Dual Queue & AQM
Interplay Between CCAs and Speed Tests

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CCAs, Speed Tests & AQM/Dual Queue

Comcast deployed ultra low latency to internet customers in the US:
- Downstream AQM (DOCSIS-PIE, RFC 8034)
- Dual queue (L4S & NQB) in downstream and upstream
- Deployed to over 7.5 million homes so far (and growing) ~270M devices

Bandwidth capacity tests (aka speed tests) used for service assurance, troubleshooting, compliance

Interesting: What happens when you have a capacity test with working latency (latency under load) that pushes the connection to a congested state and the underlying congestion control algorithm is new?

Existing Capacity Test

- An aggregate bandwidth capacity test
- Embedded into home gateways
- Bandwidth test uses iPerf3 and runs on TCP
- 700,000+ tests run per day – both scheduled (randomly) and on-demand (user-prompted, technician-prompted, AI/ML-triggered)

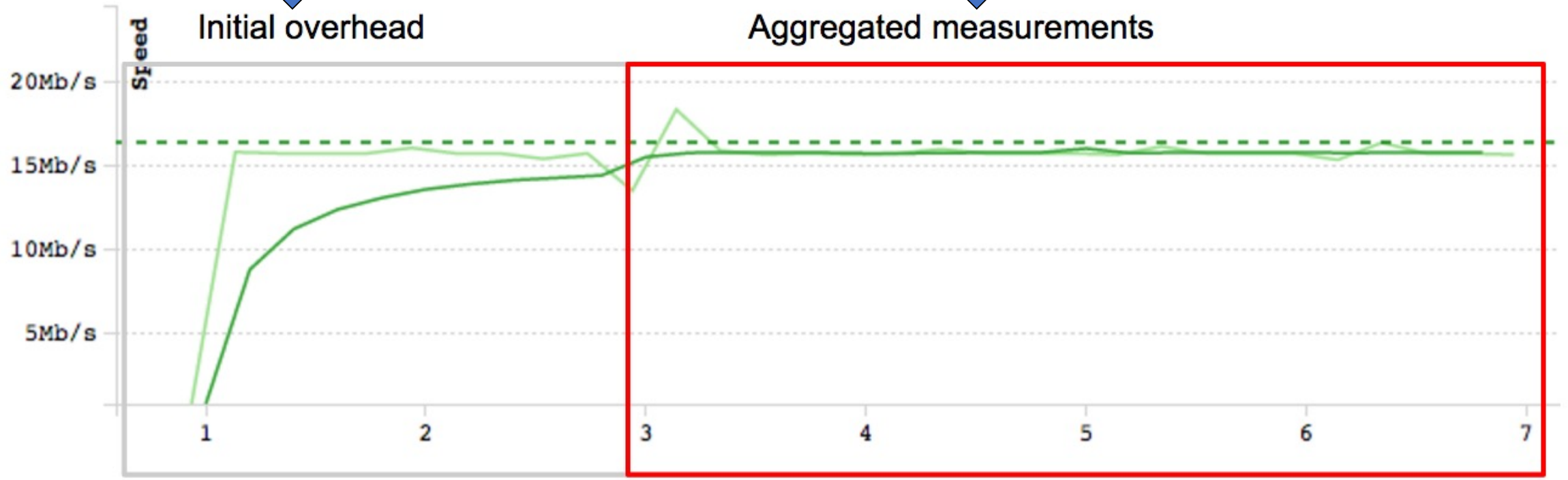
Key parameters of the existing test:

- Protocol (TCP)
- Number of parallel connections
- Omit time
- Duration time

Existing Capacity Test

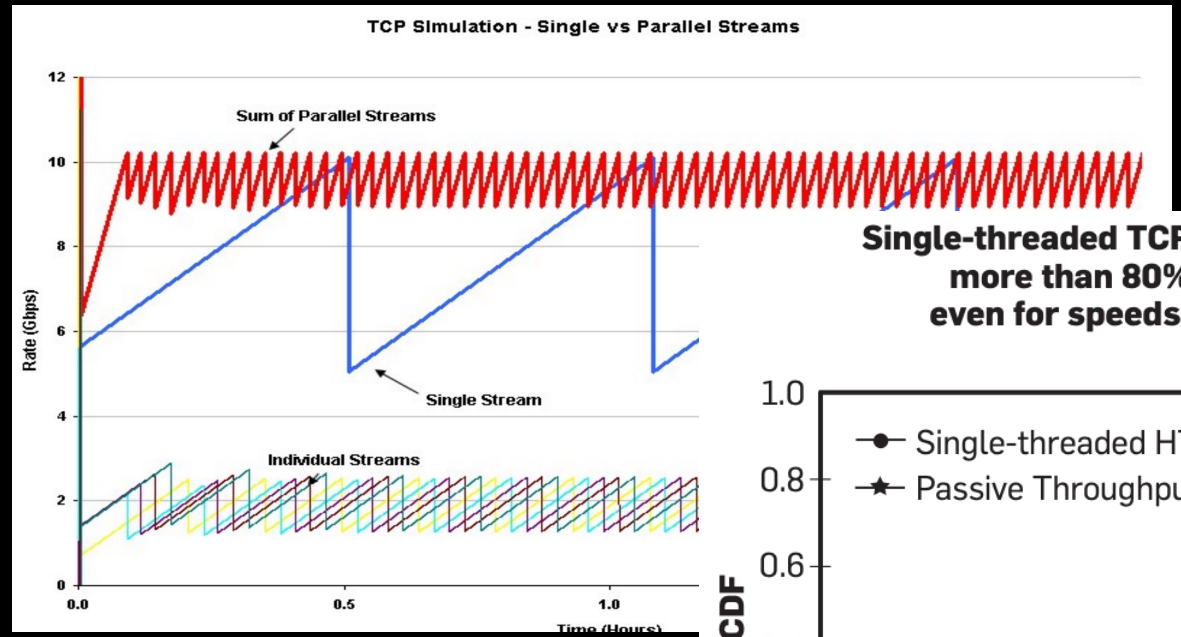
Ramp Up - Omit Time

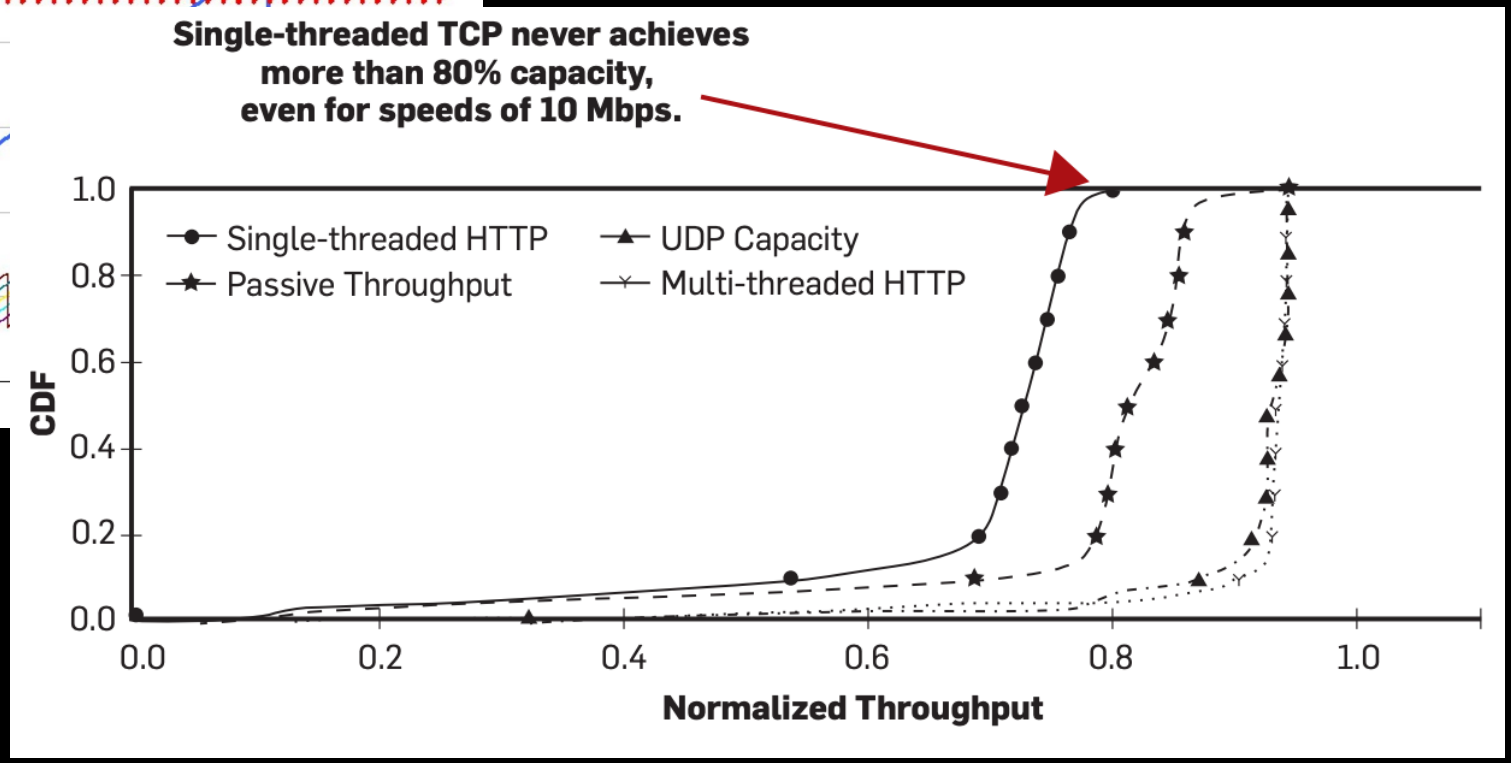
Steady State – Duration



Existing Capacity Test

One connection insufficient for aggregate capacity test, hence parallel connections

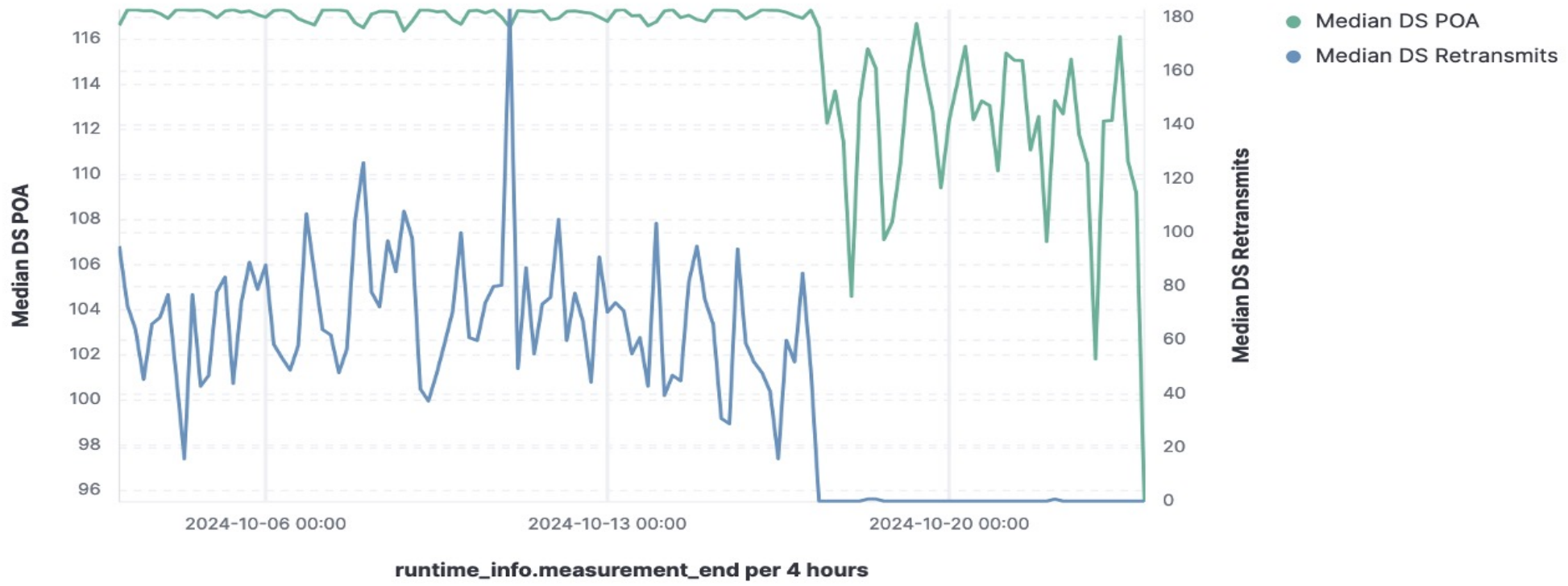




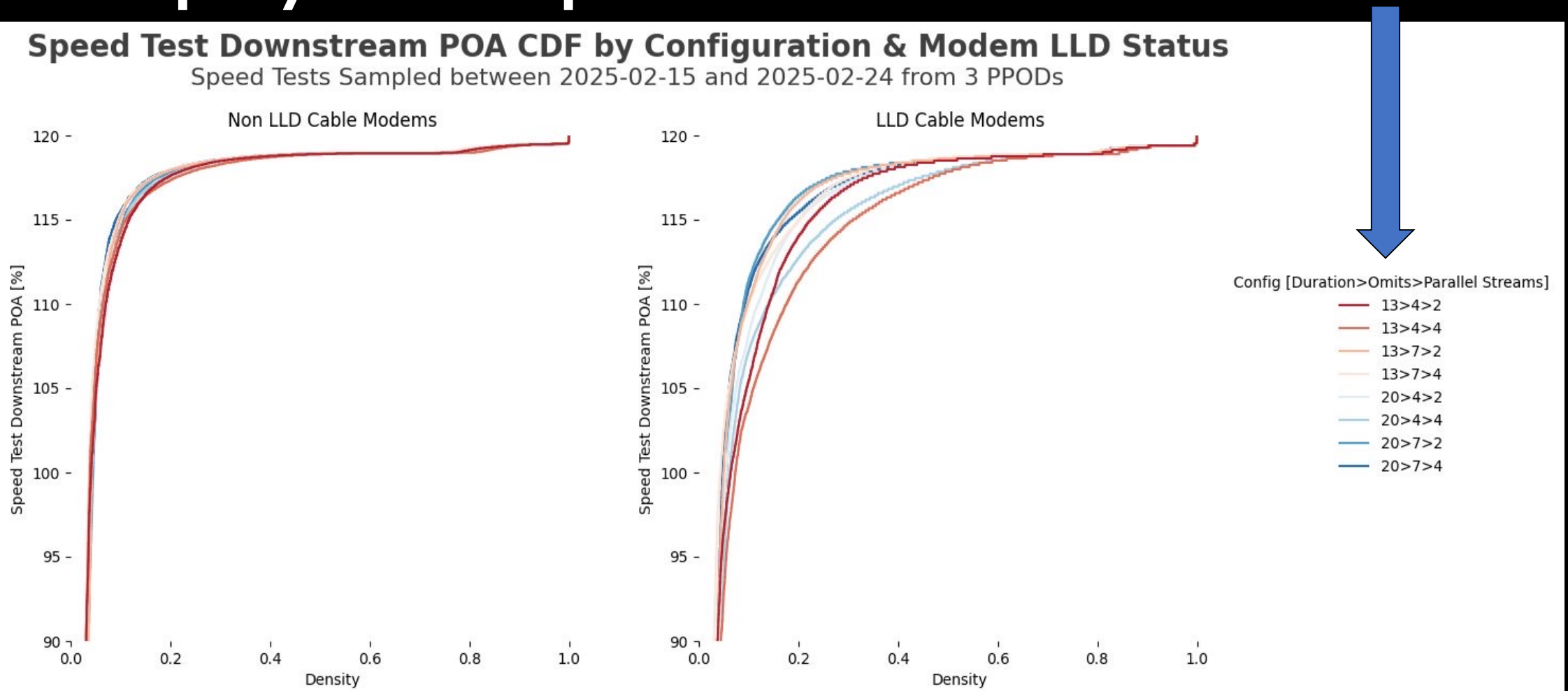
Existing Capacity Test

MAAOPP201

We don't see normal retransmit traffic? LOL



Deployment Update



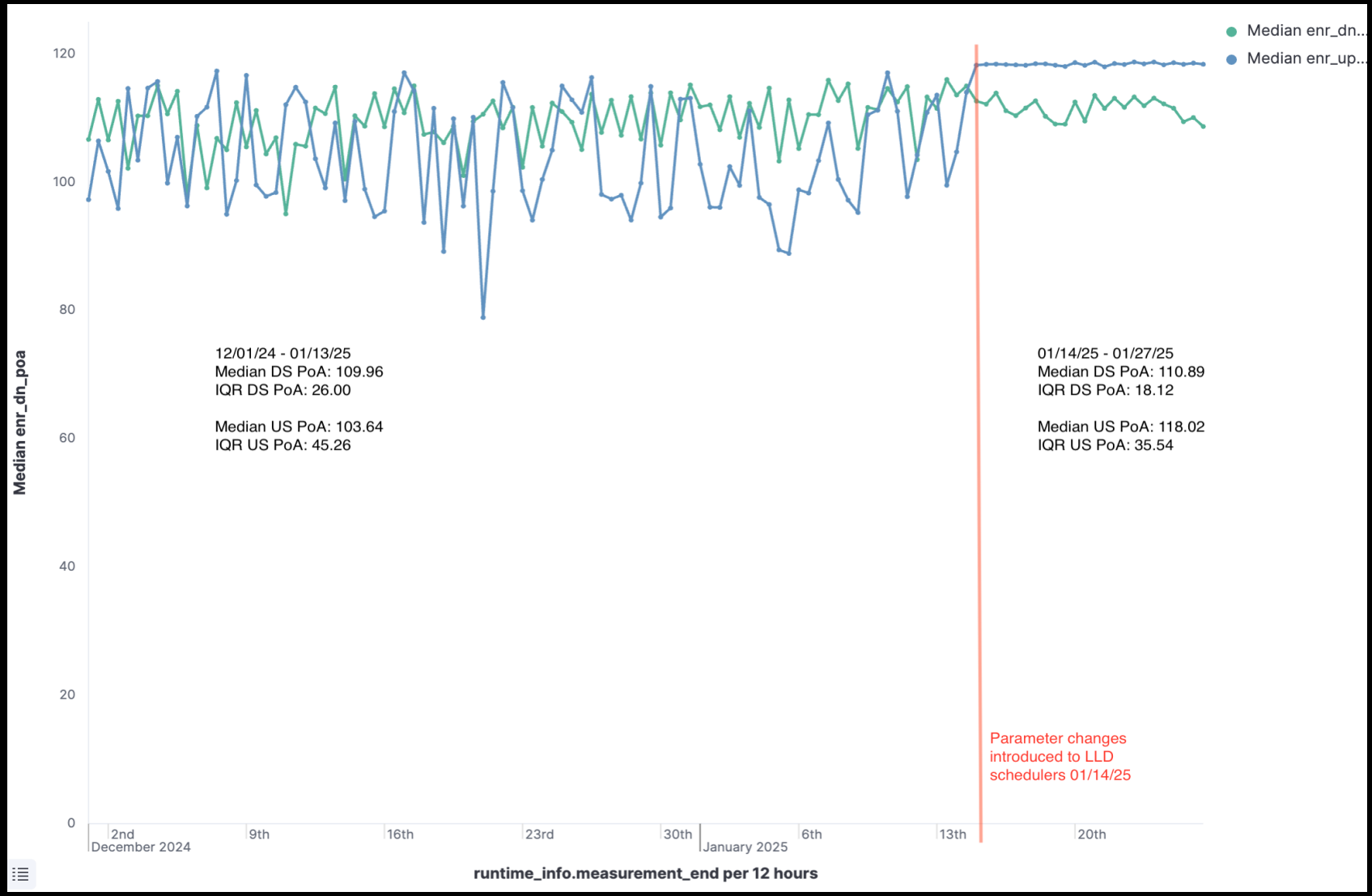
Speed test downstream performance as measured by percent-of-advertised (POA) speed achieved from non-errored tests ran on 300, 500, 800, 1000 Mbps advertised speed tiers. The scheduler ran tests on non LLD and LLD cable modems using pre-selected configurations on PPODs: CABAPP106, CABJPP102, FLNDPP107.

DS AQM Deployed

IMP Downstream classic latencies drop due AQM (DOCSIS PIE) algorithm implementation.

- DS AQM DOCSIS PIE algorithm improved Classic Flow latency (~50 ms loaded latency to near ~25ms)
  - This is loaded latency in the classic queue – due to Active Queue Management (AQM).
  - Classic flow AQM is required for LLD to influence LL queue marking density and will be deployed for all users in vCMTS 2.27

Deployment Update



Summary

- TCP-based bandwidth tests are used for many operational monitoring purposes (e.g., service assurance, troubleshooting).
- But the measurement results fundamentally change when new access network and CPE AQMs are introduced!
- Developers/users of such tests should be prepared to update test parameters.
- Questions:
  - What are better methods? UDP-based?
  - Time to de-emphasize bandwidth tests? (easier said than done)
  - Introduce new latency-focused measures such as Responsiveness Under Working Conditions? (https://datatracker.ietf.org/doc/draft-ietf-ippm-responsiveness/)

Questions?