

HTTP/3 – Why should I care?

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<https://pojman.cz/2020/http3/>



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Protocol Optimization,
Prague





275 000 servers
>150 Tbps in peak

QUIC enabled globally
HTTP/3?



HTTP

Quick recap

HTTP/1.1

```
$ nc ep2020.europython.eu 80
```

```
GET / HTTP/1.1
```

```
Host: ep2020.europython.eu
```

```
HTTP/1.1 301 Moved Permanently
```

```
Server: nginx
```

```
...
```


HTTP over TLS

```
$ openssl s_client -quiet \  
    -connect ep2020.europython.eu:443  
GET / HTTP/1.0  
Host: ep2020.europython.eu  
  
HTTP/1.1 200 OK  
Server: nginx  
...
```


HTTP/2

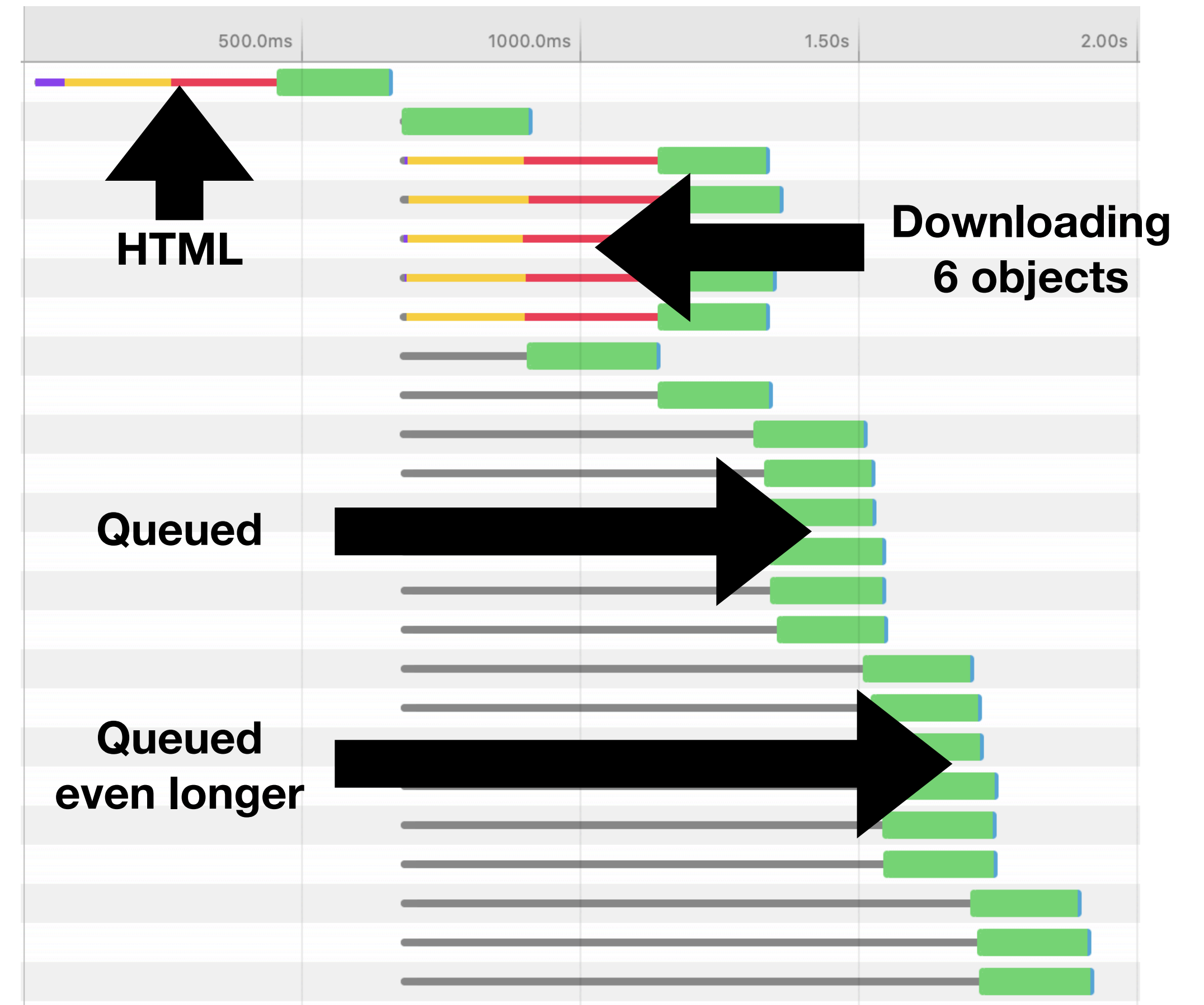
- Binary protocol
- Multiplexing
- Header compression
- Server push
- Request prioritization



Photo by Franck V. on Unsplash

Connection pool

HTTP/1.1
6 connections per domain





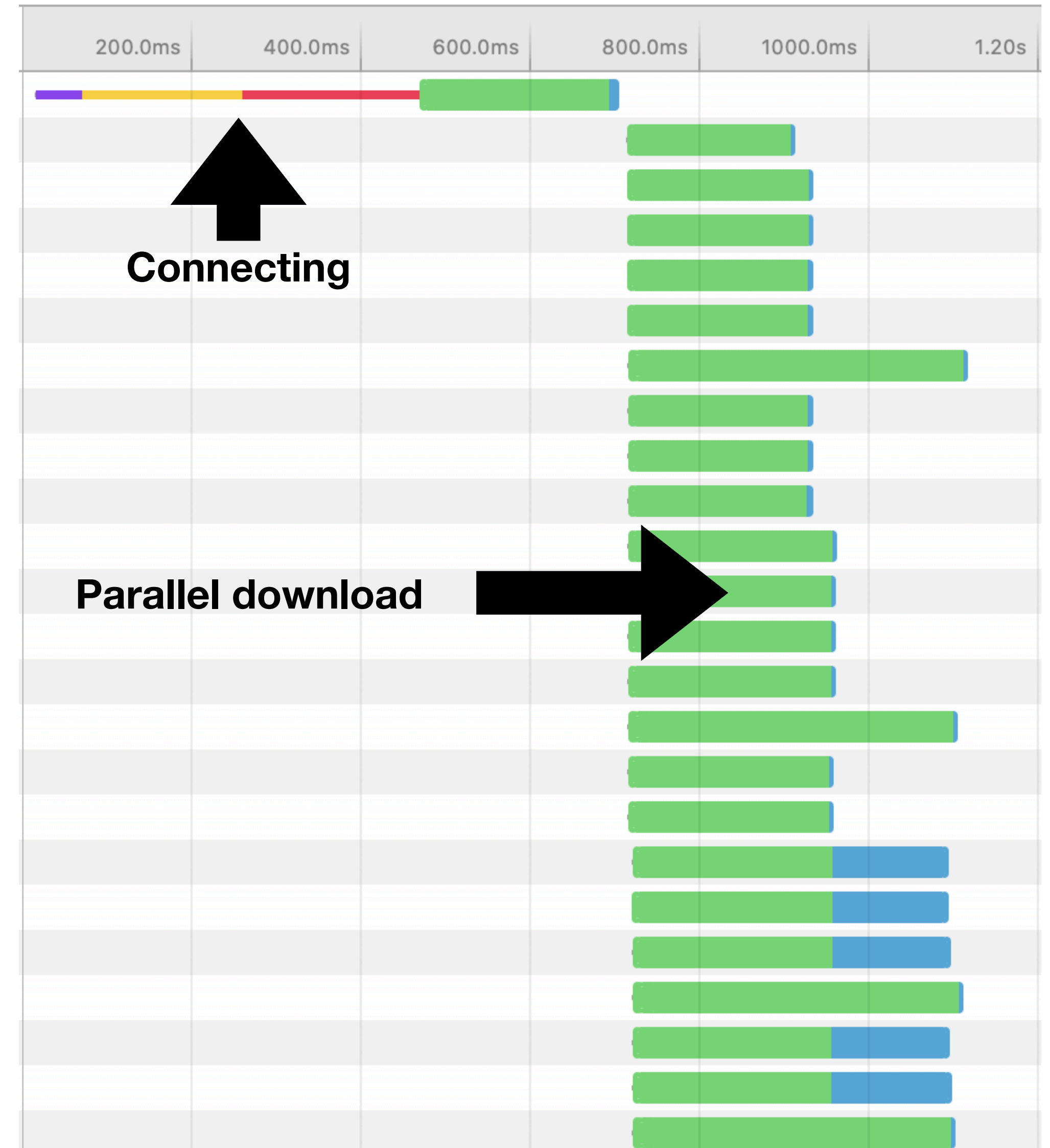
HTTP Head-of-line blocking

Photo by Jacek Dylag on Unsplash

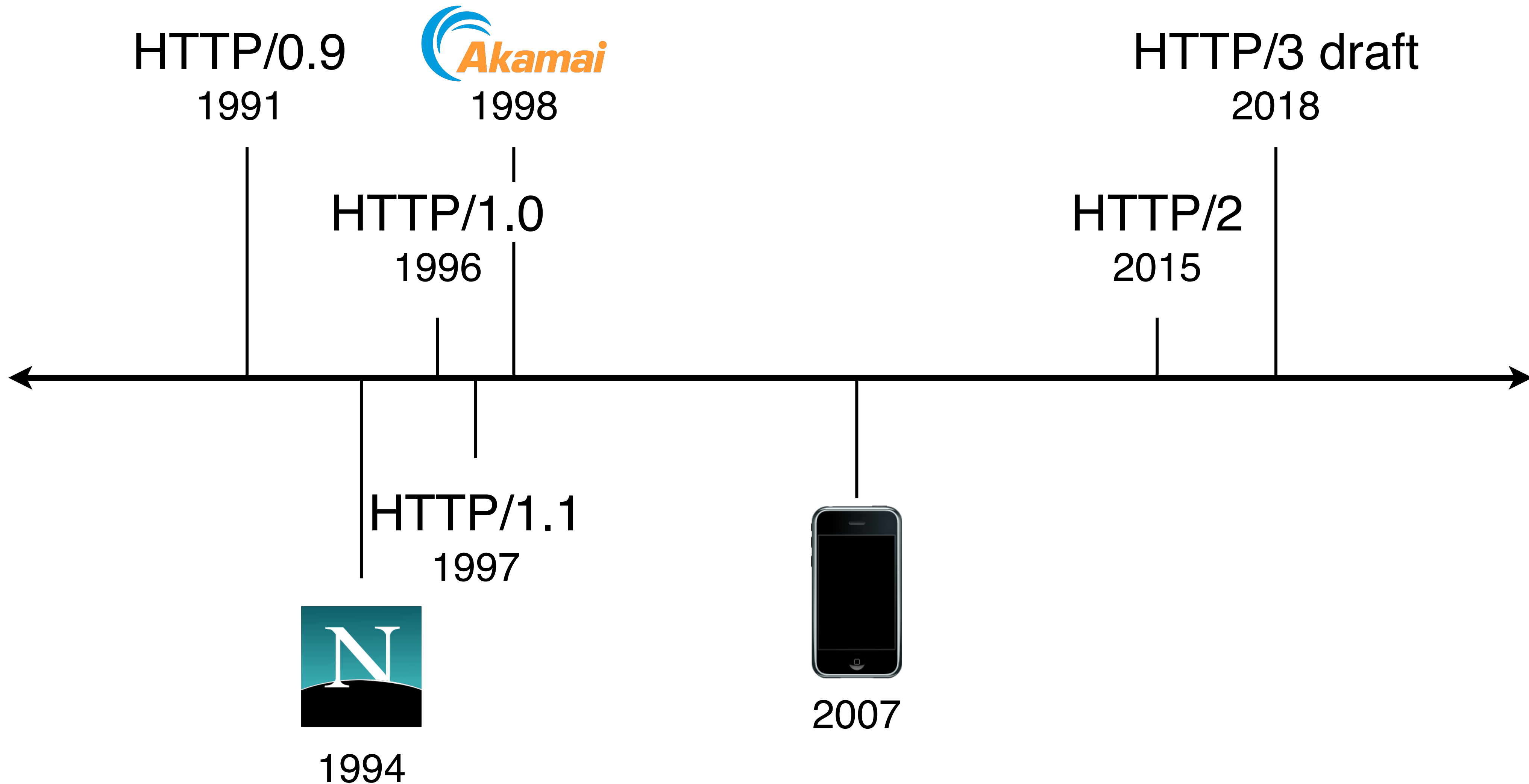
Multiplexing

HTTP/2

1 connection per domain



HTTP History





HTTP/3

Photo by Tony Hand on Unsplash

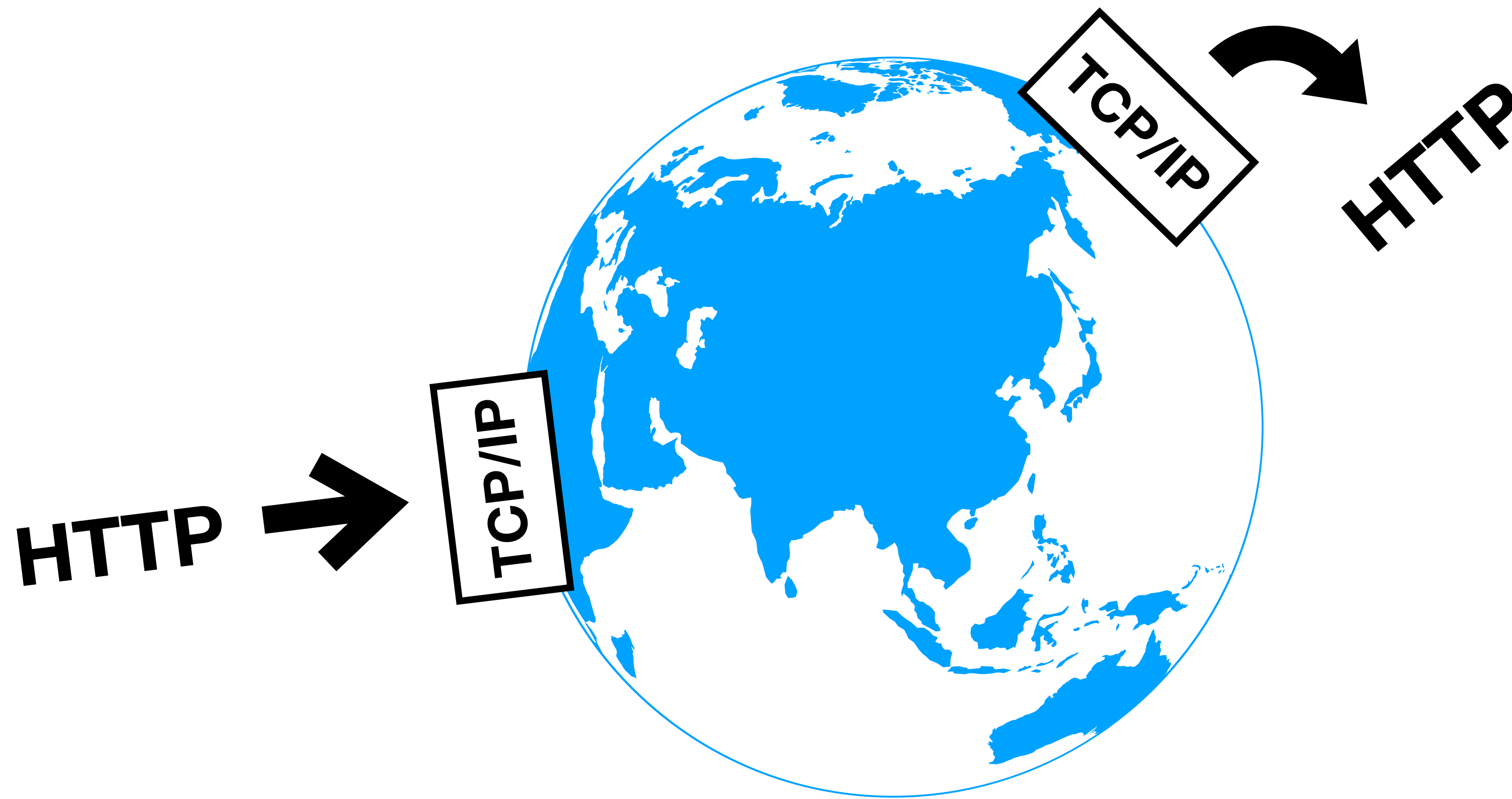
Transport protocols

How does the internet work?

Internet



TCP/IP

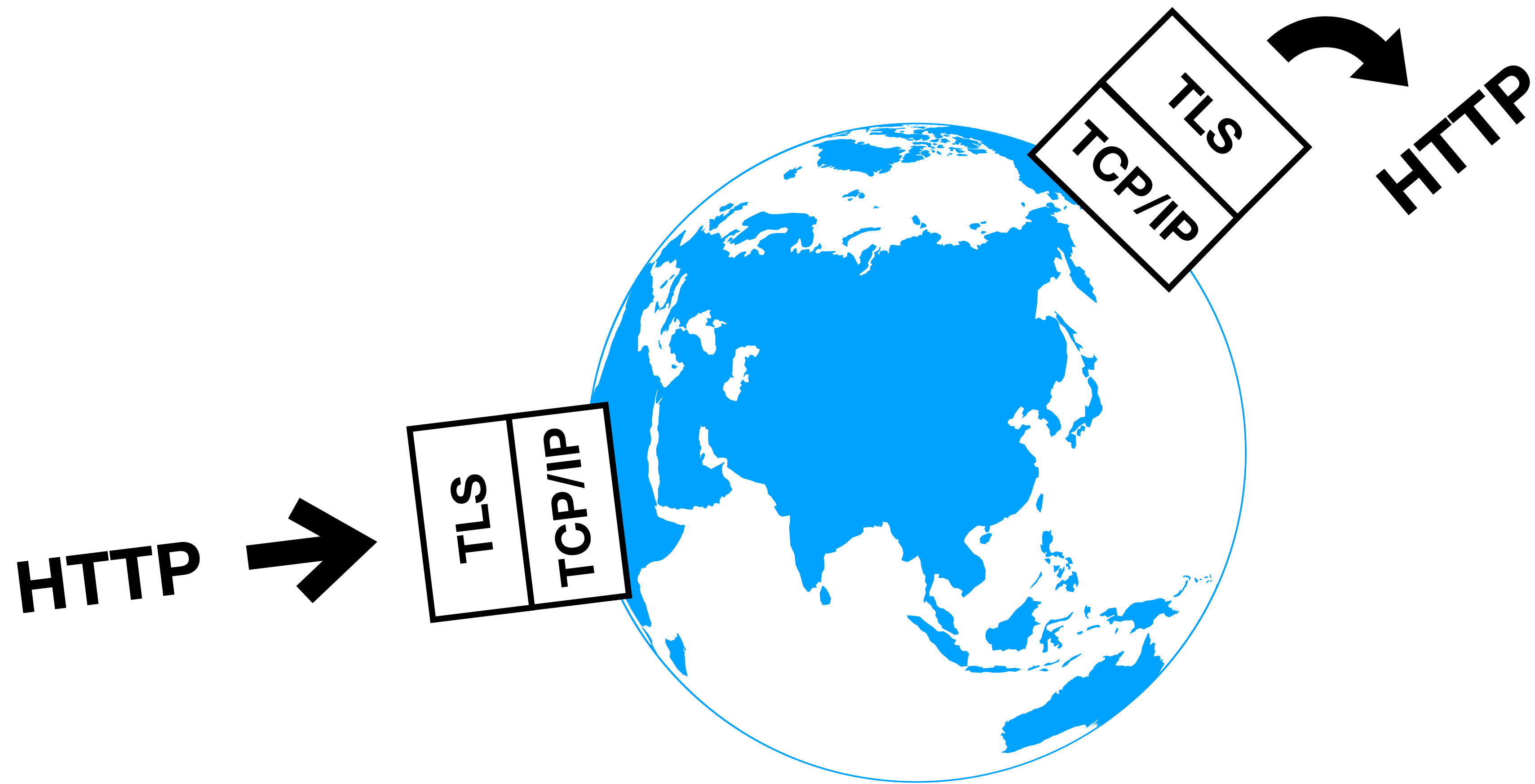


TCP in Python

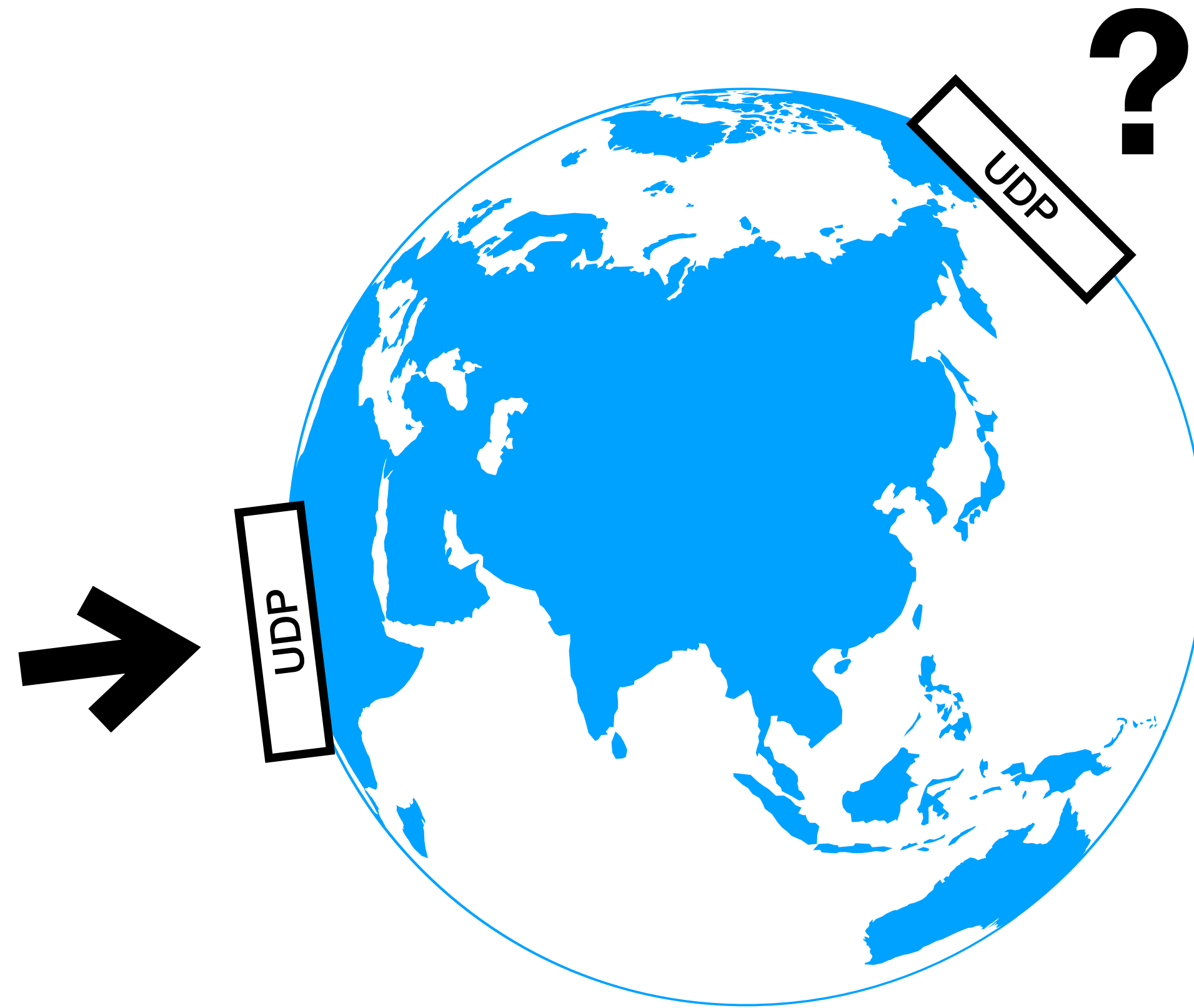
```
import socket

s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.connect(("ep2020.europython.eu", 80))
s.send(b"GET / HTTP/1.1\n")
s.send(b"Host: ep2020.europython.eu\n")
s.send(b"\n")
print(s.recv(1024))
```

TCP/IP + TLS



UDP



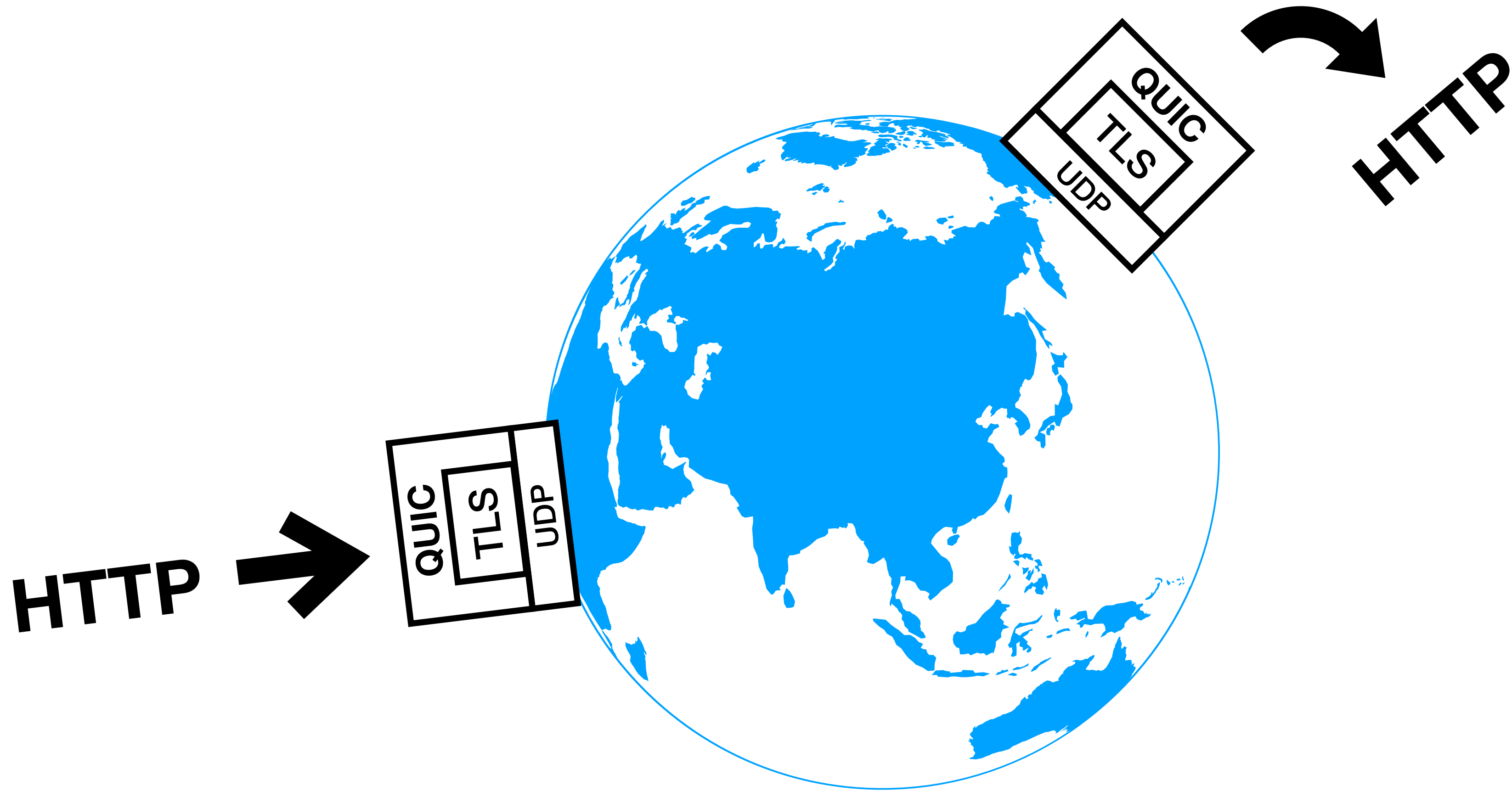
```
>>> print("\N{Thinking Face}")
```





QWIRK

QUIC



HTTP/3

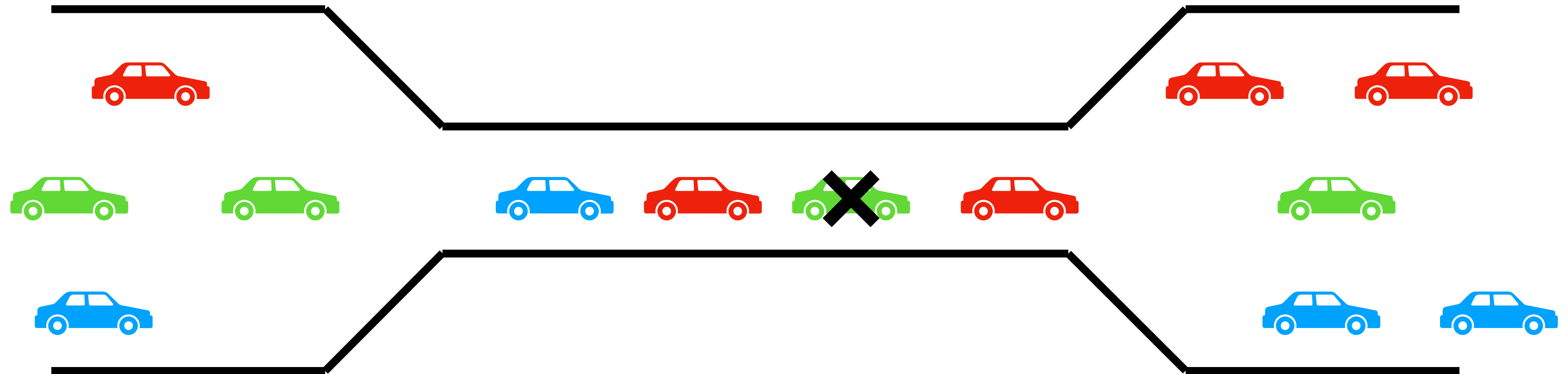
HTTP over QUIC



Independent streams

Photo by Ed 259 on Unsplash

HTTP/2

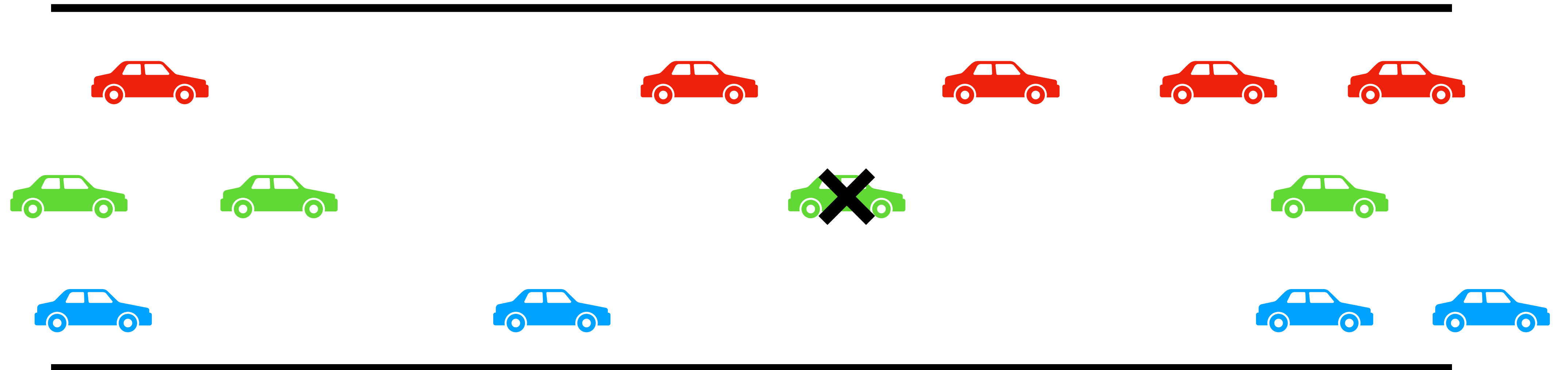


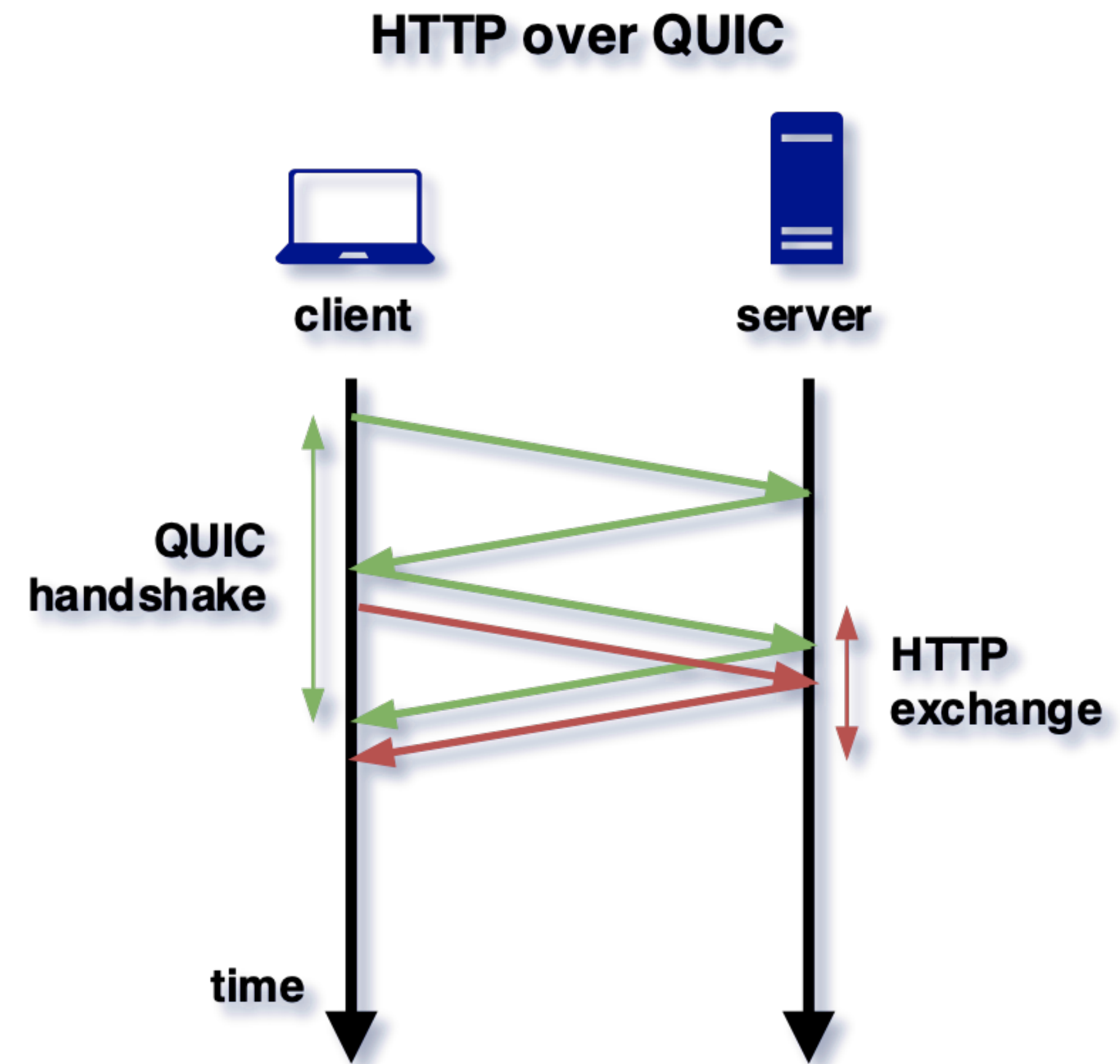
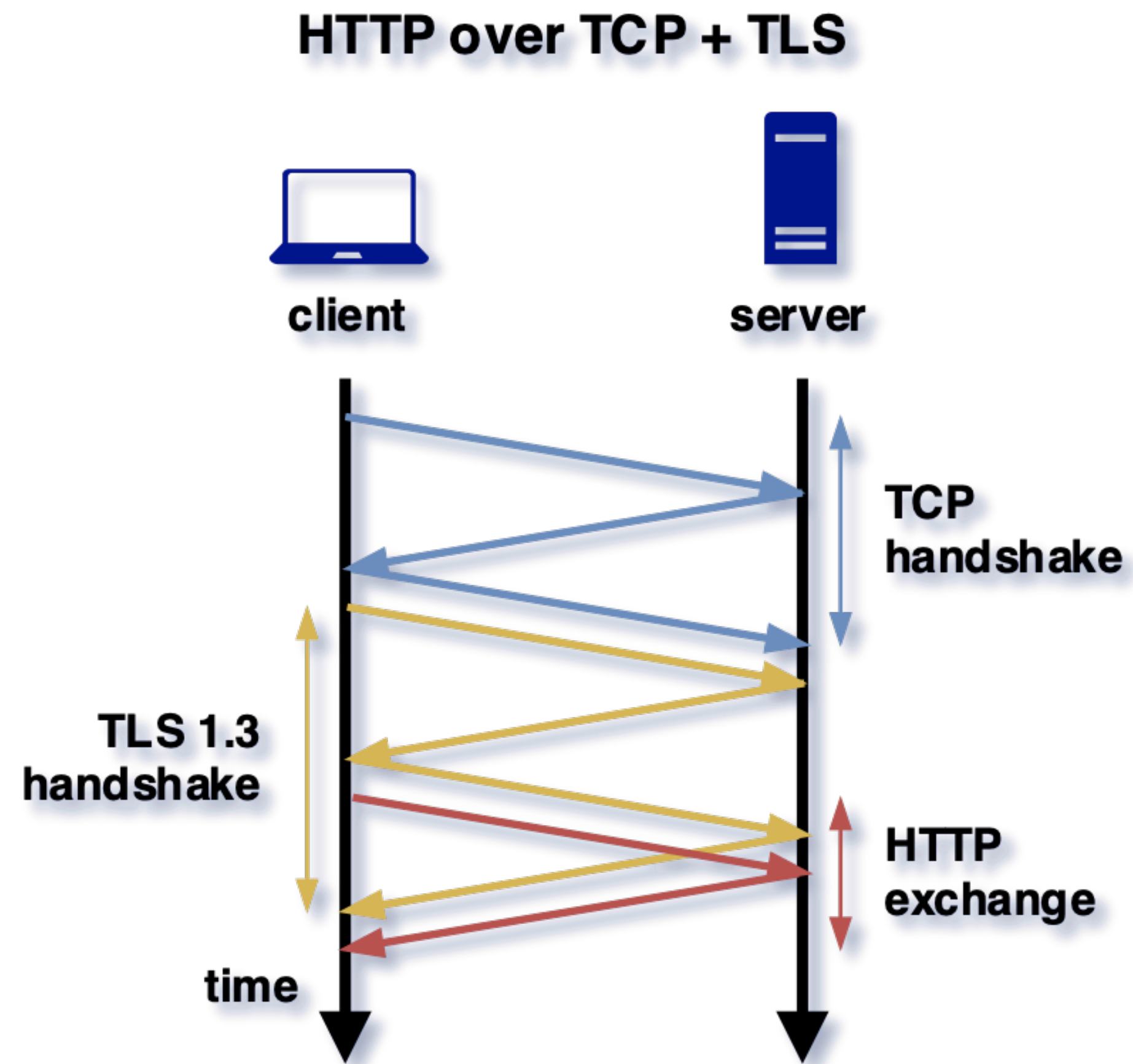


TCP head-of-line blocking

Photo by Mathis Jrdl on Unsplash

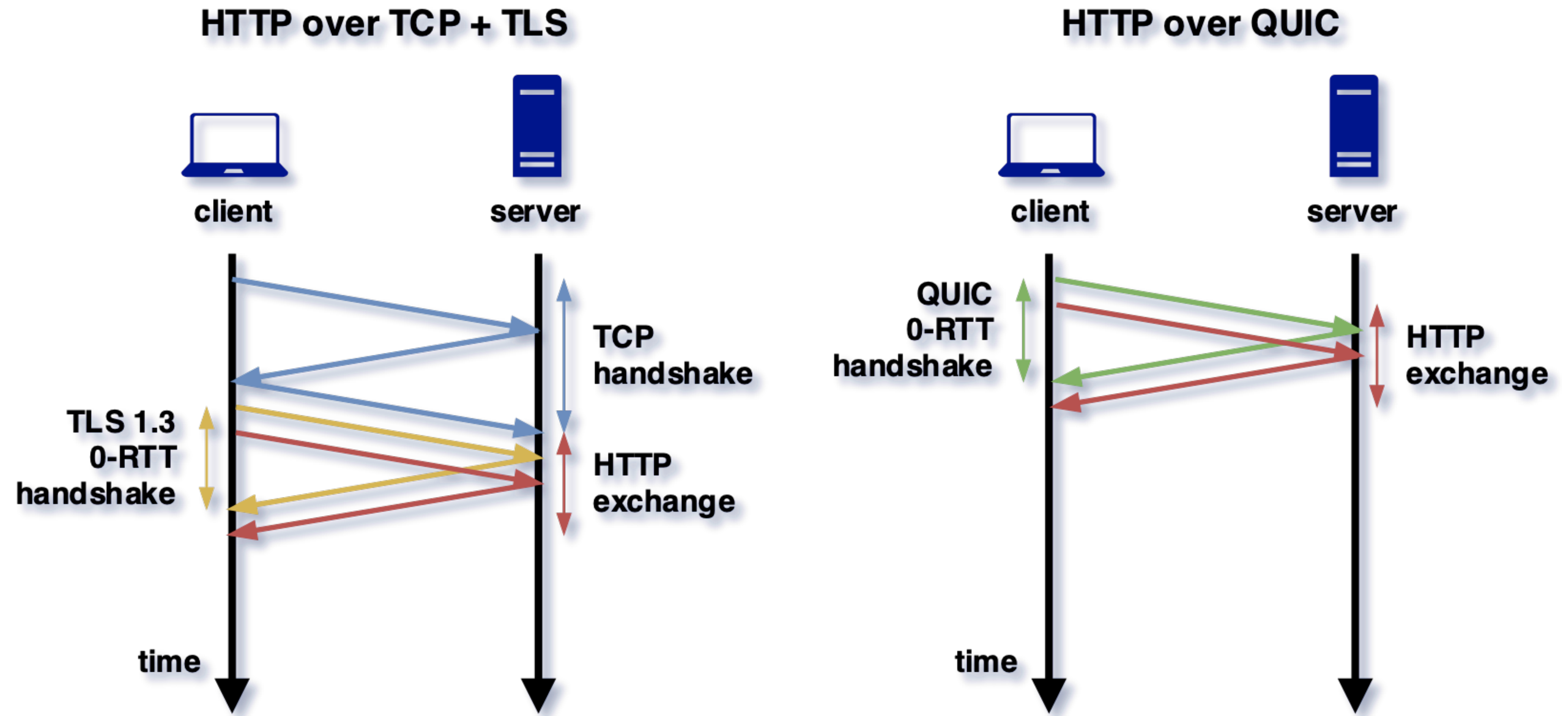
HTTP/3





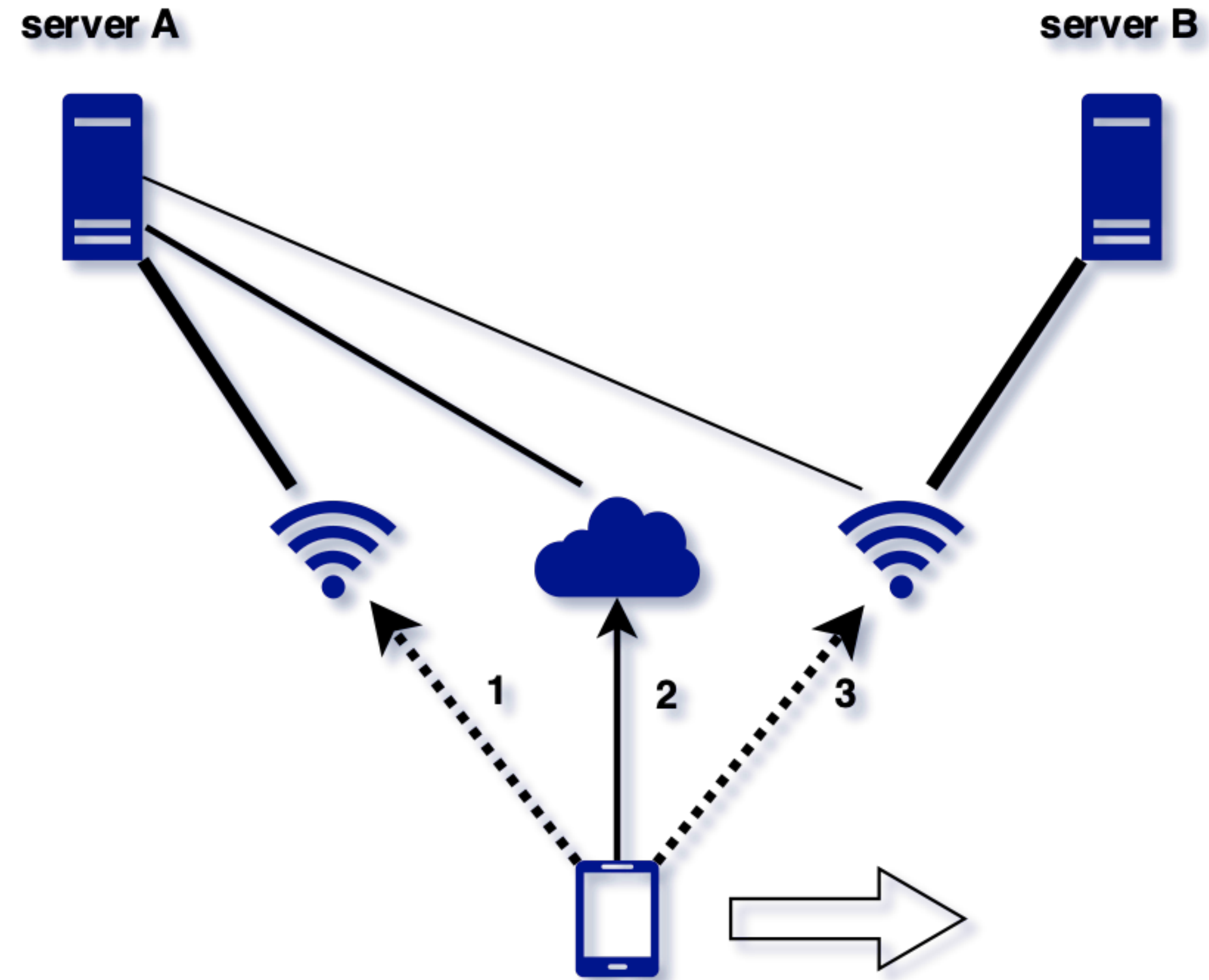
Connection handshake

1-RTT



Reconnection handshake

0-RTT



Connection migration



Fully encrypted

Photo by Feifei Peng on Unsplash

Ossification

“Helpful” middleboxes



Photo by Reuben Farrugia on Unsplash

Other QUIC advantages

- Faster development
- Prioritization changes
- More info for congestion control and loss recovery



QUIC challenges

- UDP blocking
- CPU usage
- Unoptimized UDP
- Overall complexity



Photo by Dadan Fitrayana on Unsplash

HTTP/3 support

Looking forward

Google QUIC vs IETF QUIC



I E T F[®]

Name	Method	Status	Protocol	Type	Size
 www.youtube.com	GET	200	h2	document	47.6 KB
 generate_204	GET	204	h2	text/plain	187 B
 web-animations-next-lite....	GET	200	http/2+quic/46	script	15.5 KB
 custom-elements-es5-ad...	GET	200	http/2+quic/46	script	866 B
 webcomponents-sd.js	GET	200	http/2+quic/46	script	21.5 KB
 desktop_polymer_v2-vfl5...	GET	200	http/2+quic/46	document	361 KB
 scheduler.js	GET	200	http/2+quic/46	script	2.7 KB
 www-tampering.js	GET	200	http/2+quic/46	script	3.8 KB
 www-prepopulator.js	GET	200	http/2+quic/46	script	424 B
 spf.js	GET	200	http/2+quic/46	script	12.2 KB
 network.js	GET	200	http/2+quic/46	script	4.7 KB
 css?family=YT%20Sans...	GET	200	http/2+quic/46	stylesheet	899 B
 www-main-desktop-hom...	GET	200	http/2+quic/46	stylesheet	1.5 KB
 www-onepick-2x-webp-v...	GET	200	http/2+quic/46	stylesheet	433 B
 desktop_polymer_v2.js	GET	200	http/2+quic/46	script	798 KB

Google QUIC support

Chrome (desktop and mobile)

IETF QUIC support

- Chrome Canary
- Firefox Nightly
- Safari 14 (iOS 14, macOS 11)



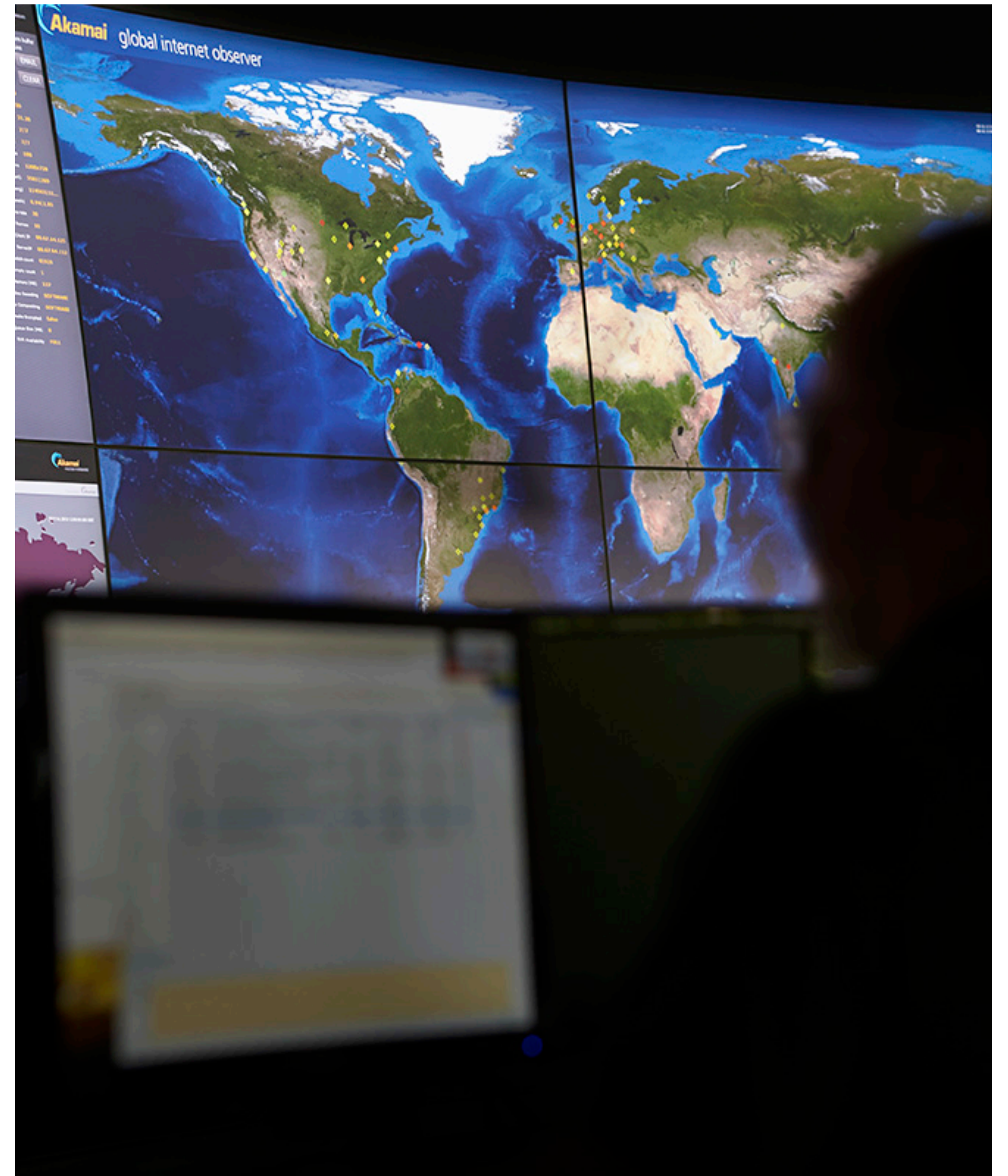
cURL

by Daniel Stenberg



CDNs

Don't want to miss



Nginx

<https://quic.nginx.org/README>



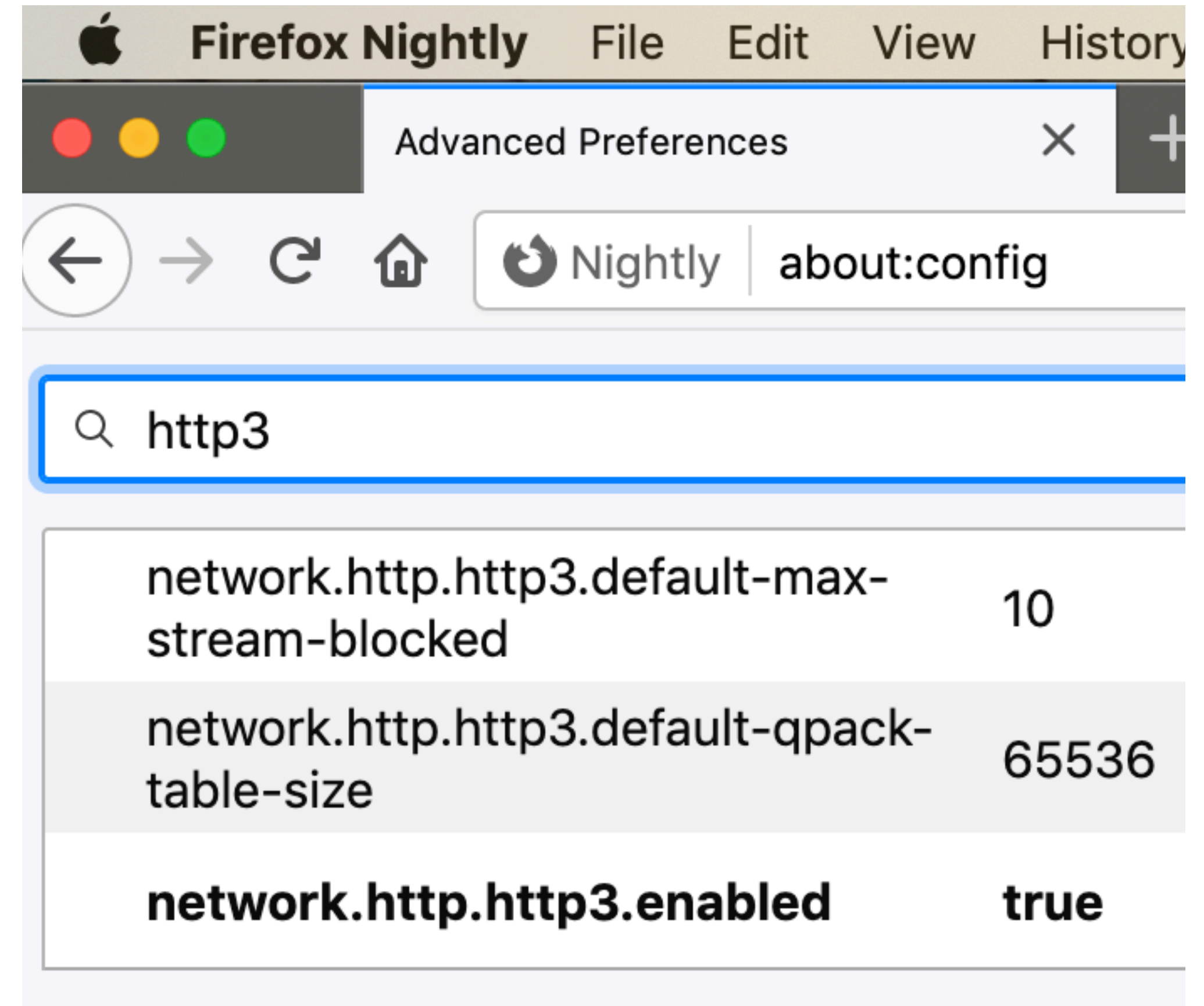
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	server →	h2o/quicly	quant	ngtcp2	mvfst	picoQUIC	msquic	f5	f5_test	ATS	quiche	lsquic	ngx_quic	AppleQUIC	quic-go	Quinn	AkamaiQUIC	aloquic	~gQUIC	kwik&flupke	Neqo	Haskell QUIC	spindump			
2	client ↓																									
3	h2o/quicly				-				-	-				-	-	-				-	-		-	-	-	-
4	quant	VHDCRZSQ MU 3	VHDCRZSQ MBAUPE	VHDCRZSQ MBAU 3	-	VHDCRZSQ MBAUP 3	VHDCRZSQ MBUP 3	VHDCRZQ UE 3	-	-	VHDCRZSQ 3	VHDCRZSQ MBAUPE 3	-	-	-	VHDCRZSQ MBAUP 3	-	VHDCRZSQ MBAUP 3	VHDCRZQ 3	-	-	VHDCRZSQ M 3	-	-	-	-
5	ngtcp2	VHDCRZ U	V	VHDCRZS MBAU 3dp	-	VHDCRZS MBAU 3	VHDCRZ MBAU 3d	VHDCRZ U 3d	-	-	VHDCRZS 3	VHDCRZS MBAU 3dp	-	-	-	VHDCRZS MBAU 3	-	VHDCRZS MBAU 3dp	VHDCRZ 3	-	-	VHDCRZS MBA 3	-	-	-	-
6	mvfst				-				-	-				-	-	-				-	-		-	-	-	-
7	picoQUIC	VHDCRZSQ MU	VHDCRZSQ MBAUPLT 3	VHDCRZSQ MBAULT 3	-	VHDCRZSQ MBAUPLT 3	VHDCRZSQ MBAUPT 3	VHDCRZQ U 3	-	-	VHDCRZSQ 3	VHDCRZSQ MBAUPT 3	-	VHDCSQ MUP 3	-	HDCRZSQ MBAUP 3	-	VHDCRZSQ MBAUPLT 3	VHDCRZQ 3	-	-	VHDCRSZQ MBA 3	-	-	-	-
8	msquic	VHCRQ U	VHDCRZSQ MBU	VHCSQ MBU	-	VHDCRZSQ MBU	VHDCRZSQ MBAUPLT 3d	VHCRQ U	-	-	VHDCRZQ 3	VHCRSQ MBU	-	VHDCQ U	-	VHDCRZSQ MBU	-	VHCRZSQ MBU	VHCQ B	-	-	VHDCRZSQ MB	-	-	-	-
9	f5				-				-	-			-	-	-		-			-	-		-	-	-	-
10	f5_test				-				-	-			-	-	-		-			-	-		-	-	-	-
11	ATS				-				-	-			-	-	-		-			-	-		-	-	-	-
12	quiche				-				-	-			-	-	-		-			-	-		-	-	-	-
13	lsquic	VHDCRSQ M 3	VSQ	VHDCRSQ M 3dp	-	VHDCRSQ MPT 3	VHDCRQ MPT 3d	VHDCRQ E 3d	-	-	VHDCRSQ 3	VHDCRSQ MPET 3dp	-	-	-	VHDCRSQ MP 3d	-	VHDCRSQ MPT 3dp	VHDCRQ 3d	-	-	VHDCRSQ MT 3d	-	-	-	-
14	ngx_quic				-				-	-			-	-	-		-			-	-		-	-	-	-
15	AppleQUIC	VHDCS 3		VHDC 3	-	VHDC 3	VHDC P 3	VHDC 3	-	-	VHDC 3	VHDC 3	-	VHDCSQ MUPT 3dp	-	VHDCS P 3	-	VHDCS P 3	VHDC 3	-	-	VHDCS 3	-	-	-	-
16	quic-go				-				-	-			-	-	-		-			-	-		-	-	-	-
17	Quinn			VHDCRZS BU 3d	-	VHDCRZS BU 3	VHDCRZS BU 3	VHDCRZ BU 3	-	-	VHDCRZS B 3	VHDCRZS B 3	-	VHDCS 3	-	VHDCRZS BU 3d	-	VHDCRZS BU 3d	VHDCRZ B 3d	-	-	VHDCRZS B 3	-	-	-	-
18	AkamaiQUIC				-				-	-			-	-	-		-			-	-		-	-	-	-
19	aloquic	VHDCRZSQ U	VHDCRZSQ MBUT 3dp	VHDCRZSQ BU 3dp	-	VHDCRZSQ MBUPLT 3	VHDCRZSQ BUPL 3	VHDCRZQ U 3d	-	-	VHDCRZSQ 3	VHDCRZSQ MBUPT 3dp	-	-	-	VHDCRZSQ BUP 3dp	-	VHDCRZSQ MBUPLT 3dp	VHDCRZQ 3d	-	-	VHDCRZSQ MBL 3	-	-	-	-
20	~gQUIC	VHDCRZQ 3	V	VHDCRZSQ B 3d	-	VHDCRZSQ 3	VHDCRQ B 3d	VHDCRZQ 3d	-	-	VHDCRZSQ 3	VHDCRZSQ 3d	-	-	-	VHDCRZSQ B 3d	-	VHDCRZSQ B 3d	VHDCRZQ B 3d	-	-	VHDCRZSQ B 3	-	-	-	-
21	Kwik&Flupke				-				-	-			-	-	-		-			-	-		-	-	-	-
22	Neqo	VHDC 3	VHDC		-	VHDC 3	VHDC 3	VHDC 3	-	-	VHDCRZ 3	VHDCRZ 3	-	-	-	VHDC 3	-	VHDC 3	VHDCRZ 3	-	-		-	-	-	-
23	Haskell QUIC	VHDCRZSQ MBA	VHDCRZSQ MBA	VHDCRZSQ MBA 3	-	VHDCRZSQ MBA 3	VHDCRZSQ MBA 3	VHDCRZQ 3	-	-	VHDCRZSQ 3	VHDCRZSQ MBA 3	-	VHDCSQ M	-	VHDCRZSQ MBA 3	-	VHDCRZSQ MBA 3	VHDCRQ B 3	-	-	VHDCRZSQ MBA 3	-	-	-	-
24	Spindump				-				-	-			-	-	-		-			-	-		-	-	-	-

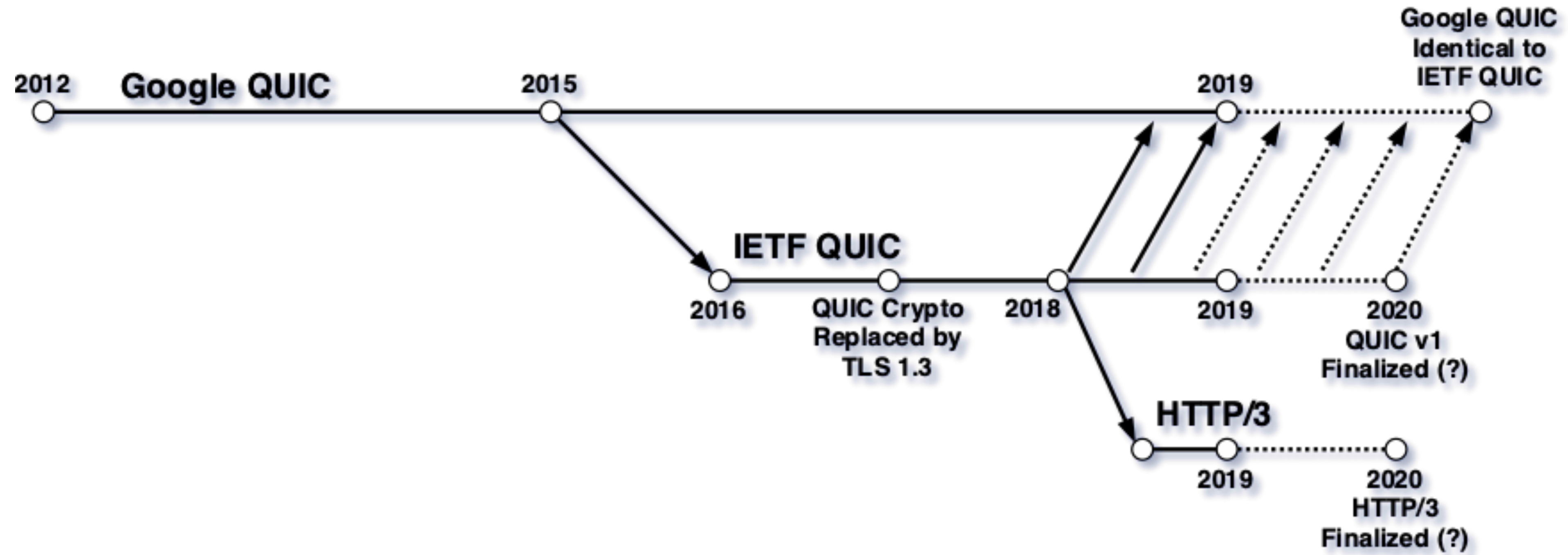
IETF QUIC compatibility

<https://docs.google.com/spreadsheets/d/1D0tW89vOoaScs3lY9RGC0UesWGAwE6xyLk0l4JtvTVg/edit>

Try HTTP/3 yourself

- <https://quic.nginx.org>
- <https://ietf.akaquic.com>
- <https://github.com/quicwg/base-drafts/wiki/Implementations>





QUIC versions

Alt-Svc

alt-svc:

```
h3-27=":443"; ma=2592000,  
h3-25=":443"; ma=2592000,  
h3-T050=":443"; ma=2592000,  
h3-Q050=":443"; ma=2592000,  
h3-Q049=":443"; ma=2592000,  
h3-Q048=":443"; ma=2592000,  
h3-Q046=":443"; ma=2592000,  
h3-Q043=":443"; ma=2592000,  
quic=":443"; ma=2592000; v="46,43"
```


HTTP/3 and Python

Practical considerations

aioquic

<https://github.com/aiortc/aioquic>

 aiortc / aioquic Sign up 

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QUIC and HTTP/3 implementation in Python

[python](#) [quic](#) [asyncio](#) [network](#) [tls](#)

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[🔗 aioquic](#)

docs

passing

pypi

v0.9.5

python

3.6 | 3.7 | 3.8

license

BSD

 tests

passing

coverage

100%

code style

black

[🔗 What is aioquic ?](#)

`aioquic` is a library for the QUIC network protocol in Python. It features a minimal TLS 1.3 implementation, a QUIC stack and an HTTP/3 stack.



Eat your own dog food?

Design considerations



Comparison with HTTP/2

- urllib3
 - <https://urllib3.readthedocs.io/>
 - Indirectly, via requests, pip, or boto3
 - Low level
- HTTPX looks nice
 - <https://www.python-httpx.org/>
 - Under active development
 - Async API
 - Uses hyper-h2 from Hyper
- Hyper
 - <https://hyper.readthedocs.io/>
 - Various HTTP and HTTP/2 tools

`urllib.request` — Extensible library for opening URLs

Source code: <Lib/urllib/request.py>

The `urllib.request` module defines functions and classes which help in opening URLs (mostly HTTP) in a complex world — basic and digest authentication, redirections, cookies and more.

See also: The [Requests package](#) is recommended for a higher-level HTTP client interface.

The `urllib.request` module defines the following functions:

```
urllib.request.urlopen(url, data=None, [timeout,]*,  
    cafile=None, capath=None, cadefault=False,  
    context=None)
```

Open the URL *url*, which can be either a string or a [Request](#) object.

```
client = httpx.AsyncClient(http23=True)  
...
```



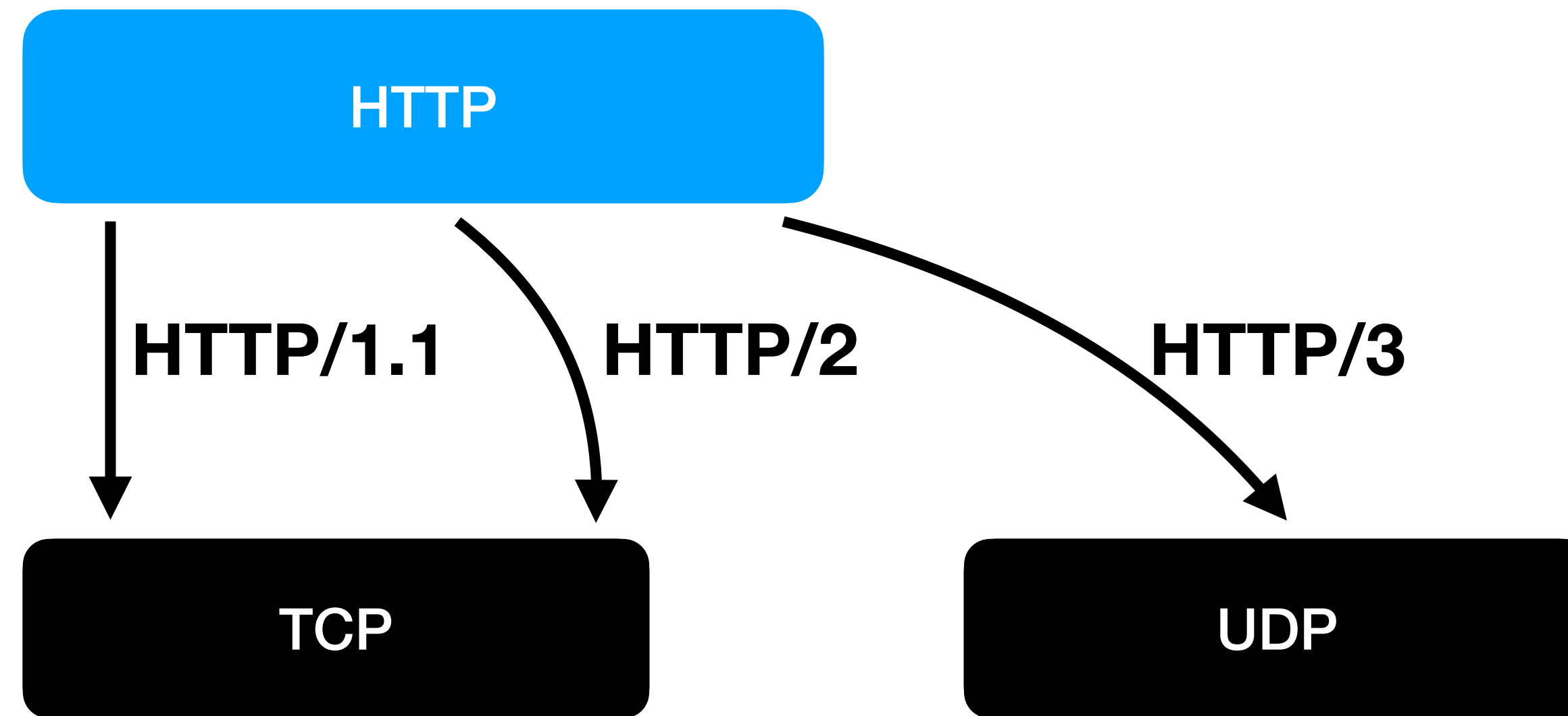
Library API

HTTP/3 for humans.

Conclusion

Why should I care?

HTTP is only one



Who cares?



...and many others

Resources

- Daniel Stenberg: HTTP/3 for everyone
<https://daniel.haxx.se/blog/2020/02/02/http-3-for-everyone/>
- Robin Marx: QUIC and HTTP/3 : Too big to fail?!
<https://calendar.perfplanet.com/2018/quic-and-http-3-too-big-to-fail/>
- IETF QUIC WG
<https://github.com/quicwg/>

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