Lost in encryption: monitoring media flows without payload in video conferencing apps

Julien Gamba

Senior data scientist – Cisco ThousandEyes

Video conferencing apps are everywhere

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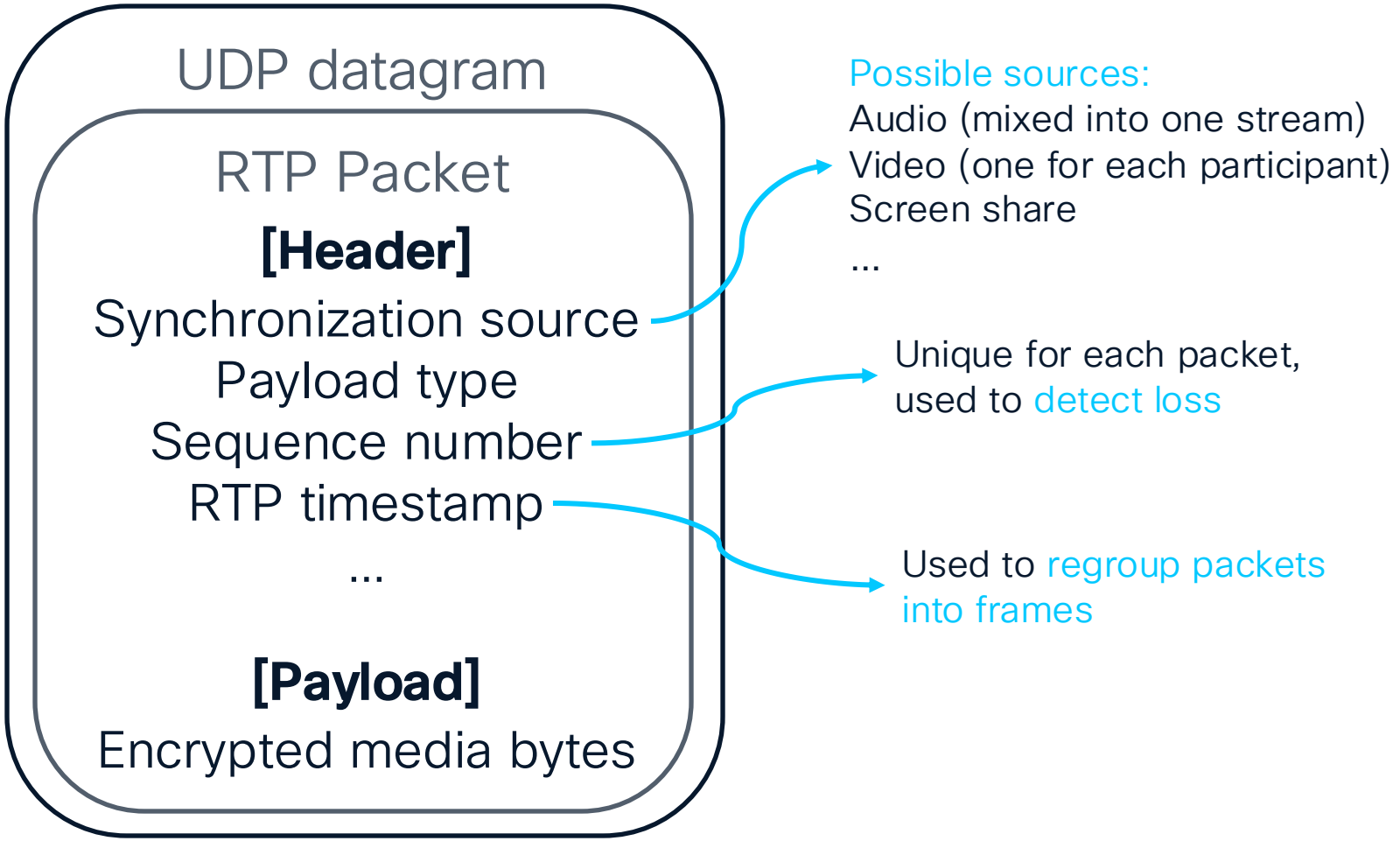
Monitoring using RTP



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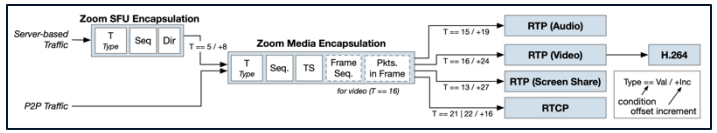
What if we lose access to the headers?

Proprietary protocols

Zoom



Michel et al., Enabling Passive Measurement of Zoom Performance in Production Networks, ACM IMC'22

Headers encryption

Network Working Group
Request for Comments: 3711
Category: Standards Track

M. Baugher
D. McGrew
Cisco Systems, Inc.
M. Naslund
E. Carrara
K. Norrman
Ericsson Research
March 2004

The Secure Real-time Transport Protocol (SRTP)

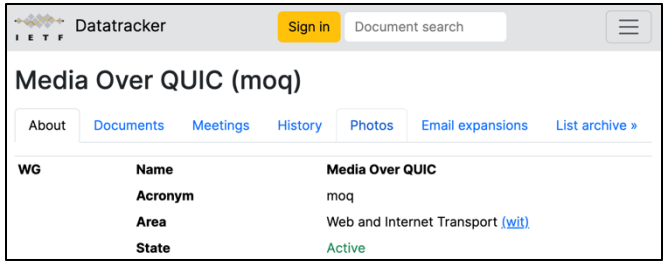
J. Uberti

Request for Comments: 9335
Updates: 3711
Category: Standards Track
Published: January 2023
ISSN: 2070-1721

C. Jennings
Cisco
S. Garcia Murillo
Millicast

Completely Encrypting RTP Header Extensions and Contributing Sources

New standards



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Our contributions

Media flow detection method relying on packet timings

Expand state-of-the-art QoE estimation using only packet timings and sizes

New directions for screen share detection and network degradation estimation

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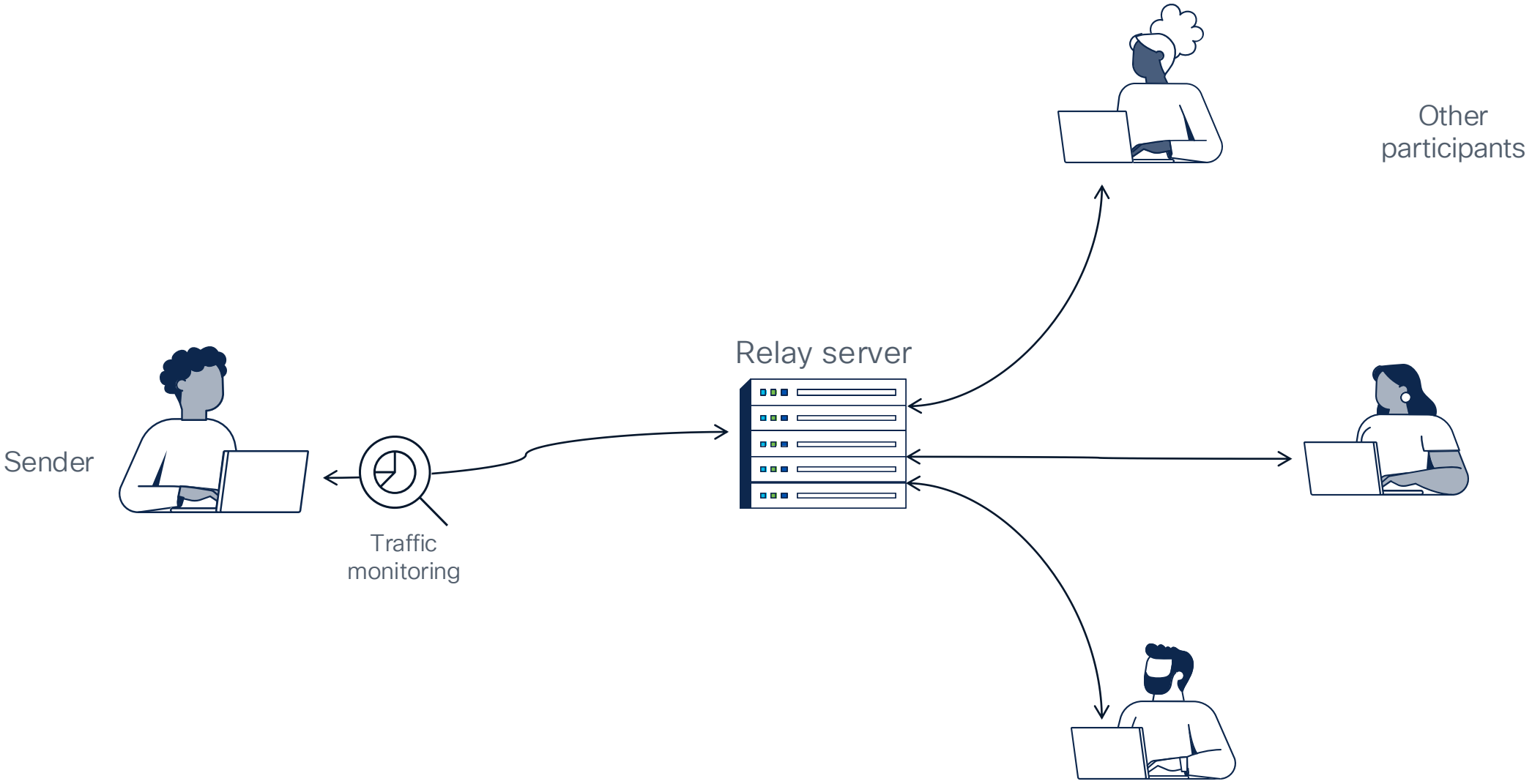
Detecting media flows



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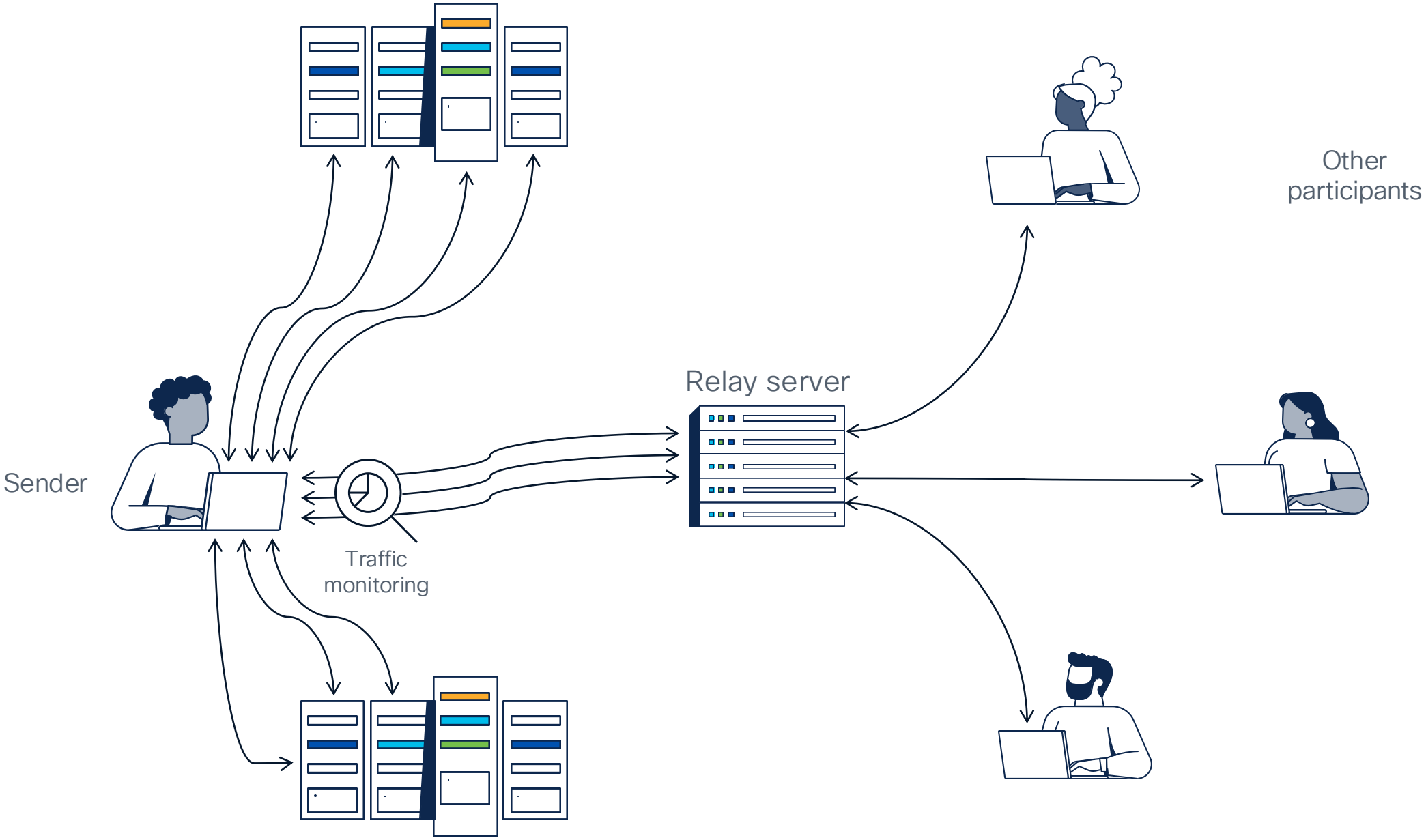

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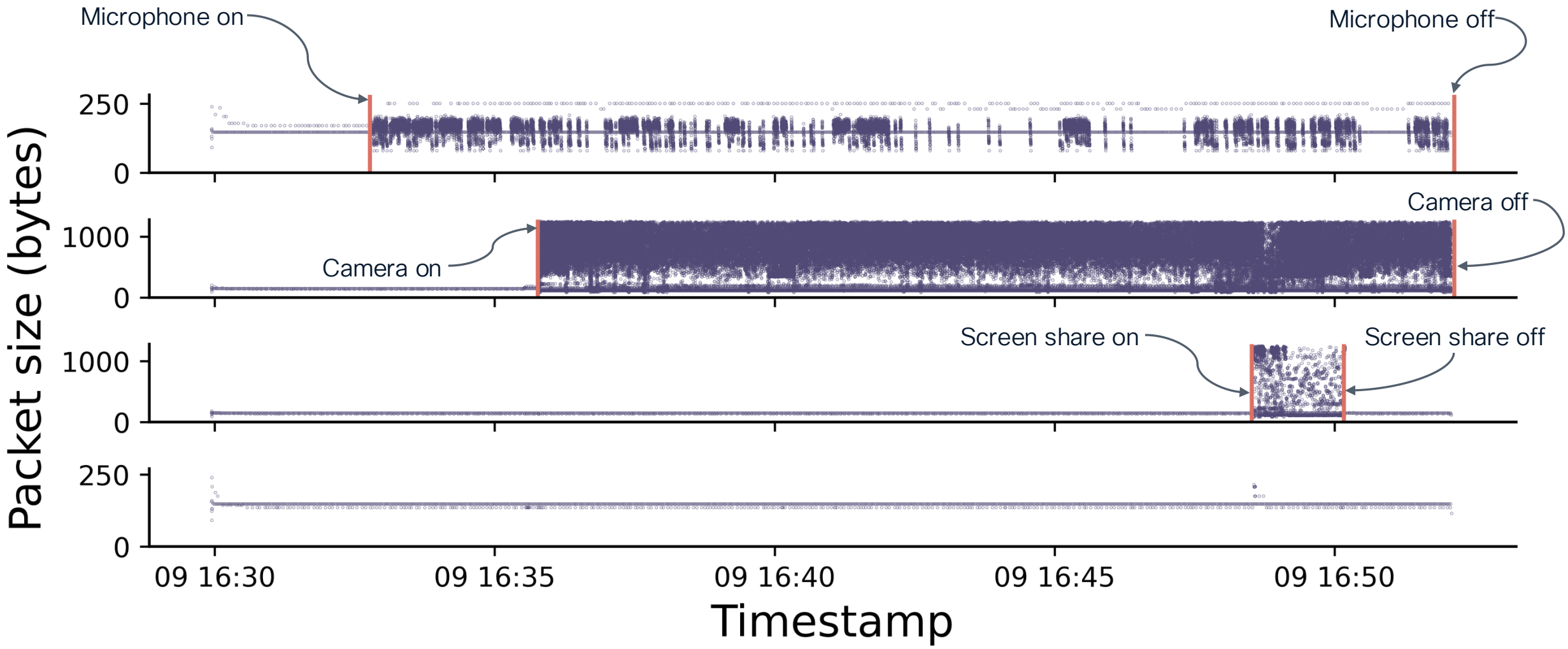
Let’s look at the traffic



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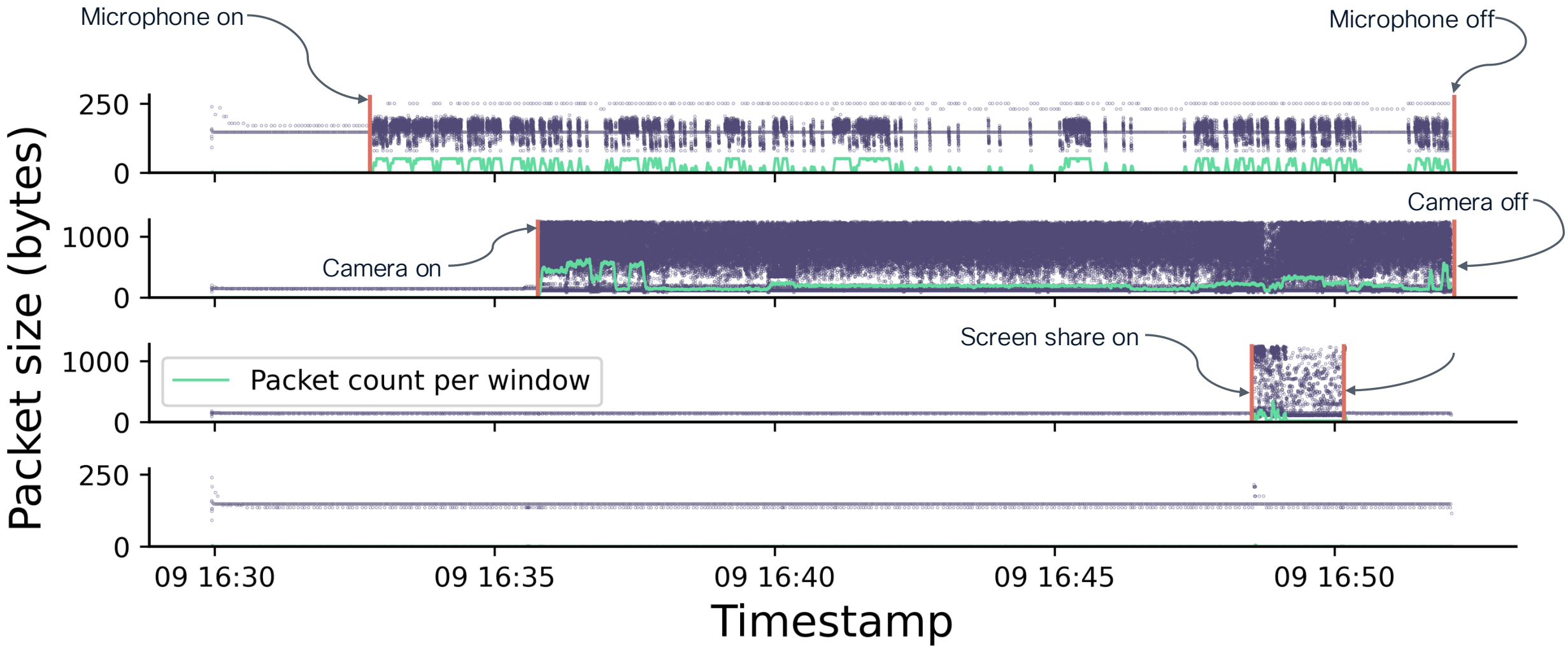
Let’s look at the traffic



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Passive QoE metrics estimation

Experiments setup

Control video stream [4] → 720p 30fps
240p 15fps

Control video stream

Relay server

Receiver

Sender

Media detection
PCAP recording

All calls done over Google Chrome
Ground truth from `chrome://webrtc-internals`

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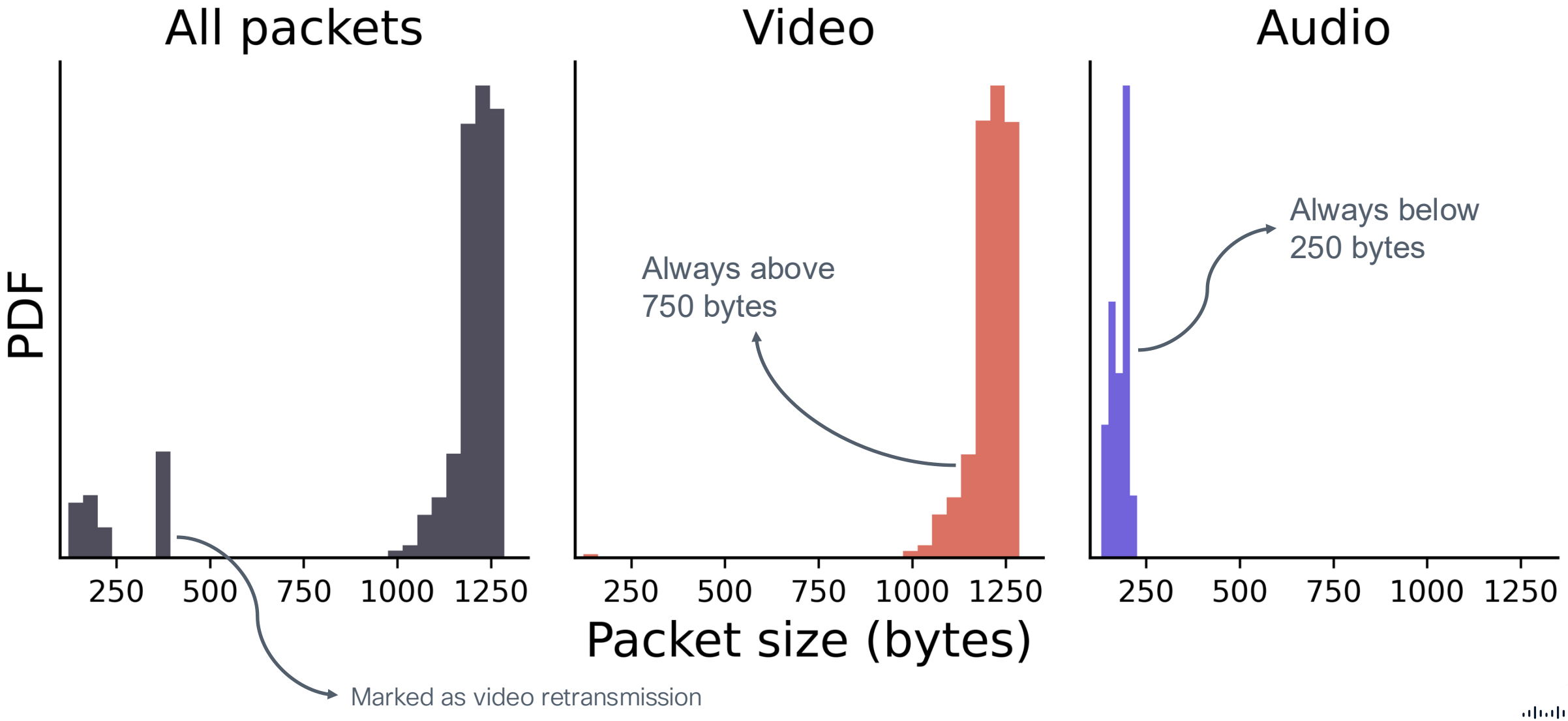
Inferring media type



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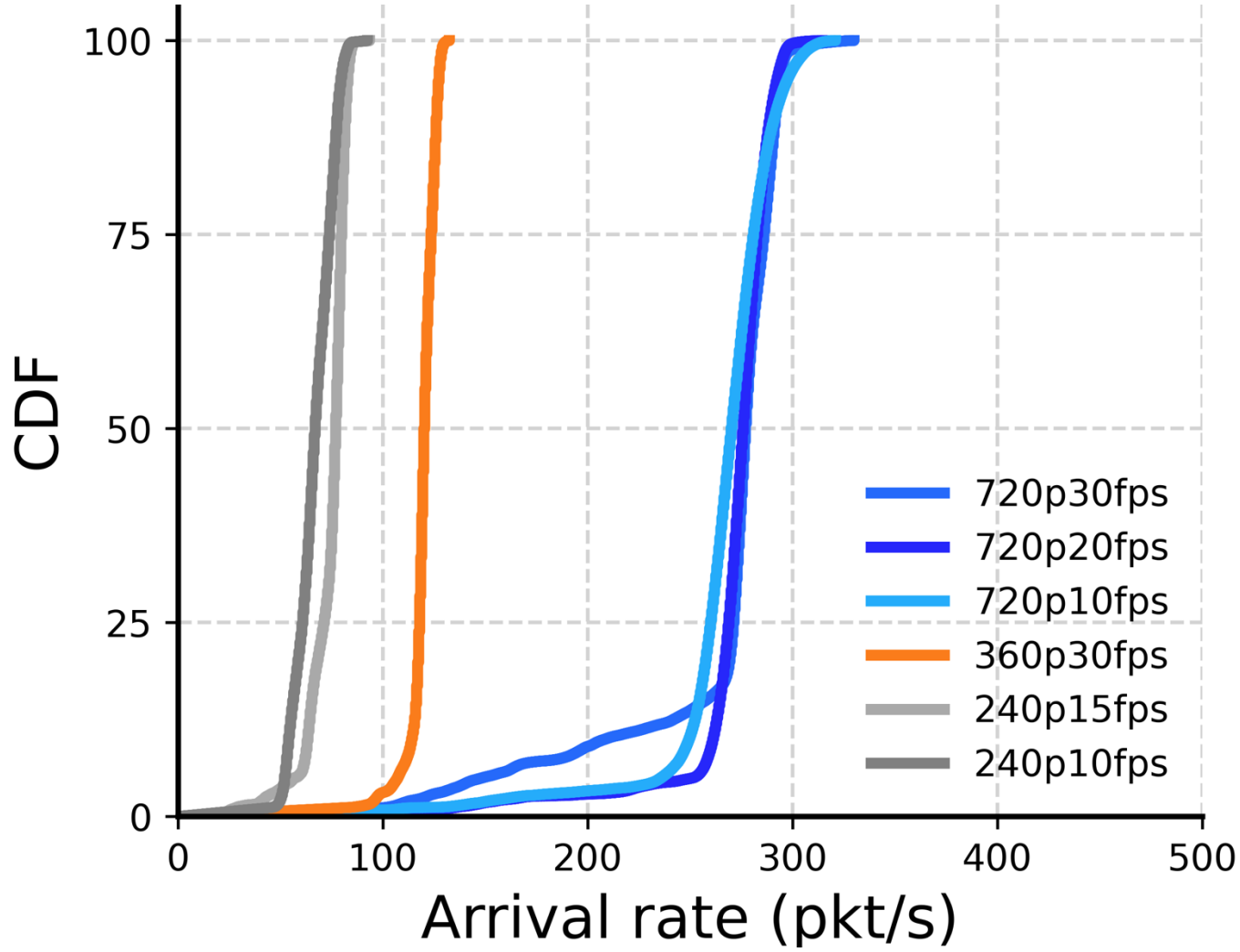
Video resolution estimation



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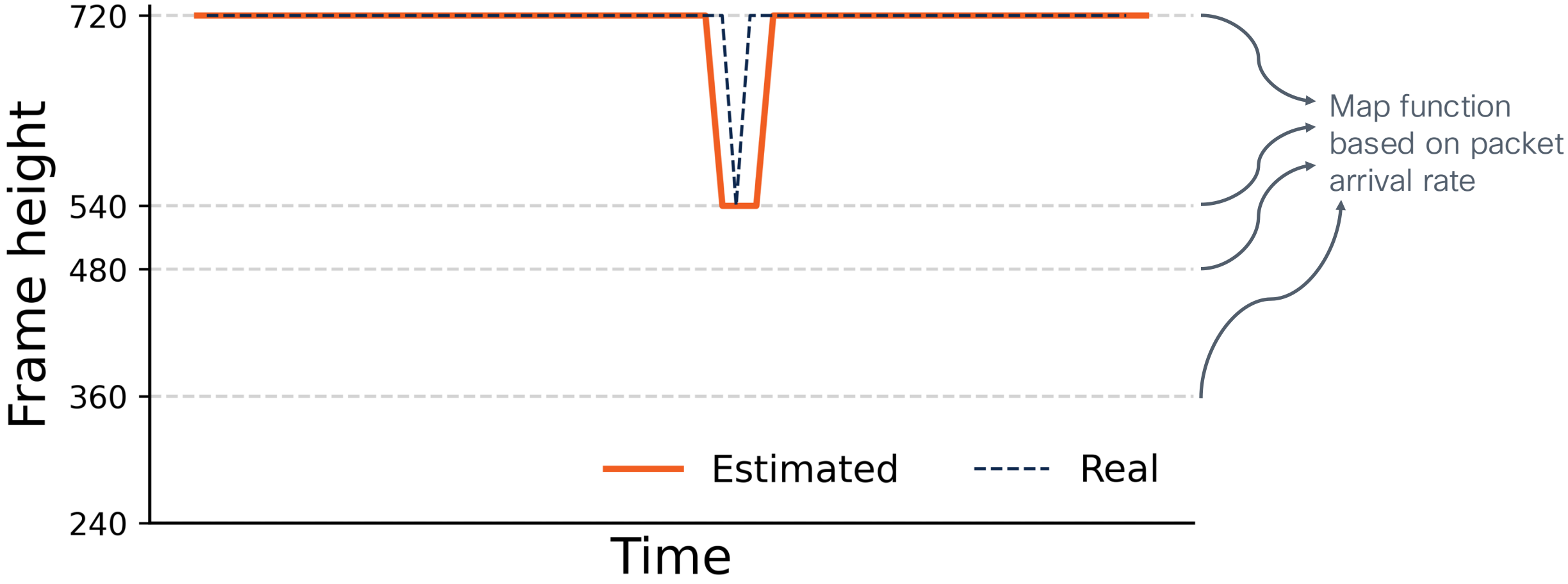
Video resolution estimation



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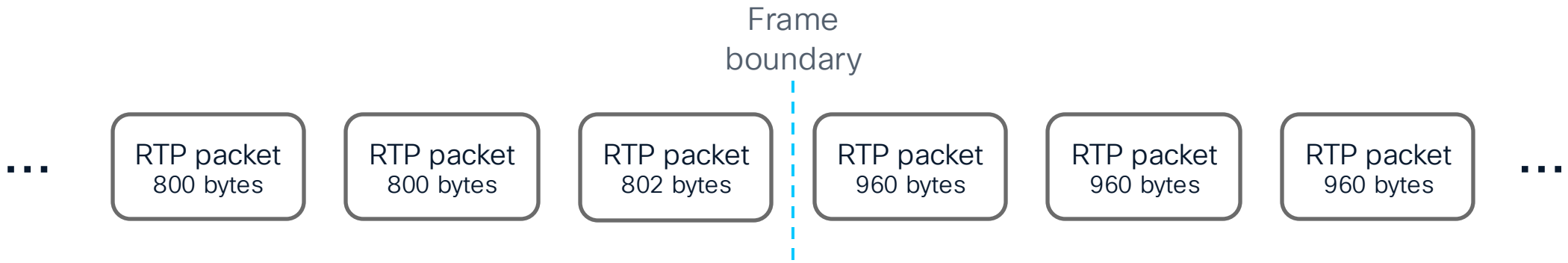
Frame boundaries identification



Sharma et al., Estimating WebRTC Video QoE Metrics Without Using Application Headers, ACM IMC'23

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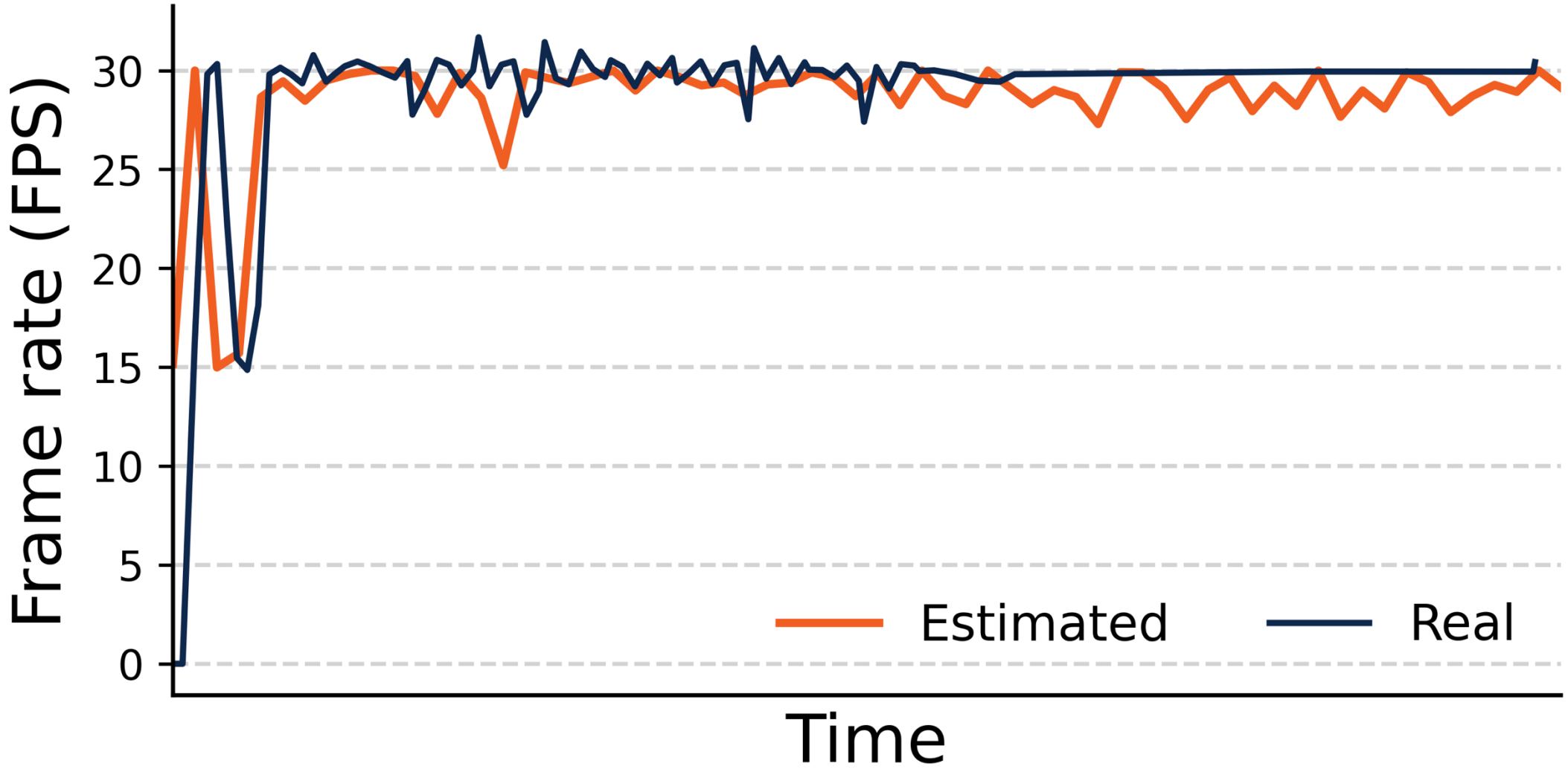
Frame rate estimation



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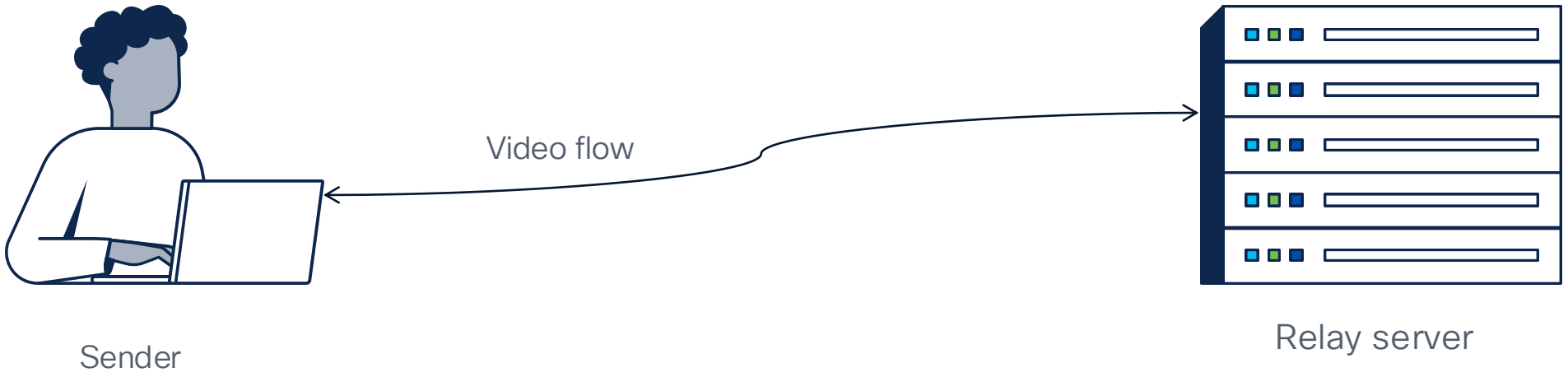
What’s next?

Screen sharing detection



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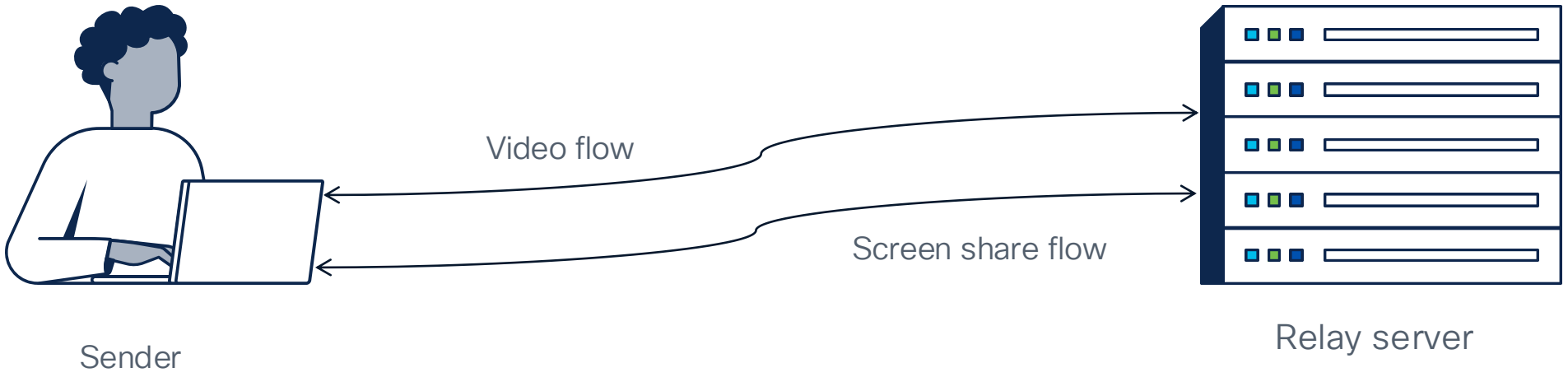
Screen sharing detection



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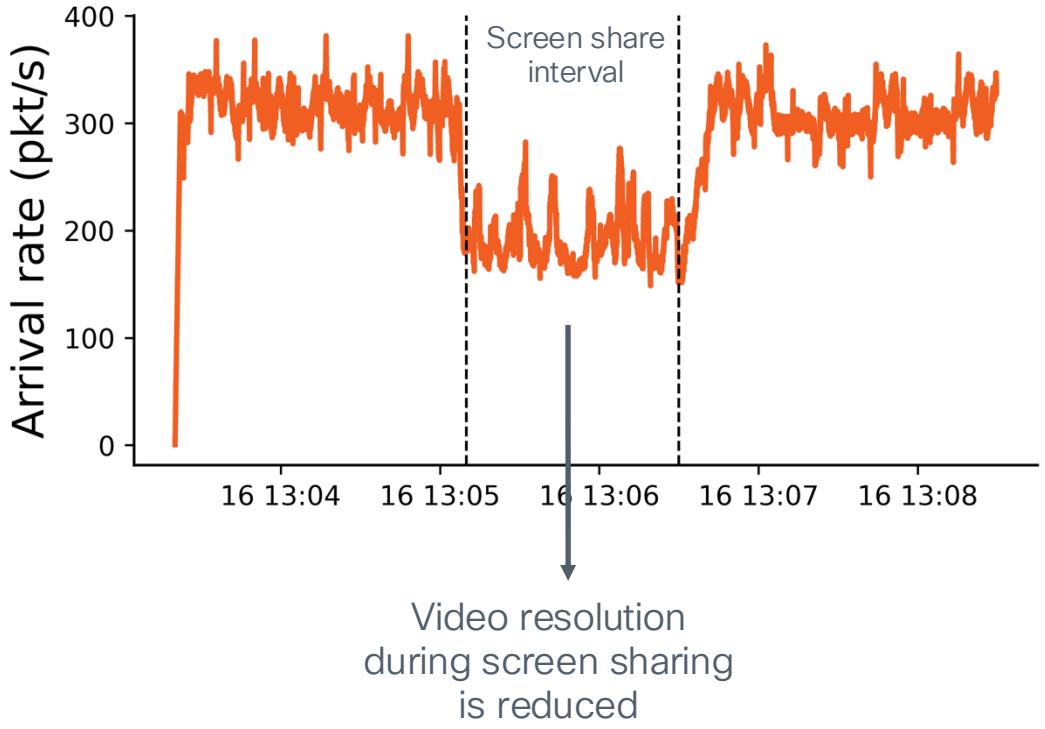
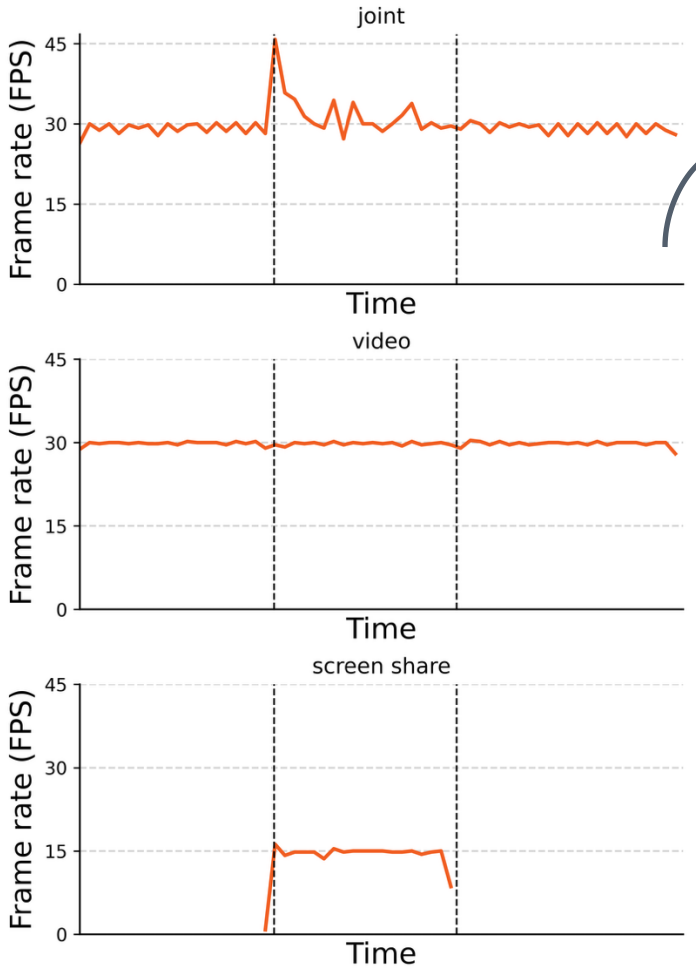
Screen sharing detection





Seen by passive estimator (no RTP header)

Tracks split with RTP header

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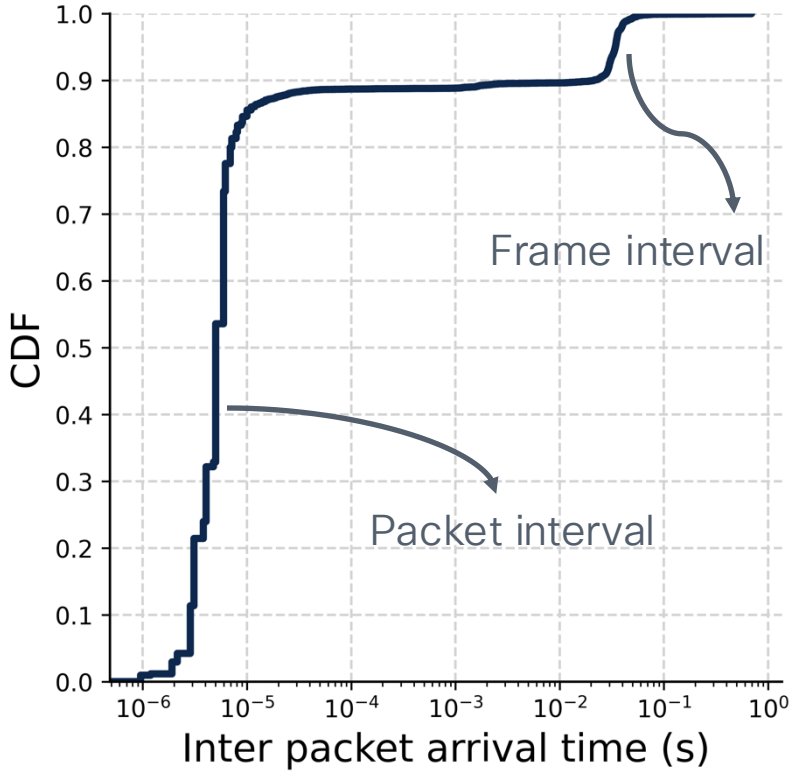
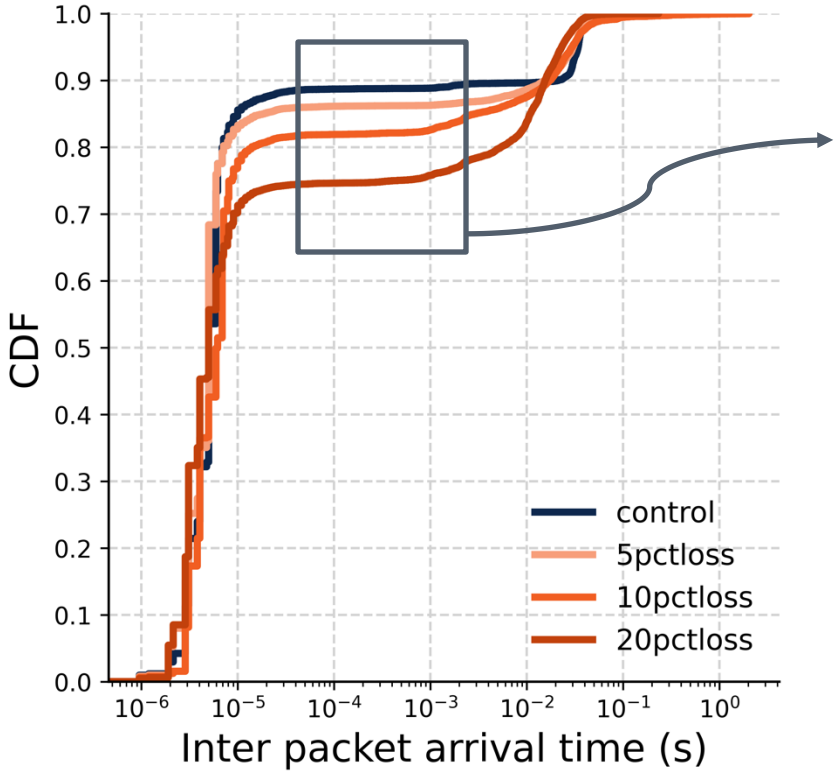
Passive loss estimation

Ideal conditions:
Two clear modes



With network degradation



Retransmission increases, disturbing the two clear modes

This could be leveraged for a packet loss score

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Thank you!

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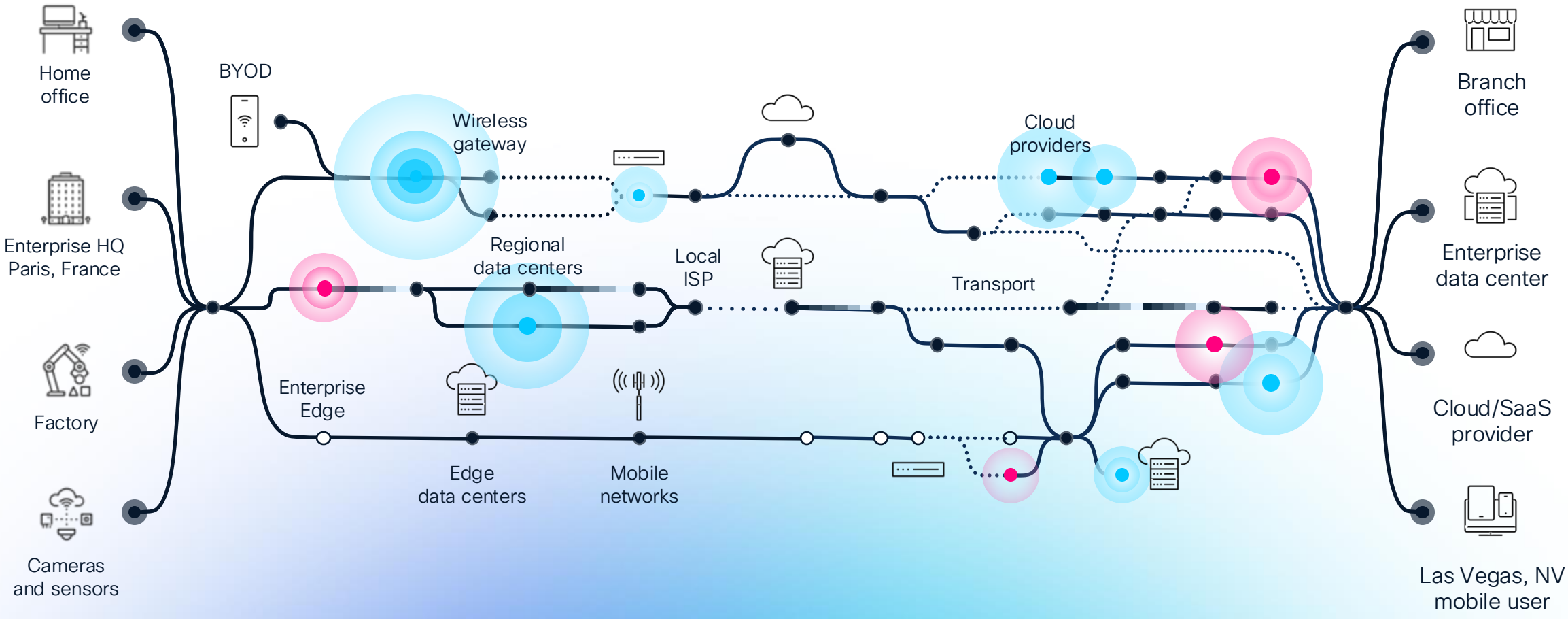
Modern networks are complicated!



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