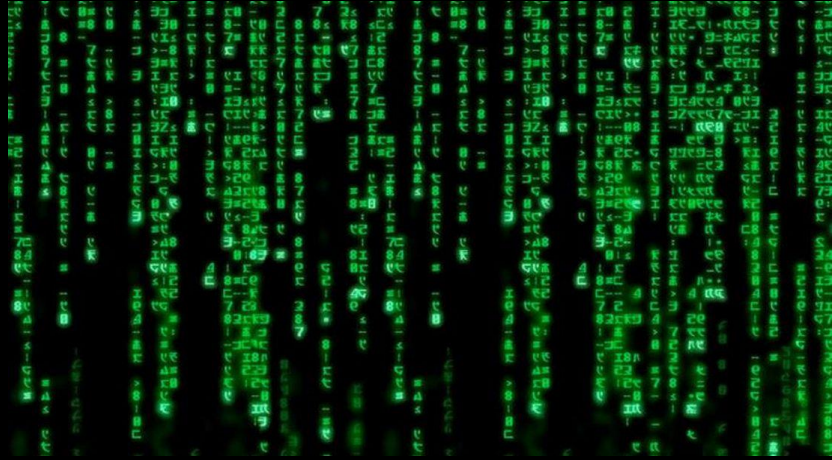
Troubleshooting with QUIC



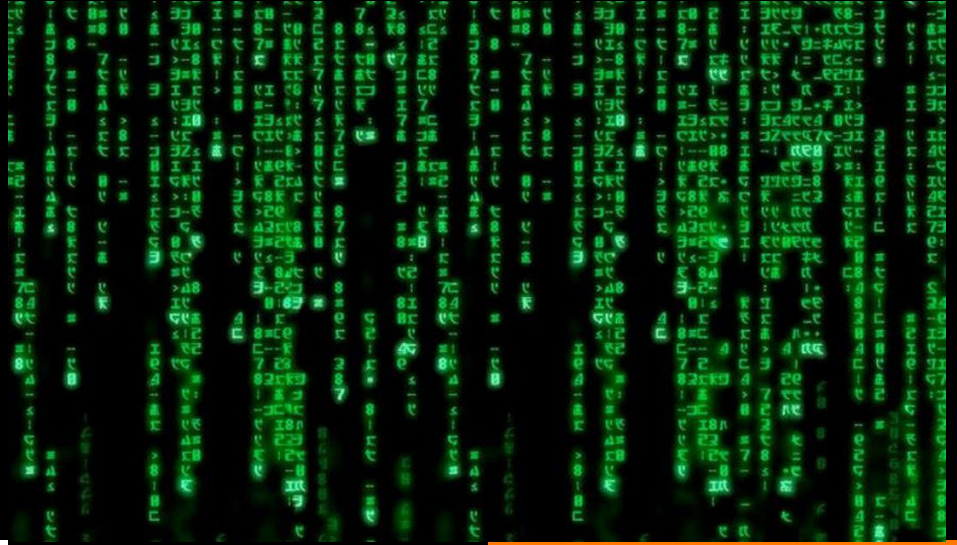
In search of lost metrics

Alexandre Ferrieux, Isabelle Hamchaoui
Orange Innovation

orange™

Orange Expert Programme

What is QUIC ?



Child of the NSA scandal : Enhanced privacy, no linkability!

A transport protocol similar to advanced

TCP

versions with deep encryption to avoid ossification

30% of

Orange traffic

Start in 2014, IETF standard in 2021

HTTP/3

QUIC

Standard Transport Layer

Layer 4 in theory

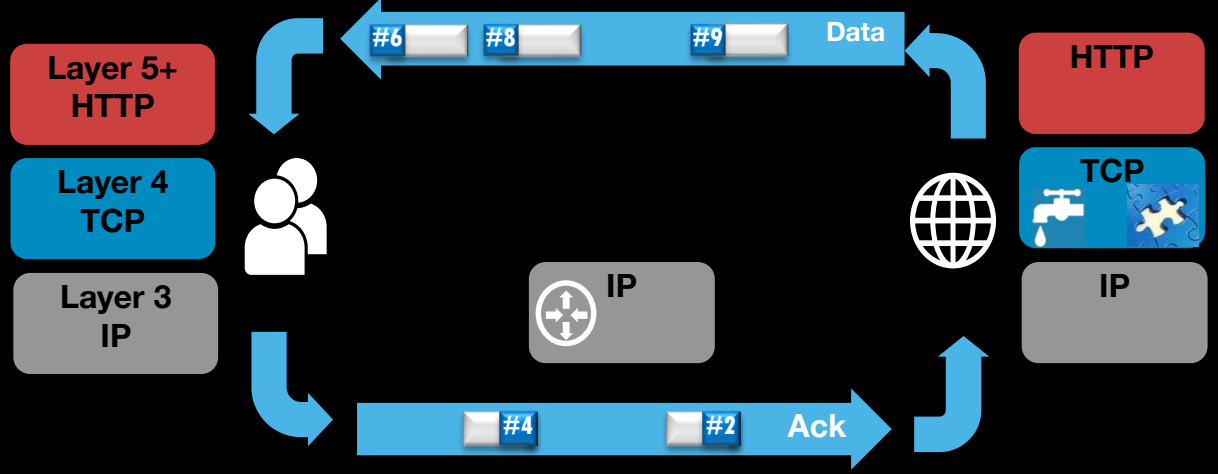
The transport layer

End-to-end connectivity

TCP, UDP

Error control (TCP)

Flow control (TCP)



Reality check

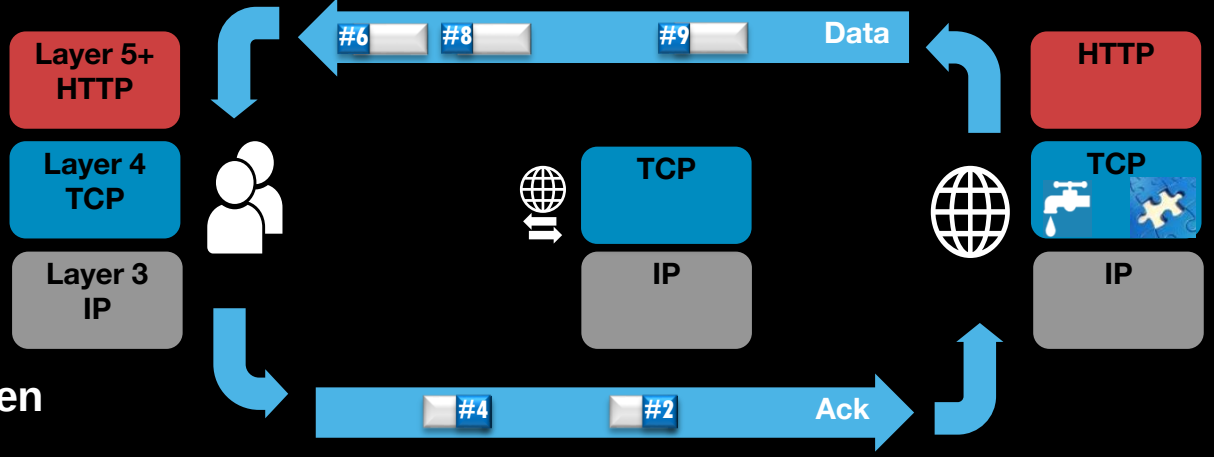
TCP transport layer

Middleboxes interfere “illegitimately” in the Transport Layer
Proxy, optimizer, etc.

Middleboxes far behind standards

→ New Transport protocols blocked

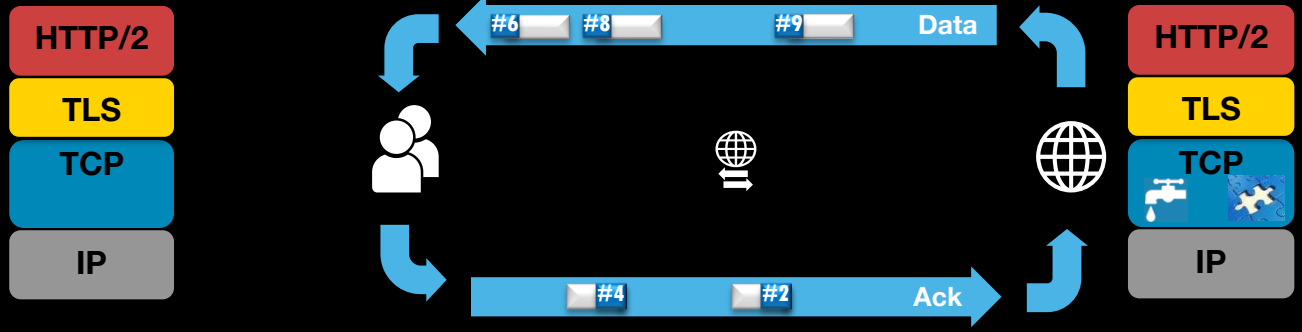
→ New TCP mechanisms blocked : e.g. TCP fast open



→ Ossification of the Internet, innovation blocked for decades

QUIC is an answer…

TCP-like transport built over UDP + encryption



Ossification-ender

Middleboxes interference made difficult by **QUIC headers encryption**

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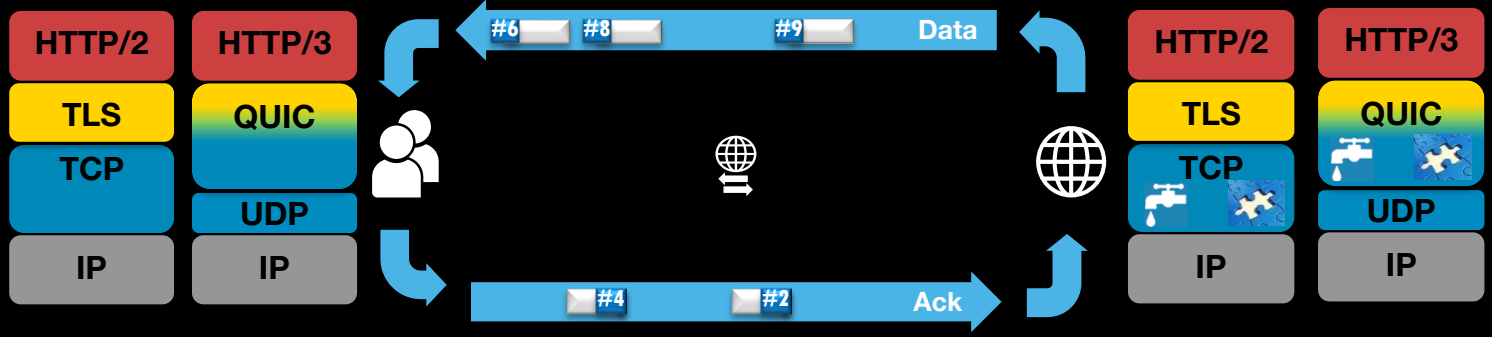

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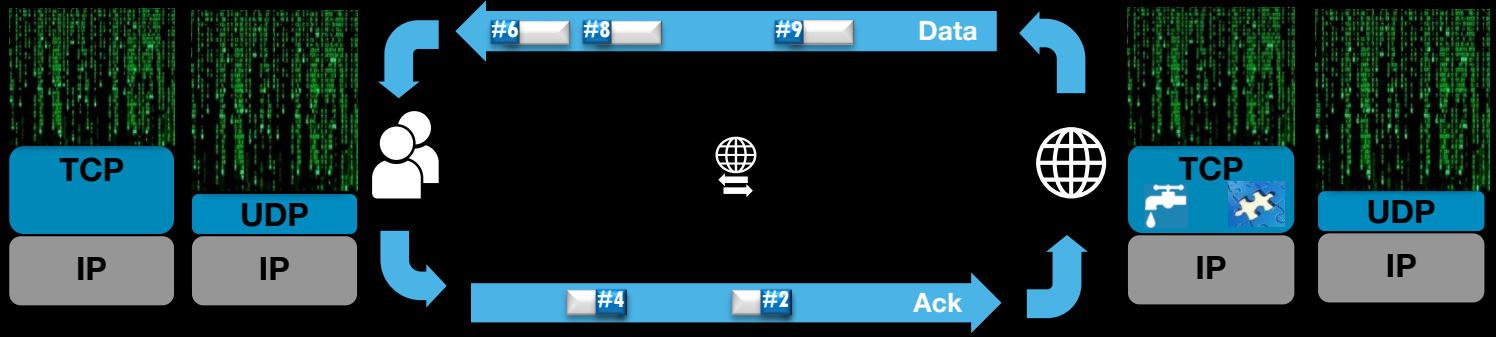
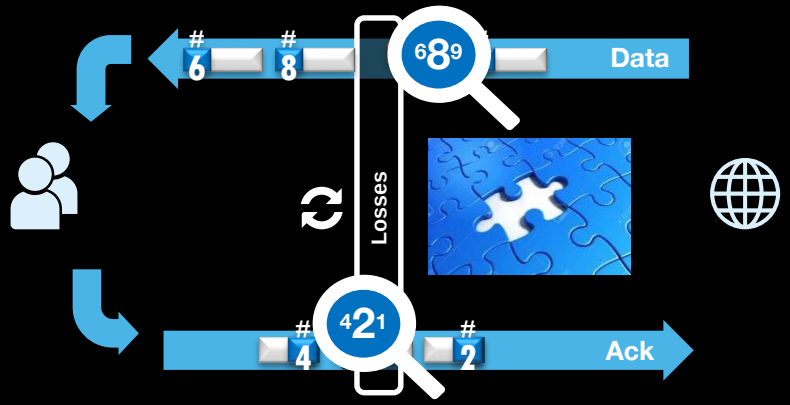
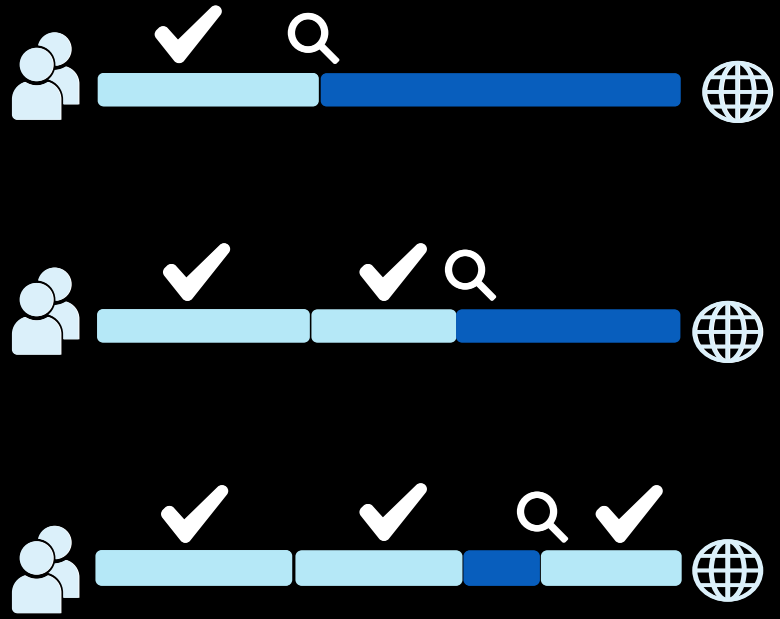


Ossification-ender

Middleboxes interference made difficult by **QUIC headers encryption**

TCP one point passive measurement

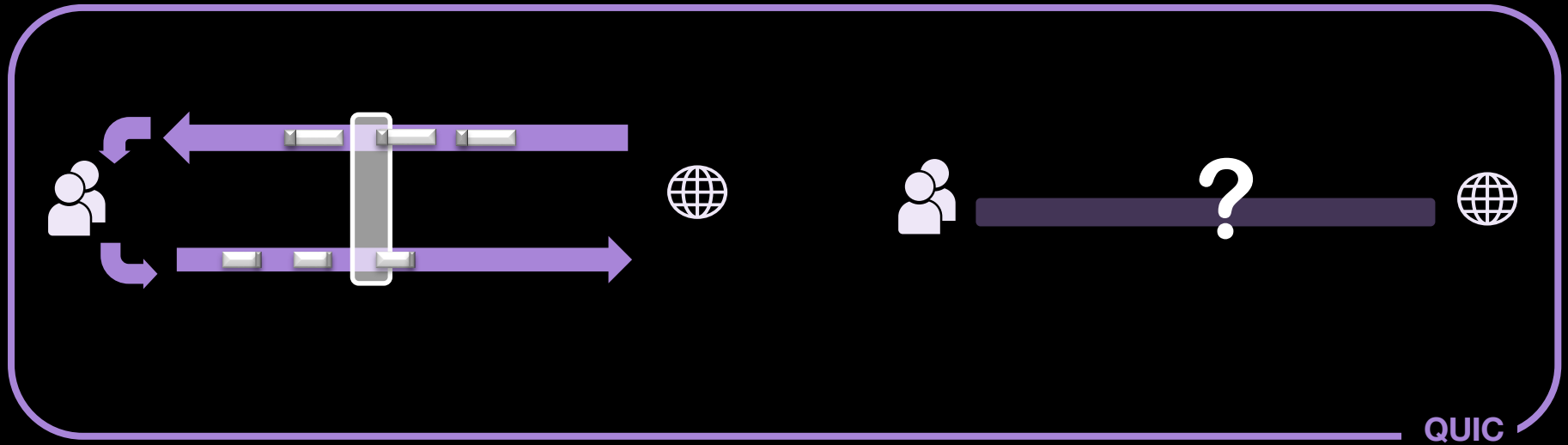




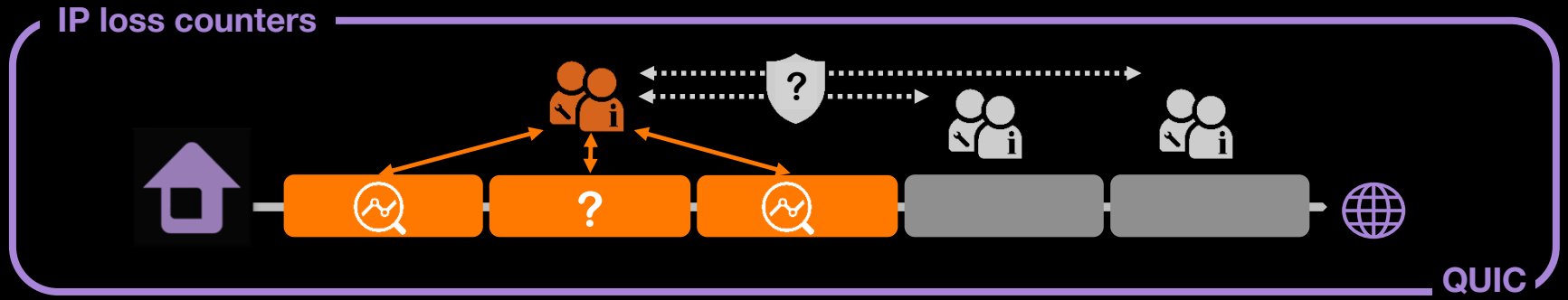
Upstream and downstream loss (+ delay)

Location of the faulty segment / actor

With QUIC, we're not in Kansas anymore….



What else then? Packet drop counters?



Poor and cumbersome diagnosis

- Counters not available in all nodes => no exhaustivity
- No upstream/downstream loss: where is the faulty segment / actor?

2-points measurements?

Access Provider lead

- No end-to-end degradation detection
- AP needs simultaneous captures from various (trusted?) actors
- Capture in customer OS?

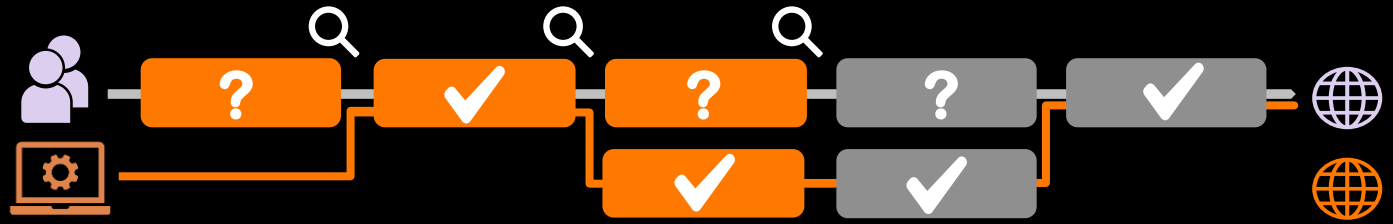
QUIC

Content Provider lead

- End-to-end degradation detection
- CP needs simultaneous captures from various (trusted?) actors
- Should we perform captures on behalf of Google? Facebook? Bullshit.com?

QUIC

Active measurement



Representativity (UE/server configuration, multipath)

→ For specific investigations only

QUIC

Key disclosure

The dream solution!

- Key disclosure by client or server
- Awesome! Back to TCP debug
- Any chance to get it?

The Loss bits mechanism

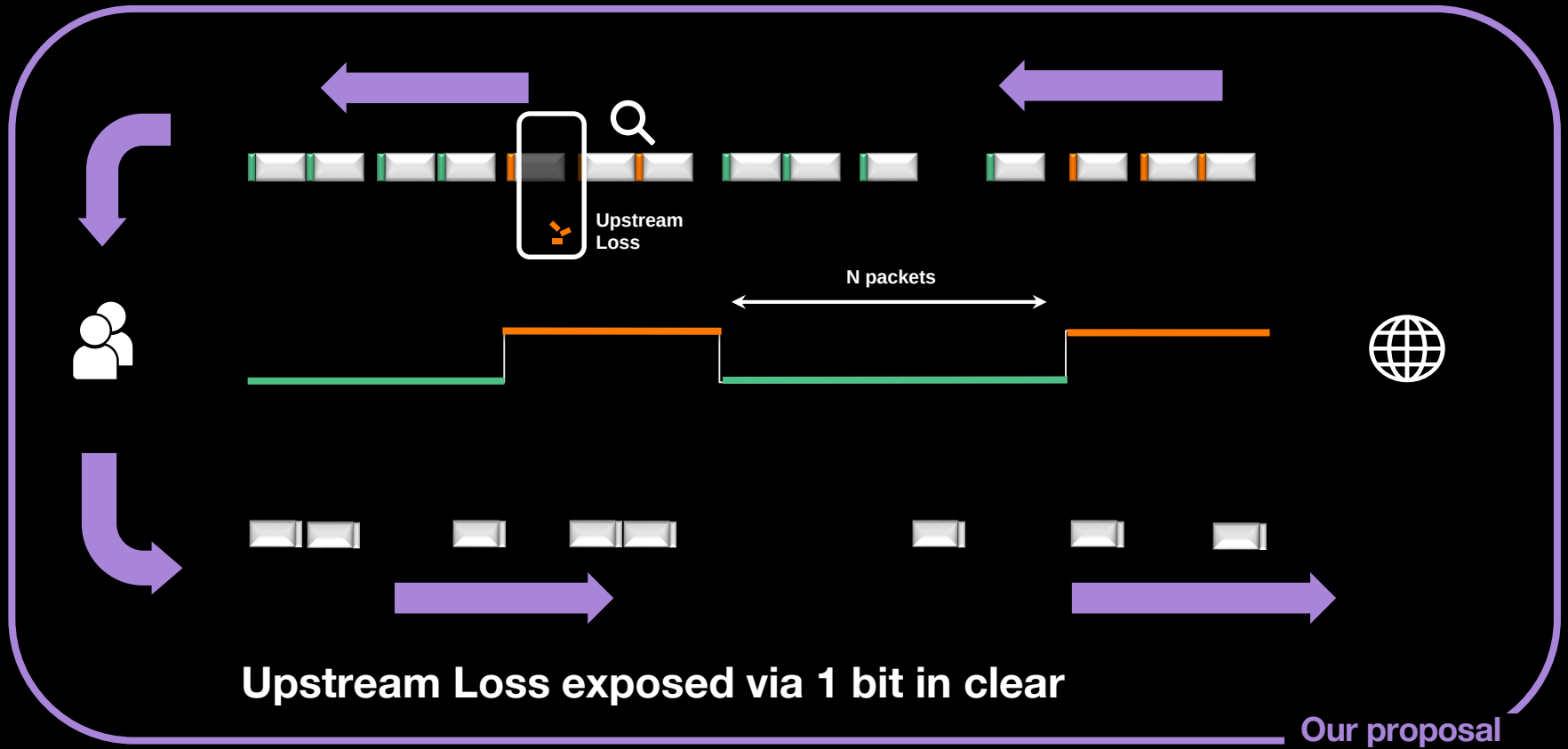
What?

Detect and locate faulty segments without packet number

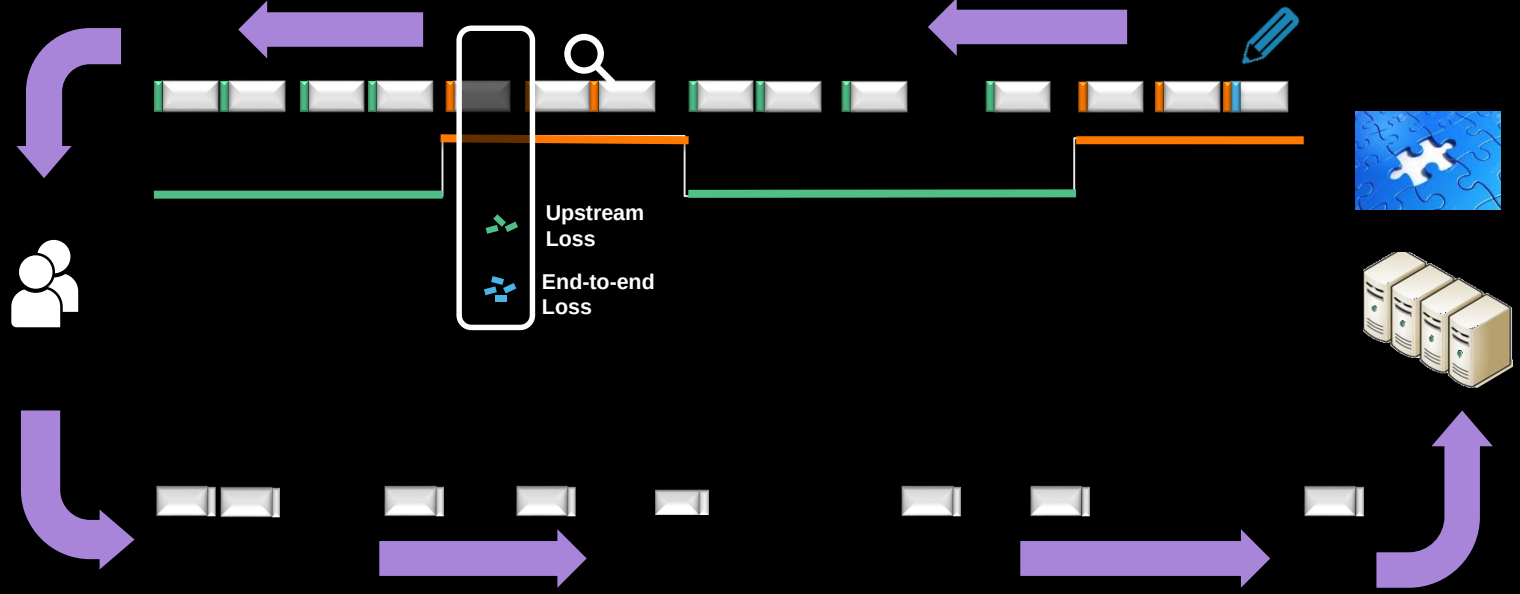
How?

Reference patterns drawn in the packet flows with 2 bits in clear in the QUIC header

The loss bits proposal (1)



The loss bits proposal (2)



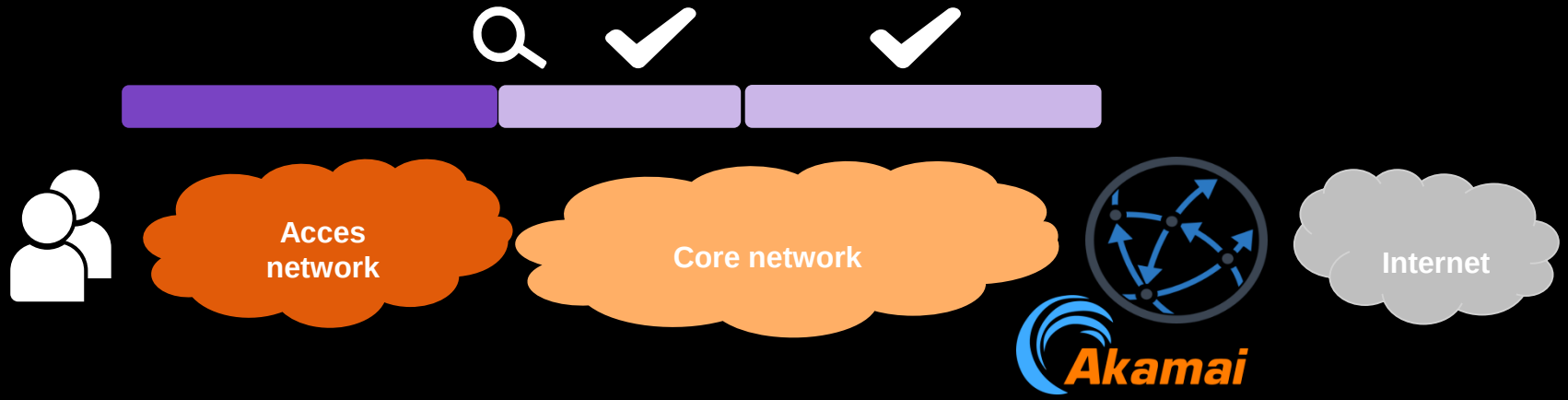
End-to-end Loss exposed via 1 bit in clear

Our proposal

The Loss Bits in the wild

Field Trial with Akamai in 4 Orange affiliates

- Akamai CDN servers with loss bits implementation
- Thousands of Orange real clients
- Loss bits mechanism refined and validated



Additional validation by Satcom on Akamai servers and a satellite link

Wrap-up

Current Troubleshooting practices are threatened

- In case of bad customer experience with QUIC, no easy way to locate faulty segment and prove actors' responsibility

New balance of power within the IETF arena

- Strong support from Akamai and CDN providers
- Very few operators expressed interest : Satcom, Telecom Italia
- Lukewarm support from Google, Microsoft, Apple
- Fierce opposition from Facebook and Mozilla

Wait… Is loss still critical?

- BBR is quite robust to mild loss
- Other Loss sensitive services ?
- Our mechanism is ultra light, energy efficienty, and still useful for strong loss

References

- First draft presented at IETF 104 (March 2019)
  https://datatracker.ietf.org/doc/draft-ferrieuxhamchaoui-quic-lossbits
- Orange-Akamai trial presented at IETF 105 (July 2019)
  https://datatracker.ietf.org/meeting/105/materials/slides-105-maprg-packet-loss-signaling-for-encrypted-protocols-01
- Akamai+lightspeed step-in at IETF 106 (November 2019)
  https://datatracker.ietf.org/doc/draft-ferrieuxhamchaoui-tsvwg-lossbits/
- Satcom trial presented at IETF 106 (November 2019)
  https://datatracker.ietf.org/meeting/106/materials/slides-106-maprg-losses-in-satcom-systems-identification-and-impact
- Joint draft with Telecom Italia (mars 2020)
  https://datatracker.ietf.org/doc/draft-mdt-ippm-explicit-flow-measurements/
- Independent evaluation from Ike Kunze et al. (Aachen university)

L, Q, R, and T: which spin bit cousin is here to stay? (ANRW '21)

Thank you