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

Bob Briscoe, CableLabs

Koen De Schepper, Nokia Bell Labs
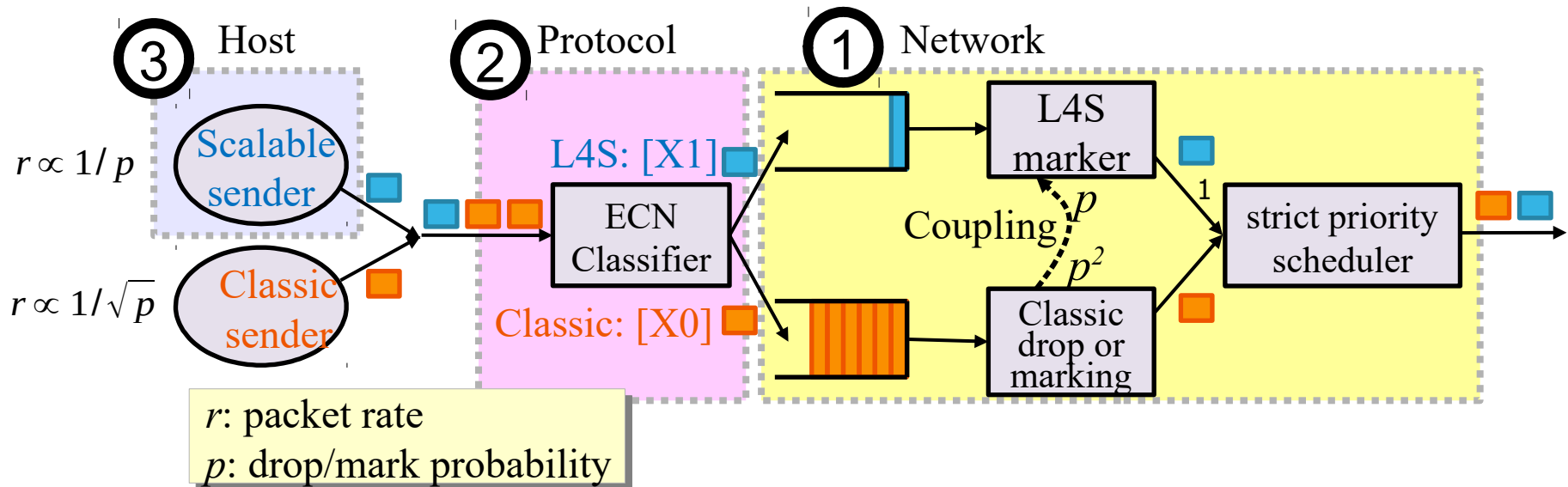
Marcelo Bagnulo, UC3M

IETF-100 Nov 2017

Recap

- ## Motivation

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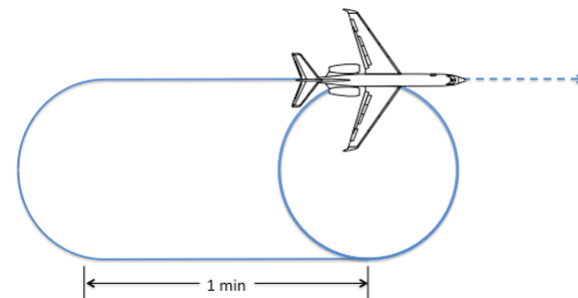 - 500 µs vs 5-15 ms (fq-CoDel or PIE)

- ## Architecture

tsvwg-l4s-arch
# tsvwg-ecn-l4s-id   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
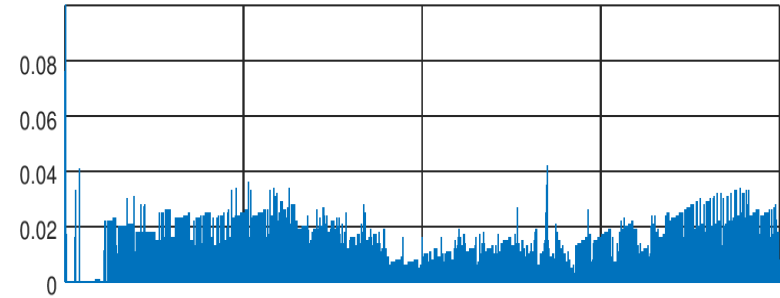
L4S Status Update (1/3)

- 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]
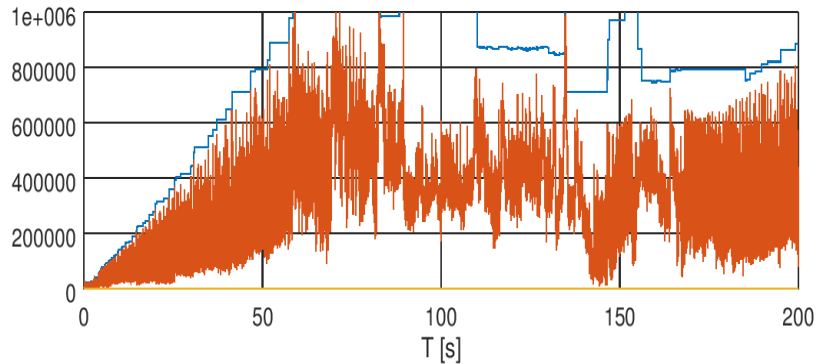 - Whole L4S system: ns3 [to be released early 2018]

SCReAM, 100Mbps , CoDel ECN
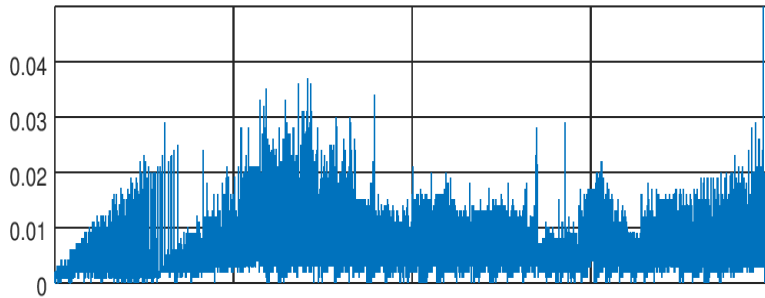
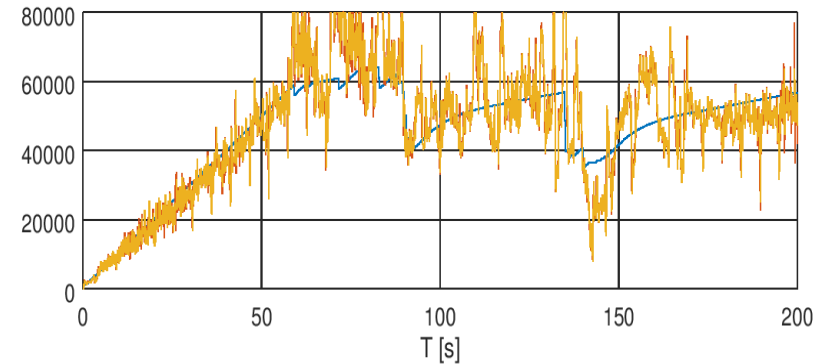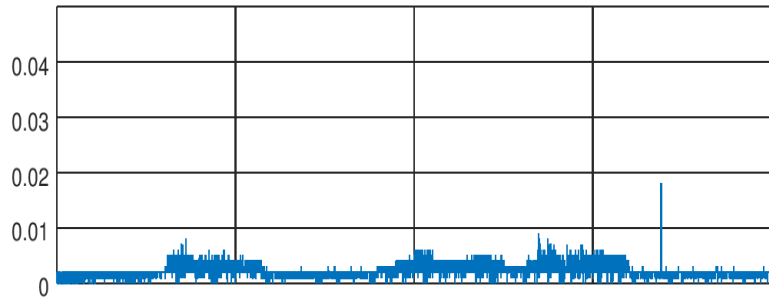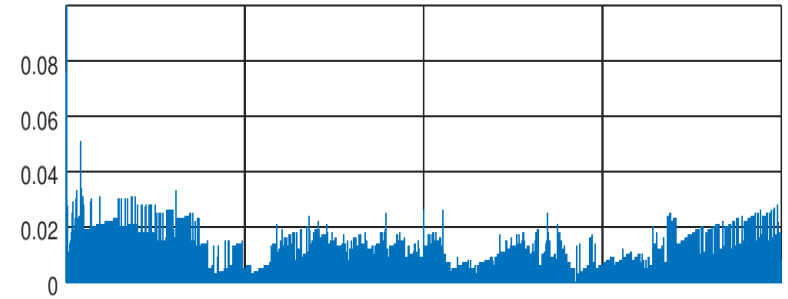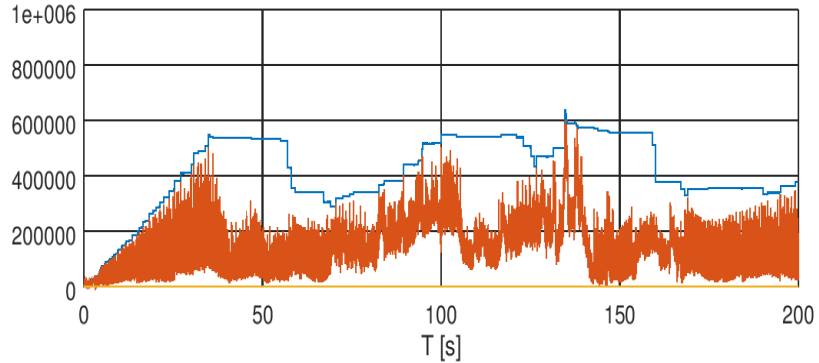# SCReAM, 100Mbps , L4S
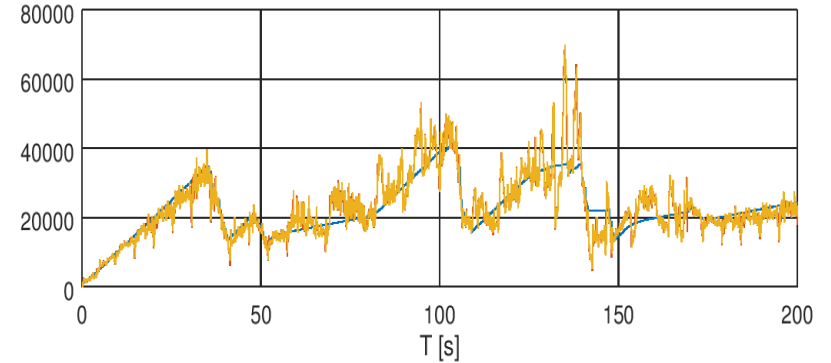
L4S Status Update (2/3)

- 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
    - Article in the IETF Journal describing the Demo in Bits-N-Bites at the IETF in Prague, July 2015. "Ultra-Low Delay for All" IETF Journal, Nov 2015.
    - "Ultra-Low Delay for All: Live Experience, Live Analysis", Proc. ACM Multimedia Systems; Demo Session (May 2016).
    - "PI2: A Linearized AQM for both Classic and Scalable TCP," Proc. ACM CONEXT 2016 (To appear Dec 2016).
    - "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

Bob Briscoe, CableLabs

Koen De Schepper, Nokia Bell Labs

IETF-100 Nov 2017

DualQ Coupled AQM: Structure

L4S

ECN marker

p_L

L4S AQM

Coupling

Condit-ional priority scheduler

IP-ECN Classifier

kp'

Base AQM

$(p')^2$

p_C

Classic

Drop/ mark
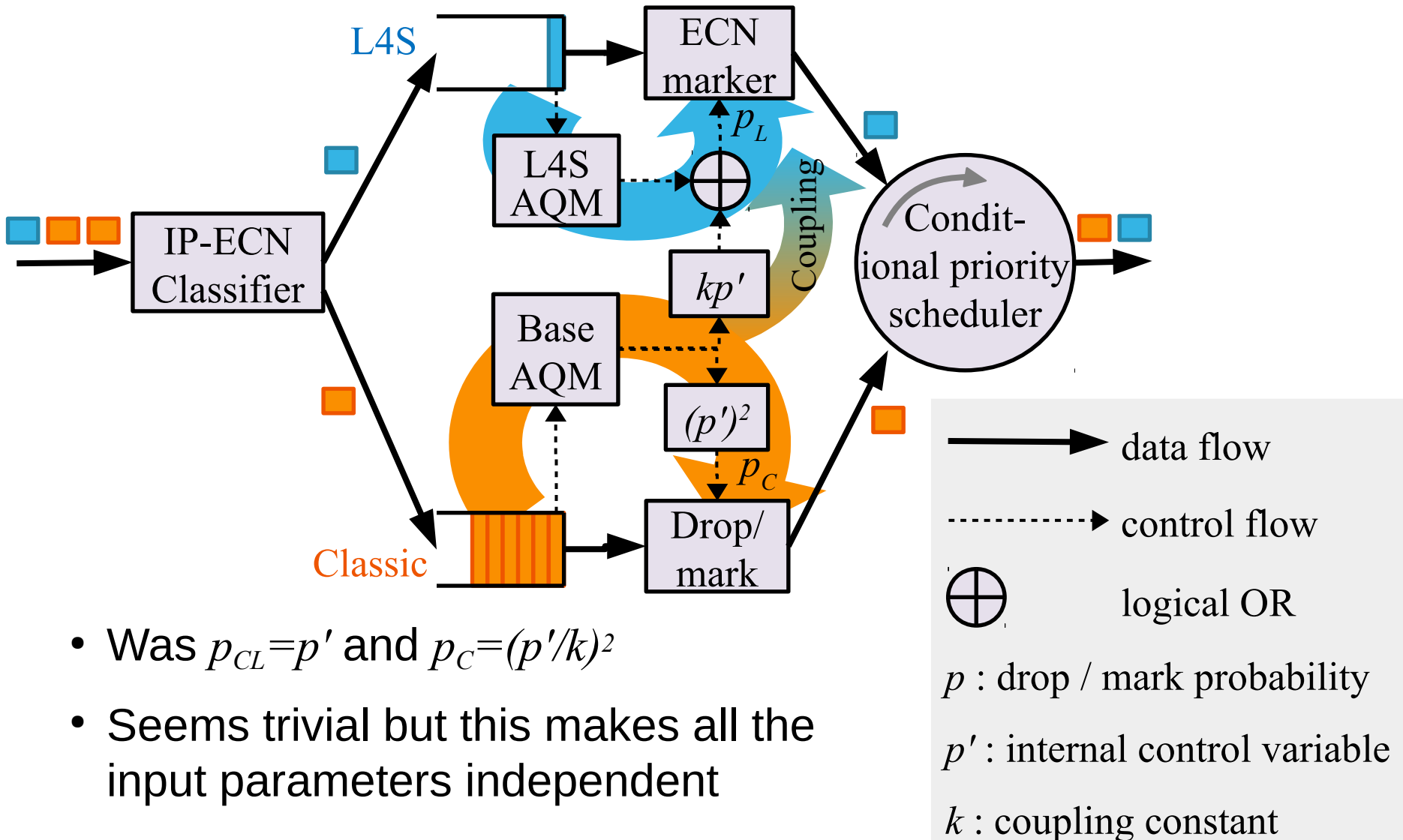
- Was $p_{CL}=p'$ and $p_C=(p'/k)^2$

- Seems trivial but this makes all the input parameters independent

data flow

---------> control flow

$\oplus$ logical OR

p : drop / mark probability

p' : internal control variable

k : coupling constant

DualQ Coupled AQM:
modular separation

Step marking threshold, RED-like ramp, etc.

ECN marker

p_L

L4S AQM

$\oplus$

IP-ECN Classifier

Time-shifted FIFO scheduler

Base AQM

kp'

p'

PI^2 (improved PIE), Curvy RED, etc.

$(p')^2$

p_C

Classic

Drop/ mark

- aqm-dualq-coupled defines:
  - MUSTS and SHOULDs for framework
  - informational appendices explaining 2 example AQMs with pseudocode
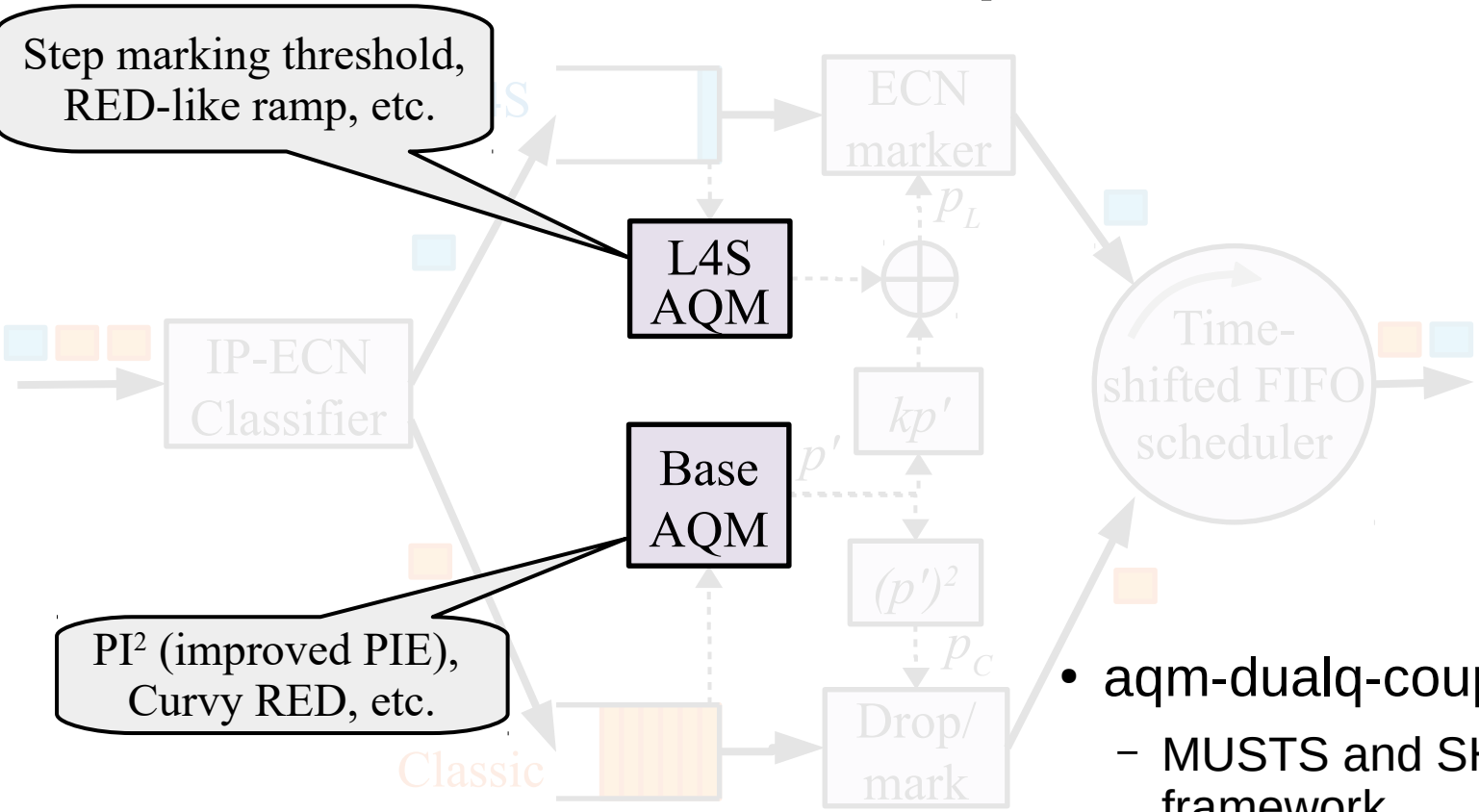
- not actually *an* AQM
  - a framework for coupling AQMs
  - drop in your chosen 'native AQM' for each queue

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 indepedent
    - Added external config of classifer (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

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Q&A