP/2
- February 2015: IESG approved HTTP/2 and HPACK drafts
- May 2015: RFC 7540 (HTTP/2) and RFC 7541 (HPACK) are published

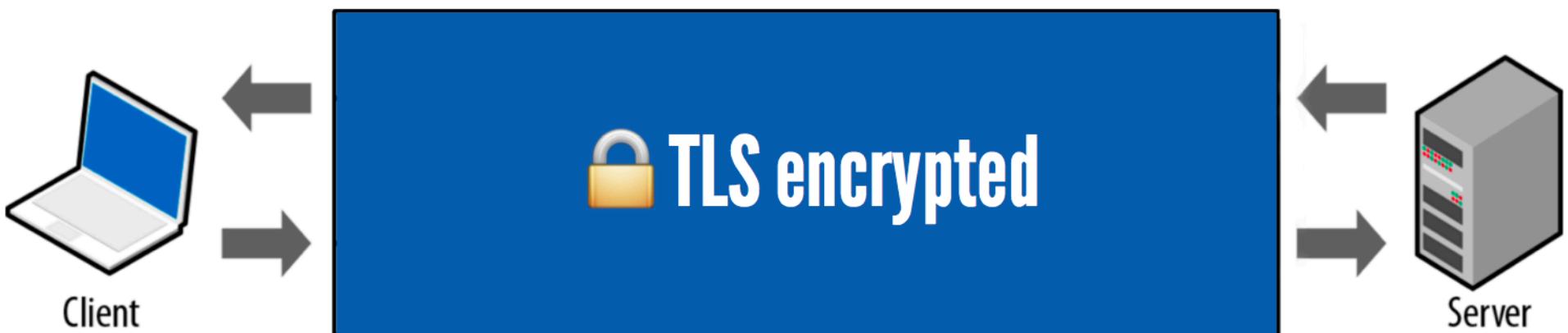
**HTTP/2 has the  
SAME  
semantics  
with HTTP/1.1**

**HTTP/2 changed the  
binary level encoding**

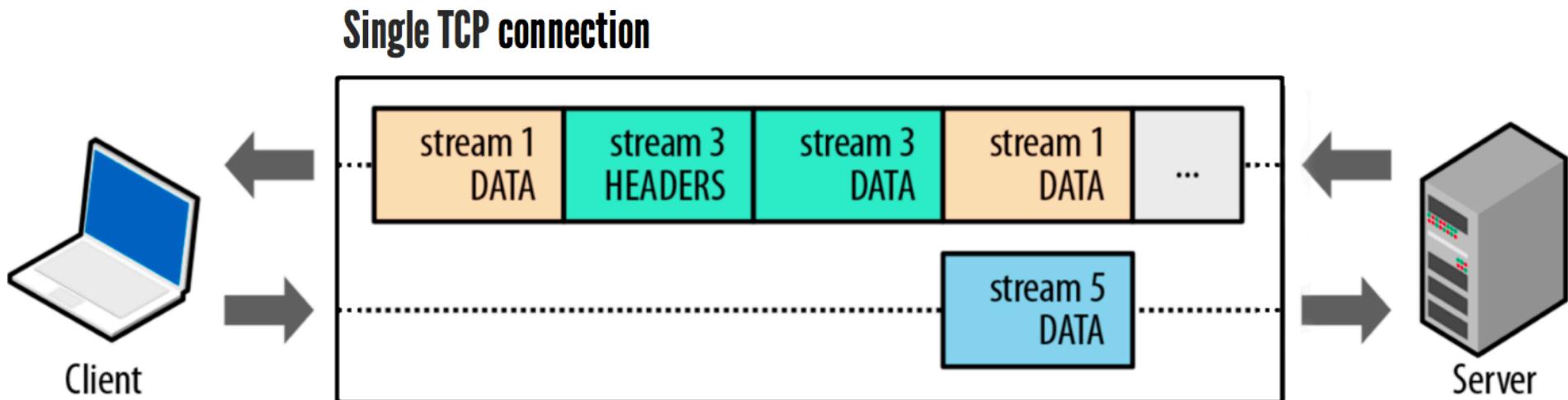
# **h2 vs h2c**

h2: HTTP/2 over TLS connection

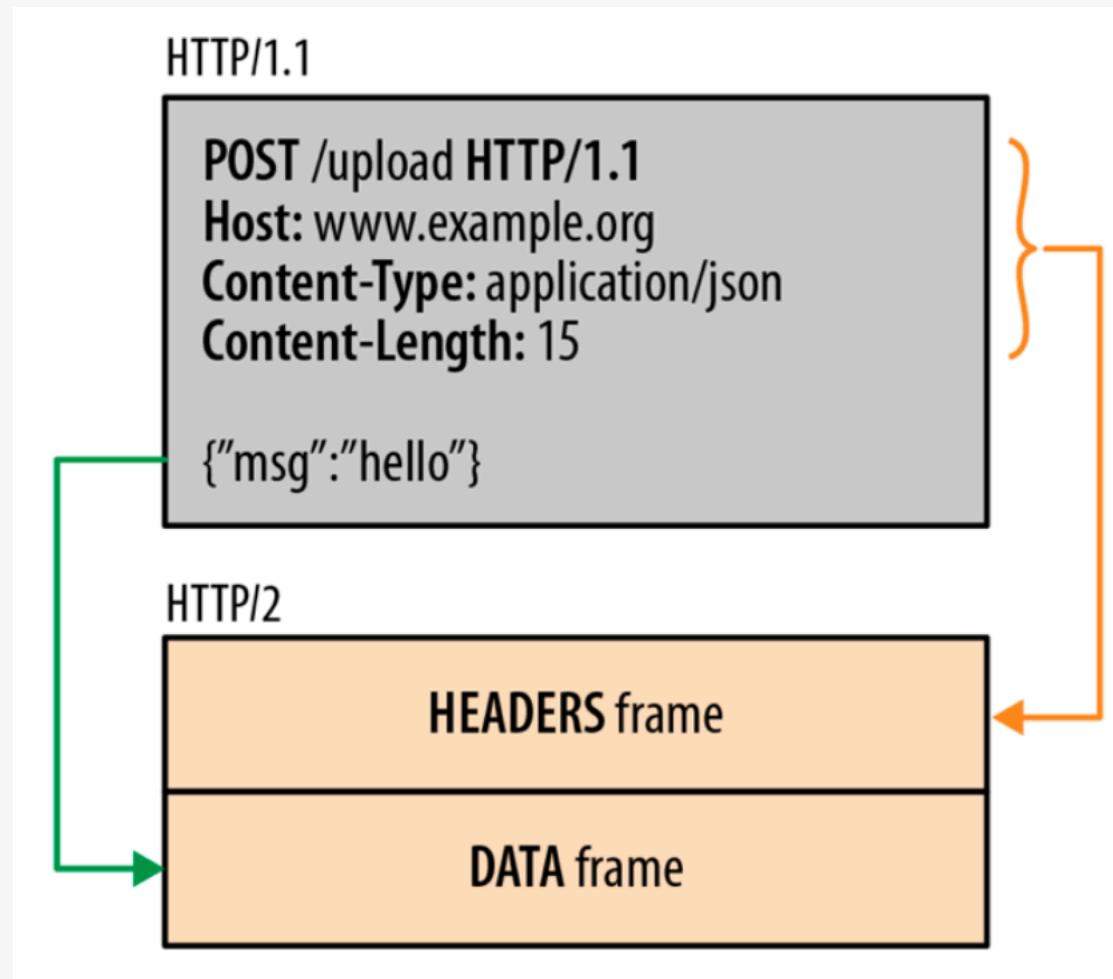
~~h2c: HTTP/2 over clear text~~



# SINGLE CONNECTION, MULTIPLE STREAMS

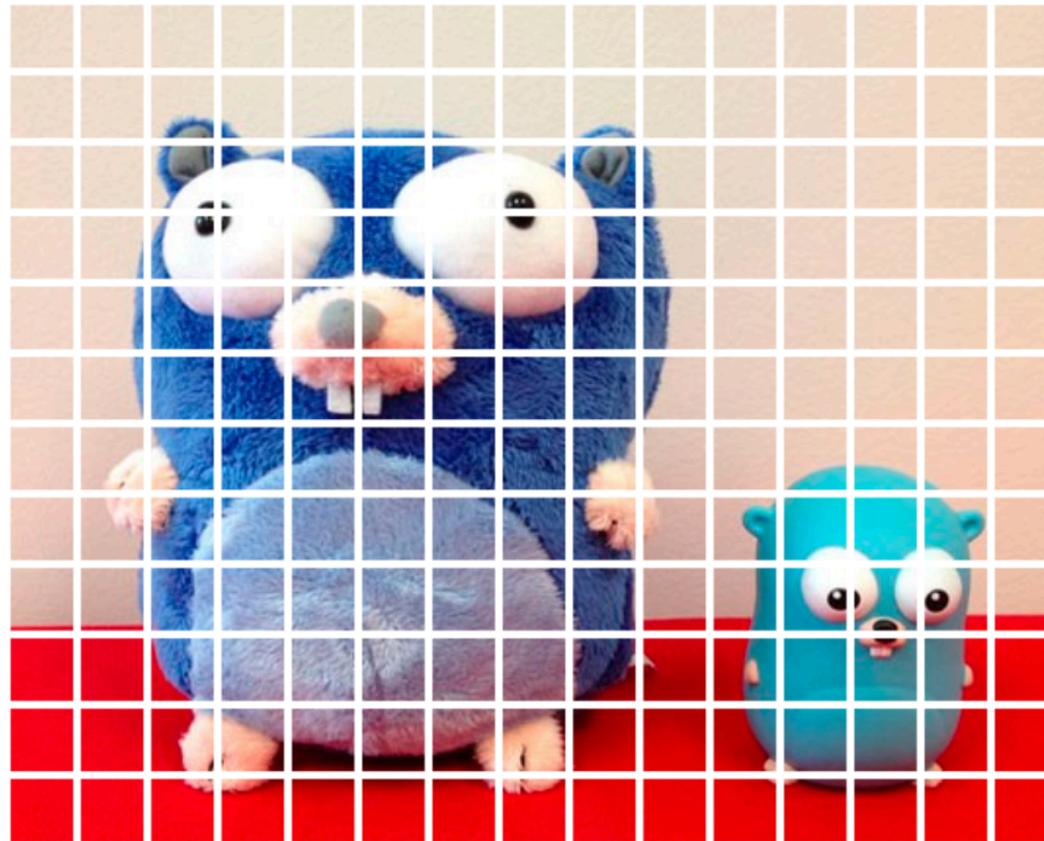


# FRAMES: HEADER, DATA, {CONTROL}



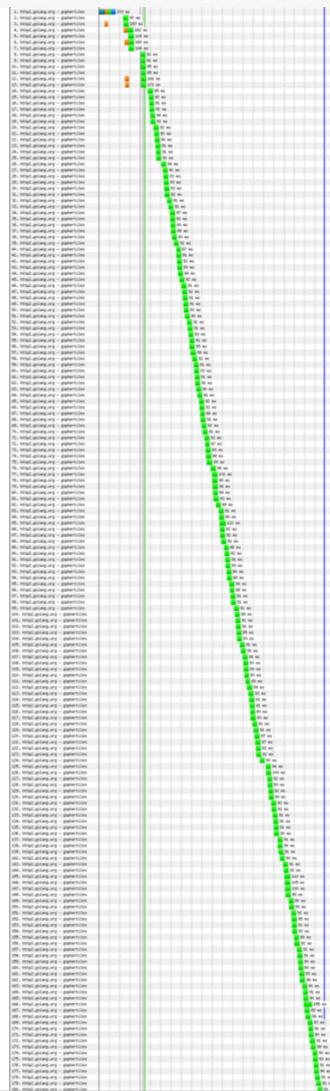
Multiplexing  
eliminates  
**HOL Blocking**

# Demo

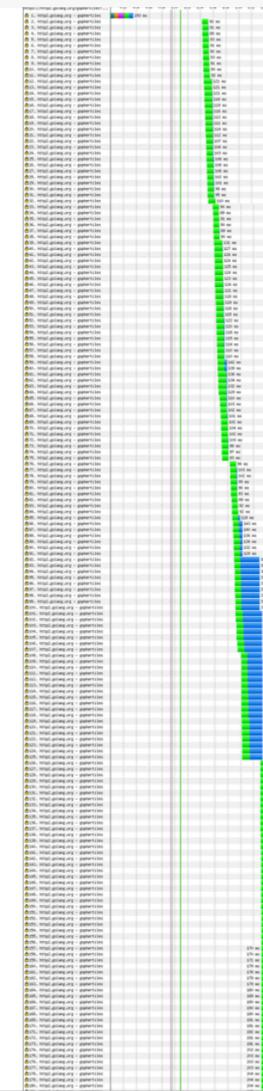


[http2.golang.org/gophertiles](http://http2.golang.org/gophertiles)

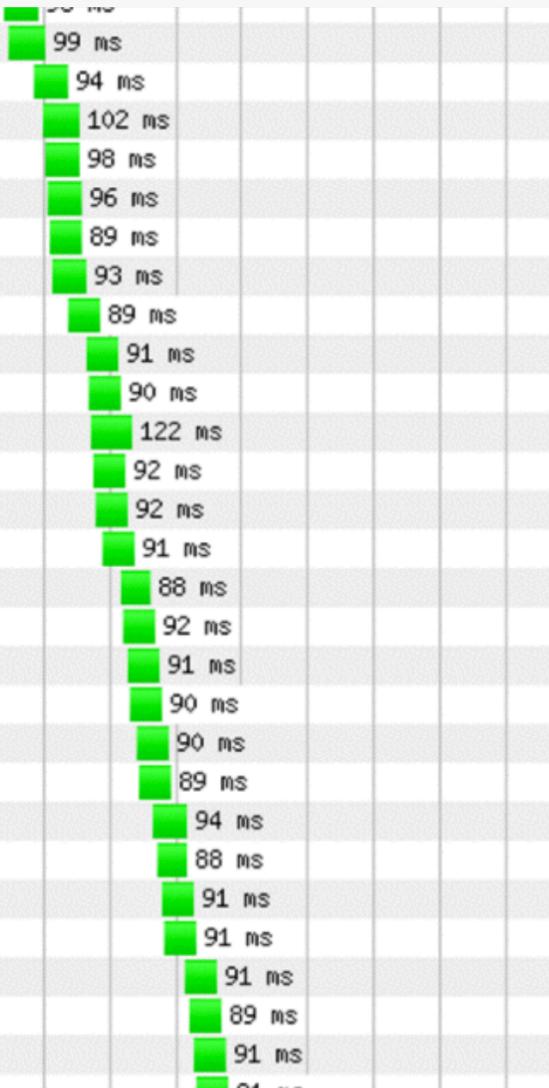
# h1



# h2



# **h1**



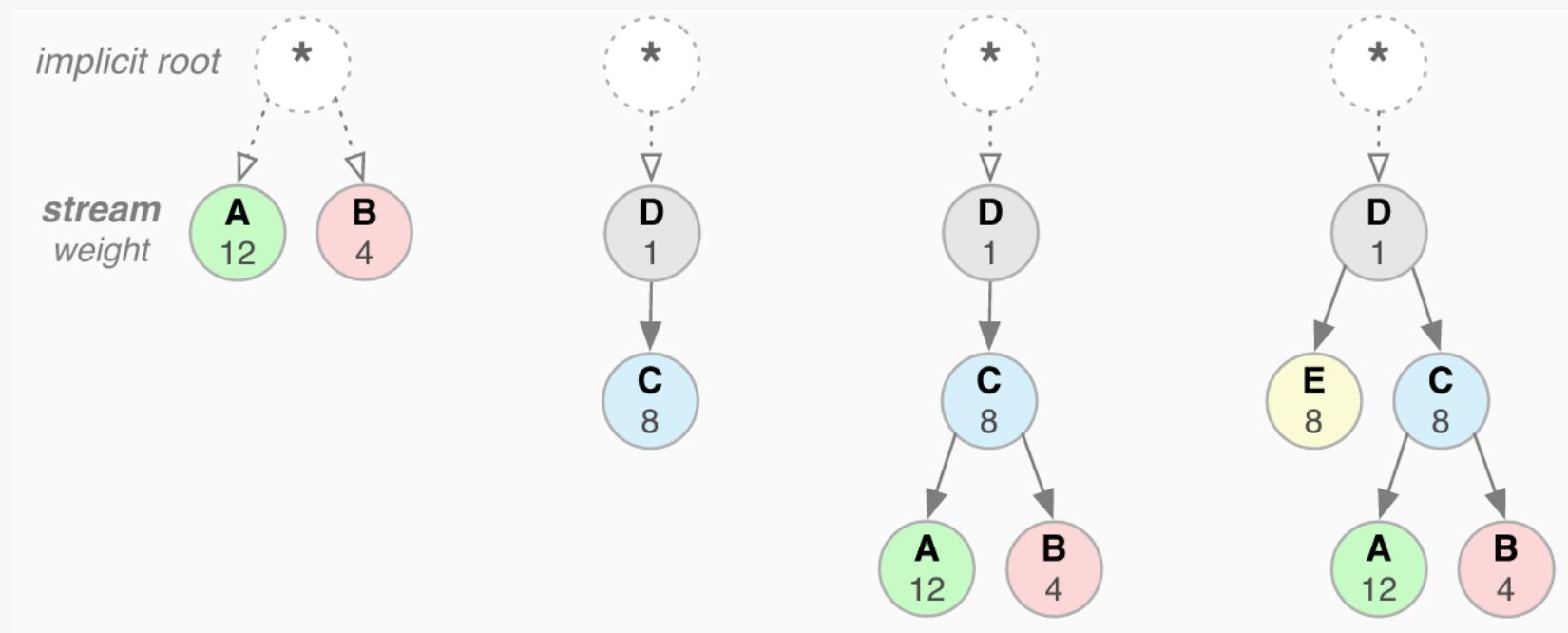
# **h2**



**WHY STREAMS ?  
CONTROL !**

# Stream Prioritization

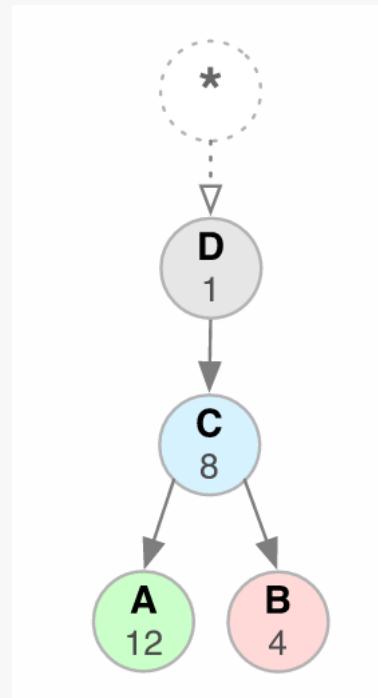
- dependency
- weight



# Flow Control

HTTP/2 defines only the format and semantics of the [WINDOW\\_UPDATE](#) frame ([Section 6.9](#)).  
This document does not stipulate how a receiver decides when to send this frame or the value that it sends, nor does it specify how a sender chooses to send packets. Implementations are able to select any algorithm that suits their needs.

# Stream Prioritization + Flow Control



# Flaw #2: Duplicate Metadata

```
GET /index.html
```

```
User-Agent: Mozilla/5.0...
```

```
Cookie: session_id=deadbeef
```

```
...
```

```
GET /script.js
```

```
User-Agent: Mozilla/5.0...
```

```
Cookie: session_id=deadbeef
```

```
...
```

# HPACK

**Header compression specifically for HTTP**

# HPACK



Client

**POST /something**  
**Host: www.example.org**



**3, Huffman("/something"), 62**

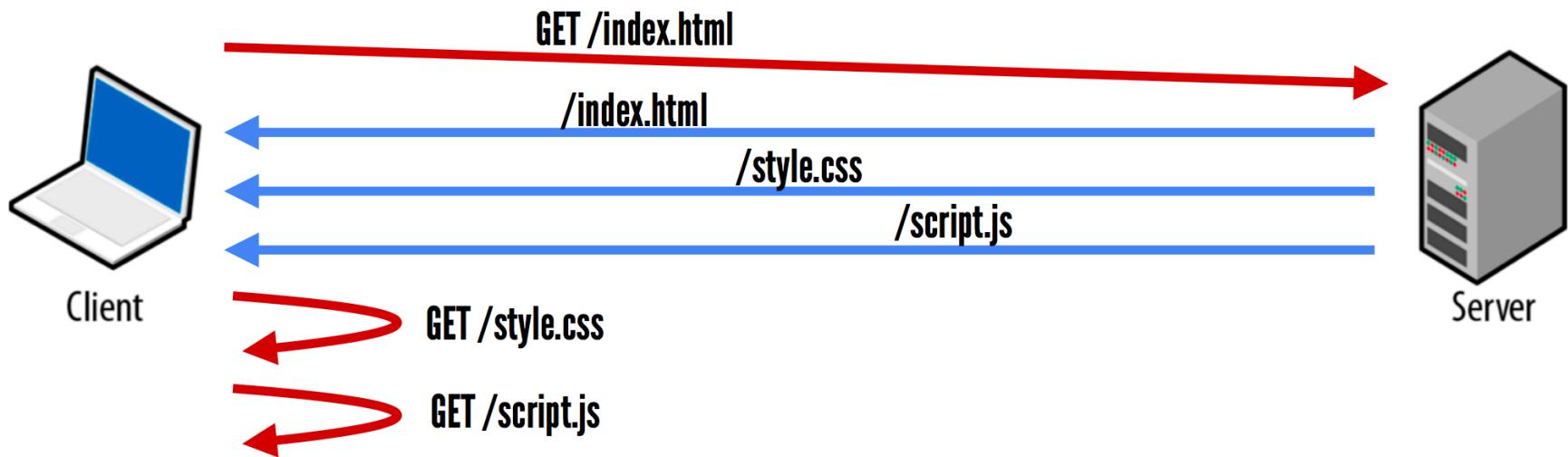
2	:method	GET
3	:method	POST
5	:path	/index.html
8	:status	200
35	Host	
61	www-authenticate	
62	Host	www.example.org
63		
...		
...		

**HPACK**

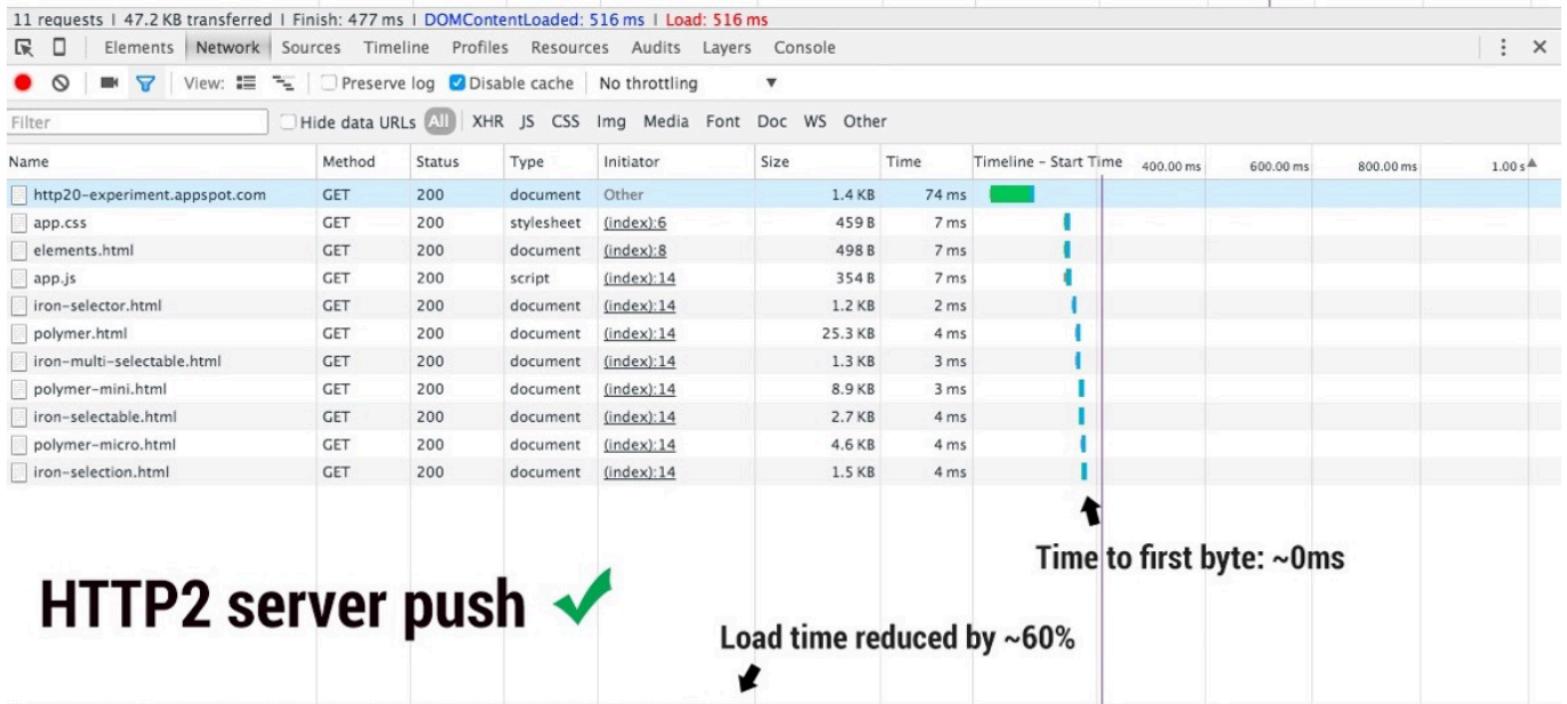
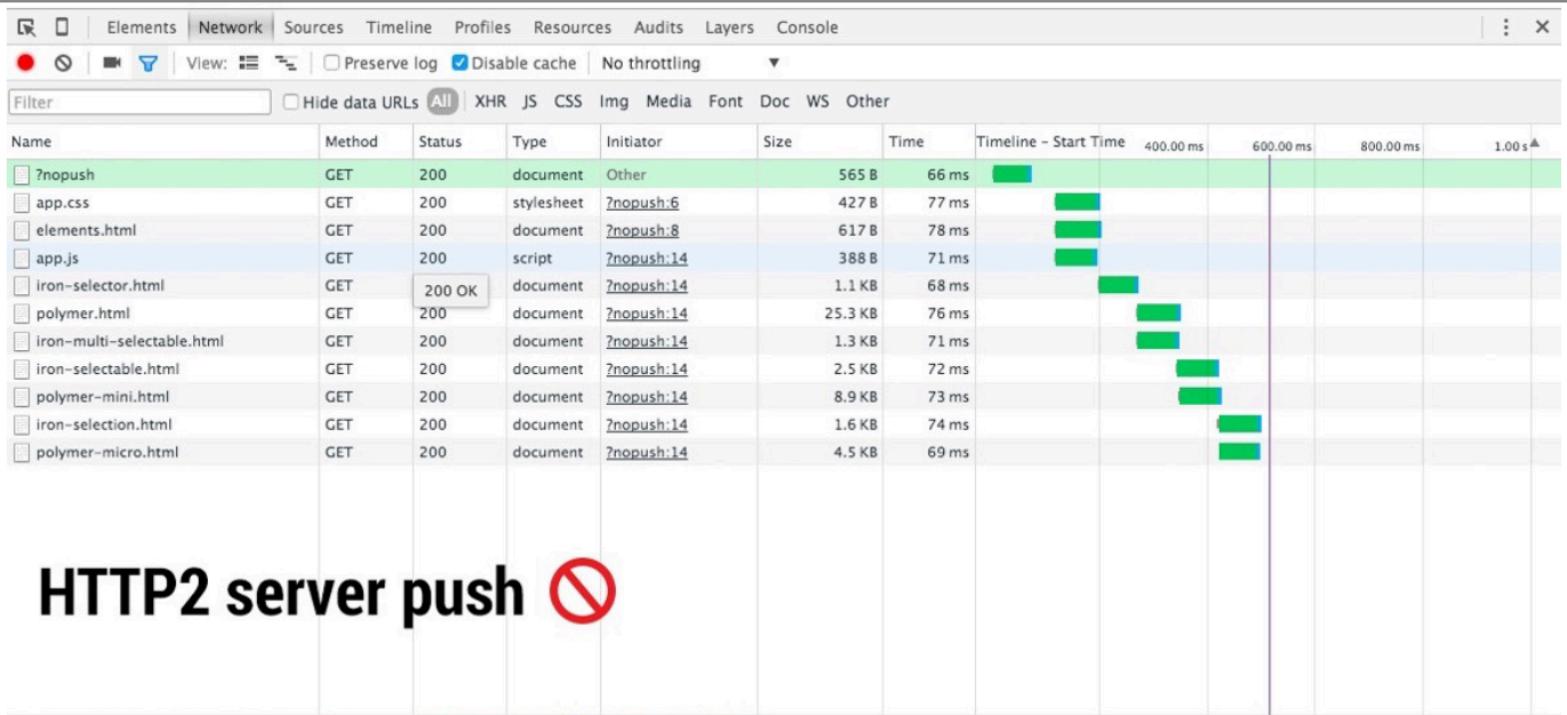
**Sharding**  
**Multiple CDNs**

# **SERVER PUSH**

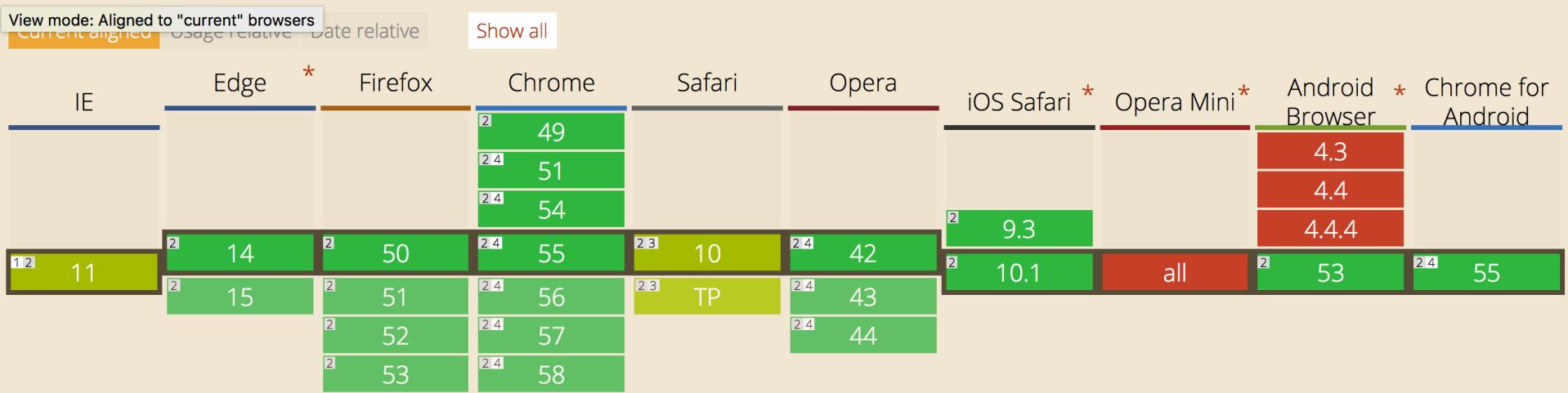
# PUSH



Read [RFC7540笔记（三）——Server Push](#) for detailed explanation



# Can I Use HTTP/2 ?



# Why do we care?

- Google & SPDY
- gRPC
- Golang
- Chrome
- ...

You're using it everyday

[HTTP/2 and SPDY indicator](#)

# Reference

- [RFC7540 HTTP/2](#)
- [RFC7541 HAPCK](#)
- [High Performance Browser Networking](#)
- [HTTP/2 101 \(Chrome Dev Summit 2015\)](#)
- [https://speakerdeck.com/surma/2-101](#)
- [RFC7540笔记（三）——Server Push](#)