

Dr Quiclove

How I learned to stop
worrying and love the
probes

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Setting the scene

No linkability!

“Ability to follow one connection across network handovers, thus jeopardizing privacy”

No Internet ossification!

“The process of becoming set in a rigidly conventional pattern”

Layer 4 in theory

The transport layer

End-to-end connectivity

TCP, UDP

Error control
(TCP)



Flow control
(TCP)



Layer 5+
HTTP

Layer 4
TCP

Layer 3
IP



HTTP

TCP

IP



Reality check

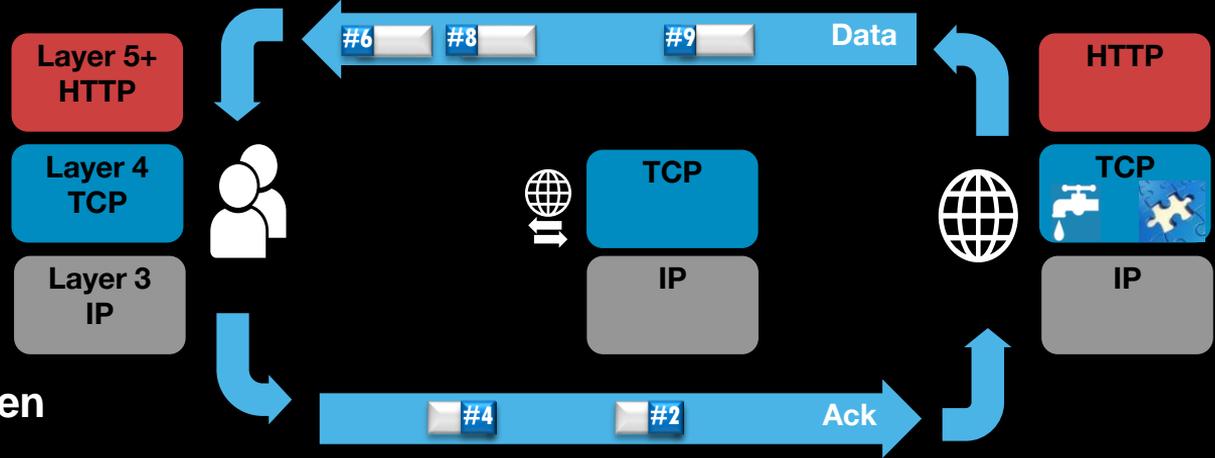
TCP transport layer

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

Middleboxes far behind standards

→ New Transport protocols blocked

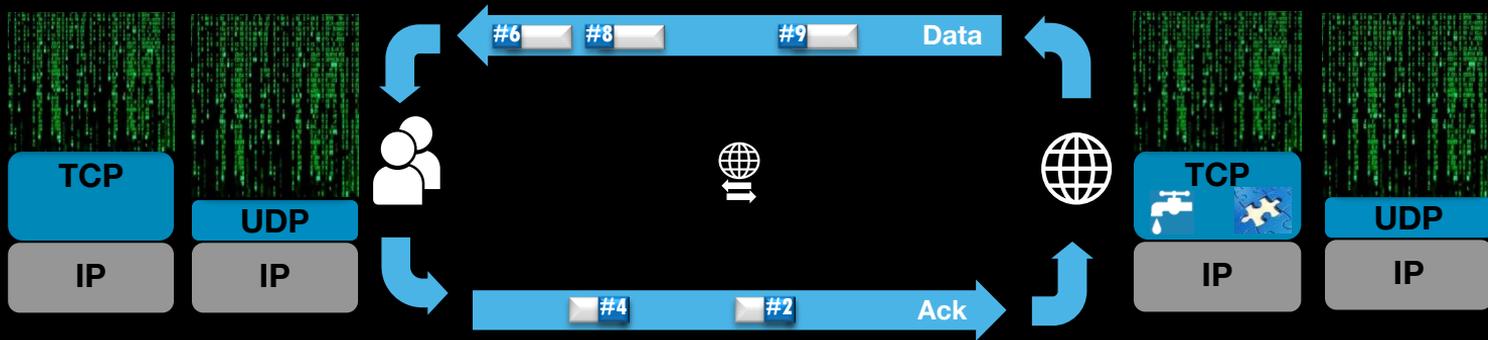
→ New TCP mechanisms blocked : e.g. TCP fast open



→ **Ossification of the Internet, innovation blocked for decades**

QUIC is an answer...

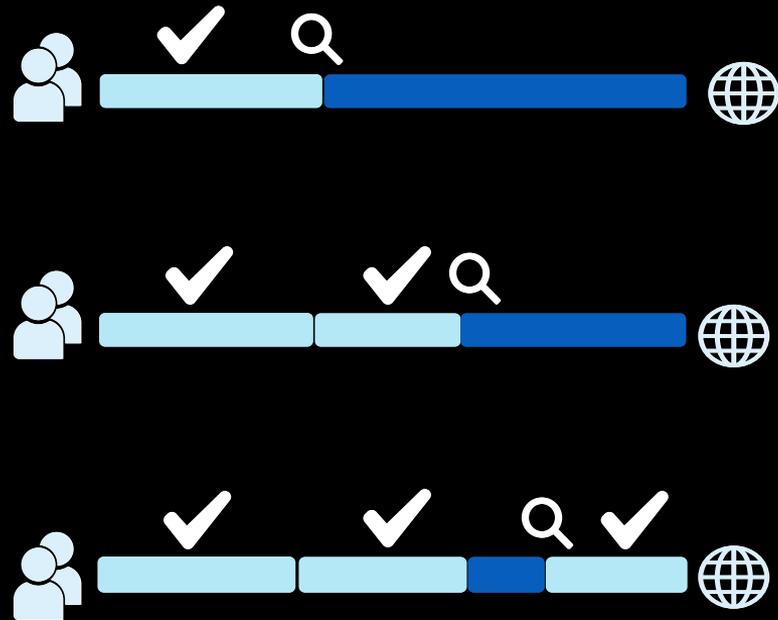
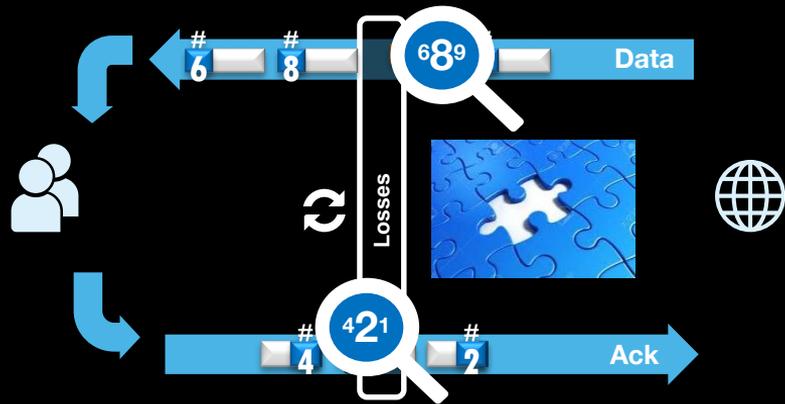
TCP-like transport built over UDP + encryption



Ossification-ender

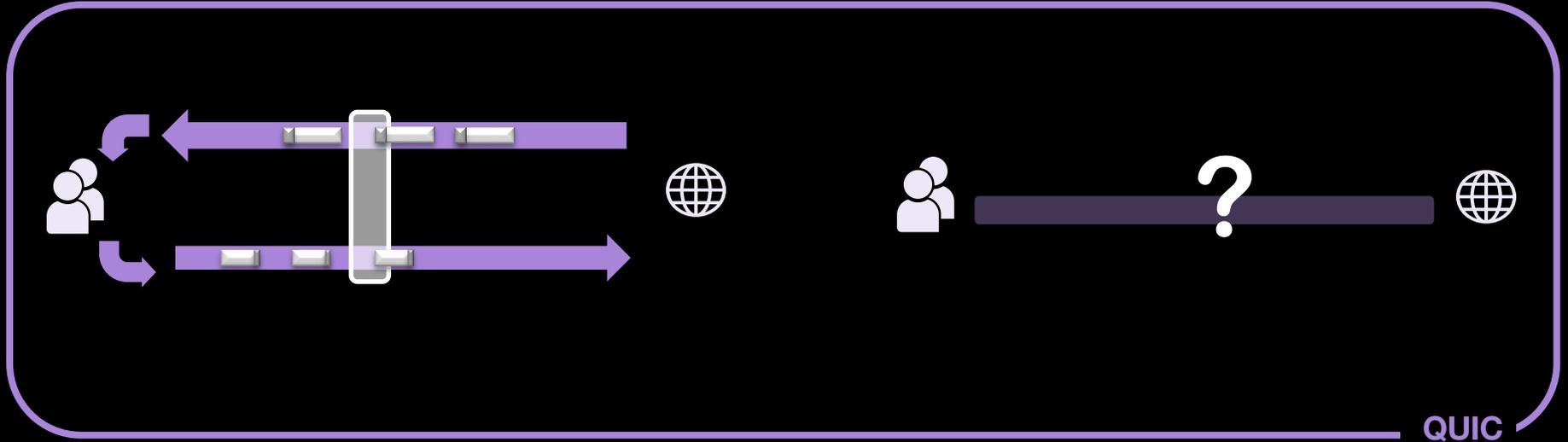
Middleboxes interference made difficult by **QUIC** headers encryption

TCP one point passive measurement

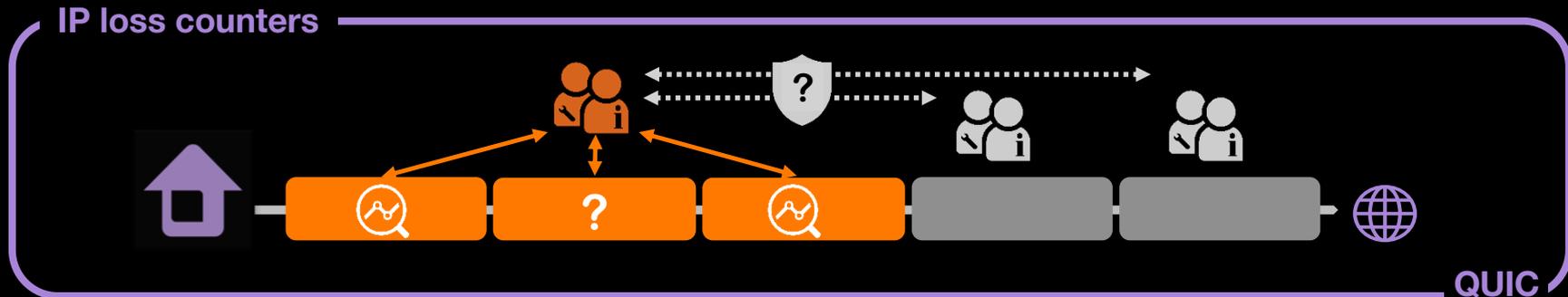


Upstream and downstream loss (+ delay)
Location of the faulty segment / actor

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

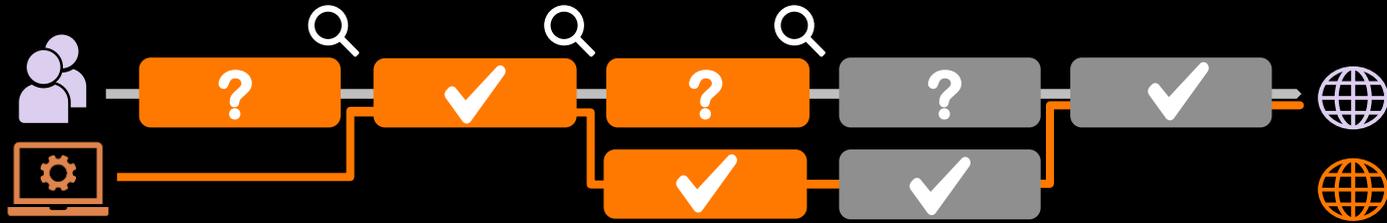
Content Provider lead



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

QUIC

Active measurement



Representativity (UE/server configuration, multipath)

→ For specific investigations only

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

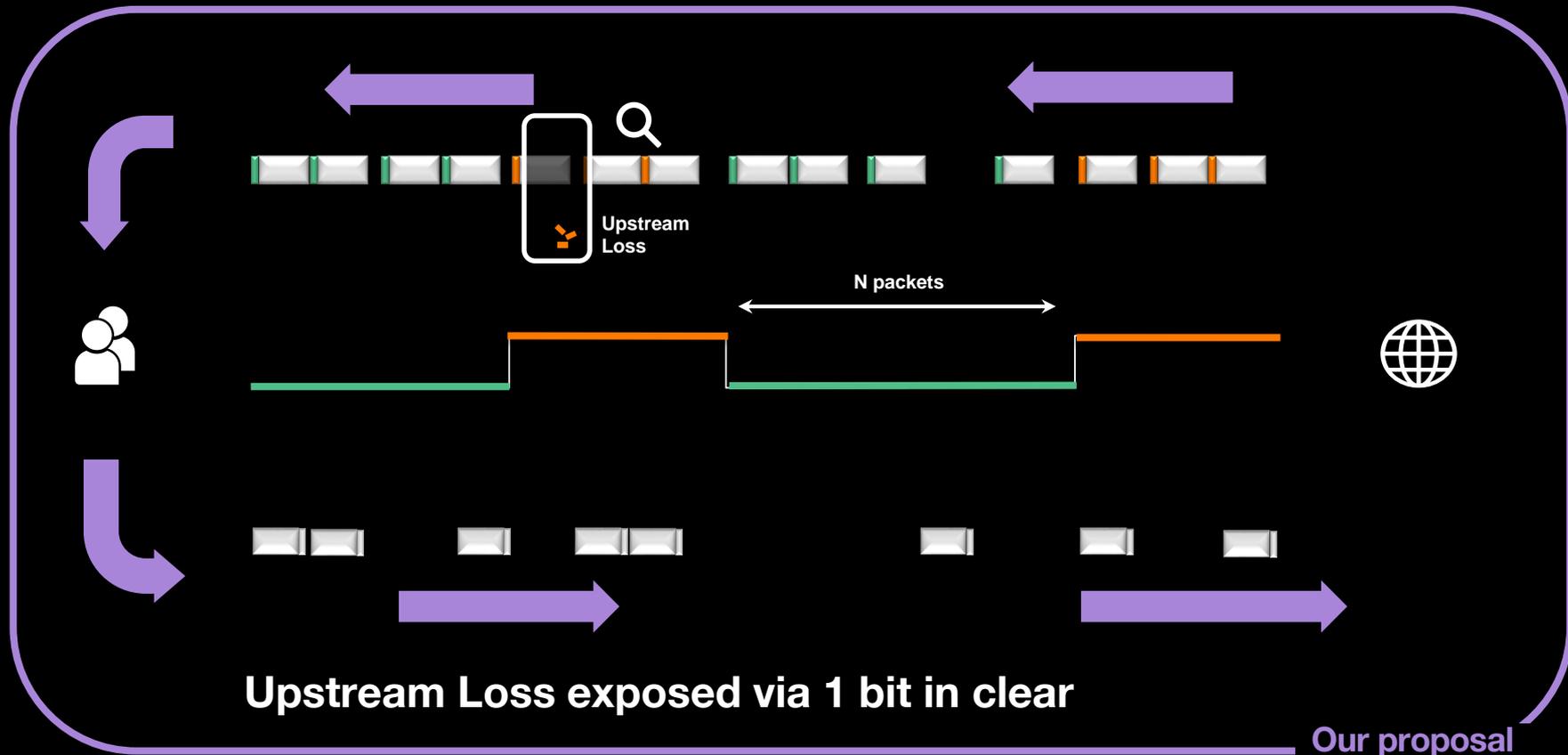
What?

Detect and locate faulty segments without packet number

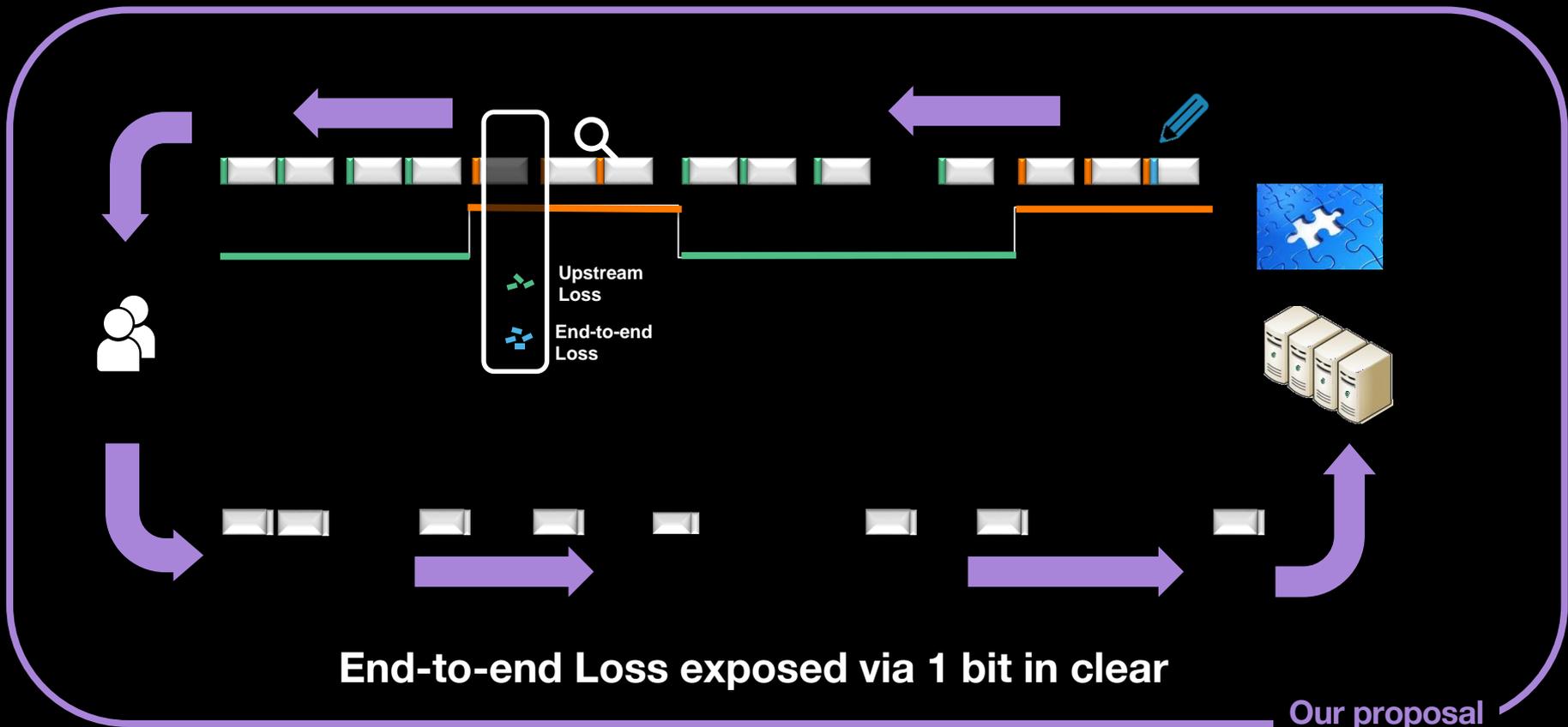
How?

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

The loss bits proposal (1)



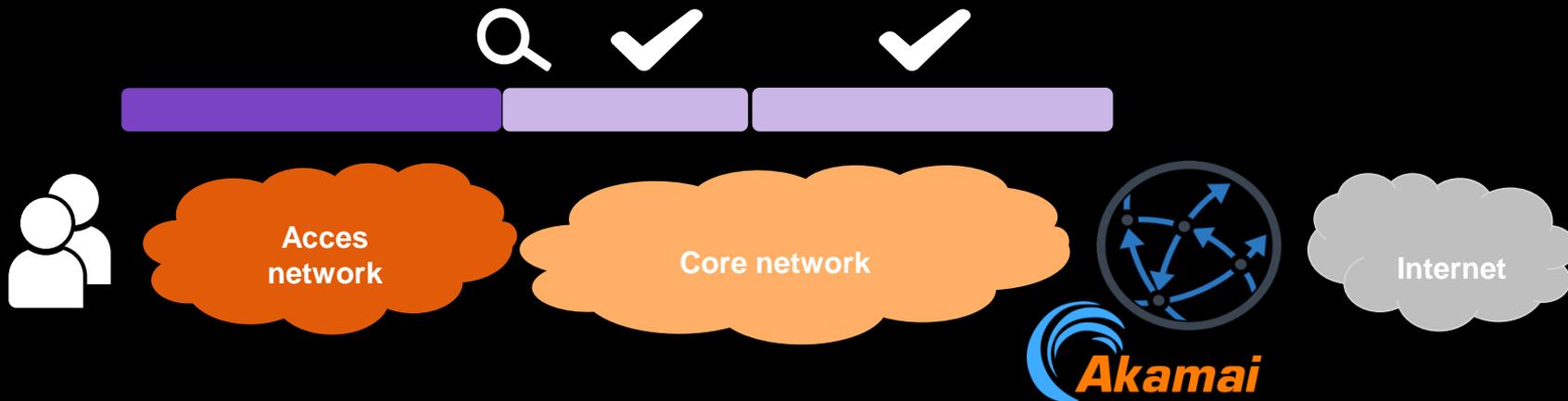
The loss bits proposal (2)



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 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)

Merci

