L4S: Low Latency, Low Loss, Scalable Throughput Internet Service Architecture and Identifier

draft-ietf-tsvwg-l4s-arch-01
draft-ietf-tsvwg-ecn-l4s-id-01

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Recap

• Motivation
  • Extremely low queuing delay for all Internet traffic
  • already 1-2 orders better than state of the art
  • 500 μs vs 5-15 ms (fq-CoDel or PIE)

• Architecture

\[ r \propto \frac{1}{p} \]

\[ r \propto \frac{1}{\sqrt{p}} \]

\( r \): packet rate
\( p \): drop/mark probability
tsvwg-l4s-arch status

• Now in a holding pattern
  • pending possible changes to main assumptions about the “TCP Prague Requirements”
  • Exit holding pattern when reference implementation of TCP Prague complete

• Reviews, comments from implementers etc, obviously welcome
L4S Status Update (1/3)

• Source Code
  – Dual Queue Coupled AQM, DualPI2 for Linux [UPDATED internally, release shortly]
  – Data Centre TCP (DCTCP) for Linux (in the mainline kernel), FreeBSD patch, ns2 patch.
  – Accurate ECN TCP Feedback for Linux [UPDATED, but still not fully tested]

• Implementations
  – DualQ Coupled AQM: in at least one chipset aimed at the data centre environment [NEW – availability TBA]
  – L4S Scalable congestion control: rmcat SCReAM [NEW]
  – Whole L4S system: ns3 [to be released early 2018]
SCReAM, 100Mbps, CoDel ECN
SCReAM, 100Mbps, L4S
L4S Status Update (2/3)

- **IETF specs**
  - Low Latency, Low Loss, Scalable Throughput (L4S) Internet Service: Architecture <draft-ietf-.tsvwg-l4s-arch-01> [MINOR UPDATE]
  - A proposed new identifier for Low Latency, Low Loss, Scalable throughput (L4S) packets <draft-ietf-.tsvwg-ecn-l4s-id-01> [MINOR UPDATE]
  - Dual-queue AQM: <draft-ietf-.tsvwg-aqm-dualq-coupled-02> [UPDATED]
  - enabled by <draft-ietf-.tsvwg-ecn-experimentation> [Passed IESG; UPDATED]
  - scalable TCP algorithms, e.g. Data Centre TCP (DCTCP) <RFC8257>, TCP Prague [RFC PUBLISHED]
  - Accurate ECN: <draft-ietf-tcpm-accurate-ecn-05> [UPDATED – WGLC LIKELY]
  - ECN++ Adding ECN to TCP control packets: <draft-ietf-tcpm-generalized-ecn-02> [UPDATED]
  - ECN support in trill <draft-ietf-trill-ecn-support-03>, motivated by L4S [Completed WGLC]
  - ECN in QUIC <draft-johansson-quic-ecn-03>, motivated by L4S [DES TEAM FORMED]

- **3GPP Proposal**
  - ECN visibility to Radio Link Control (RLC) layer, motivated by L4S [Rejected for R15; Retry for R16]
L4S Status Update (3/3)

- Papers
  - “Data Centre to the Home: Deployable Ultra-Low Queuing Delay for All” [Journal submission]

- Landing page for code, specs, papers
  https://riteproject.eu/dctth/
DualQ Coupled AQM
for Low Latency Low Loss Scalable throughput (L4S)

draft-ietf-tsvwg-aqm-dualq-coupled-02
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DualQ Coupled AQM: Structure

- Was $p_{CL} = p'$ and $p_C = (p'/k)^2$
- Seems trivial but this makes all the input parameters independent

$p$ : drop / mark probability
$p'$ : internal control variable
$k$ : coupling constant
DualQ Coupled AQM: modular separation

- Step marking threshold, RED-like ramp, etc.
- L4S AQM
- Base AQM
- PI² (improved PIE), Curvy RED, etc.

• not actually an AQM
  - a framework for coupling AQMs
  - drop in your chosen 'native AQM' for each queue

• aqm-dualq-coupled defines:
  - MUSTS and SHOULDs for framework
  - informational appendices explaining 2 example AQMs with pseudocode
DualQ Coupled AQM:

**Management Requirements**

- **Configuration**
  - 3 categories:
    1) Framework
    2) Base AQM
    3) Native L4S AQM

- **Monitoring**
  - per queue per sample interval
    - Bits forwarded
      → utilization
    - Packets arriving; enqueued; dequeued
    - Packets marked; dropped (ECT & not-ECT)

- Linux ref. implementation
  - Fixed the API so each config parameter is independent
  - Added external config of classifier (Linux classifier arch)
  - Made classful: visibility of each queue (e.g. stats) consistent externally
Status & Next Steps

• Draft is now understandable to implementers
  • thanks to Sowmini Varadhan & Gabi Bracha

Next:

• Management requirements for experiments
  • prompted by IESG review of tsvwg-ecn-experimentation
• Release changes to Linux implementation
• Relationship to Diffserv
• Policing / queue protection
Q&A