[qlog]

structured event logging for (encrypted) protocols

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What's in a name?

= QUIC Logging

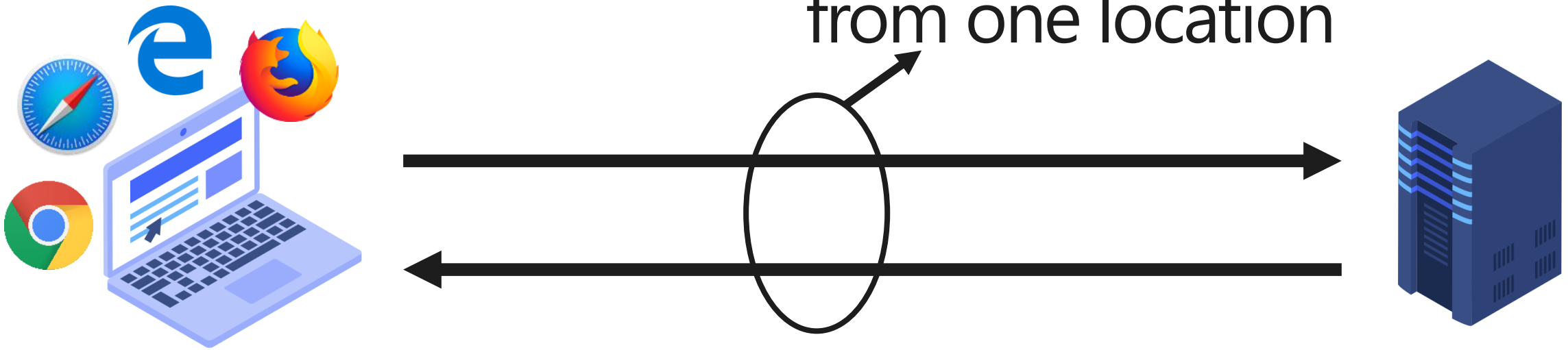
QUIC and HTTP/3 are complex

- Will need good debugging and analysis **tools**
- Tools need **data** to ingest

https://tools.ietf.org/html/draft-marx-qlog-main-schema-02
https://tools.ietf.org/html/draft-marx-qlog-event-definitions-quic-h3-02

Typical network logging

get raw wire image
from one location



tv-netflix-problems-2011-07-06.pcap

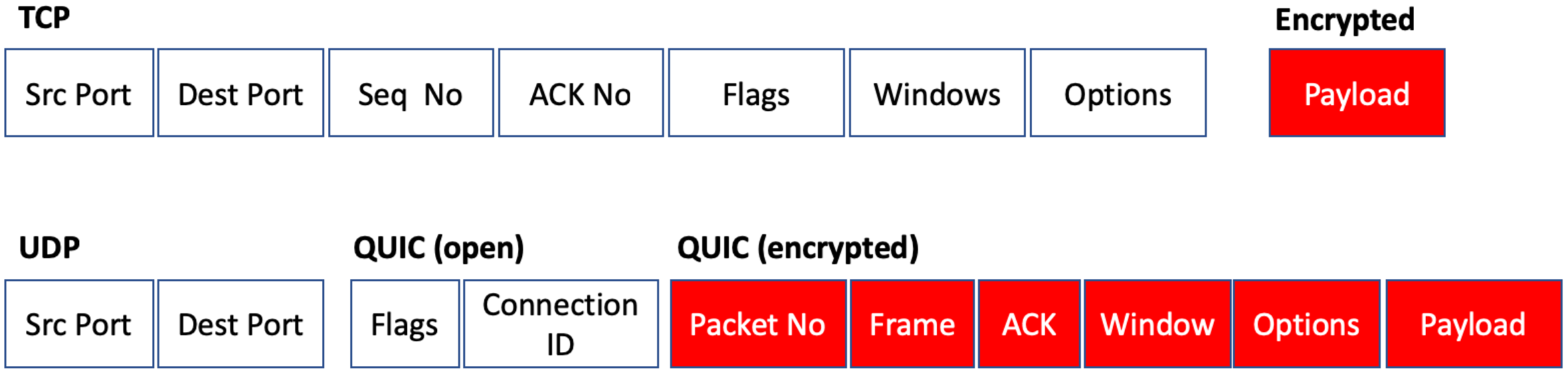
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/> Expression... +

No.	Time	Source	Destination	Protocol	Length	Info
343	65.142415	192.168.0.21	174.129.249.228	TCP	66	40555 → 80 [ACK] Seq=1 Ack=1 Win=5888 Len=0 TSval=491519346 TSecr=551811827
344	65.142715	192.168.0.21	174.129.249.228	HTTP	253	GET /clients/netflix/flash/application.swf?flash_version=flash_lite_2.1&v=1.5&nr
345	65.230738	174.129.249.228	192.168.0.21	TCP	66	80 → 40555 [ACK] Seq=1 Ack=188 Win=6864 Len=0 TSval=551811850 TSecr=491519347
346	65.240742	174.129.249.228	192.168.0.21	HTTP	828	HTTP/1.1 302 Moved Temporarily
347	65.241592	192.168.0.21	174.129.249.228	TCP	66	40555 → 80 [ACK] Seq=188 Ack=763 Win=7424 Len=0 TSval=491519446 TSecr=551811852
348	65.242532	192.168.0.21	192.168.0.1	DNS	77	Standard query 0x2188 A cdn-0.nflximg.com
349	65.276870	192.168.0.1	192.168.0.21	DNS	489	Standard query response 0x2188 A cdn-0.nflximg.com CNAME images.netflix.com.edge
350	65.277992	192.168.0.21	63.80.242.48	TCP	74	37063 → 80 [SYN] Seq=0 Win=5840 Len=0 MSS=1460 SACK_PERM=1 TSval=491519482 TSecr
351	65.297757	63.80.242.48	192.168.0.21	TCP	74	80 → 37063 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1460 SACK_PERM=1 TSval=3295
352	65.298396	192.168.0.21	63.80.242.48	TCP	66	37063 → 80 [ACK] Seq=1 Ack=1 Win=5888 Len=0 TSval=491519502 TSecr=3295534130
353	65.298687	192.168.0.21	63.80.242.48	HTTP	153	GET /us/nrd/clients/flash/814540.bun HTTP/1.1
354	65.318730	63.80.242.48	192.168.0.21	TCP	66	80 → 37063 [ACK] Seq=1 Ack=88 Win=5792 Len=0 TSval=3295534151 TSecr=491519503
355	65.321733	63.80.242.48	192.168.0.21	TCP	1514	[TCP segment of a reassembled PDU]

wireshark

1. QUIC is almost entirely encrypted

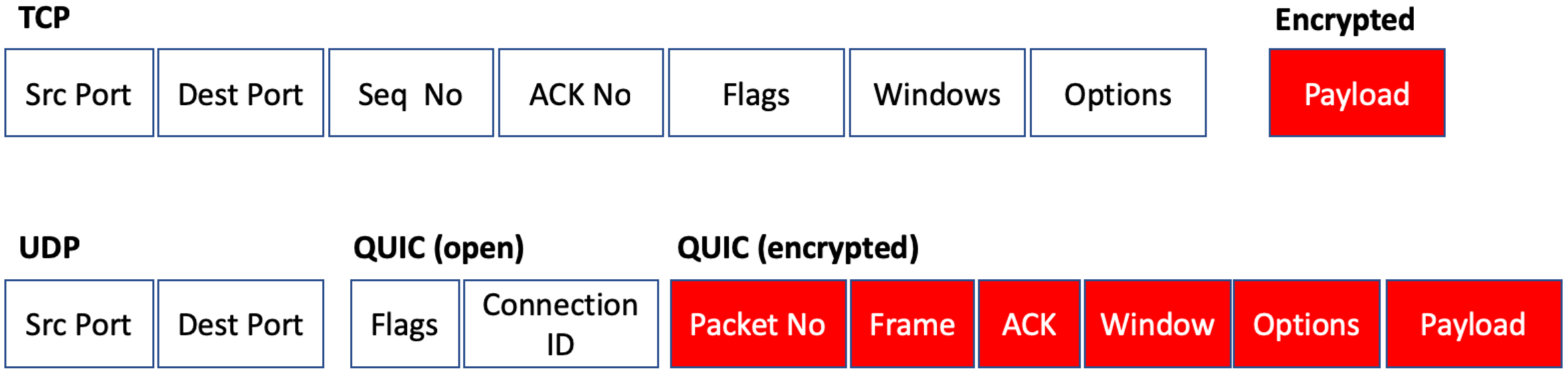


Storing full packet captures and TLS secrets is bad for:

- scalability
- privacy

img src: https://labs.apnic.net/?p=1207

1. QUIC is almost entirely encrypted

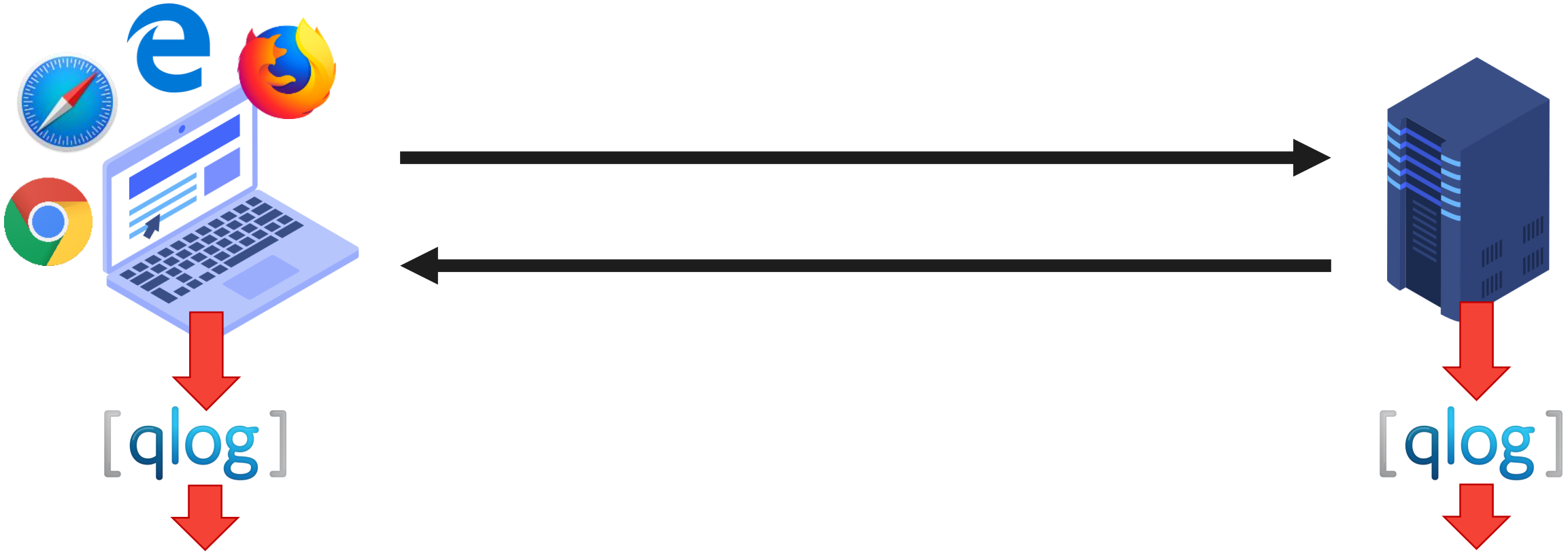


2. not everything is sent on the wire

congestion control, decision making, internal errors, …

img src: https://labs.apnic.net/?p=1207

[qlog] structured endpoint logging



get data from (both) implementations directly

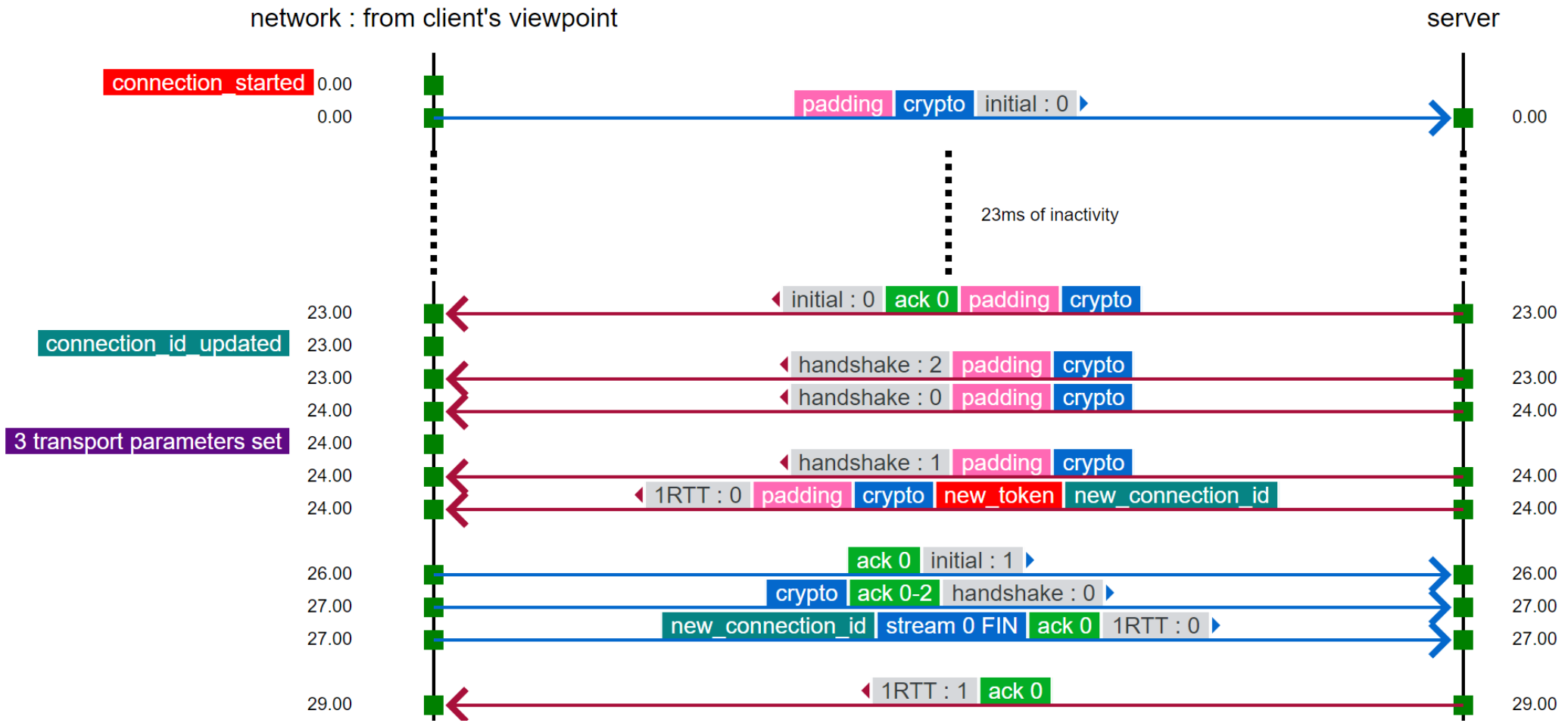
Event examples

```
{
"time": 15000,
"name": "transport:packet_received",
"data": {
    "header": {
        "packet_type": "1rtt",
        "packet_number": 25
    },
    "frames": [
    {
        "frame_type": "ack",
        "acked_ranges": [
            [10,15],
            [17,20]
        ]
     }]
}}
```

```
{
"time": 15001,
"name": "recovery:metrics_updated",
"data": {
  "min_rtt": 25,
  "smoothed_rtt": 30,
  "latest_rtt": 25,

  "congestion_window": 60,
  "bytes_in_flight": 77000,
}
```

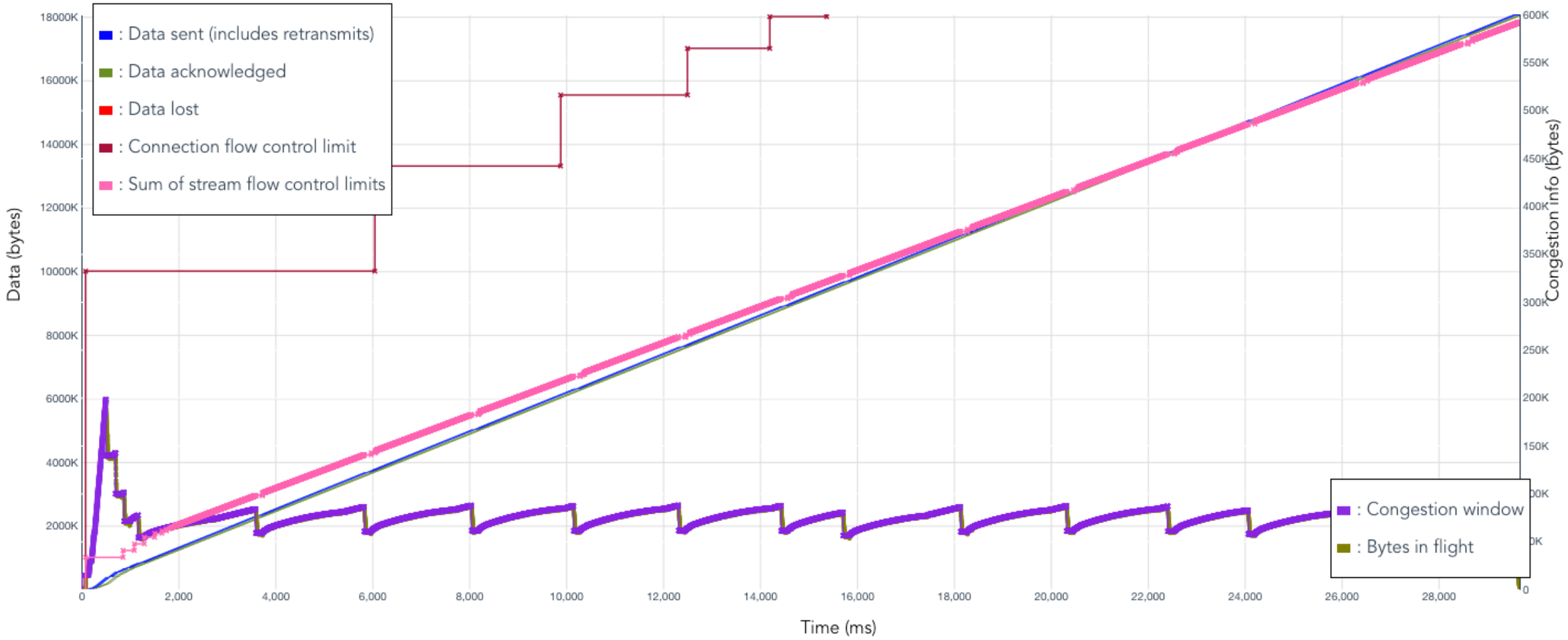
QUIC and HTTP/3 tools



https://qvis.quictools.info

https://github.com/quiclog/qvis

<qvis> "TCPtrace" for QUIC



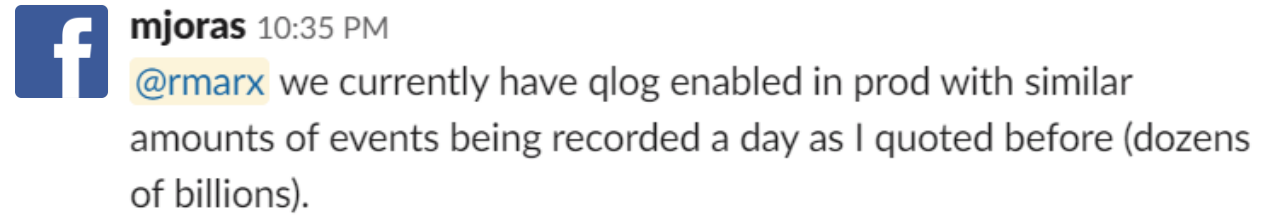
https://qvis.quictools.info

https://github.com/quiclog/qvis
https://blog.cloudflare.com/cubic-and-hystart-support-in-quiche

[qlog] support

> 75% of QUIC/H3 stacks support direct qlog output:

- mvfst
- ngtcp2
- quiche
- quic-go
- aioquic
- quicly / H2O
- neqo
- picoquic
- ...



https://qlog.edm.uhasselt.be/anrw

[qlog] adoption

qlog draft adoption in QUIC wg

- Expected before or during IETF 111
- Part of recharter

Goals

- Flesh out schema's for QUIC and HTTP/3

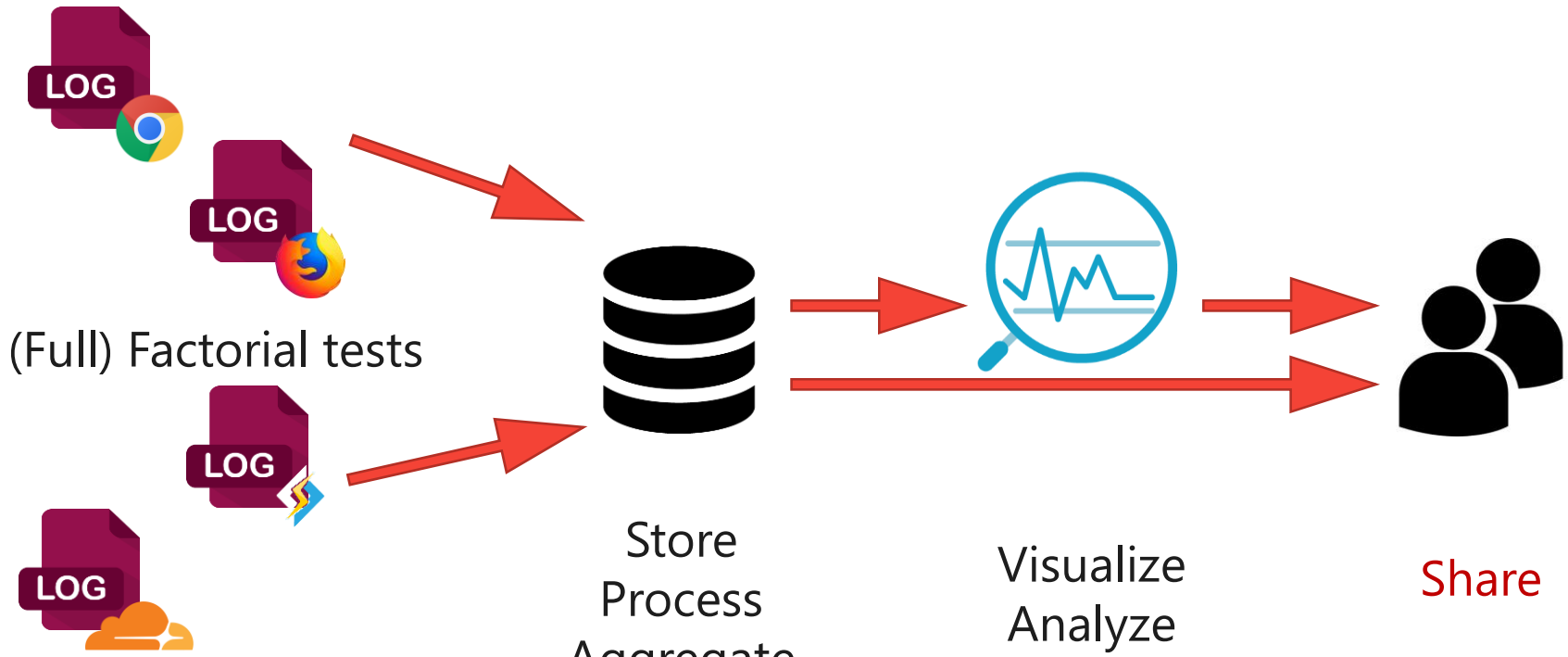
- **Prepare qlog for broader use with other protocols / applications**
  - TCP + TLS + HTTP/x
  - DNS, BGP, WebTransport
  - Multipath TCP and QUIC, MASQUE
  - Adaptive BitRate (ABR) video streaming logic
  - …

https://tools.ietf.org/html/draft-marx-qlog-main-schema-02
https://tools.ietf.org/html/draft-marx-qlog-event-definitions-quic-h3-02
https://research.edm.uhasselt.be/~mwijnants/pdf/herbotsCONEXT2020.pdf

Facilitate research

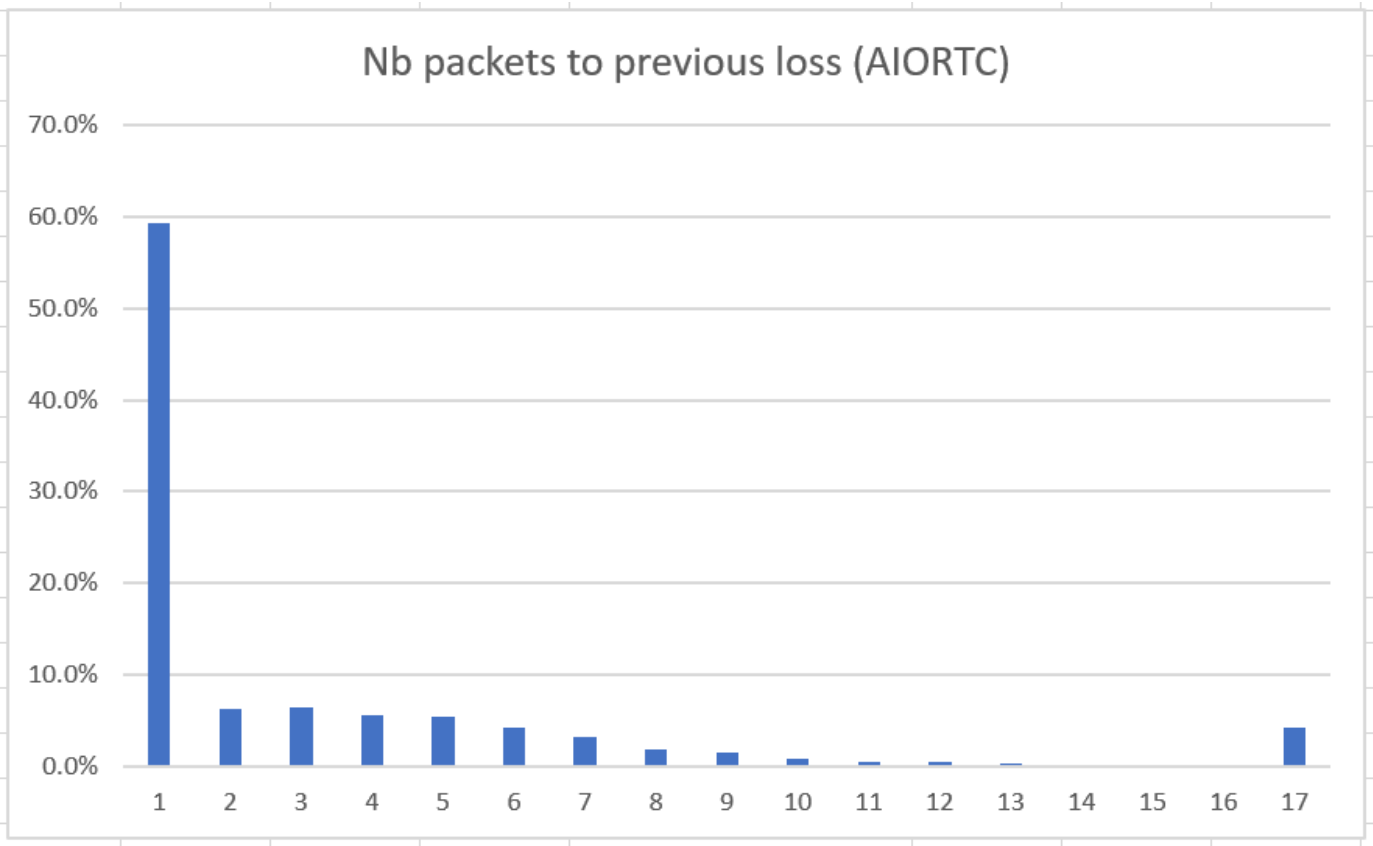
Easier to:

- Compare different implementations
- Share datasets
- Get access to production/deployment datasets



https://qlog.edm.uhasselt.be
https://github.com/quiclog/internet-drafts
http://cs.brown.edu/~tab/papers/QUIC_WWW21.pdf

Datamining (sanitized) production data



"In almost 60% of the events describing the loss of packet number N, the packet number N-1 was also lost"

https://huitema.wordpress.com/2020/07/21/scrubbing-quic-logs-for-privacy
https://huitema.wordpress.com/2020/07/12/parsing-quic-logs-and-assessing-packet-losses

Next steps

Come join us:

- Drafts adoption in the QUIC wg (part of recharter)
- Expected before or during IETF 111

In the mean time

- Join us on github.com/quiclog/internet-drafts
- Join the qlog IETF mailing list ietf.org/mailman/listinfo/qlog