Second IETF L4S Interop @ IETF Hackathon

IETF 115
5-10 November 2022
London, UK

Champions: Greg White (CableLabs), Koen De Schepper (Nokia)

Hackathon/Interop Plan

Low Latency, Low Loss and Scalable Throughput (L4S)

- L4S Congestion Control & AQM Architecture
  - draft-ietf-tsvwg-l4s-arch (RFC-to-be 9330)
  - draft-ietf-tsvwg-ecn-l4s-id (RFC-to-be)
  - draft-ietf-tsvwg-aqm-dualq-coupled (RFC-to-be)
- Accurate ECN for TCP (QUIC supports accurate ECN natively)
  - draft-ietf-tcpm-accurate-ecn
- L4S involves three components
  - Congestion control @ sender
  - Congestion marking @ bottleneck
  - Marking feedback @ receiver

Hackathon Implementations

- Congestion control
  - Apple QUIC Prague
  - Linux TCP Prague
  - Google BBRv2
  - Nokia RT-Prague
  - Ericsson SCReAM
- Marking Feedback
  - Apple QUIC
  - Linux AccECN/TCP
  - FreeBSD AccECN/TCP
  - Nokia RT-Prague
  - Ericsson SCReAM

Hackathon Implementations

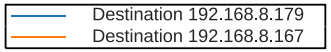
- Four bottleneck link implementations
  - Nokia Beacon 6 WiFi AP
  - Nokia 5G Network (emulated RF)
  - Nokia Fixed Network Emulator
  - Ericsson 5G Network (test license)

What got done, so far…

- Interop testing of Ericsson SCReAM, Nokia RT-Prague & TCP Prague on Nokia L4S WiFi, Nokia 5G-RAN & Ericsson 5G-RAN
- One Nokia RT-Prague with 100 TCP Prague flows on one 5G UE (every flow got ~1.5 Mbps)
- Apple L4S QUIC on 5G RAN
- Improving FreeBSD AccECN Implementation

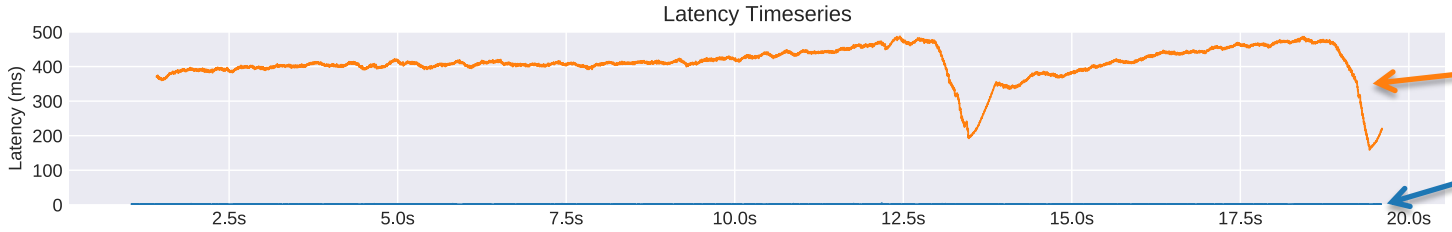
- ToDo:
  - Apple L4S QUIC on Nokia WiFi
  - Interop testing of Apple L4S QUIC & Nokia RT-Prague
  - Etc..

2022_11_06_14_25_24 downstream statistics



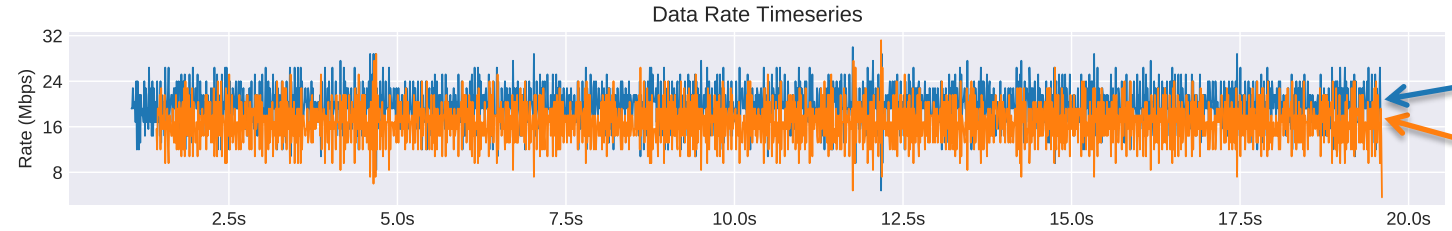
NOKIA Bell Labs

5G RAN Testing



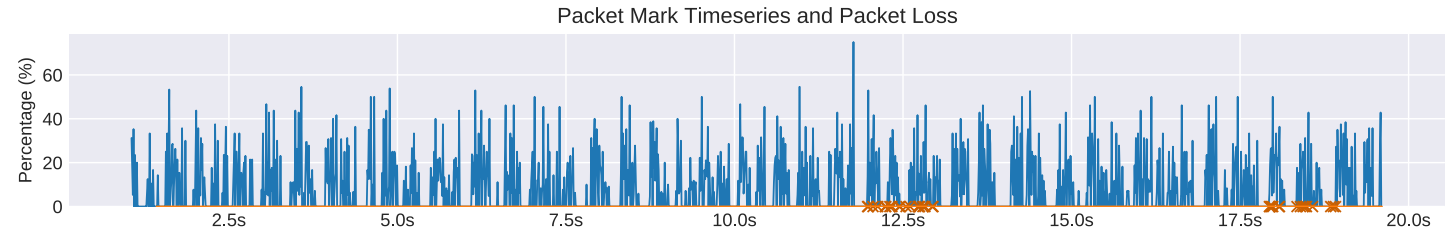
Classic Latency

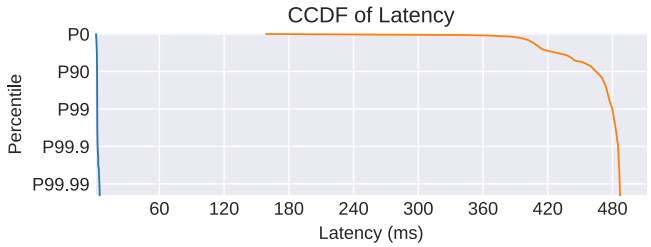
L4S Latency



L4S Thruput

Classic Thruput





	192.168.8.179	192.168.8.167
P50/P90/P99	1.777/2.243/2.361	409.976/464.618/479.875
P99.9/P99.99	2.779/4.241msec	485.212/486.900msec
Packet loss	0.00%(0/30013)	0.19%(50/25801)
Packet NoECT	0.00%(0/30013)	0.00%(0/25296)
Packet ECT_0	0.00%(0/30013)	100.00%(25296/25296)
Packet ECT_1	92.42%(27738/30013)	0.00%(0/25296)
Packet mark	7.58%(2275/30013)	0.00%(0/25296)
Avg rate	19.426Mbps	16.688Mbps

Downstream one-way delay under optimal radio conditions

P99 Latency

L4S: 2.3 ms

Classic: 479.9 ms

Participating Organizations (11)

Apple
CableLabs
Domos
Ericsson
Google
Independent
Liberty Global
Nokia
Netapp
Virgin Media O2
Vodafone

Participants (21)

Peter Bergvik
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Felipe Plaza
Richard Scheffenegger
Kevin Smith
Johan Strand
Craig Taylor
Michael Tüxen
Bjørn Teigen
Greg White

Upcoming Interop Opportunities

- Second CableLabs L4S Interop – Denver, January 2023
- Third IETF L4S Interop (IETF 116) – Yokohama, March 2023

- Interested participants contact:

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