Testing Congestion Control and Queue Management Mechanisms

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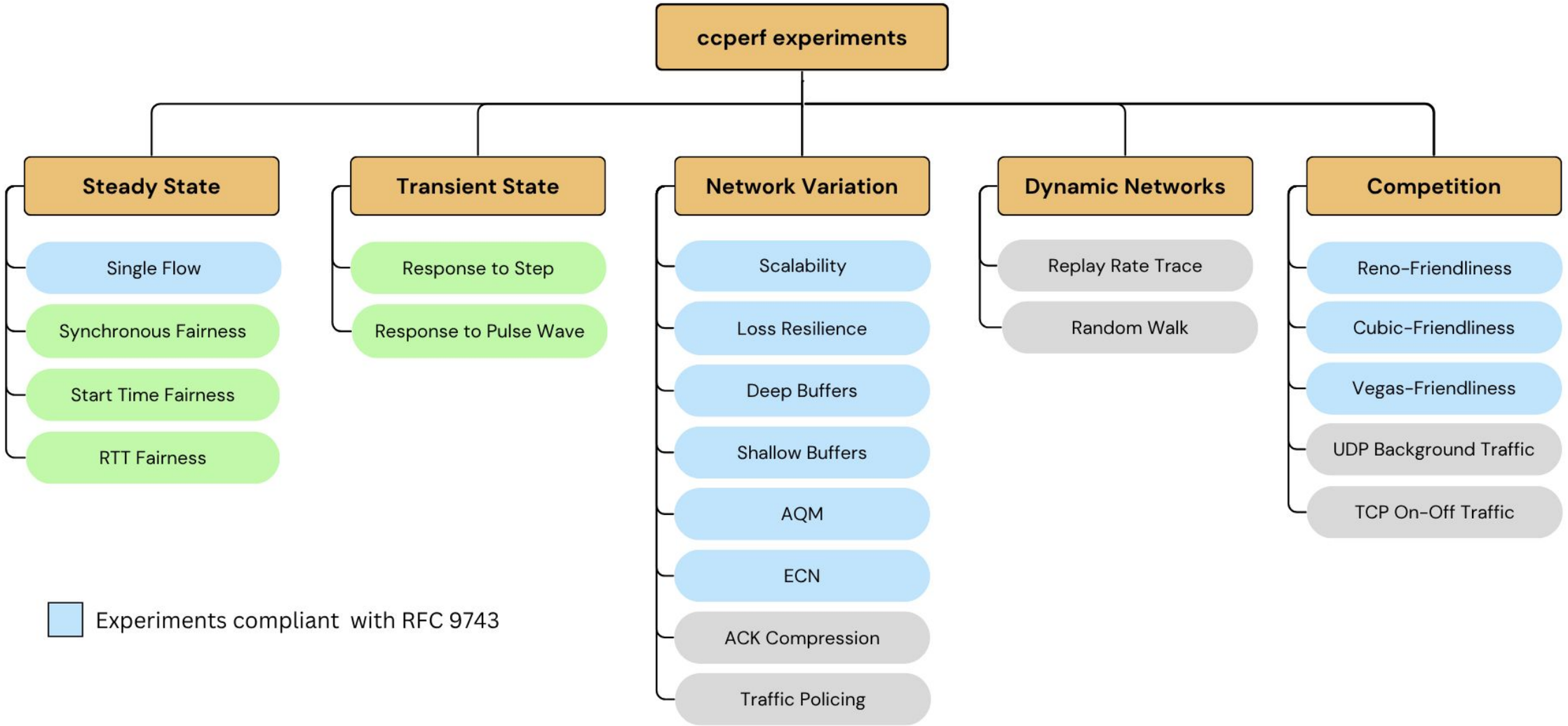
IETF 123, Congestion Control Working Group (CCWG)

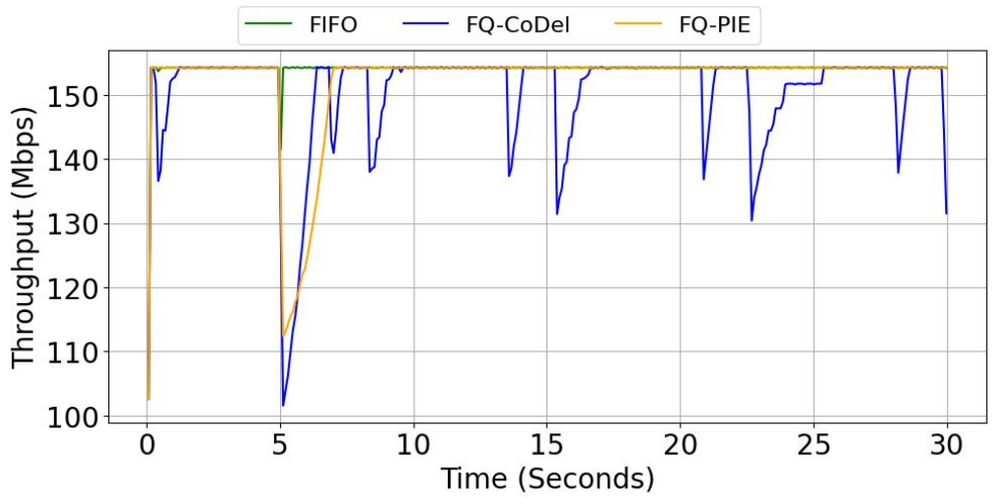
Objectives of the IETF 123 Hackathon

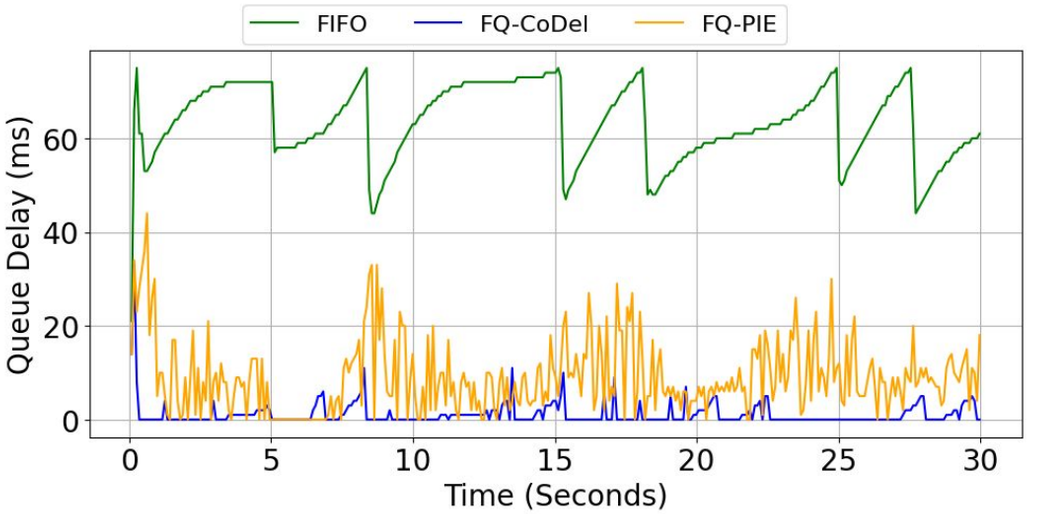
NeST
Network Stack Tester

1. Testing of FQ-CoDel and FQ-PIE using ns-3, NeST and WiFi APs
   - Status: **completed**
2. Improving the delay-throughput tradeoff with a new version of CoDel
   - Status: **completed**
3. An example for rate-limited sender implementation in ns-3
   - Status: **pending**
4. Testing the effectiveness of Alternative Backoff with ECN (ABE) using ns-3
   - Status: **completed**
5. Testing and validating the ns-3 implementation of HTB queue discipline
   - Status: **partially completed**

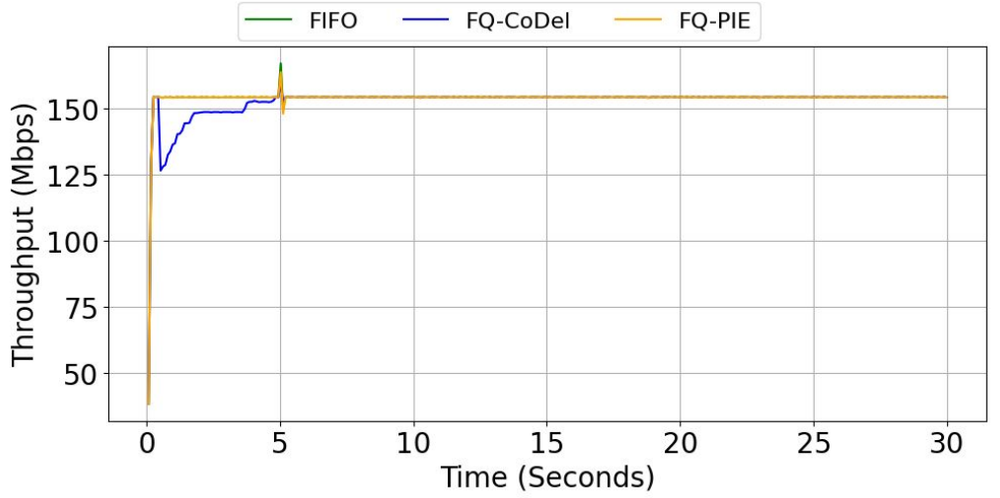

ccperf experiments
Steady State
Single Flow
Synchronous Fairness
Start Time Fairness
RTT Fairness
Transient State
Response to Step
Response to Pulse Wave
Network Variation
Scalability
Loss Resilience
Deep Buffers
Shallow Buffers
AQM
ECN
ACK Compression
Traffic Policing
Dynamic Networks
Replay Rate Trace
Random Walk
Competition
Reno-Friendliness
Cubic-Friendliness
Vegas-Friendliness
UDP Background Traffic
TCP On-Off Traffic
Experiments compliant with RFC 9743

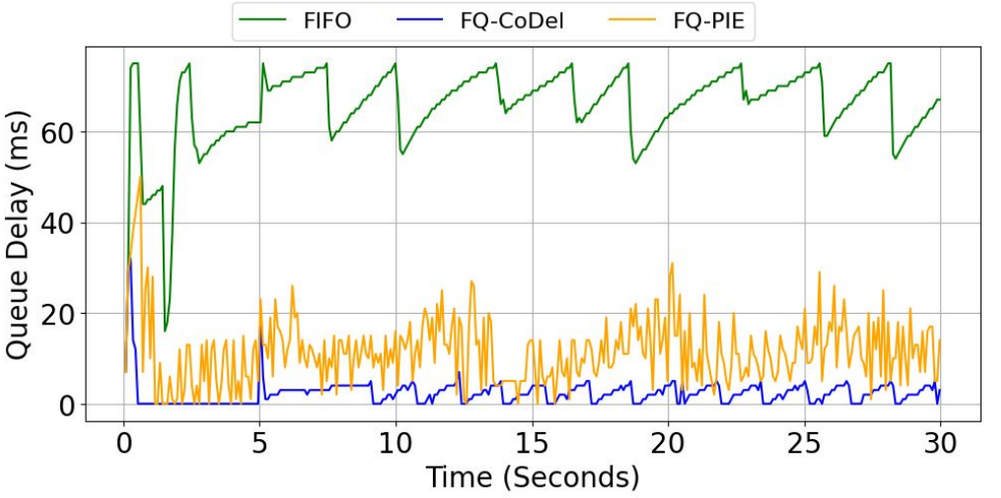
FQ-*: Increasing RTT from 15ms to 30ms





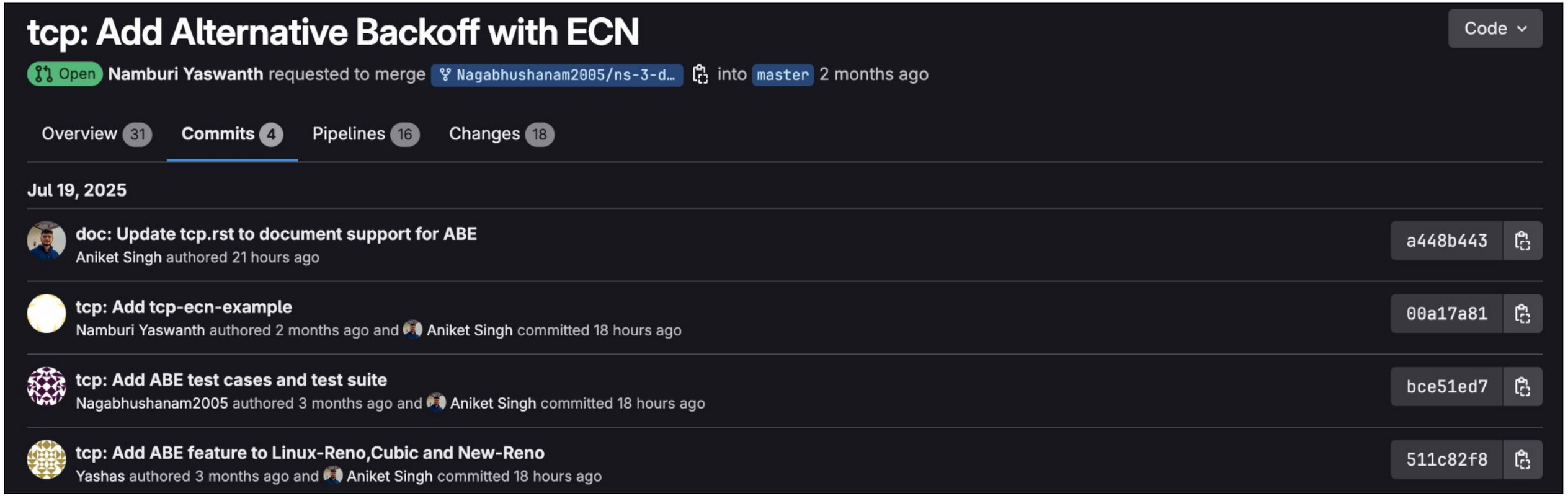
FQ-*: Decreasing RTT from 30ms to 15ms





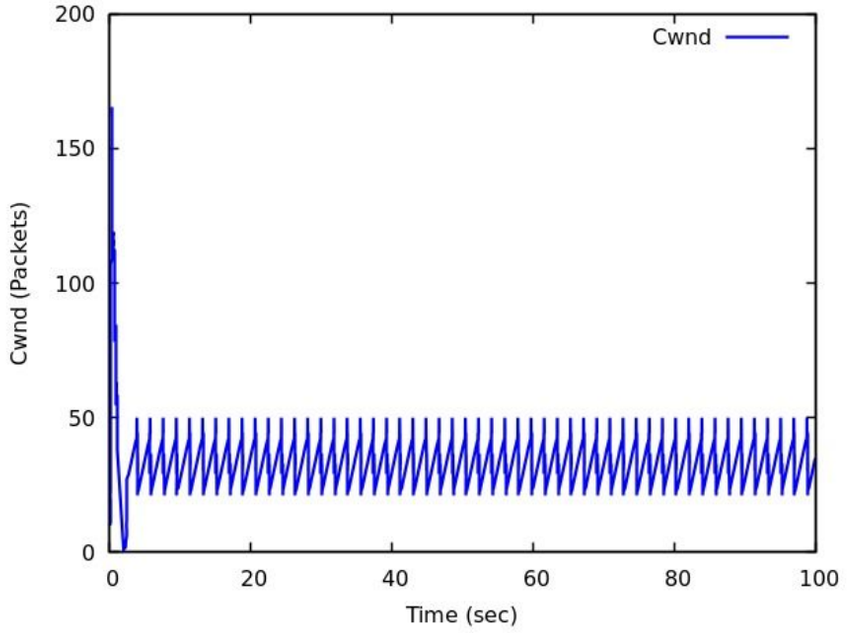
Join us at tsvwg: https://www.ietf.org/id/draft-tahiliani-tsvwg-fq-pie-02.html

ABE (RFC 8511) merge request in ns-3

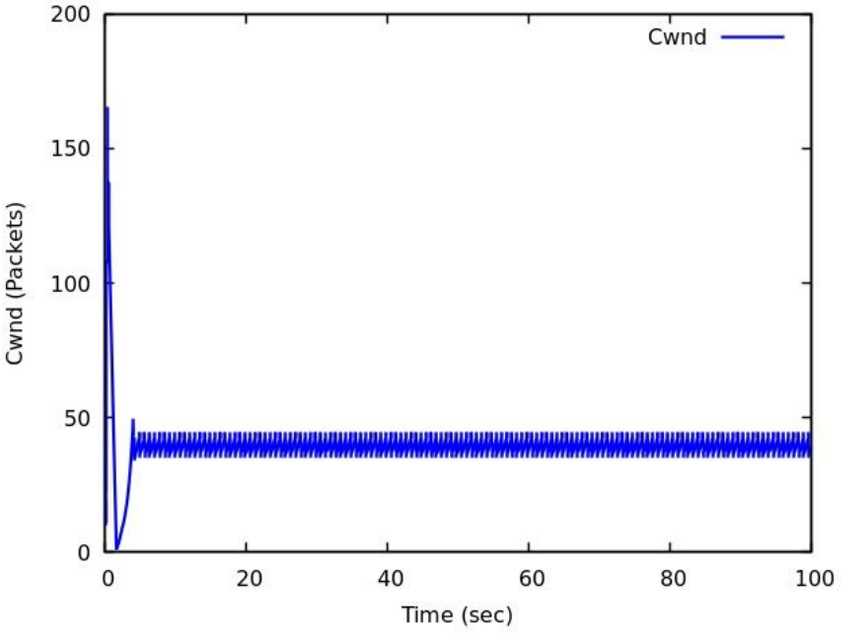


Merge request: https://gitlab.com/nsnam/ns-3-dev/-/merge_requests/2410/

CUBIC + CoDel: with and without ABE using ns-3



without ABE



ABE

Launching AQM Evaluation Suite for ns-3 shortly

AQM Evaluation Suite for ns-3

An Automated Framework to Evaluate ns-3 Queue Disciplines

GET STARTED

RFC 7928 Compliant

The automated test cases provided in this project are in line with those mentioned in RFC 7928. RFC 7928 is an Informational RFC that provides a set of guidelines to characterise AQM algorithms.

Easy to Use

This project automates the cycle of simulation setup, topology creation, traffic generation, program execution, results collection and graphical representation (as recommended in RFC 7928).

Easy to Modify

The procedure to add a new AQM algorithm (such as the one designed by you) to this suite and compare its performance with others is very simple, provided the new algorithm is implemented in ns-3.

Available Scenarios

RFC Section	Scenario Name	Description
5.1.1	TCPFriendlySameInitCwnd	TCP flows with identical initial congestion windows
5.1.2	TCPFriendlyDifferentInitCwnd	TCP flows with varying initial congestion windows
5.2	AggressiveTransportSender	Single aggressive TCP flow (CUBIC variant)
5.3.1	UnresponsiveTransport	Single UDP flow without congestion control
5.3.2	UnresponsiveWithFriendly	UDP flow competing with TCP traffic
8.2.1	MildCongestion	Light network congestion scenario
8.2.2	MediumCongestion	Moderate network congestion scenario
8.2.3	HeavyCongestion	Heavy network congestion scenario

Configuration Options

Parameter	Description	Default
`--number`	Run scenario by RFC section number	-
`--name`	Run scenario by name or "All"	-
`--QueueDiscMode`	Queue discipline mode (PACKETS/BYTES)	PACKETS
`--isBql`	Enable Byte Queue Limits	false
`--ecn`	Enable Explicit Congestion Notification	false
`--BaseOutputDir`	Output directory path	aqm-eval-output

Looking for collaborators!

- Build automated congestion control evaluation tools
  - For ns-3: the idea is to extend ccperf (it already supports experiments compliant with RFC 9743)
  - For NeST: requires building the tool from scratch
    - will help test congestion control algorithms available in Linux (mainline/out-of-the-tree)
- Help required for:
  - Finalizing topology design and configurations
    - this includes choosing values for bandwidth, delay, and queue capacity
    - single bottleneck or multiple bottleneck topologies
  - Finalizing application mix for evaluation (large uploads/downloads, web traffic, etc)
  - Prioritizing sections of RFC 9743 for phase-wise implementation
  - Any other points to be taken into consideration while developing the evaluation framework

Thank you!

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