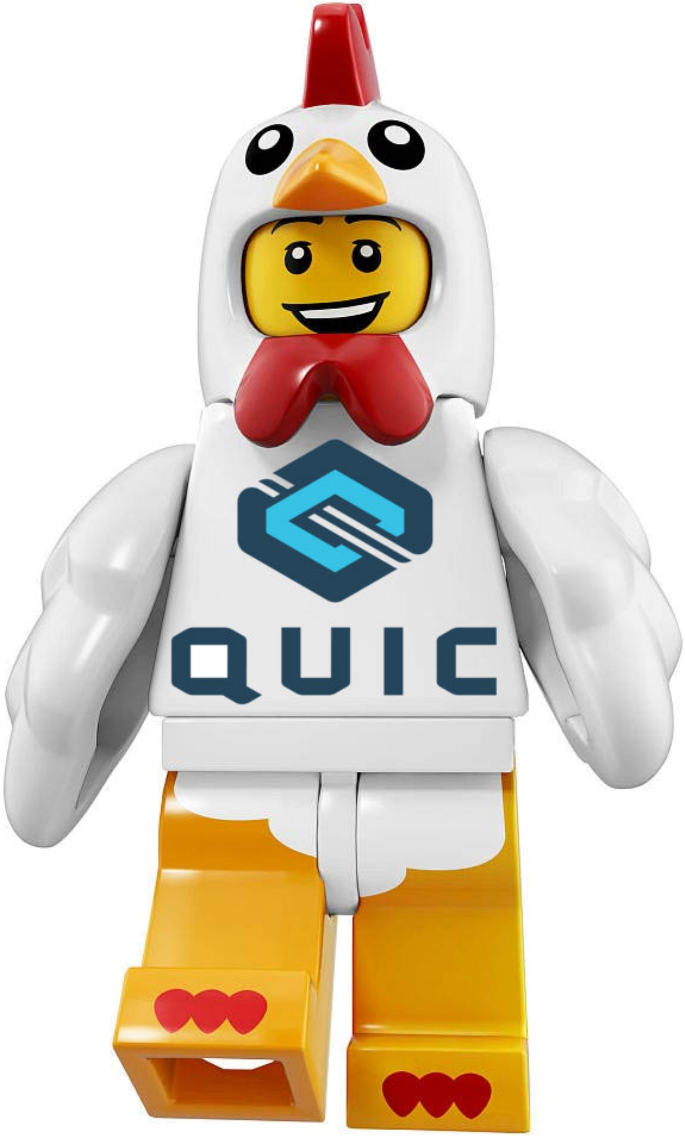
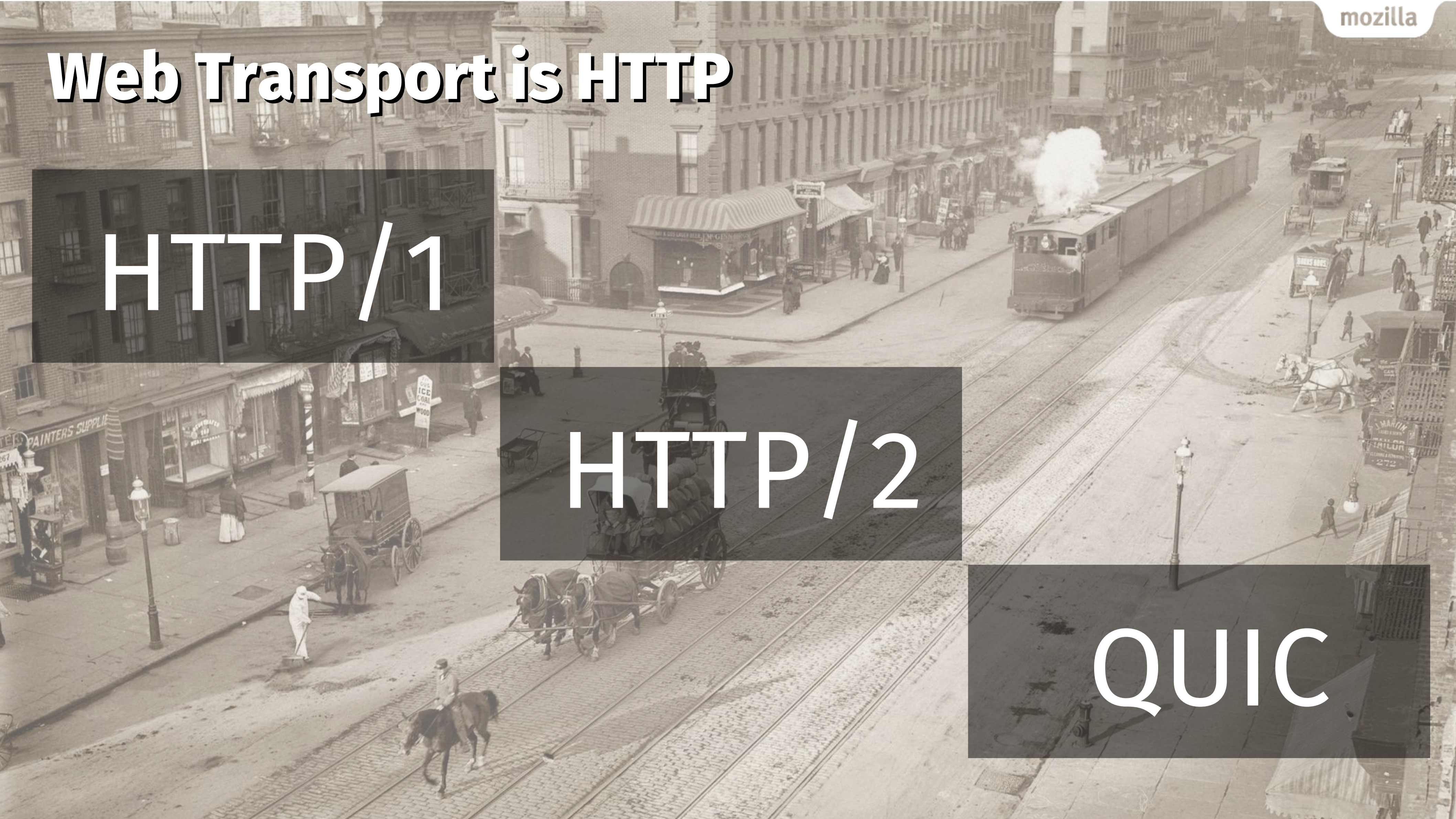

QUIC

Web Transport is HTTP

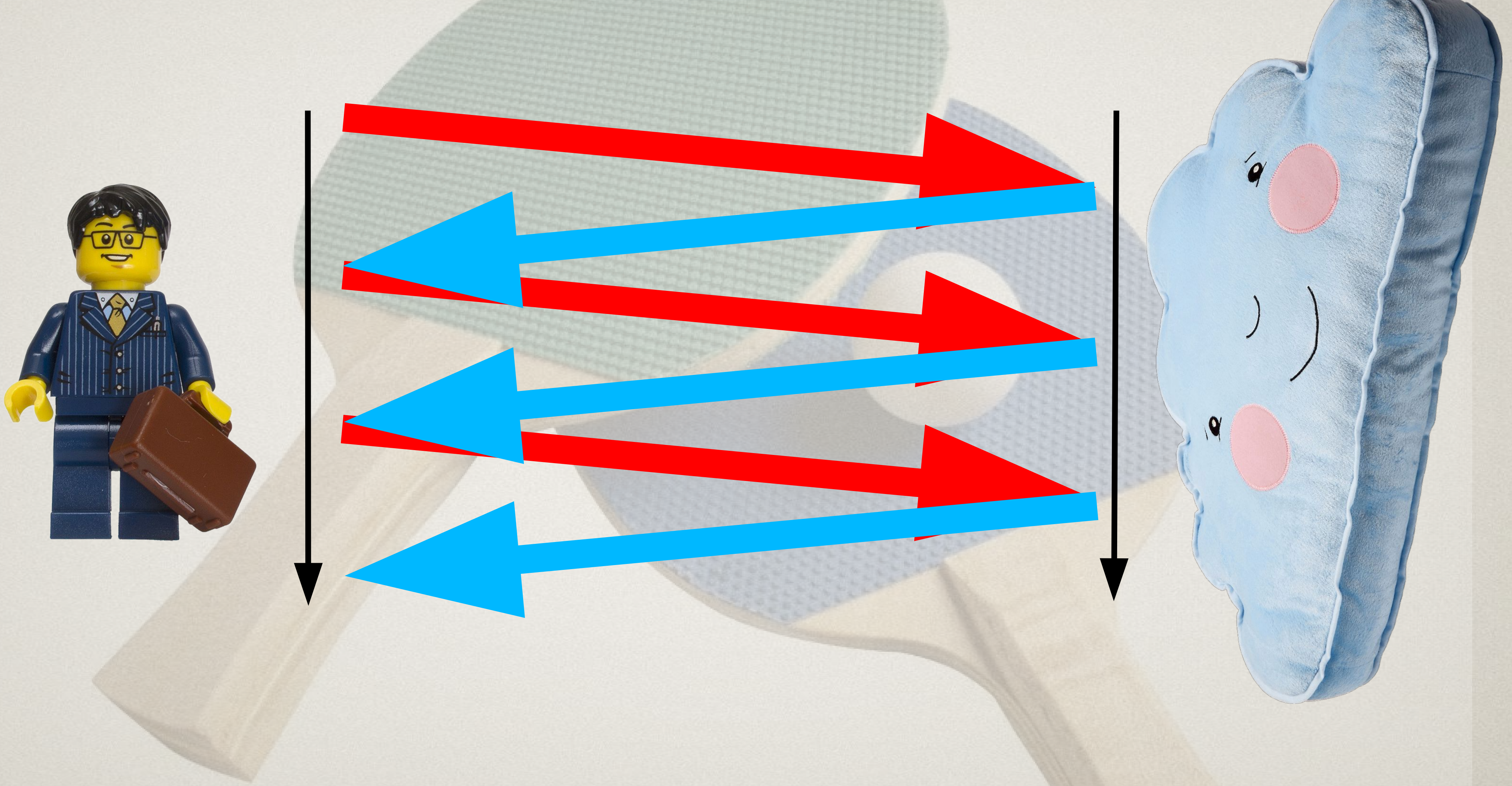


HTTP/1

HTTP/2

QUIC

Roundtrip Bonanza



http2

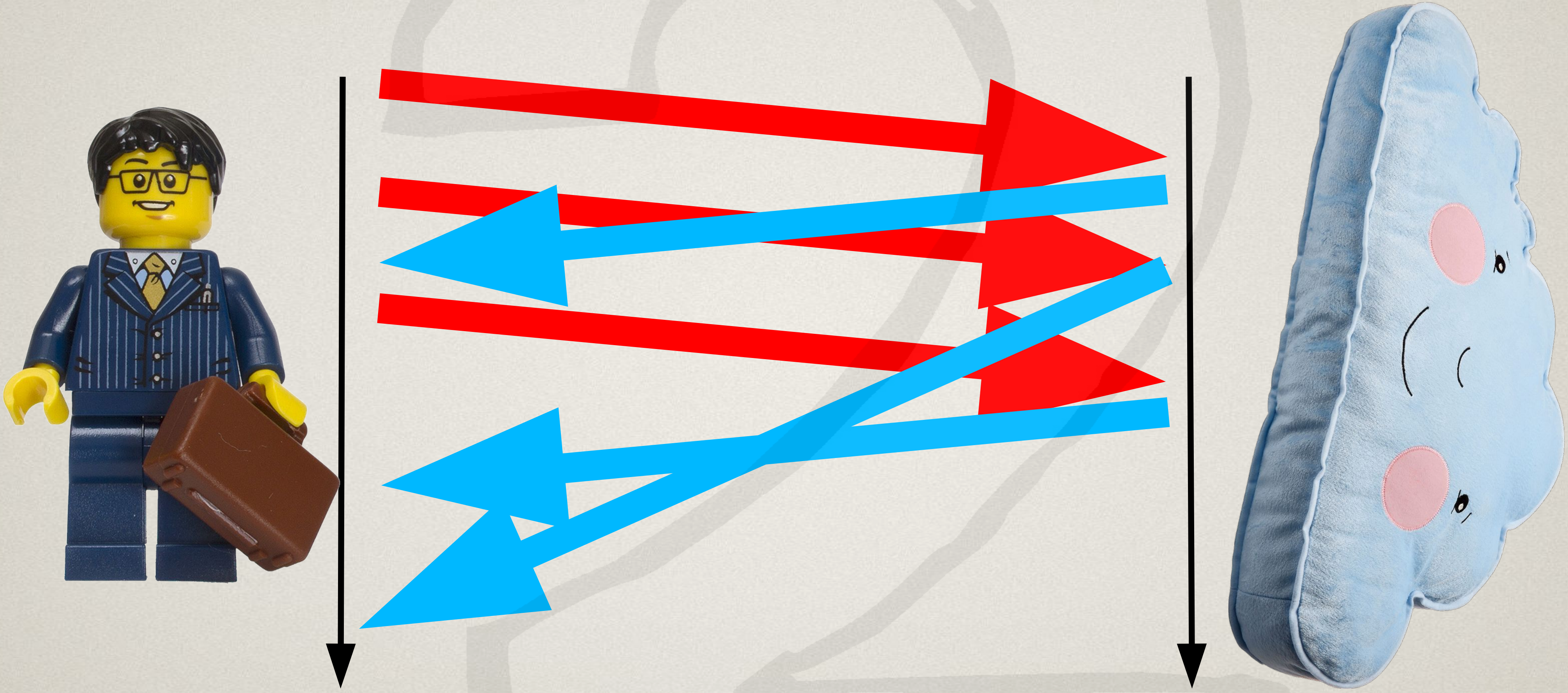
HTTP/2

Maintain HTTP semantics, change how it is transported

Multiplexed (1/2)

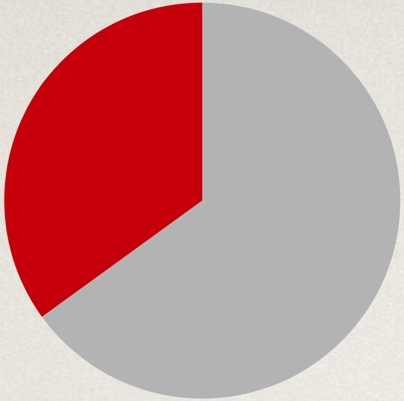
Multiplexed (2/2)

Better utilization of bandwidth



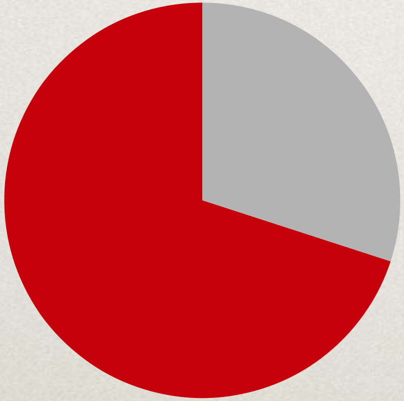
Firefox stats – March 2018

HTTP/2:

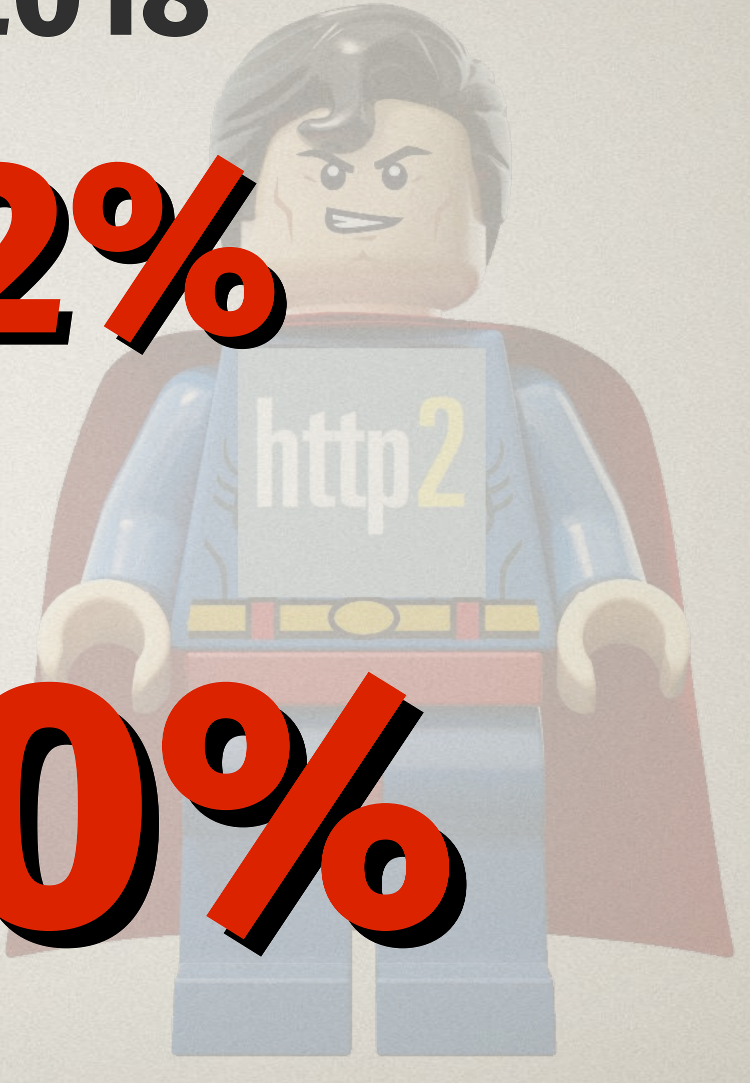


42%

Share of HTTPS:



70%



Internetz – March 2018

24% of top 10 million

Doubled last 12 months

38% of top 1000

Winners and losers

The remote corners of Internet

Percentile	Desktop	Mobile
5	1	11
25	20	44
50	79	94
75	194	184
95	800	913

Milliseconds RTT

The remote corners of Internet

Percentile	Desktop	Mobile
5	1	11
25	20	44
50	79	94
75	194	184
95	800	913

Milliseconds RTT

Queuing time h1 vs h2

(Time waiting internally to send off a HTTP request)

Percentile	HTTP 1	HTTP 2
80	100 ms	2 ms
95	2000 ms	16 ms

>100ms: H1 **20%**, H2 **3%**

0% packet loss

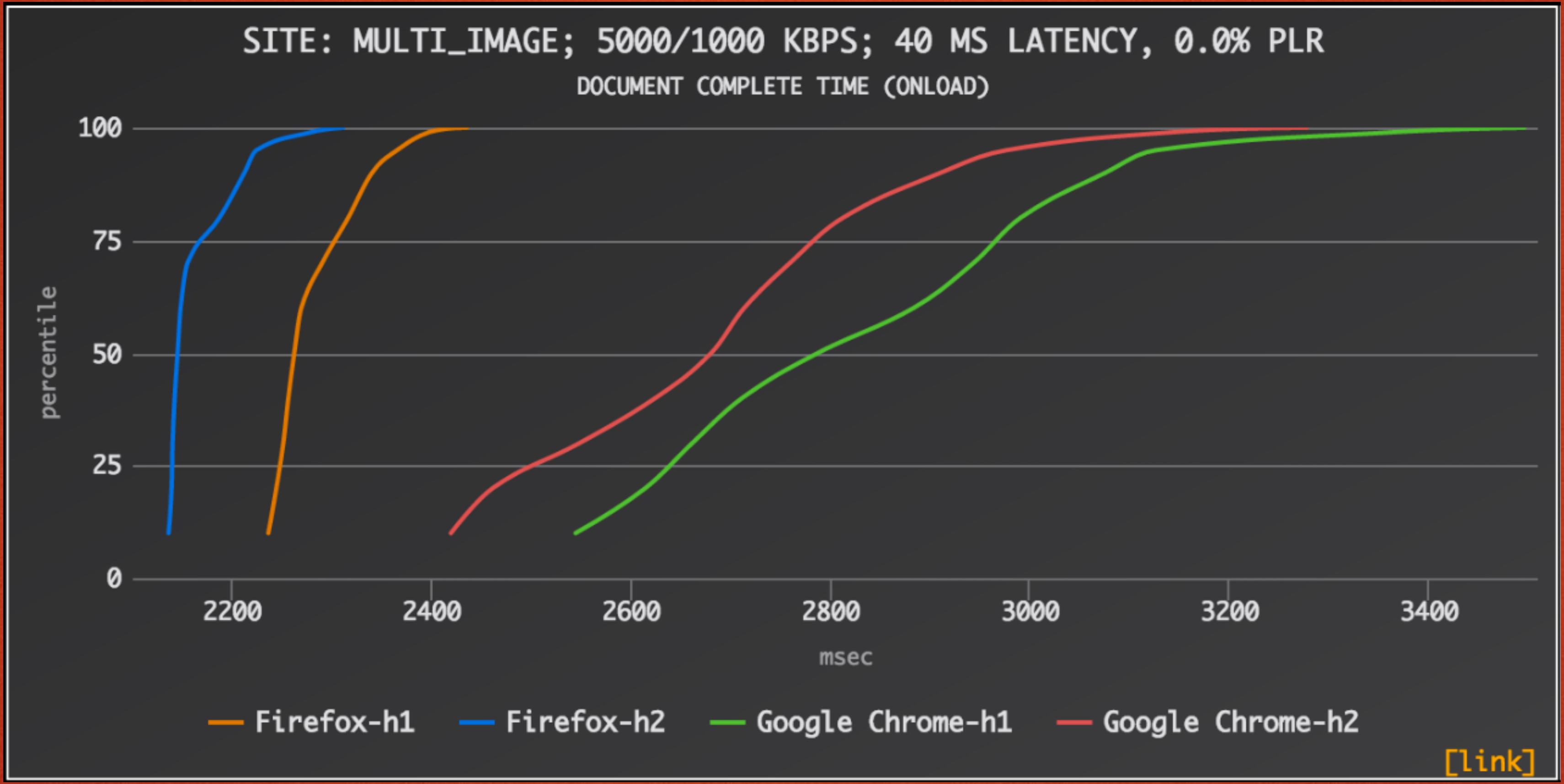


Image and data by Hooman Beheshti, Fastly

2% packet loss

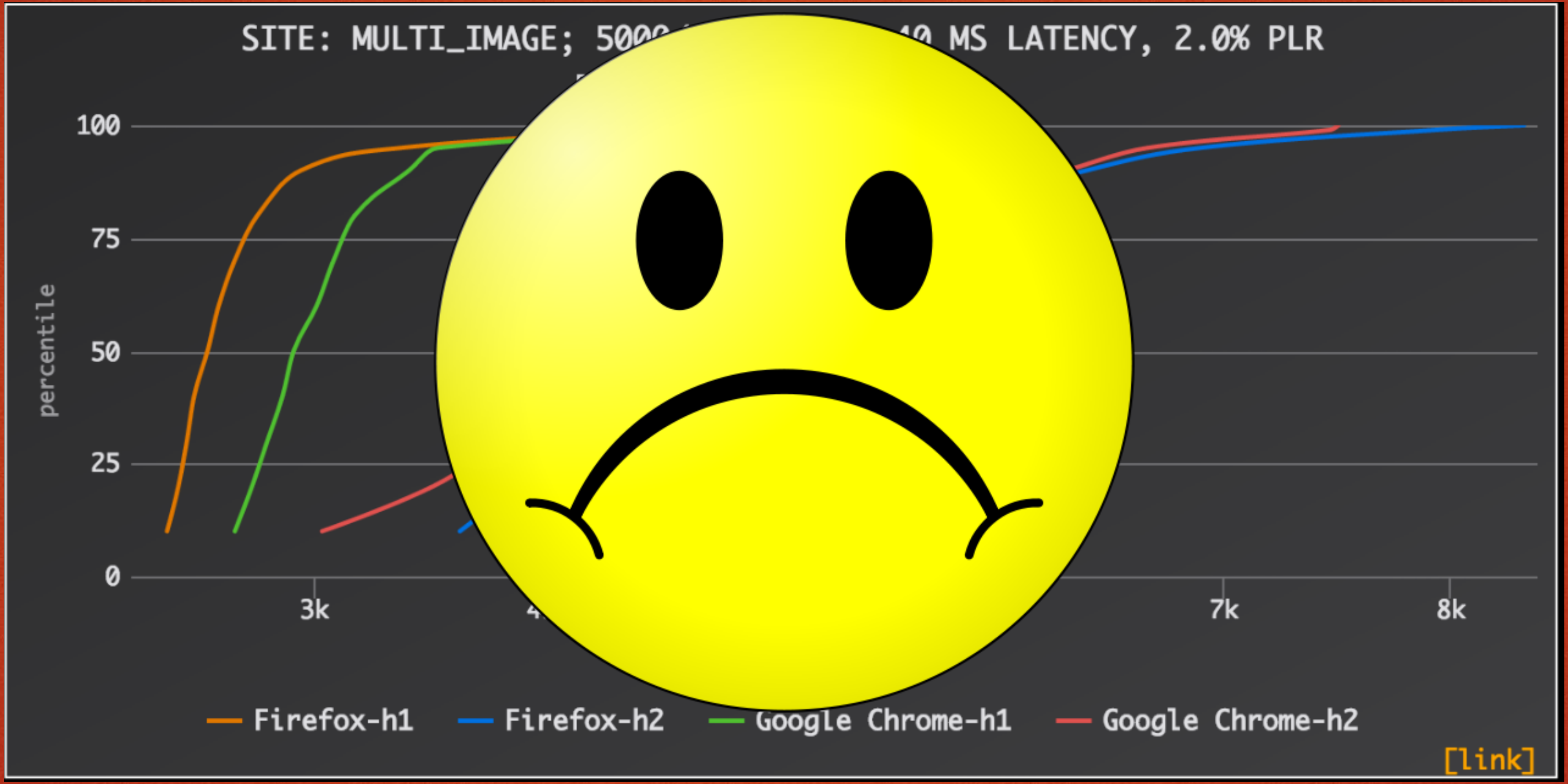
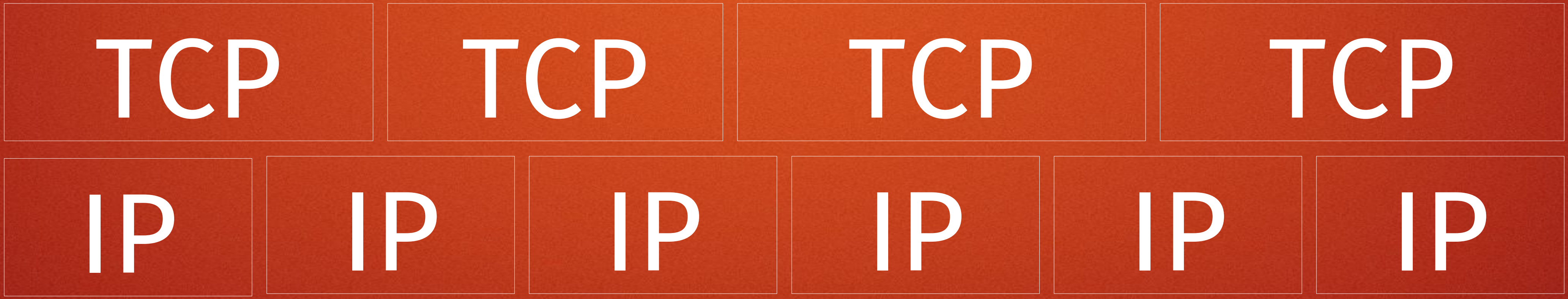


Image and data by Hooman Beheshti, Fastly

Packet loss, hey?

A single dropped packet blocks all streams

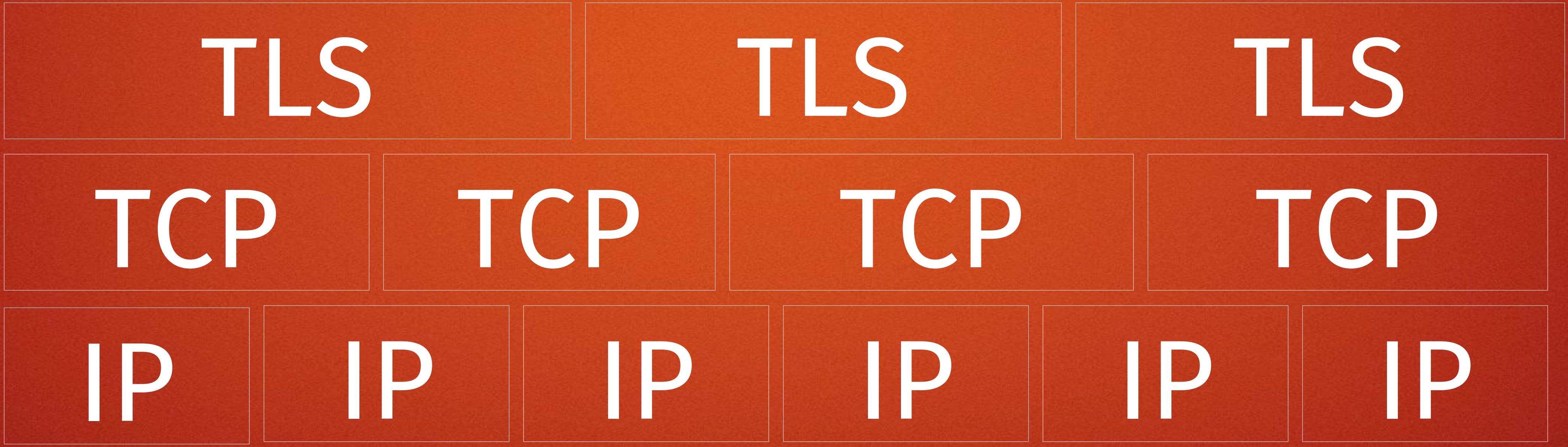
Packet loss, hey?



TCP TCP TCP TCP

IP IP IP IP IP IP

Packet loss, hey?

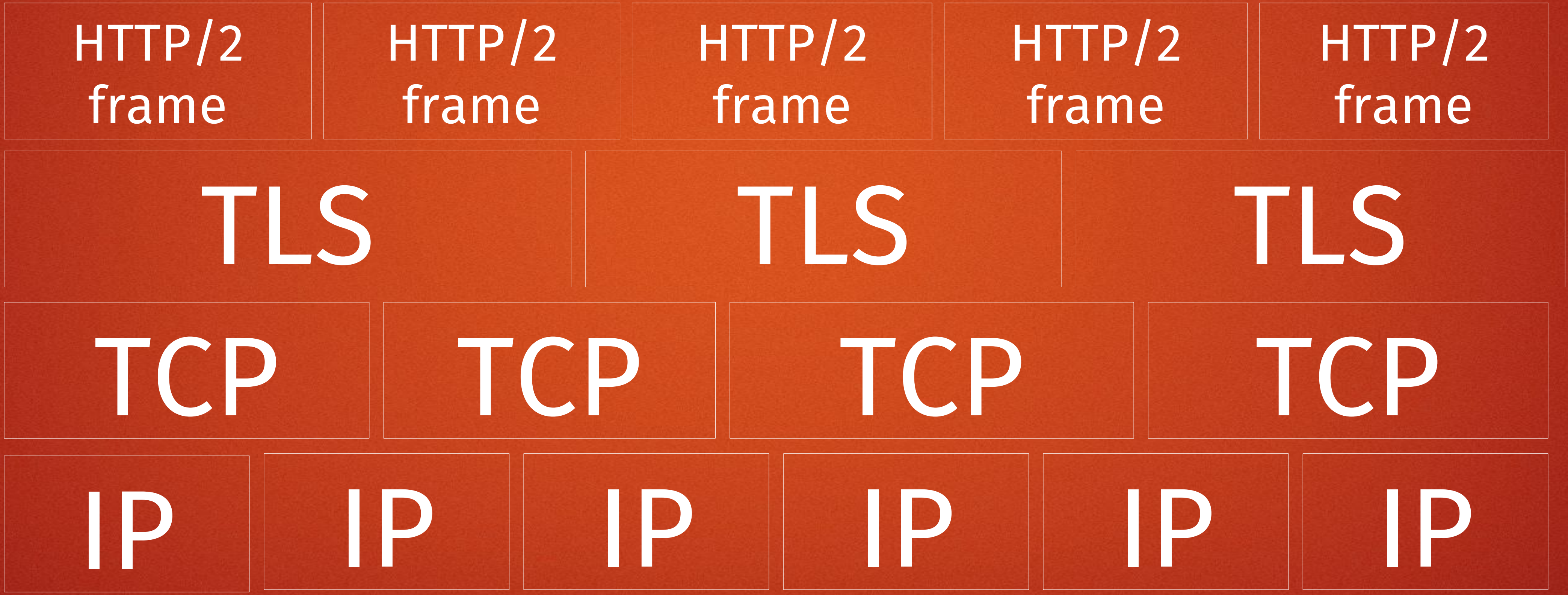


TLS TLS TLS

TCP TCP TCP TCP

IP IP IP IP IP IP

Packet loss, hey?



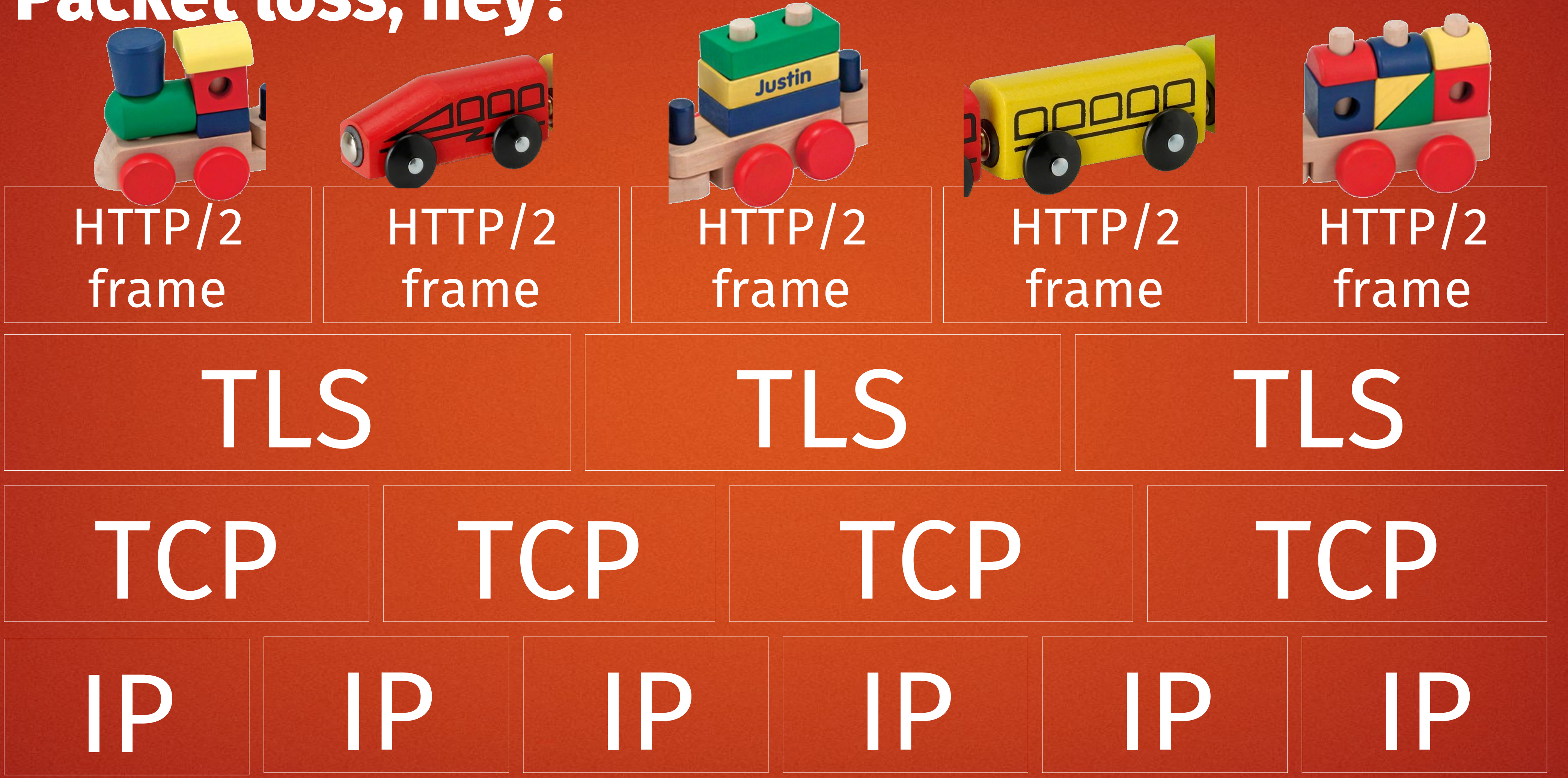
HTTP/2 frame | HTTP/2 frame | HTTP/2 frame | HTTP/2 frame | HTTP/2 frame

TLS | TLS | TLS

TCP | TCP | TCP | TCP

IP | IP | IP | IP | IP | IP

Packet loss, hey?



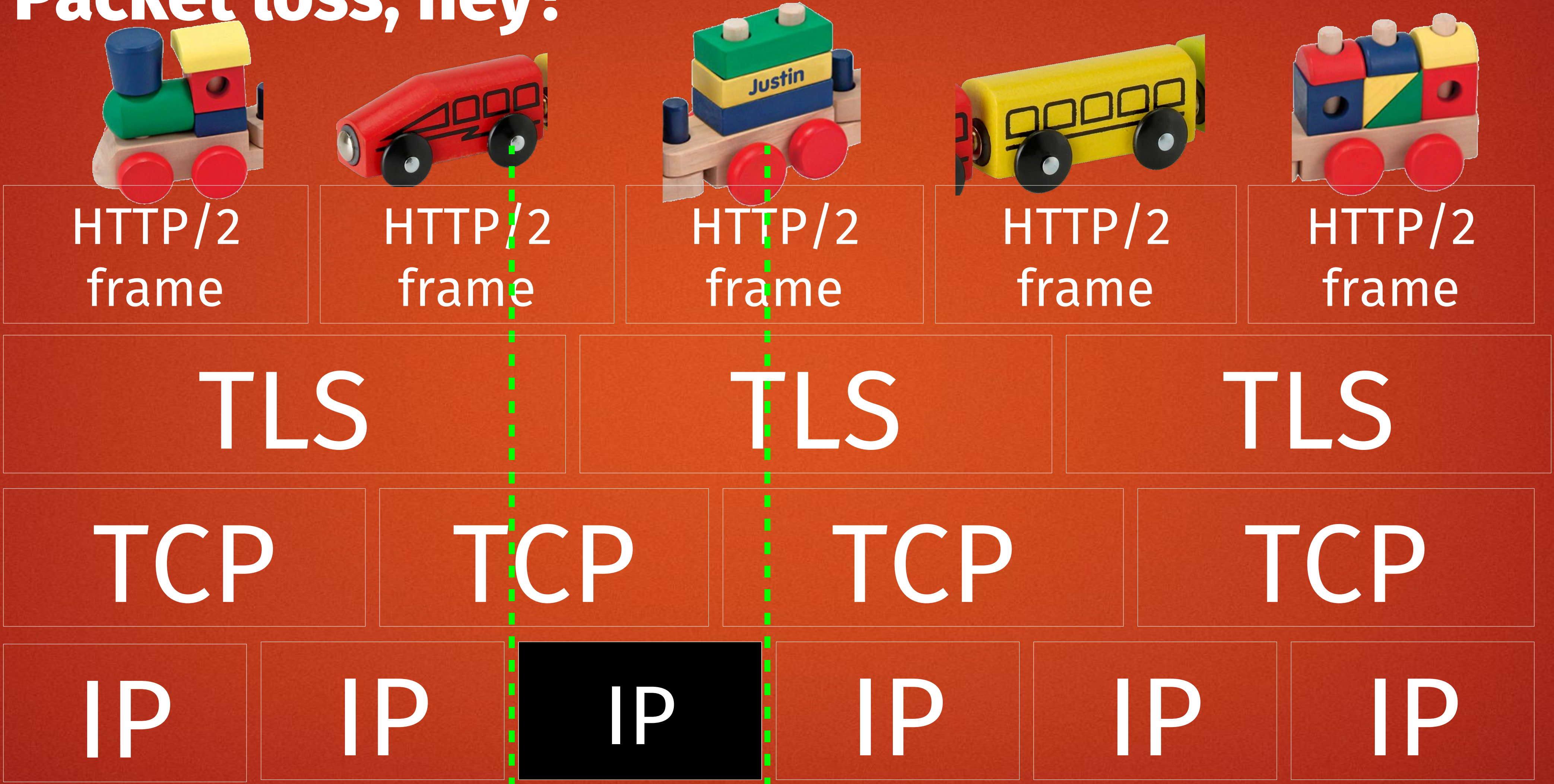
HTTP/2 frame | HTTP/2 frame | HTTP/2 frame | HTTP/2 frame | HTTP/2 frame

TLS | TLS | TLS

TCP | TCP | TCP | TCP

IP | IP | IP | IP | IP | IP

Packet loss, hey?

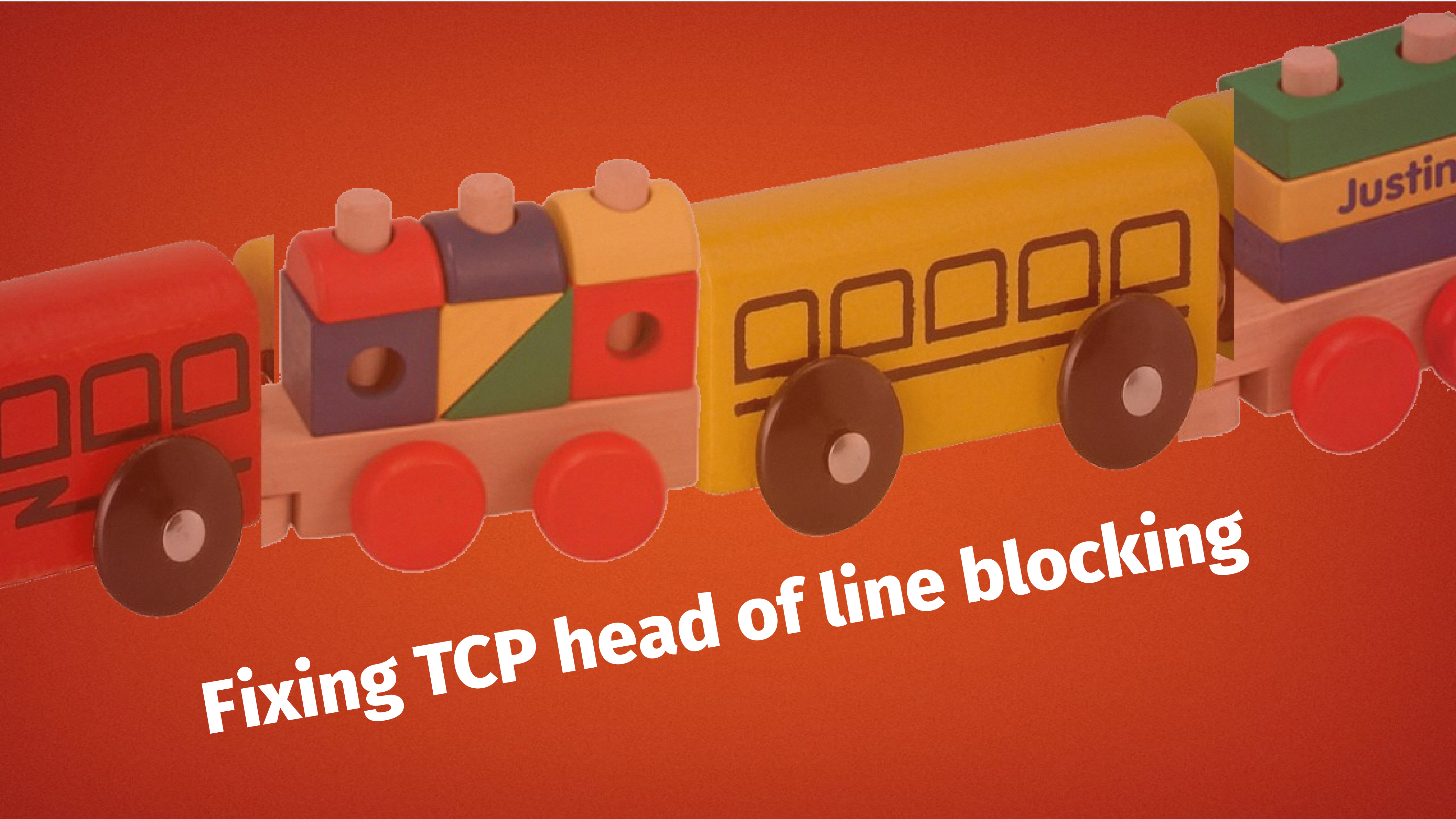


HTTP/2 frame | HTTP/2 frame | HTTP/2 frame | HTTP/2 frame | HTTP/2 frame

TLS | TLS | TLS

TCP | TCP | TCP | TCP

IP | IP | IP | IP | IP | IP



Fixing TCP head of line blocking

A non-blocking TCP + TLS + HTTP/2

independent packets

… that are stream aware

Needs retransmissions/ACKs

New protocol?

Fixing TCP takes decades – if even doable

QUIC

over UDP and end-to-end crypto

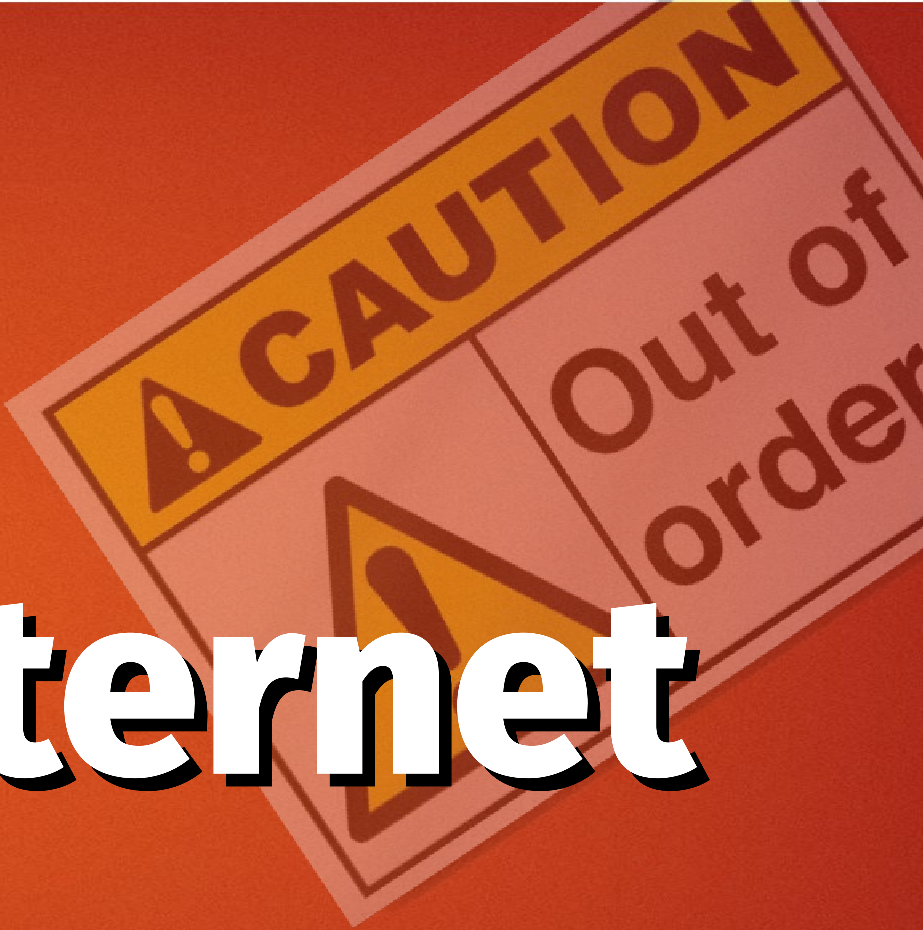
no TCP head of line blocking

Independent streams

0RTT

“TCP improvements” faster

Google-QUIC



7% of Internet

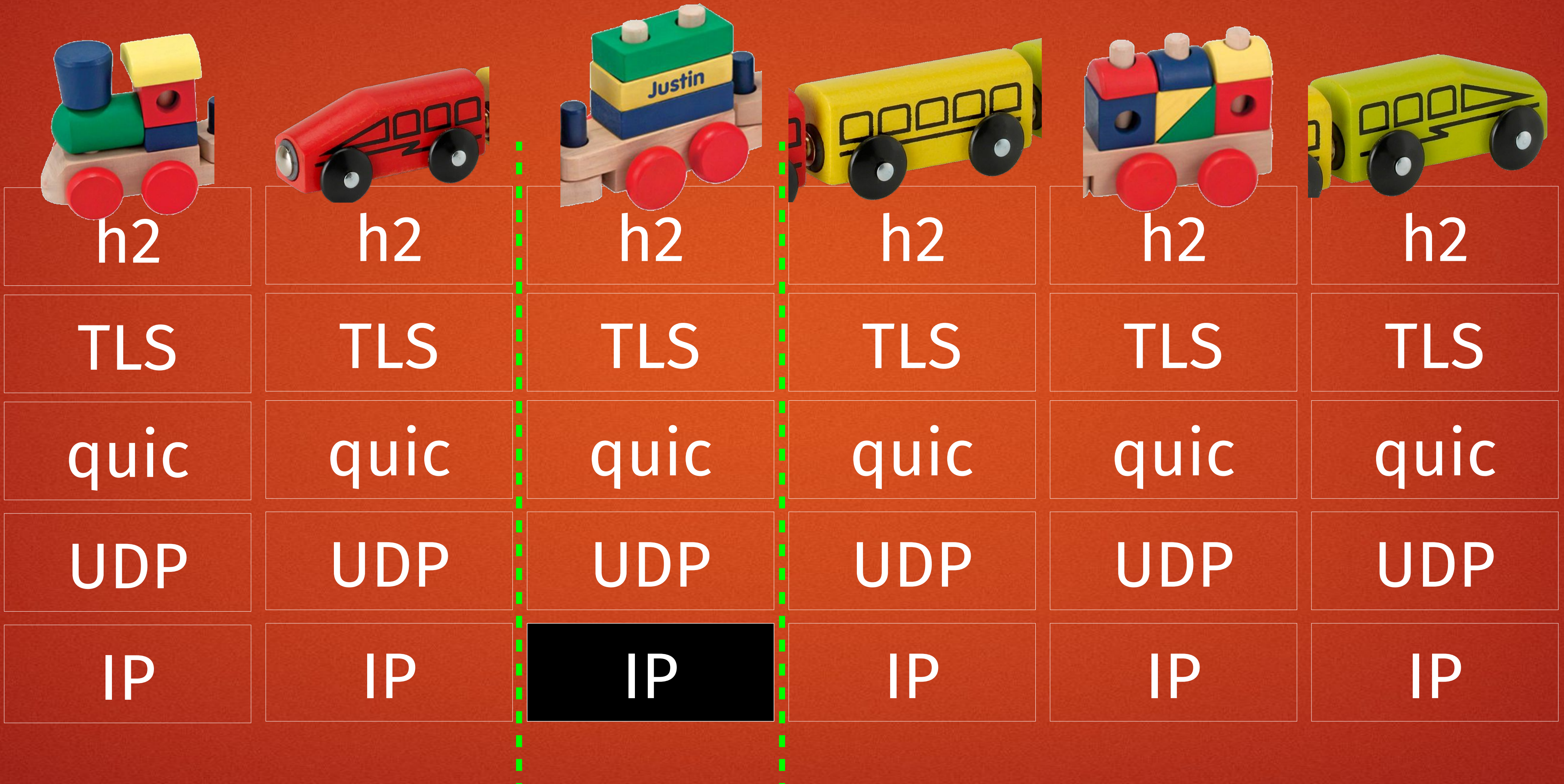
QUIC

Maintain HTTP semantics, change how it is transported

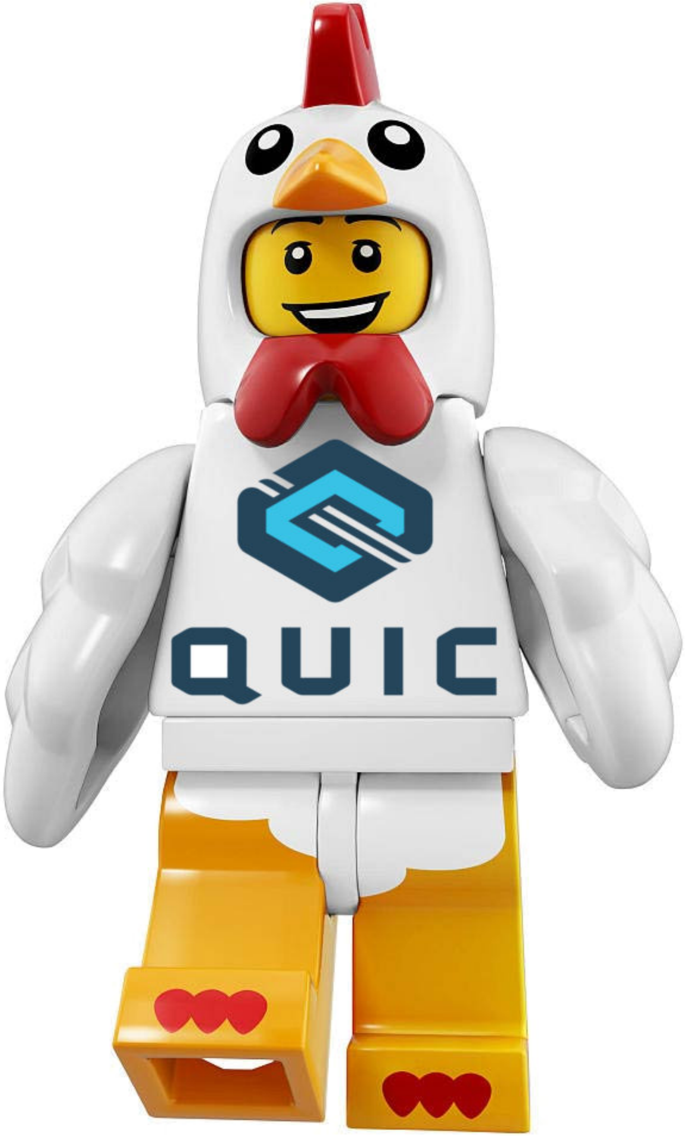
Packet loss, hey?

h2	h2	h2	h2	h2	h2
TLS	TLS	TLS	TLS	TLS	TLS
quic	quic	quic	quic	quic	quic
UDP	UDP	UDP	UDP	UDP	UDP
IP	IP	IP	IP	IP	IP

Packet loss, hey?



h2	h2	h2	h2	h2	h2
TLS	TLS	TLS	TLS	TLS	TLS
quic	quic	quic	quic	quic	quic
UDP	UDP	UDP	UDP	UDP	UDP
IP	IP	IP	IP	IP	IP


QUIC

The IETF QUIC wg

Started in 2016

Massive interest

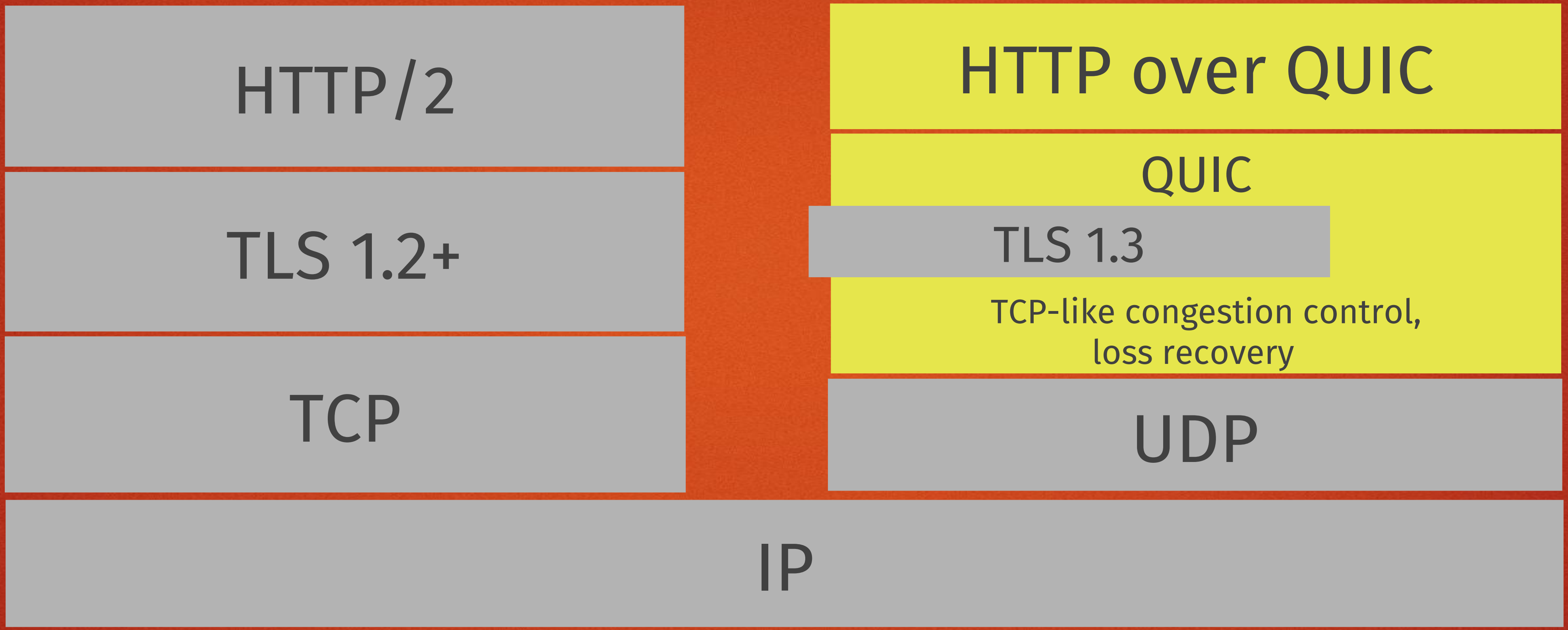
More than “h2-like”

Fifth interim in Stockholm in June ‘18

IETF-QUIC vs Google-QUIC

Done by the end of 2018!

The IETF-QUIC stack



HTTP/2

TLS 1.2+

TCP

HTTP over QUIC

QUIC

TLS 1.3

TCP-like congestion control,
loss recovery

UDP

IP

This is QUIC

https://daniel.haxx.se/this-is-quic/

This is QUIC

by Daniel Stenberg and
random people from the Internet

QUIC in curl (1/2)

Not started yet

Base on nghq (based on ngtcp2) ?

Similiar integration as HTTP/2

Start out with “known QUIC peer”; add alt-svc later

TLS integration might get quirky; start simple

Test server in nghq?

QUIC in curl (2/2)

Get started ASAP - who’s in?

Initial thoughts by the next QUIC Interim in Stockholm (June 2018)