Flow Queue PIE: A Hybrid Packet Scheduler and Active Queue Management Algorithm

draft-ietf-tsvwg-fq-pie-01

Mohit P. Tahiliani

TSVWG, IETF 125

Overview of the draft

- Combines “flow queuing” and PIE algorithm
  - Similar to how FQ-CoDel combines FQ and CoDel
- The functioning of FQ is similar to RFC 8290
  - Incoming packets are hashed into buckets, each having its own queue
  - Packets are dequeued using a DRR-based packet scheduler
- The functioning of PIE is similar to RFC 8033 with minor modifications
  - Uses timestamps to calculate queue delay
- Implementations of FQ-PIE
  - Linux
    - Supported in multiple Linux distributions
  - FreeBSD (thanks to Grenville Armitage and team!)
  - network simulator - 3 (ns-3)

Status of FQ-PIE

	CoDel	FQ-CoDel	PIE	FQ-PIE
Linux/FreeBSD implementation	Yes	Yes	Yes	Yes
Specification	RFC 8289	RFC 8290	RFC 8033	ID adopted

Thanks: Michael Welzl

History of the document

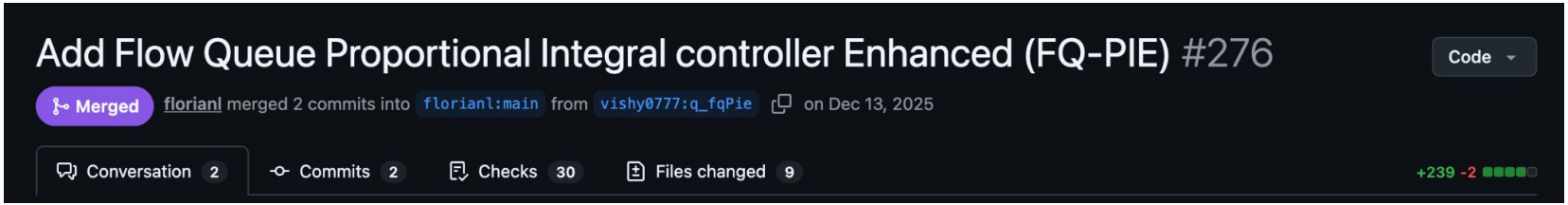
- -00 draft described FQ-PIE
- -01 draft updated the scope of experimentation by adding scenarios from RFC 7928
- -02 draft adds text about the FreeBSD implementation of FQ-PIE
- adopted during IETF 124
- -00 IETF draft published after IETF 124
- -01 IETF draft incorporates suggestions from the mailing list

Discussions on the draft

- Greg White: It would be interesting to study what impact it has on the performance when timestamps are used for estimating queue delay.
  - Status: Done; presented the work during IETF 124. Thanks for the suggestion!
- Chris Box suggested a few points (thanks!)
  - Minor changes suggested: Done; the latest IETF version of the ID (01) includes the changes.
  - L4S support for FQ-PIE: more insights are needed prior to enabling L4S in FQ-based mechanisms. FQ-CoDel supports L4S, but an in-depth study would help understand the performance impact. Perhaps, a separate draft describing how to enable L4S support in FQ-based mechanisms is needed.
  - Assessment of performance differences of FQ-PIE vs FQ-CoDel: Ongoing; a few results were discussed in the past IETF meetings, and some are in the next slides

Enabling support of FQ-PIE in tools

- go-tc: traffic control in pure go - it allows to read and alter queues, filters and classes
  - Enabled the support for FQ-PIE: https://github.com/florianl/go-tc/pull/276



- QoSmate: Quality of Service tool for OpenWrt
  - Ongoing work to enable support for FQ-PIE:
    https://github.com/hudra0/qosmate/pull/114
    https://github.com/hudra0/luci-app-qosmate/pull/25

Credits: Vishal Kamath

Observations from WiFi tests

- Bufferbloat tests using QQ-IW-235: 22-25 users on a room AP; 5 GHz channel

FQ-CoDel

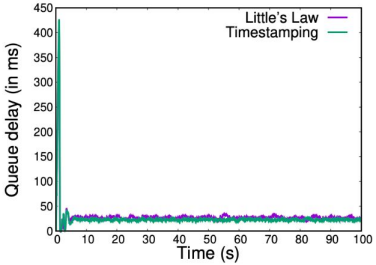
FQ-PIE

Credits: Vikas Patel, Quantum Networks, India

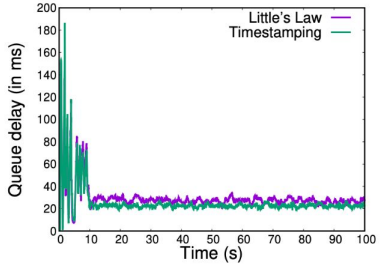
Additional slides (IETF 125)

Suggestion from IETF 123

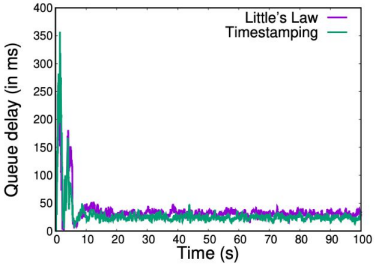
- Greg White: It would be interesting to study what impact it has on the performance when timestamps are used for estimating queue delay.



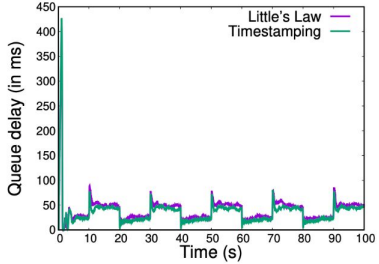
(a) Synchronous Fairness



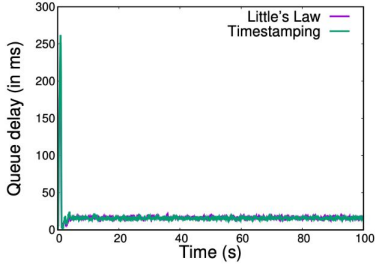
(b) Start-time Fairness



(c) RTT Fairness



(d) Pulse wave



(e) UDP Background

Credits: Arun Kumar Rajaraman