Update on NADA Evaluation Results

draft-ietf-rmcat-nada-13

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Updated NADA Draft Status

- Updated to version -13 to address comments from Genart and Secdir last call reviews and Telechat reviews
- No algorithmic changes; mostly revised discussions for clarification
- Detail of revisions summarized on mailing list

Updated NADA Implementation in Mozilla

- Incorporated all algorithm features — including non-linear delay warping and loss-based congestion signal penalties — as specified in the draft
- Added similar logging mechanism to the default rate adaptation module
- Enabled on-the-fly switching between NADA-based and default rate adaptation as browser configuration
- Updated code at: https://github.com/zhuxqing/gecko-dev/tree/nada2

Test Setup for Browser-based Evaluations

Firefox Nightly

- On-the-fly configuration to run either default or NADA-based bandwidth adaptation algorithm
- Logging of outgoing stats and per-packet feedback info
- NADA rate limit: R_max = 3 Mbps, R_min = 300 Kbps
- Default resolution: 720 p

Chrome

- Feedback interval @ 50ms with per-packet information (trans_cc ON)
- Stats monitoring of incoming flow displayed via *webrtc-internals* tab

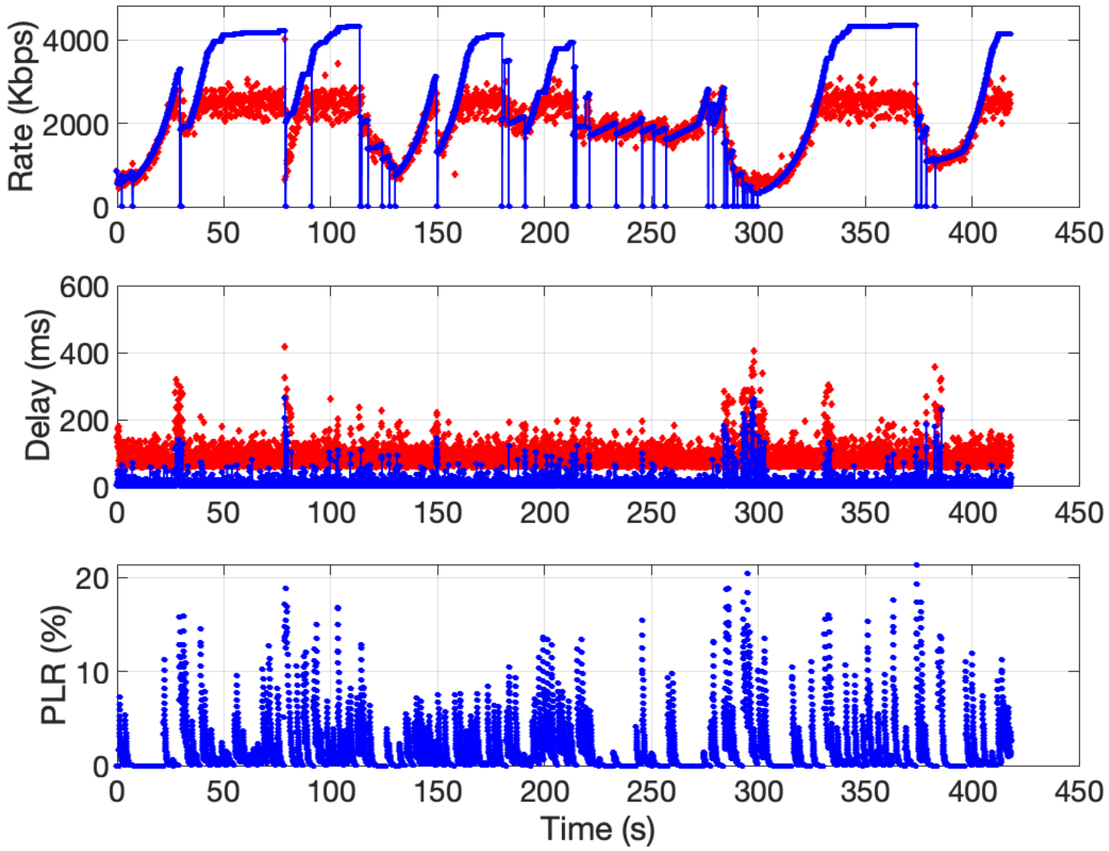
Comparing Default and NADA Algorithms

- Comparison mechanism:
  - *Back-to-back* sessions between the same sender/receiver pair
  - *Parallel* sessions sharing the same path and sender/receiver pair

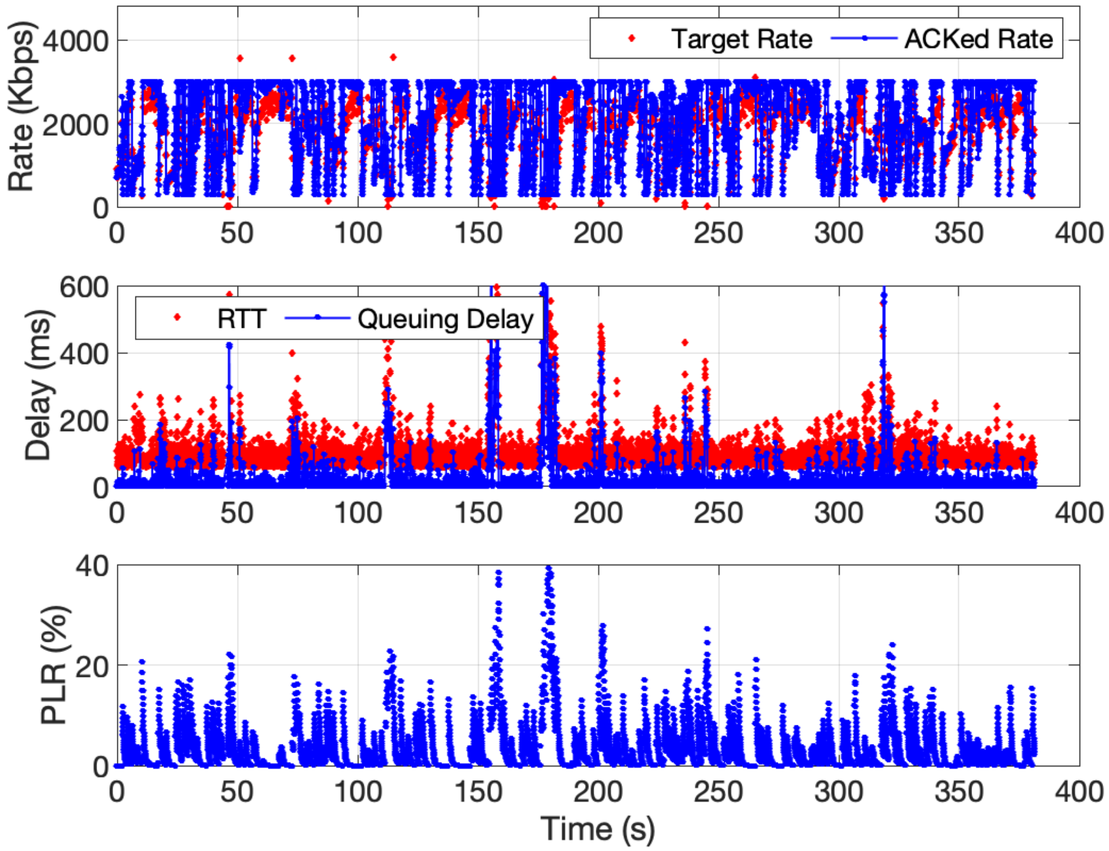
- Evaluation scenarios:
  - *Cross-Continent:* between Austin, Texas and San Jose, California in US; both sides connected via enterprise-grade Wi-Fi
  - *Cross-Atlantic:* between Austin, Texas, USA (home Wi-Fi connected to Google Fiber) and Valencia, Spain (enterprise-grade Wi-Fi)

Cross-Continent Sessions: *Back-to-Back*

Default



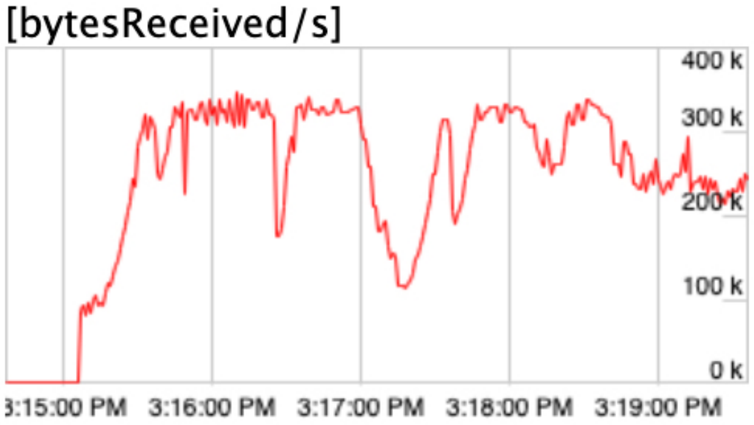
NADA

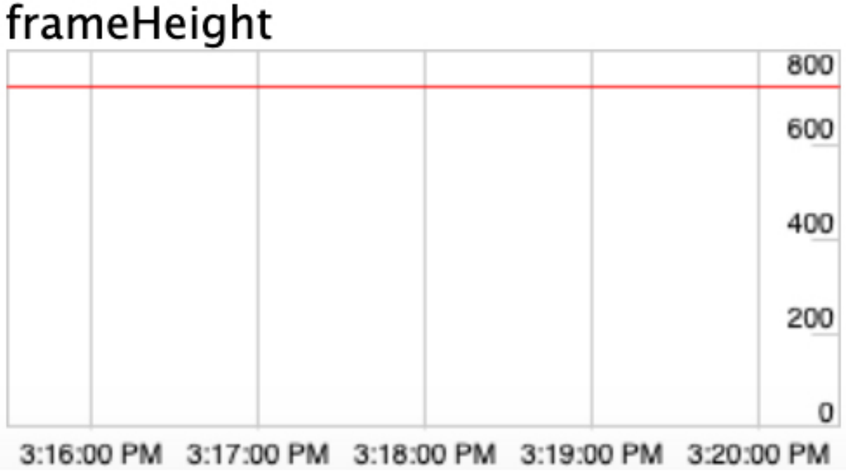


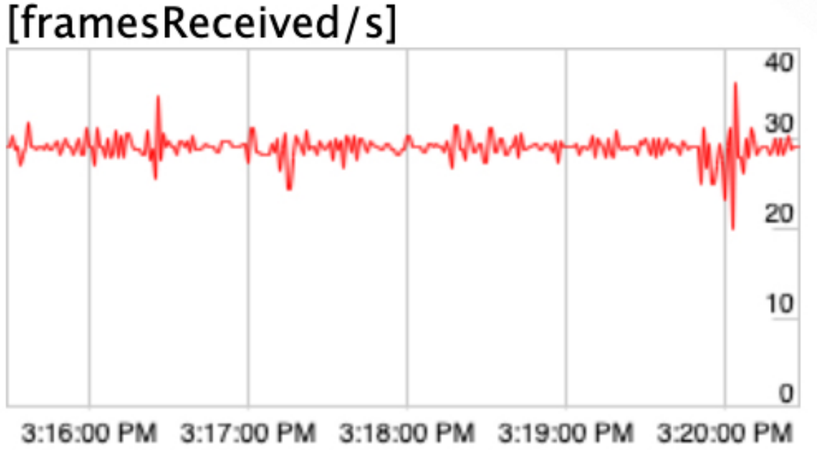
Path Characteristic: Baseline RTT: ~60ms | Max RTT: ~2.2 s

Cross-Continent Sessions: *Back-to-Back* Screenshot from Chrome Browsers

Default







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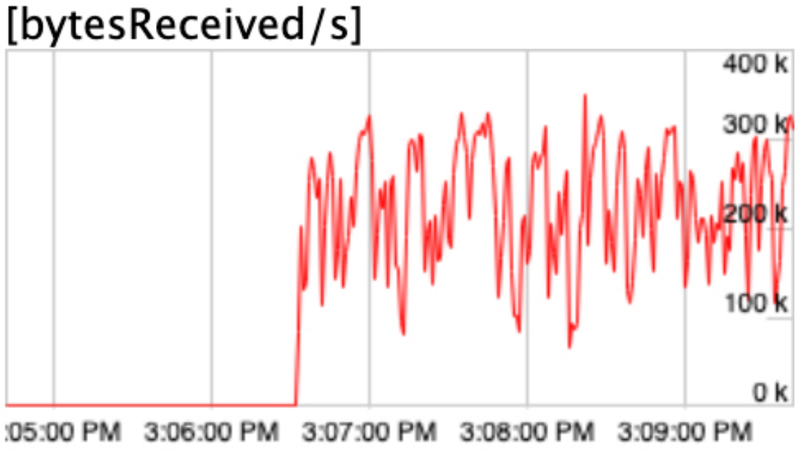
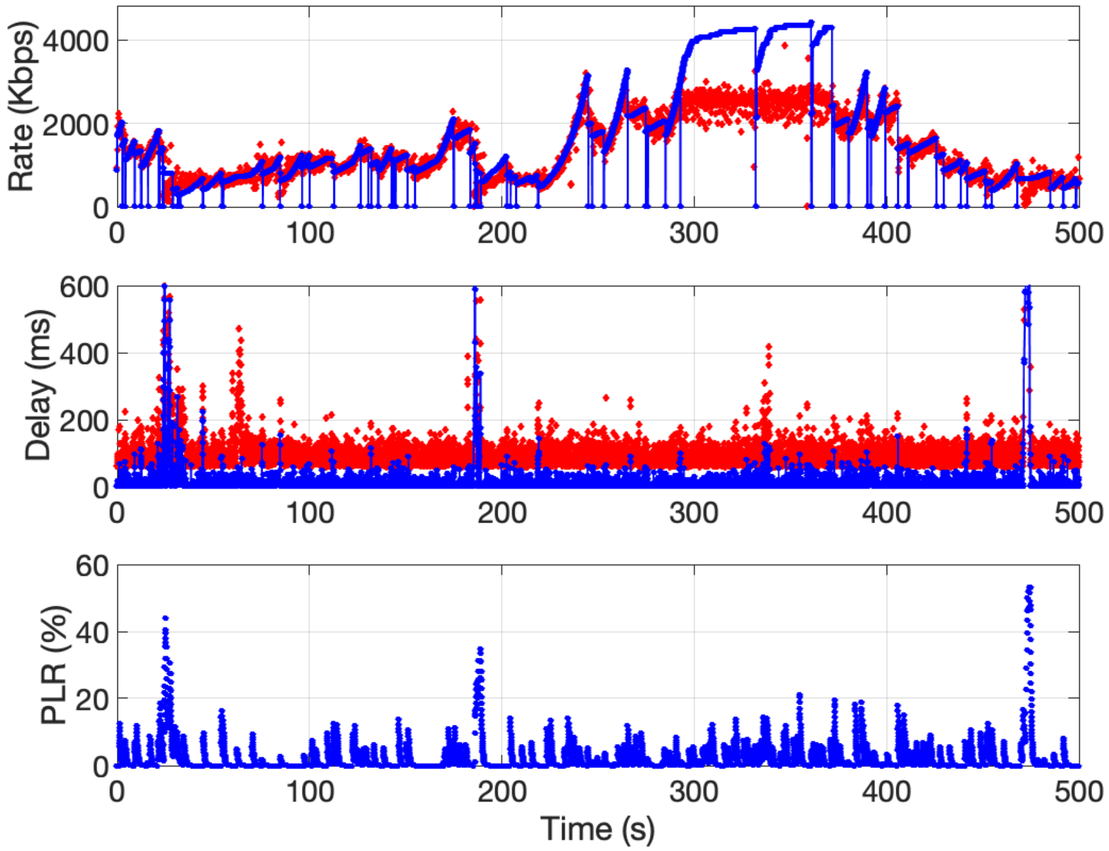


Cross-Continent Sessions: *Parallel*

Default



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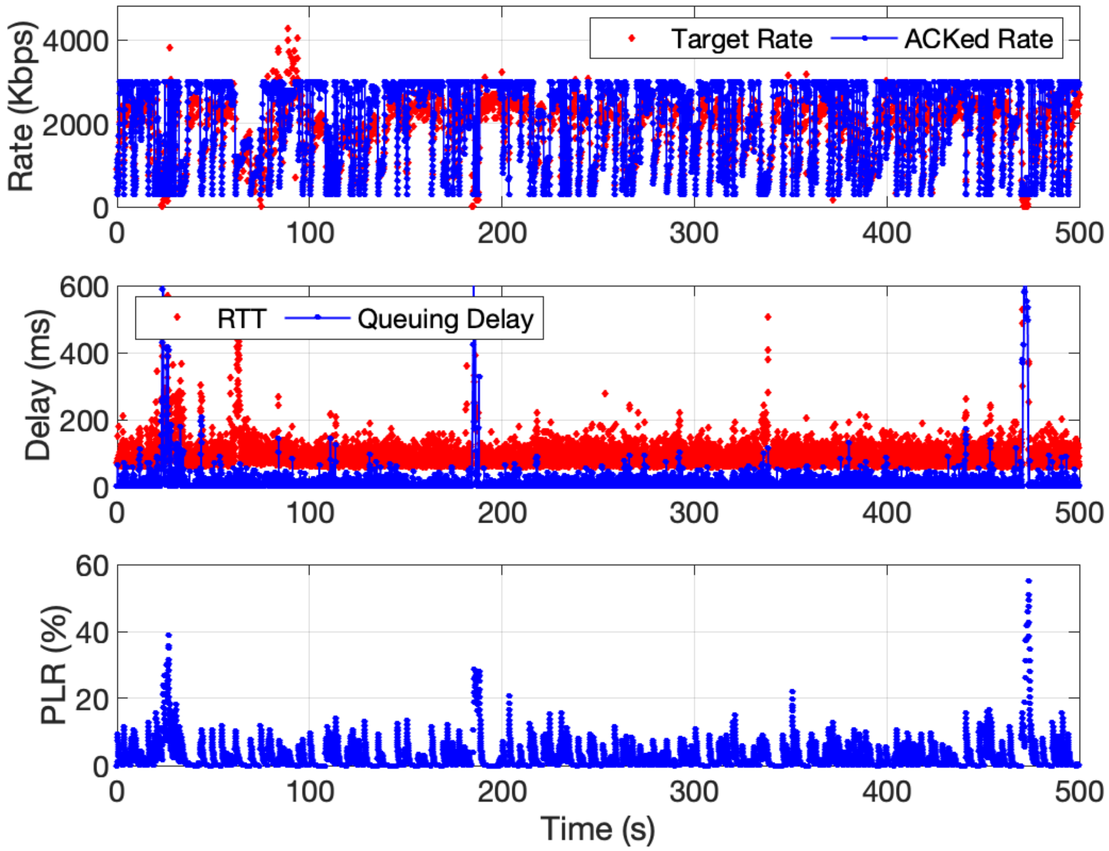

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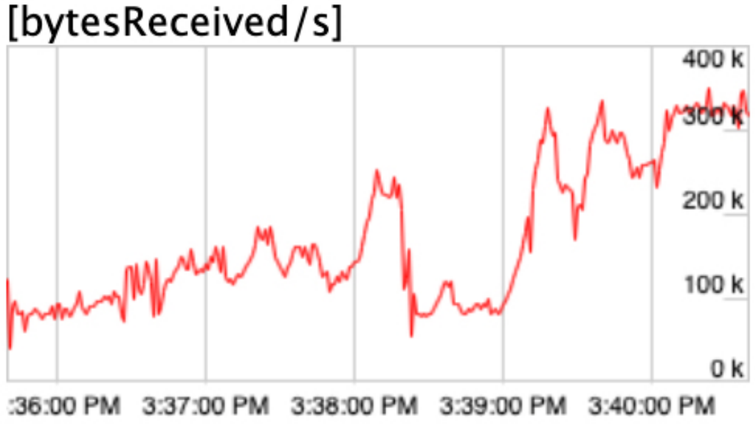
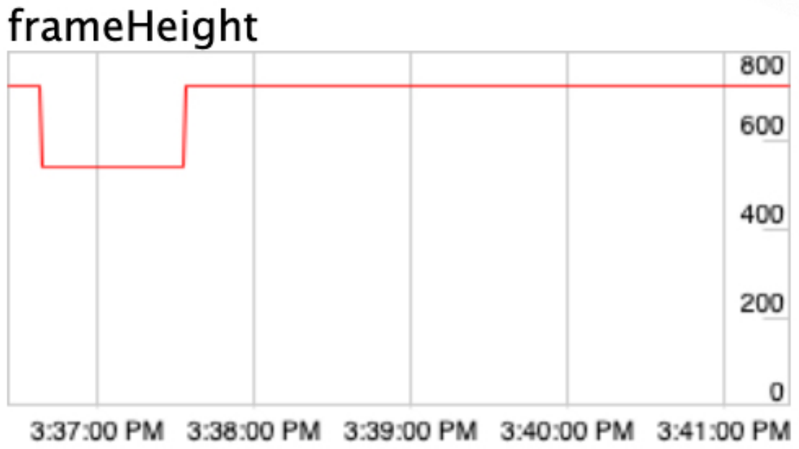
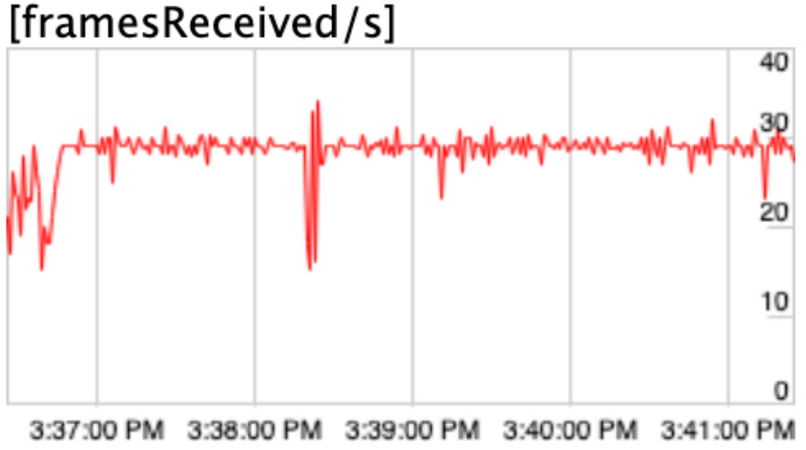
Cross-Continent Sessions: *Parallel* Screenshot from Chrome Browsers

Default







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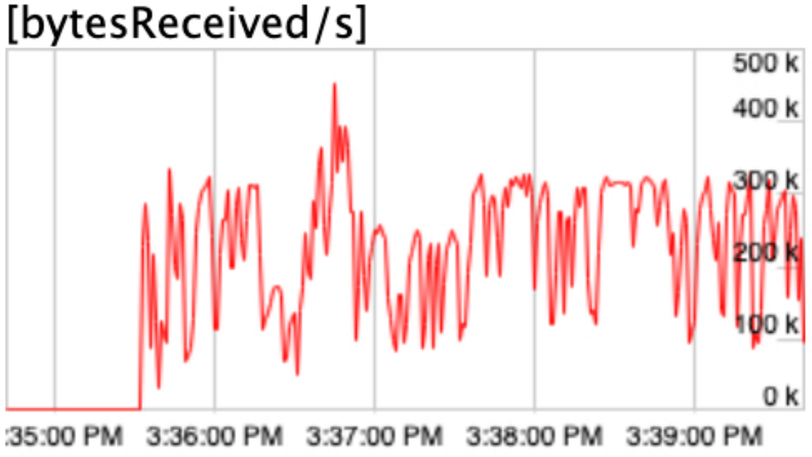
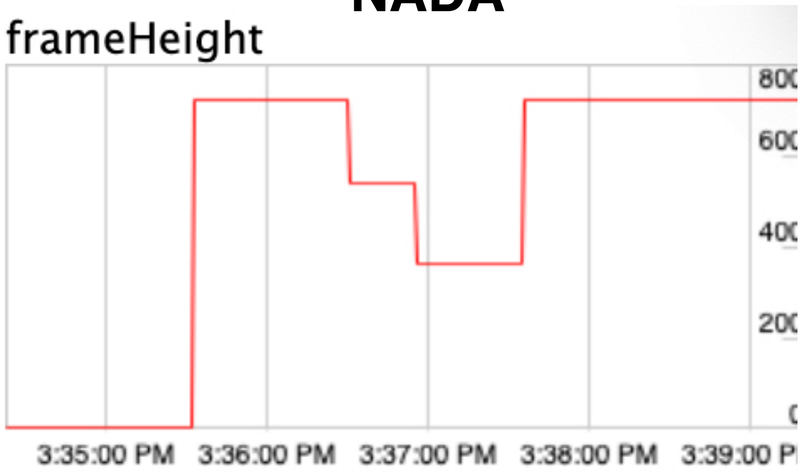
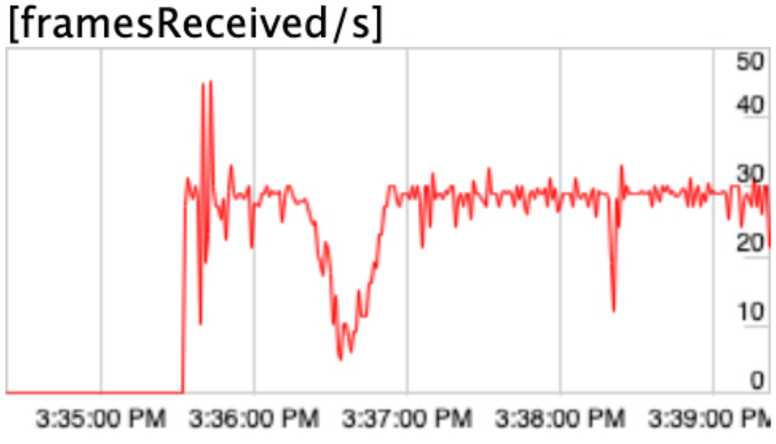
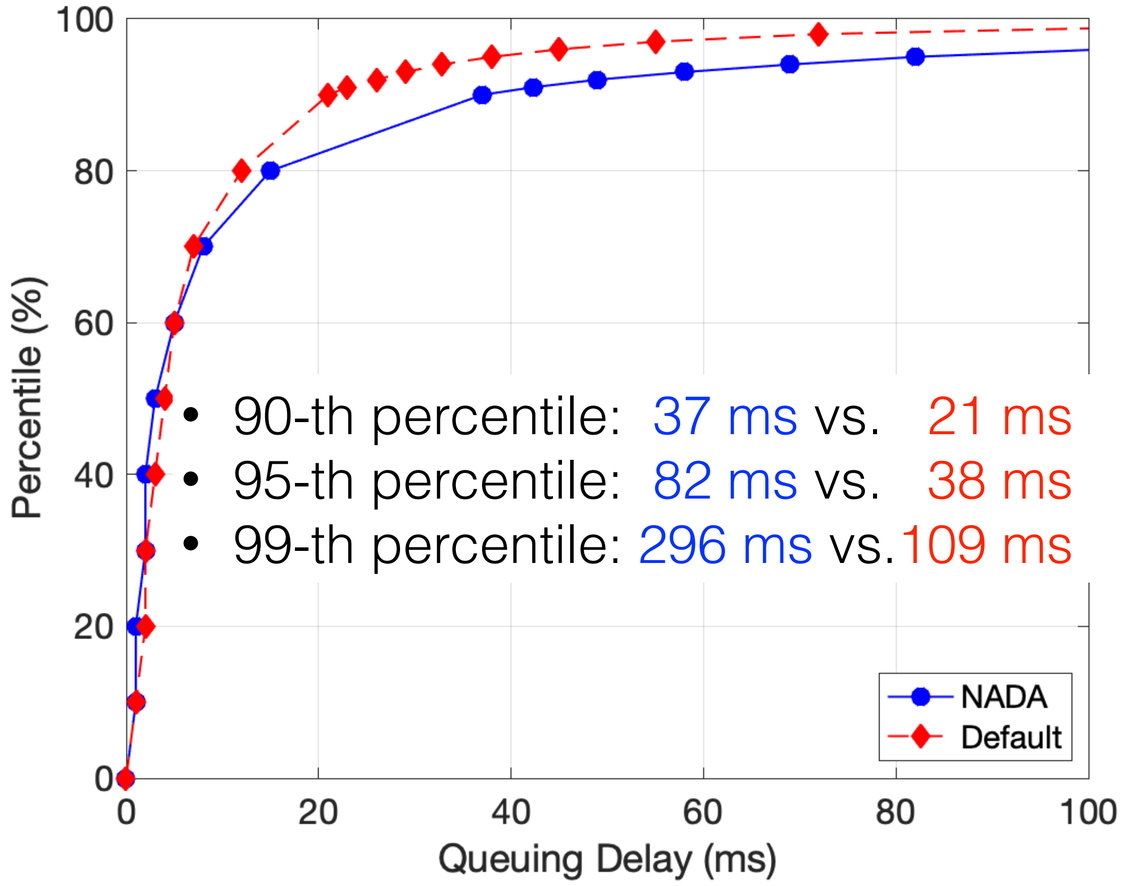




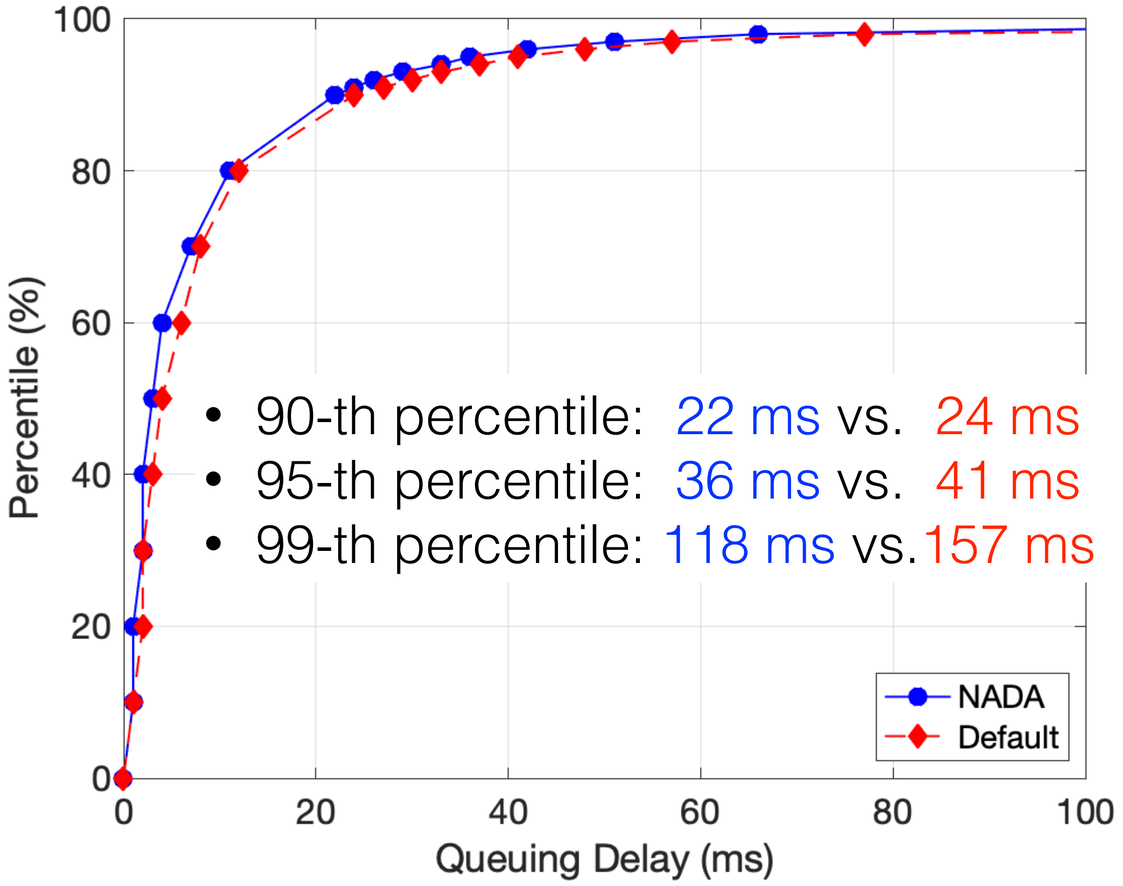


Cross-Continent Sessions: Comparison of Queuing Delays

Back-to-Back Sessions

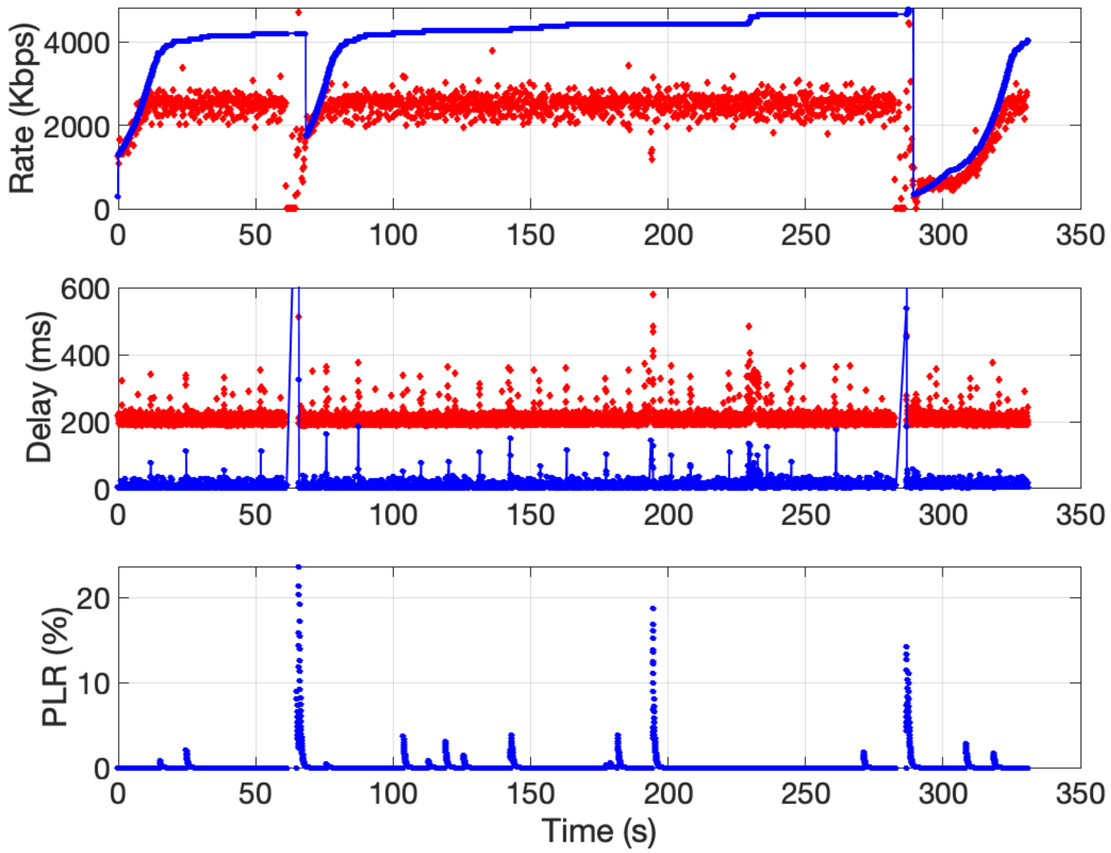


Parallel Sessions



Cross-Atlantic Sessions: *Back-to-Back*

Default



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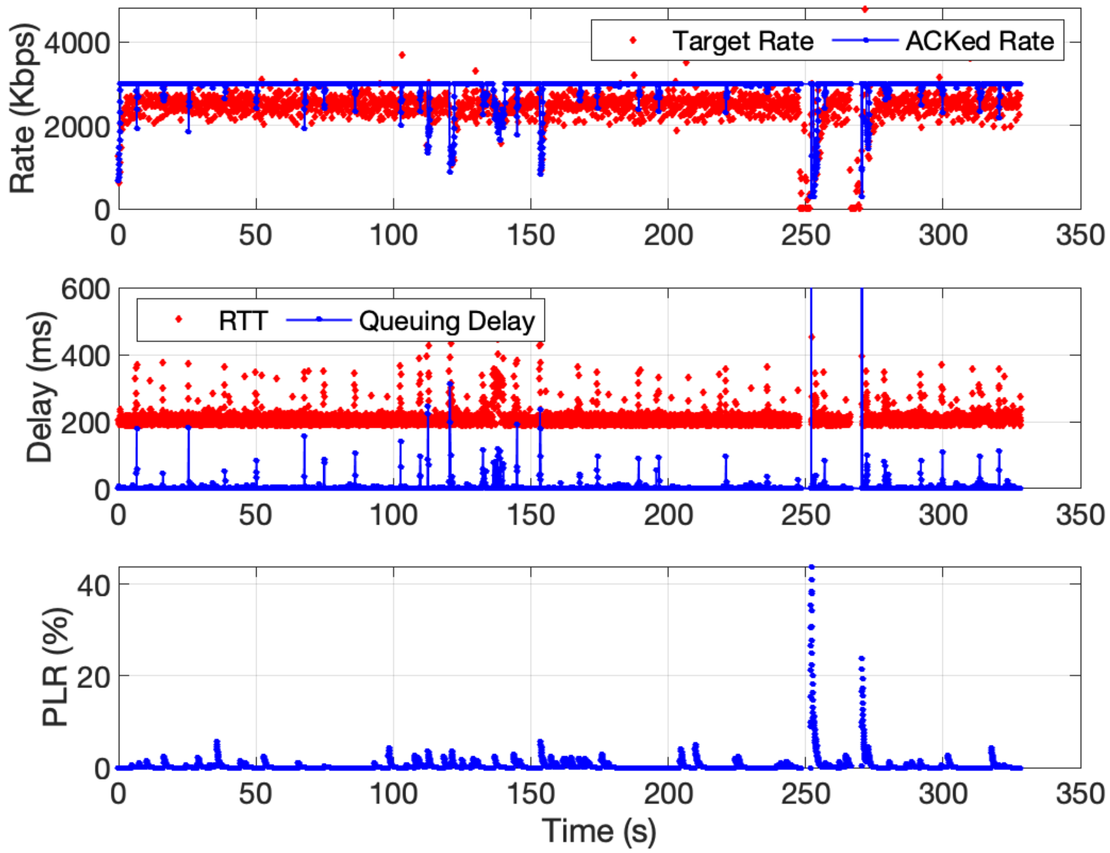
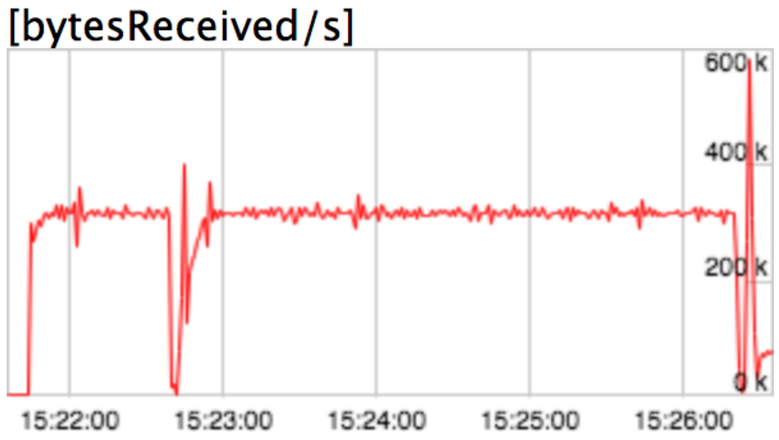
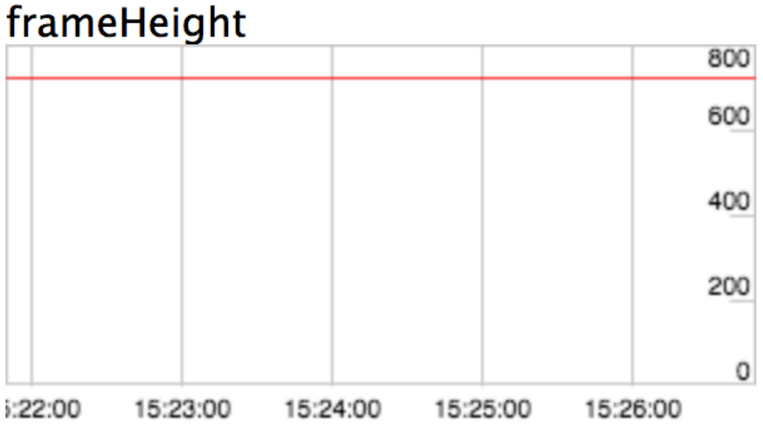


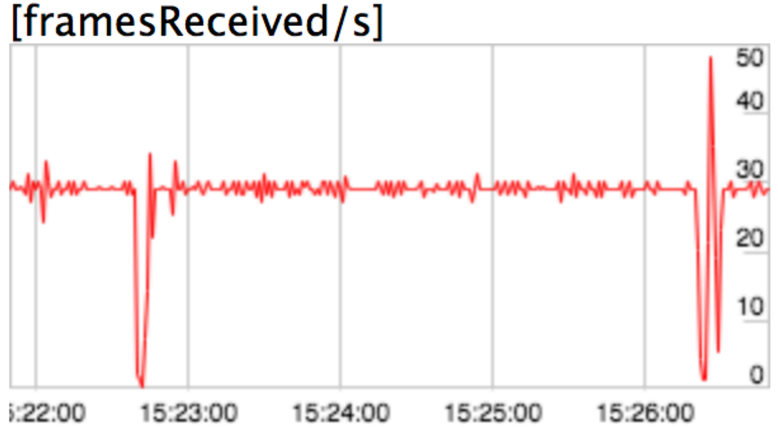
Path Characteristic: Baseline RTT: ~190ms | Max RTT: ~4.5 s

Cross-Atlantic Sessions: *Back-to-Back*
Screenshots from Chrome Browser

Default







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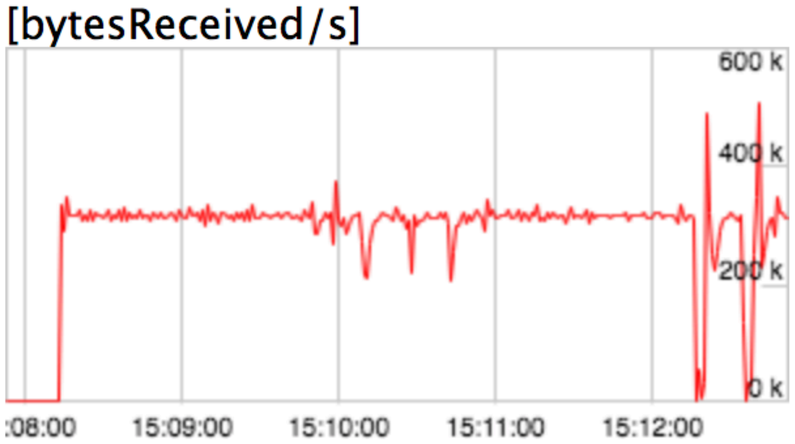
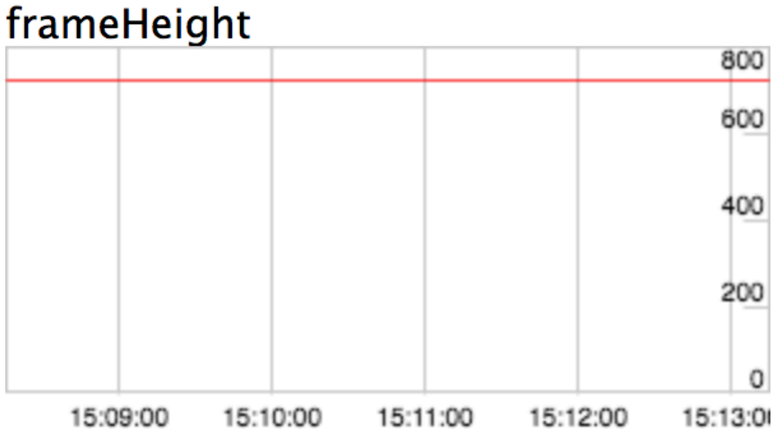
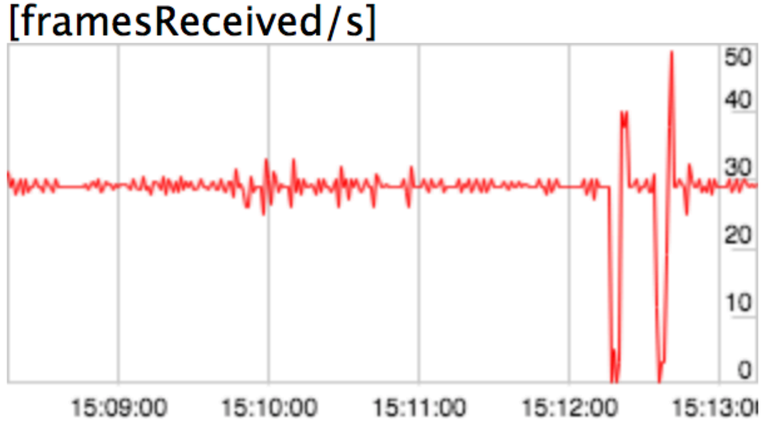
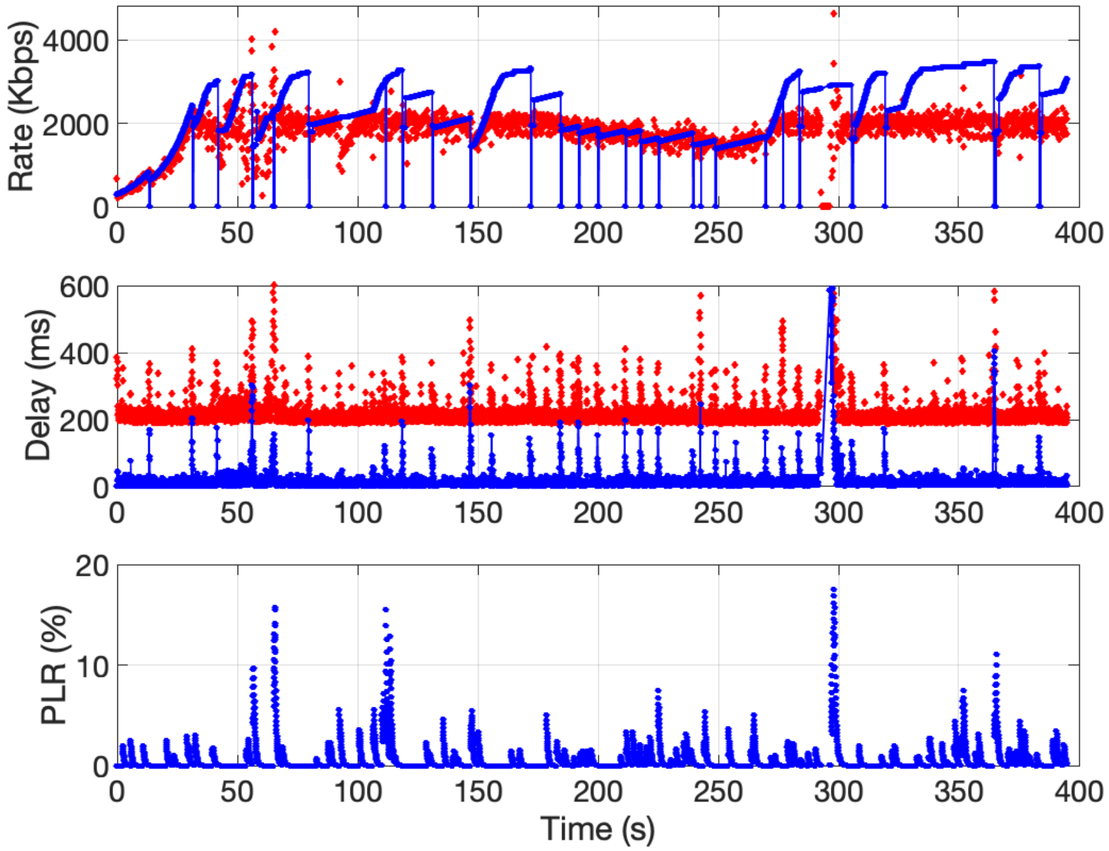






Cross-Atlantic Sessions: *Parallel*

Default



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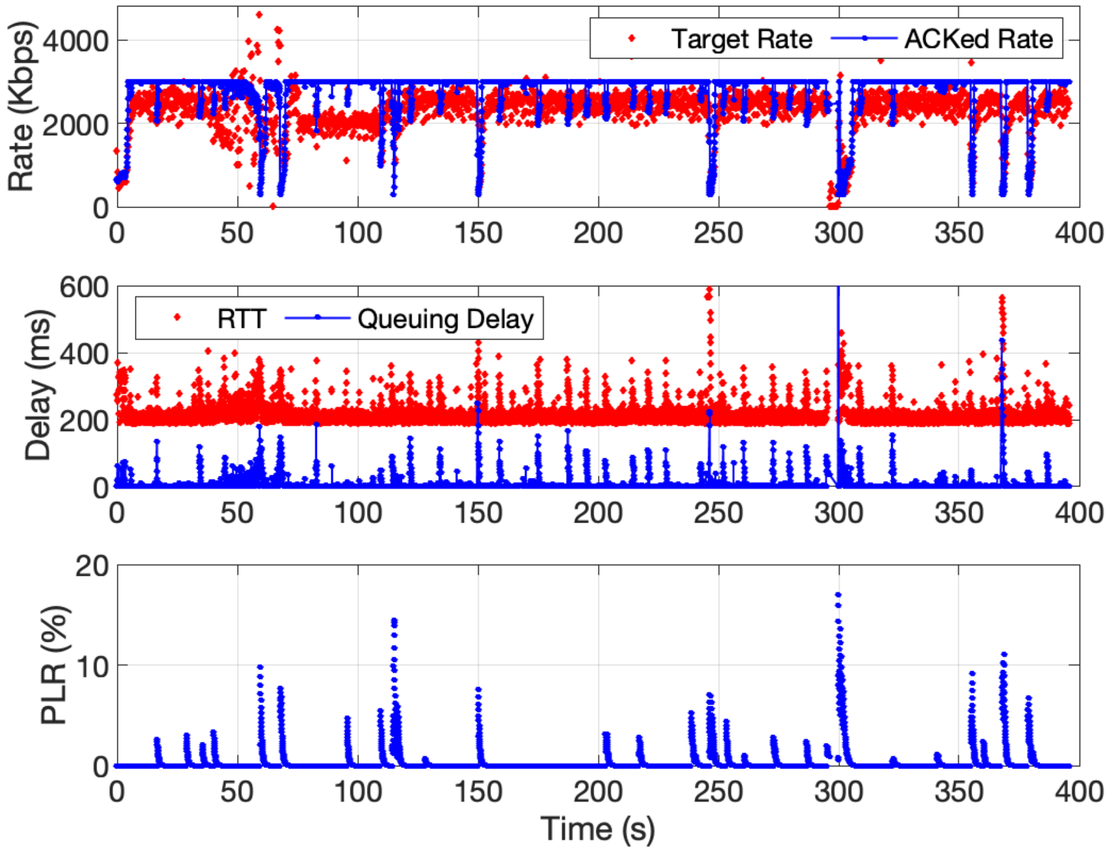

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Cross-Atlantic Sessions: *Parallel* Screenshots from Chrome Browser

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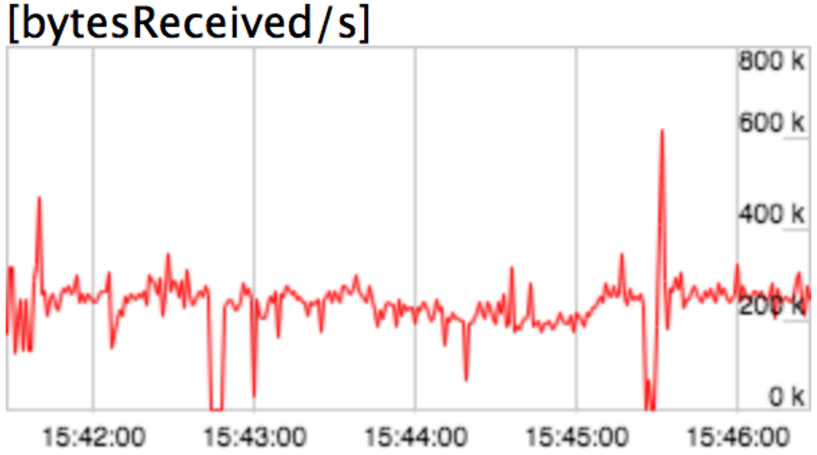
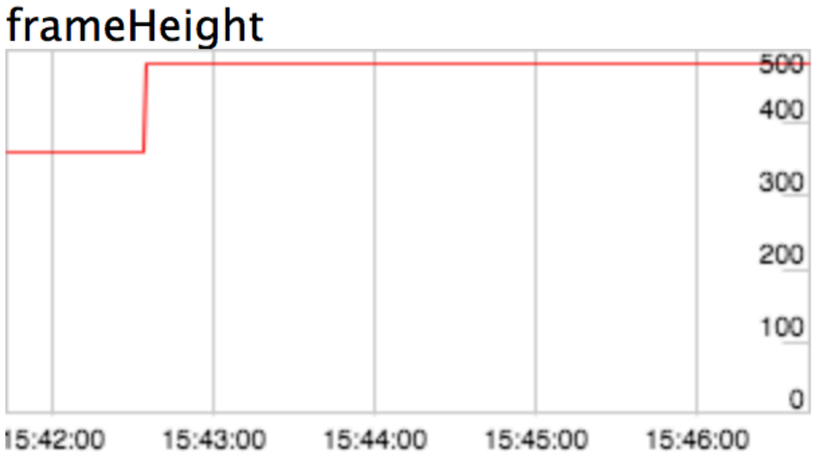
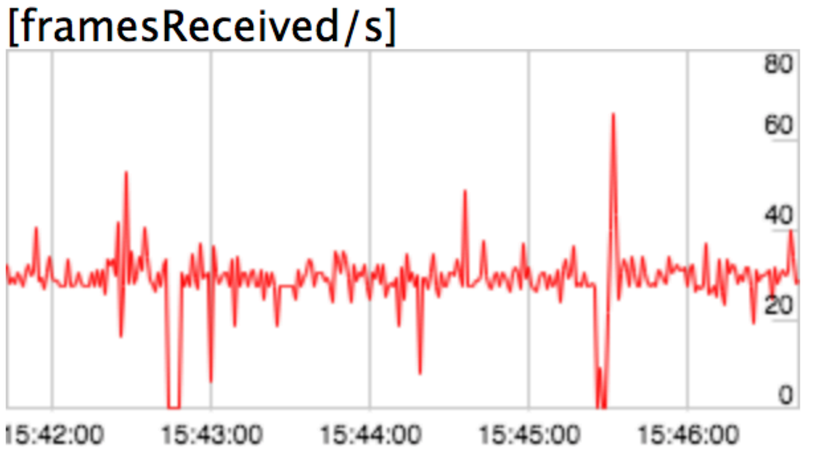
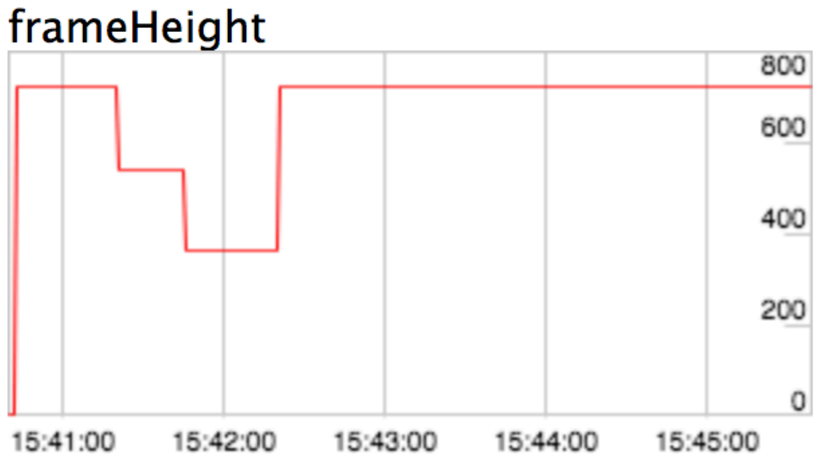


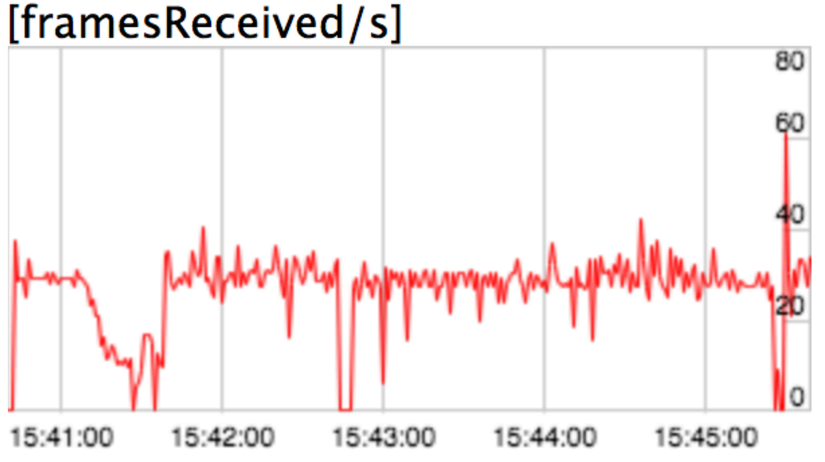




NADA

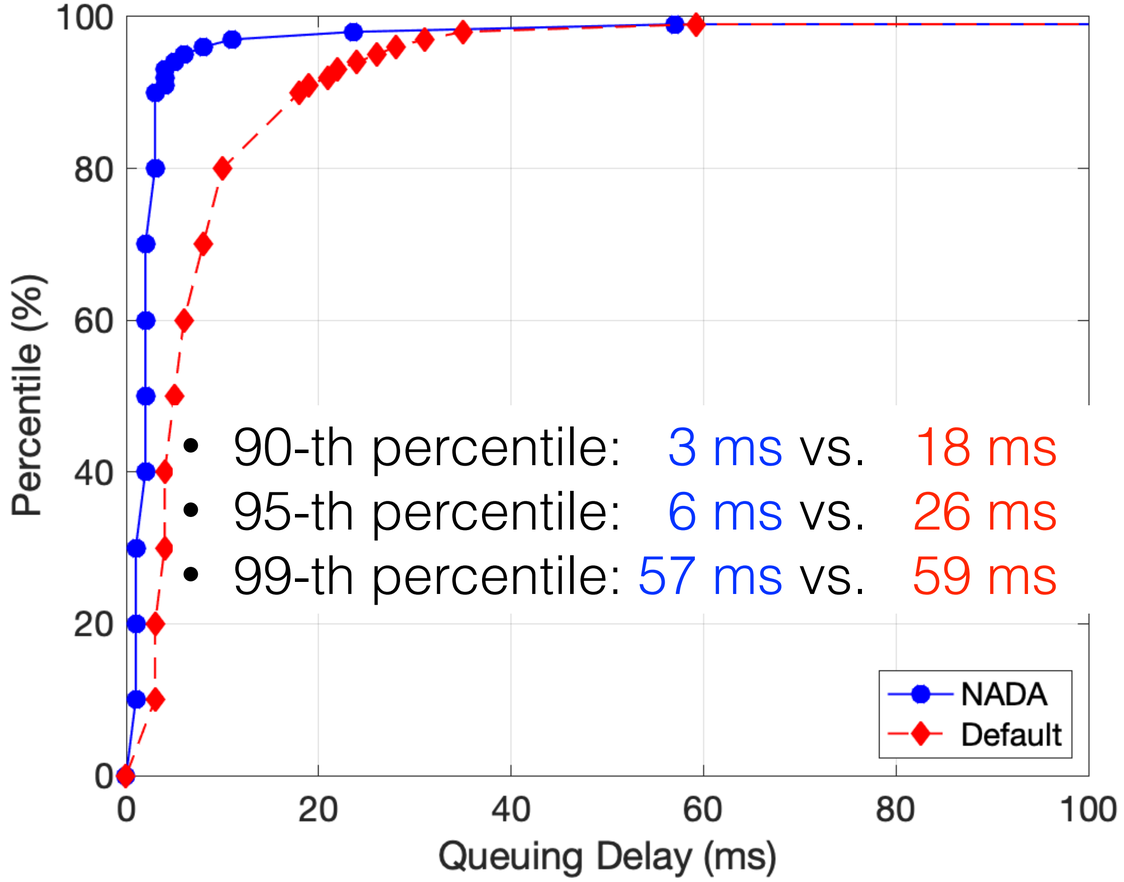
Forgot to capture





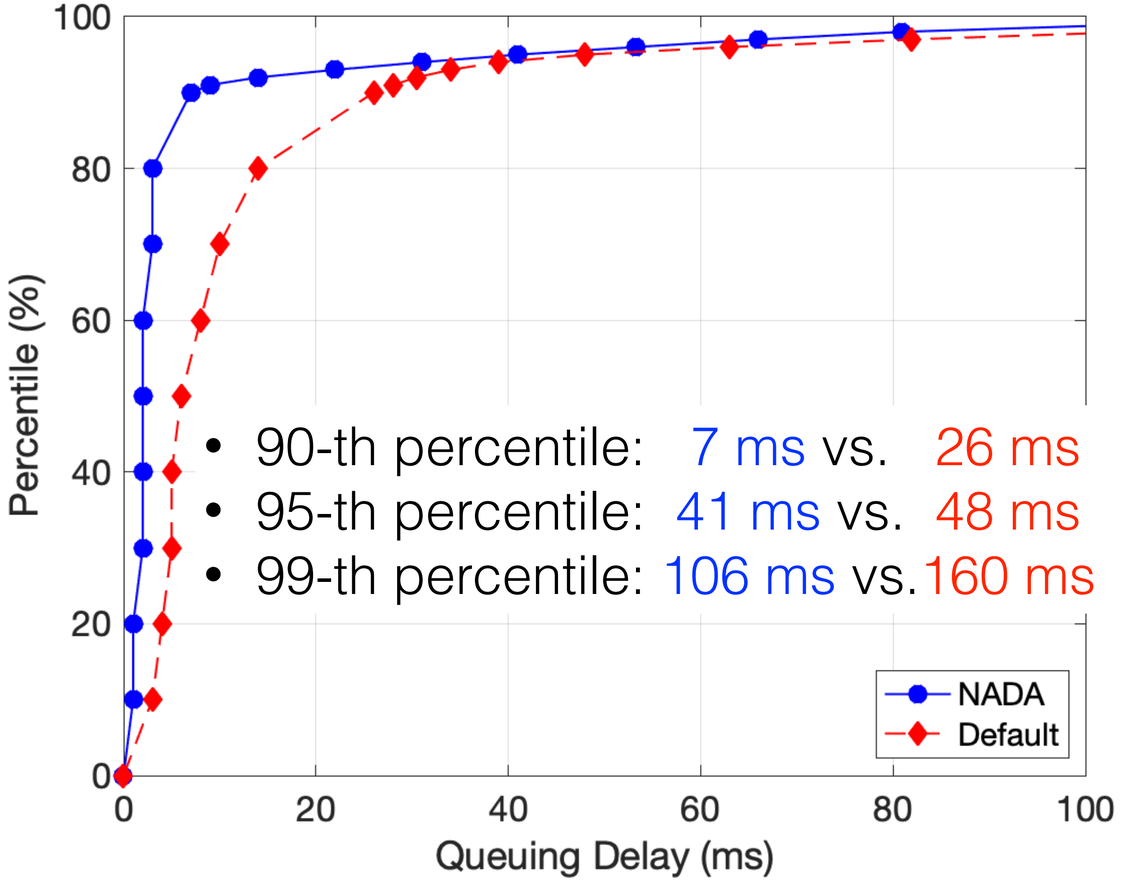
Cross-Atlantic Connection: Comparison of Queuing Delays

Back-to-Back Sessions



- 90-th percentile: 3 ms vs. 18 ms
- 95-th percentile: 6 ms vs. 26 ms
- 99-th percentile: 57 ms vs. 59 ms

Parallel Sessions



- 90-th percentile: 7 ms vs. 26 ms
- 95-th percentile: 41 ms vs. 48 ms
- 99-th percentile: 106 ms vs.160 ms

Observations and Next Steps

- Fast initial ramp up to maximum allowed rate, typically within a few seconds
- Recovers quickly from temporary losses and queuing delay spikes
- Effectively limits queuing delay build up (90-th percentile below
- Does not starve competing WebRTC flows with default rate adaptation behavior
- Further investigations:
  - Performance over bandwidth-limited connections, e.g., over LTE links
  - Coexistence of multiple NADA-based streams
  - Coexistence with TCP-like background traffic