PragueCC

Low Latency first, then Throughput

draft-briscoe-iccrg-prague-congestion-control

Many contributors in Open-Source repositories:

[L4STeam/linux: Kernel tree with TCP-Prague and DualPI2](L4STeam/linux)

[L4STeam/udp_prague: UDP-Prague CC object and examples](L4STeam/udp_prague) (still under construction)

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L4S Standards Status

DOCSIS:
- Has DualQ-AQM since DOCSIS 3.1 and 4.0

3GPP:
- R18 has L4S in RAN (CU/DU) Low Latency DRBs support L4S
- L4S in next ongoing R19 targets further user plane nodes

WBA/WFA/IEEE:
- WBA implementation guideline for DualPI2 on WiFi MAC
  LOW LATENCY LOW LOSS SCALABLE THROUGHPUT (L4S) - Wireless Broadband Alliance (wballiance.com)
- WFA/IEEE latency improved WiFi EDCA/MAC (WMM = tripleplay legacy)

BBF:
- L4S project launched
  ATA publishes TR-497 and launches new L4S project to enhance broadband services with low latency - Broadband Forum (broadband-forum.org)

Prague Objectives

- Making E2E low latency service deployment easier and scalable
- For adaptive & interactive applications
- First Low Latency (=speed), then Throughput (=quantity)
- Prague/L4S offers an interactive service to applications next to Classic buffered traffic
  - Offers to Apps the choice:
    - Choose L4S for interactive tasks that require minimal latency with a safe (high) throughput
    - Choose Classic when maximum throughput is the only metric
  - Offers to the NW:
    - Easily identifiable L4S packets, for differential lower layer treatment (MAC/PHY)
    - Rate Control without the need for queue buildup
  - Expects support from the NW:
    - Marking instead of blocking or dropping
    - Provide a smooth low jitter path

Optimization by NW/Application collaboration

Prague Status

- Apple QUIC-Prague
  - Falls back to Cubic on loss
  - Beta in MacOS13 and iOS16, Released in MacOS14 and iOS17

- Linux TCP-Prague (recent features explained in ICCRG meeting on Friday)
  - For kernel versions:
    5.15 L4STeam/linux, 6.1 minuscat/l4steam6.1.y, 6.6 minuscat/l4steam-6.6.y, 6.7 minuscat/net-next/tree/upstream_l4steam
  - Rpi 6.6 minuscat/rpi-6.6.y
  - 6.11 (for main lining soon)

- UDP-Prague L4STeam/udp_prague
  - Prague congestion control protocol for UDP-based applications targeting very interactive user experience
  - Single source C++ reference PragueCC object directly controlling application data generation rate
  - Iperf2: Supporting precise app level latency measurements (without socket buffering)
  - Further additions: RT-Prague for Video, Cubic on loss, …

- UDP-Prague based applications (like Nvidia GeForce Now)

- Draft exists in ICCRG: draft-briscoe-iccrg-prague-congestion-control