Performance effects of DNSSEC validation

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Hypothesis

- "DNSSEC validation requires more resources"
  - Is that valid in 2022?
- What "resources," specifically?
  - Latency, bandwidth, OS sockets, CPU, memory?

Test data set: source

- Real traffic capture
  - Anonymized
  - European telco, February 2022
    - Lots of signed domains!
  - Mix of landline & mobile clients

Test data set: scaling

- Testing with 9 – 135 k QPS
  - "Queries are not equal"
    - Cache hit/miss, size, ...
- Down-sampling
  - A client IP address randomly included/excluded
    - All queries from a given client included/excluded

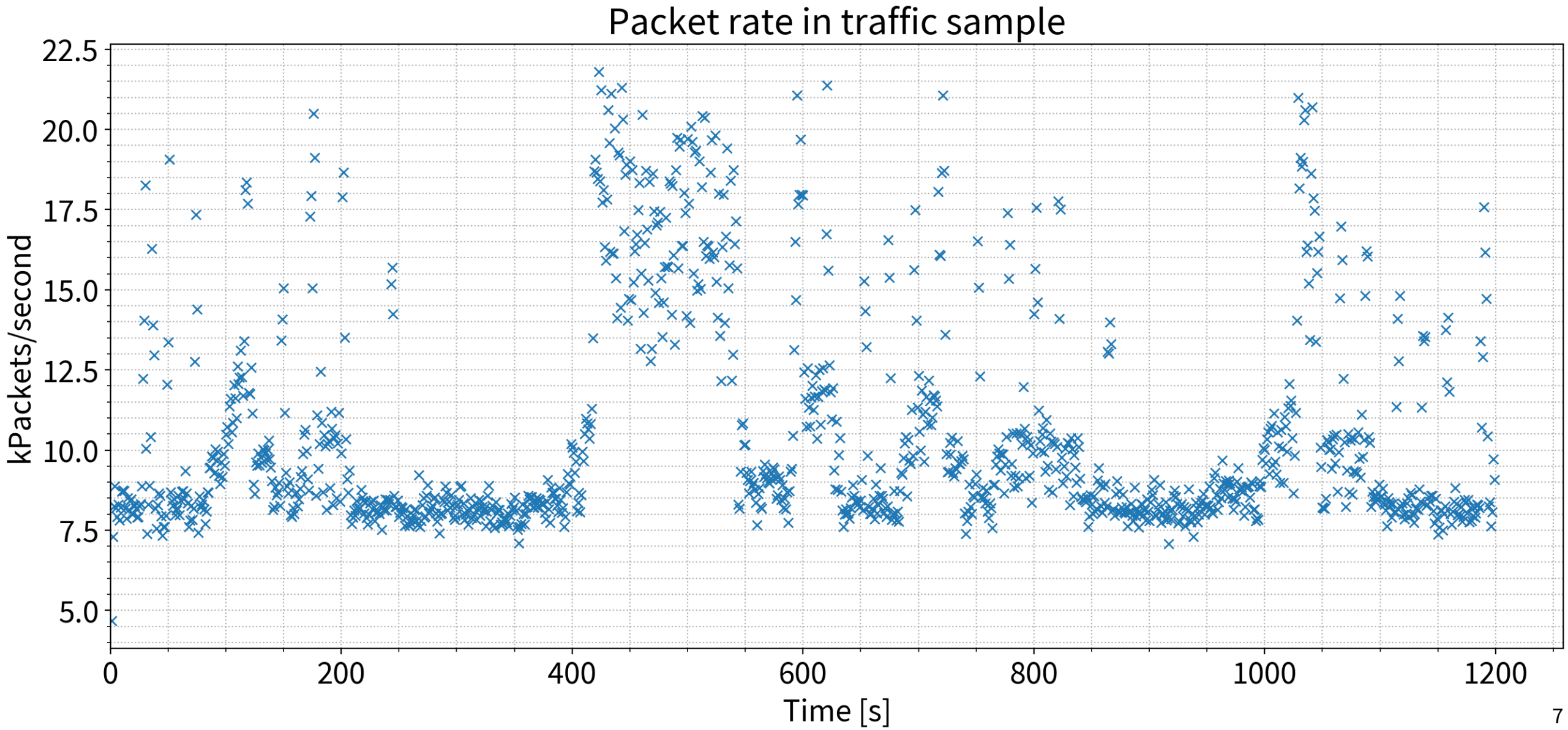
Test setup

- Resolver: BIND 9.18.4
  - Empty cache, validation on/off
- Client simulator: DNS Shotgun
  - Keeps query timing/cache hit rate
- Live Internet
  - Measure, rinse, repeat: 10 times
- Custom resource monitoring

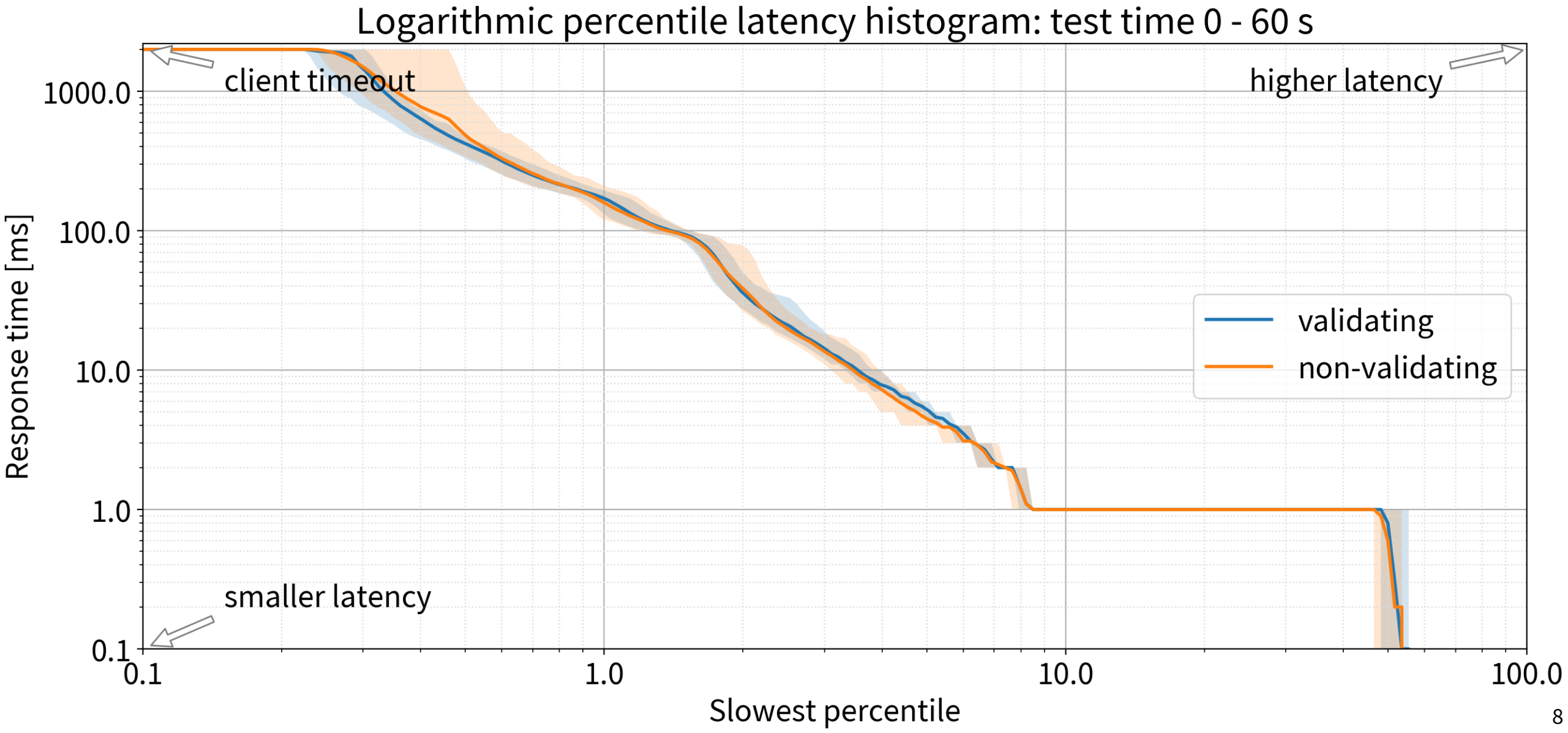
Scenario # 1

9 k QPS

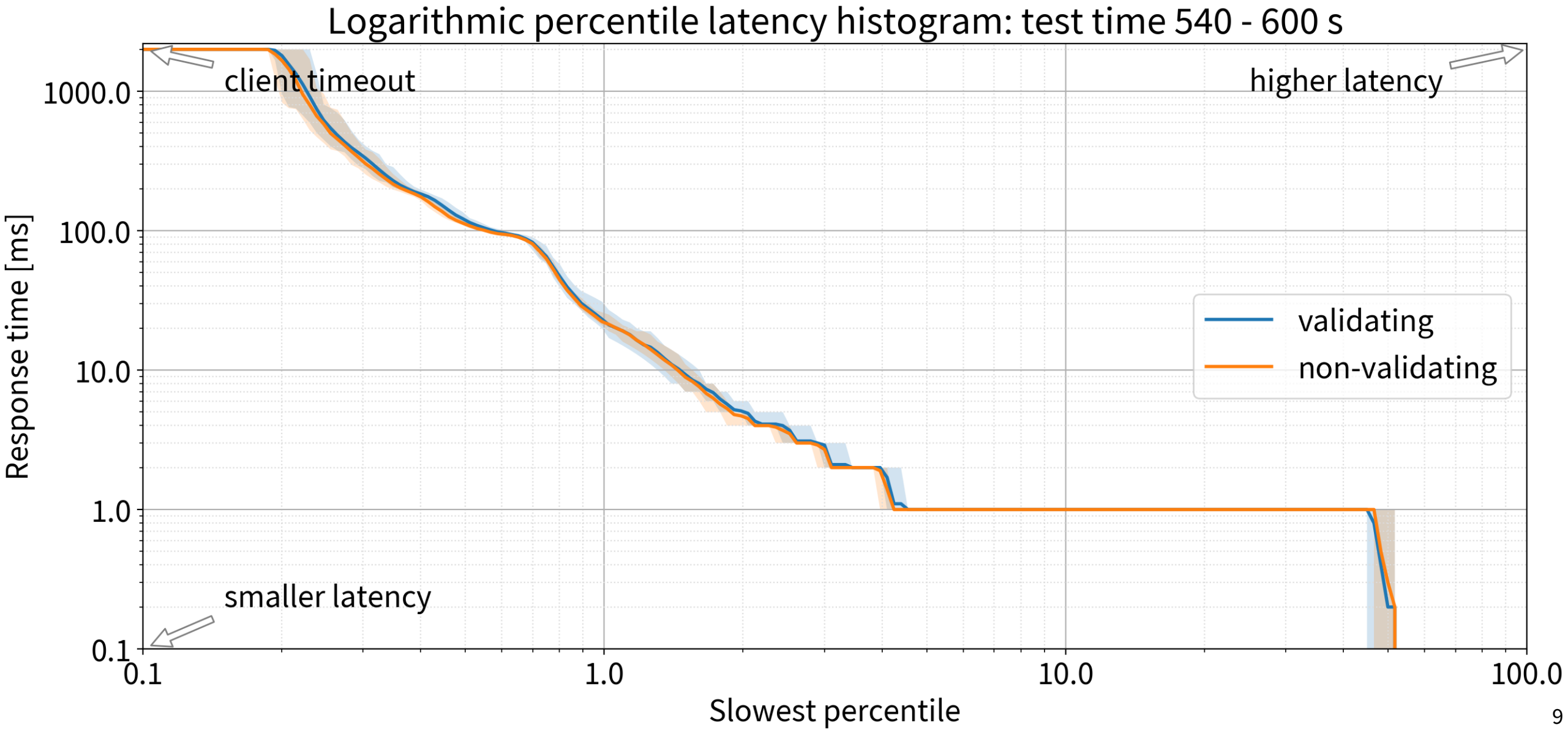
9 k QPS ???


Packet rate in traffic sample
kPackets/second
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
0
200
400
600
800
1000
1200
Time [s]

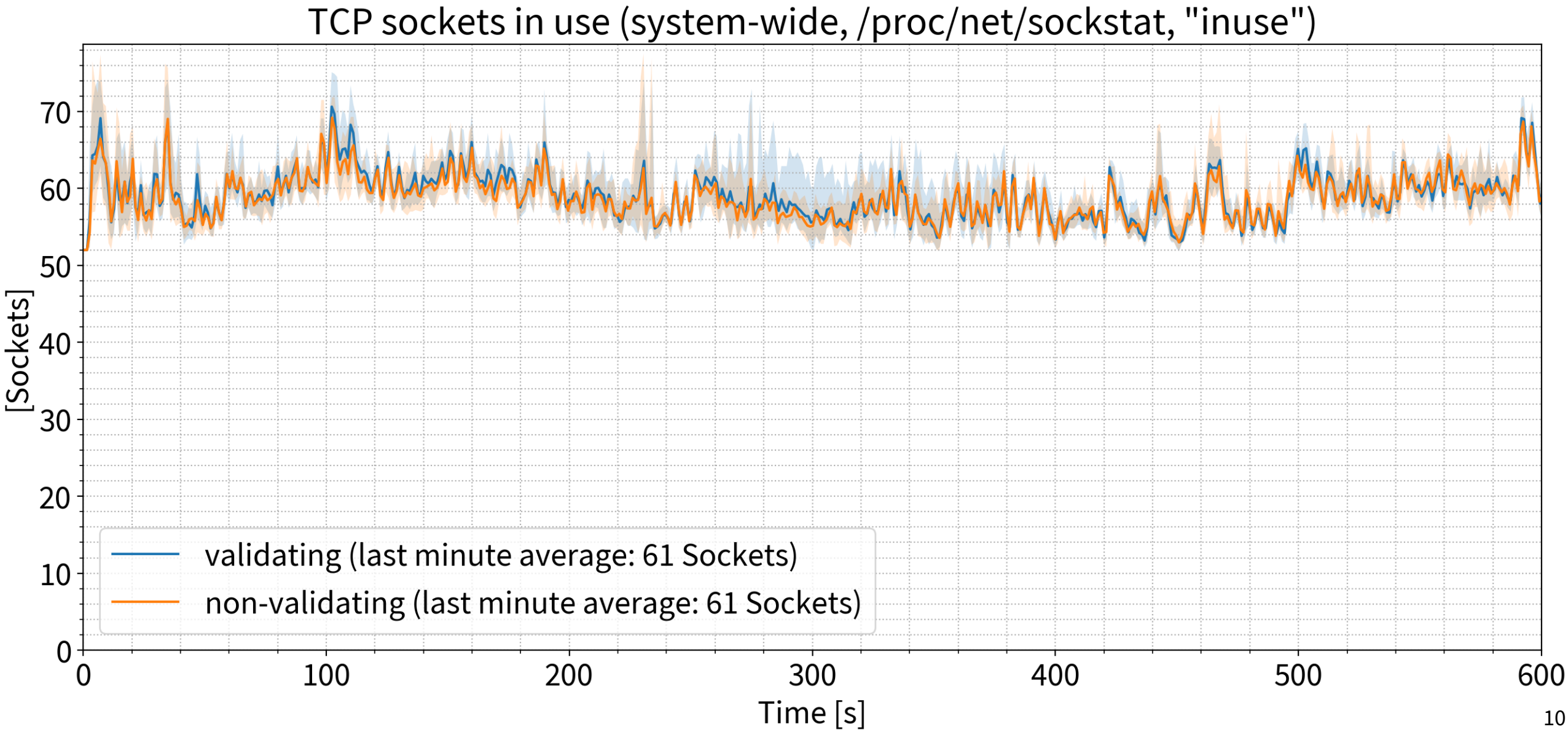
9 k QPS, Cold cache latency



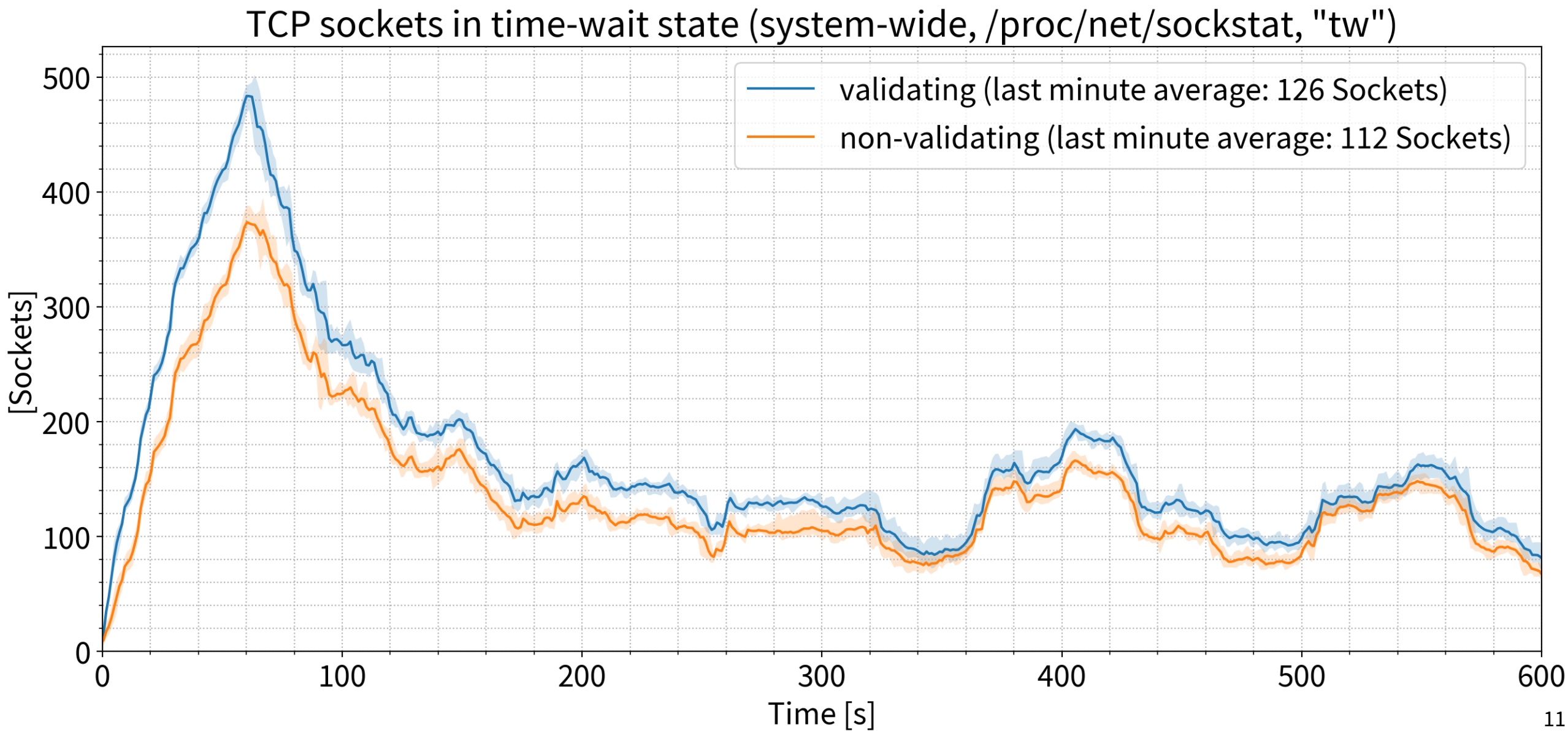
9 k QPS, Hot cache latency



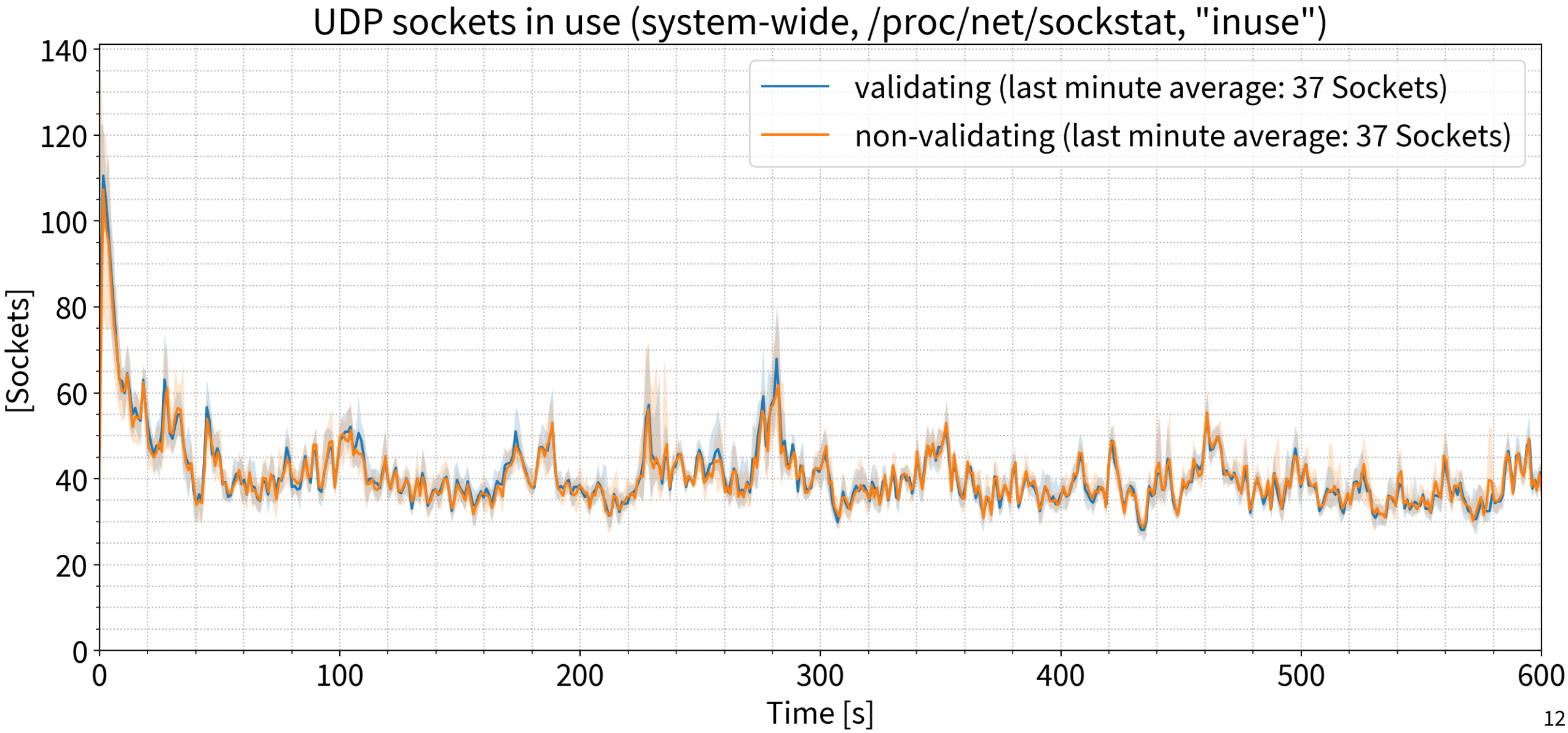
9 k QPS, TCP sockets



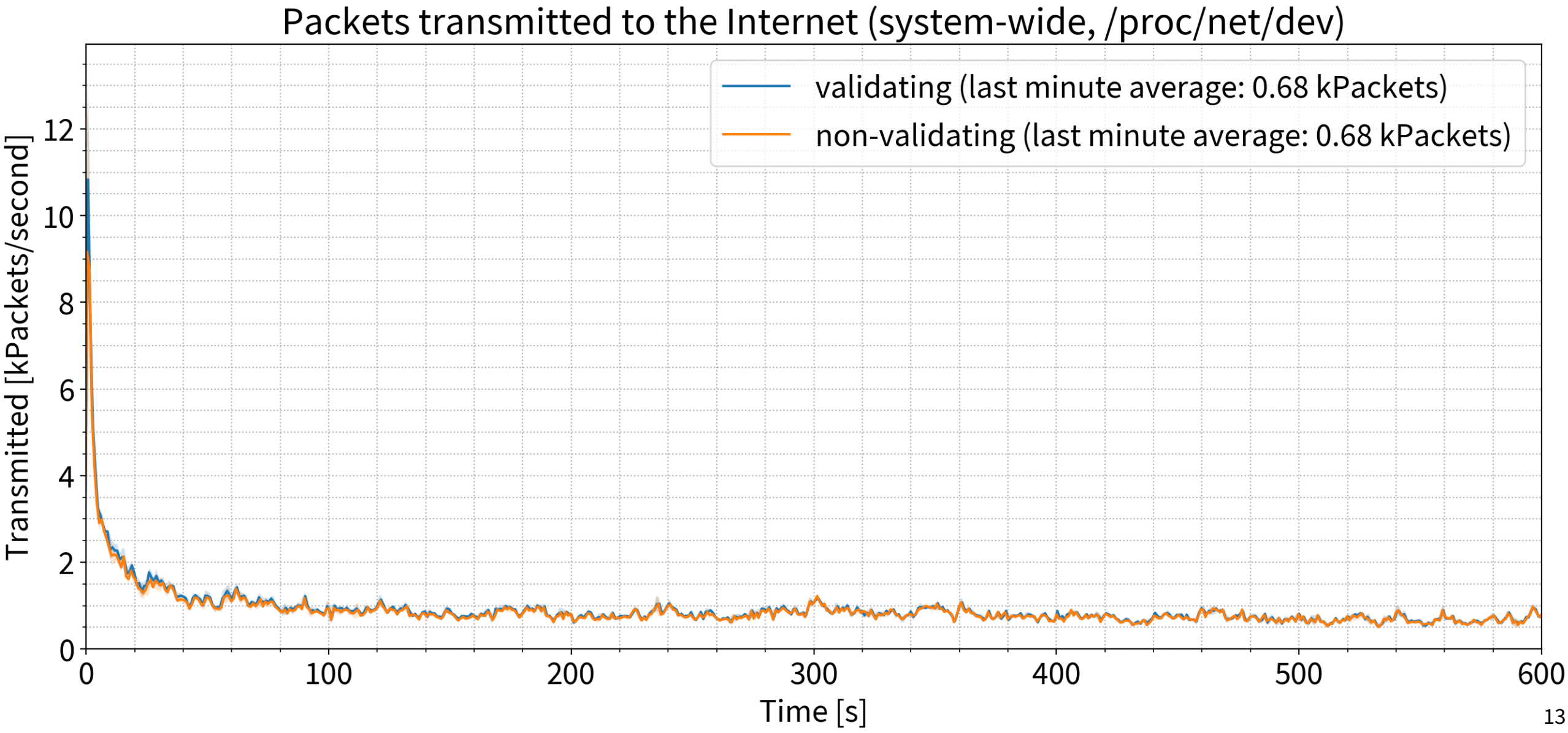
9 k QPS, TCP sockets



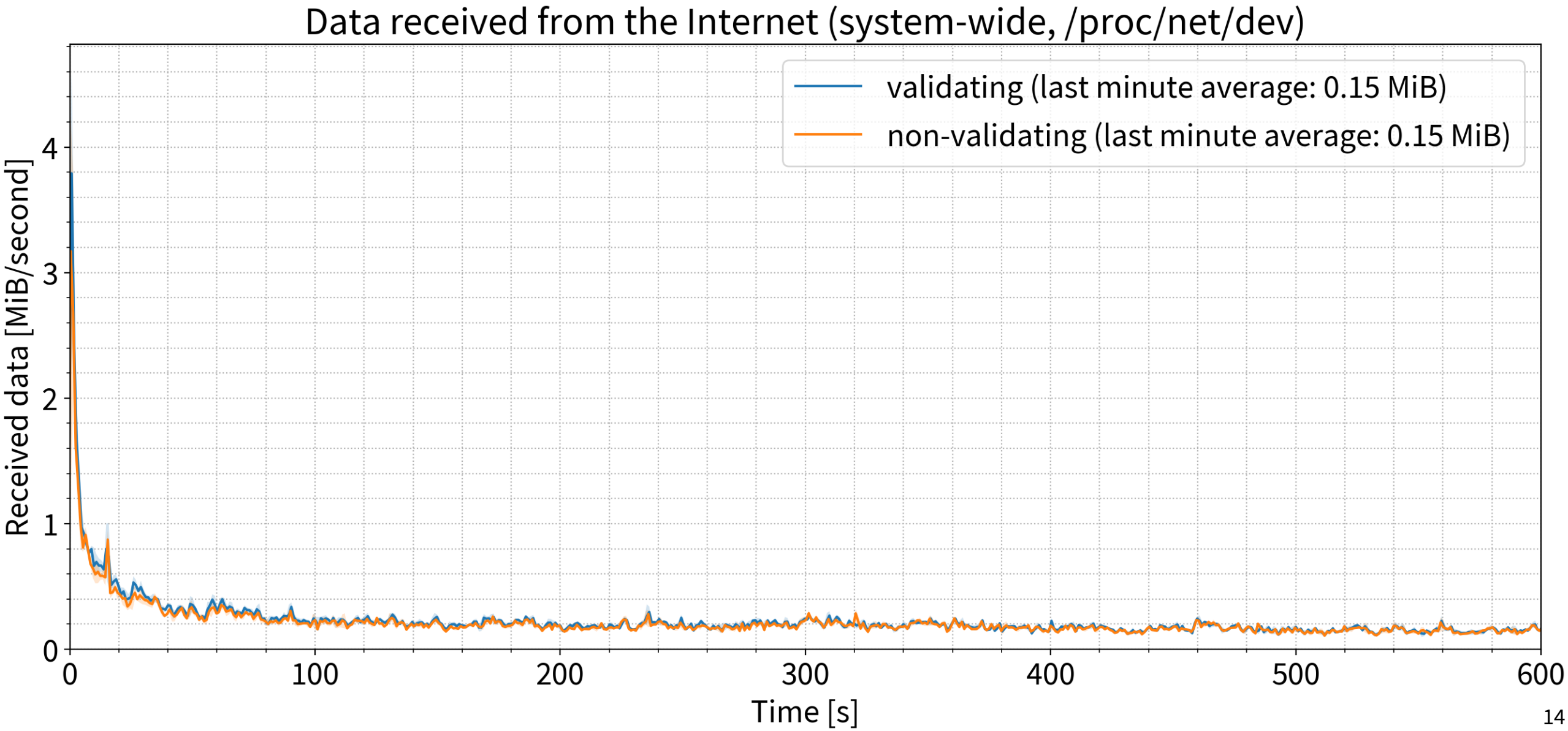
9 k QPS, UDP sockets



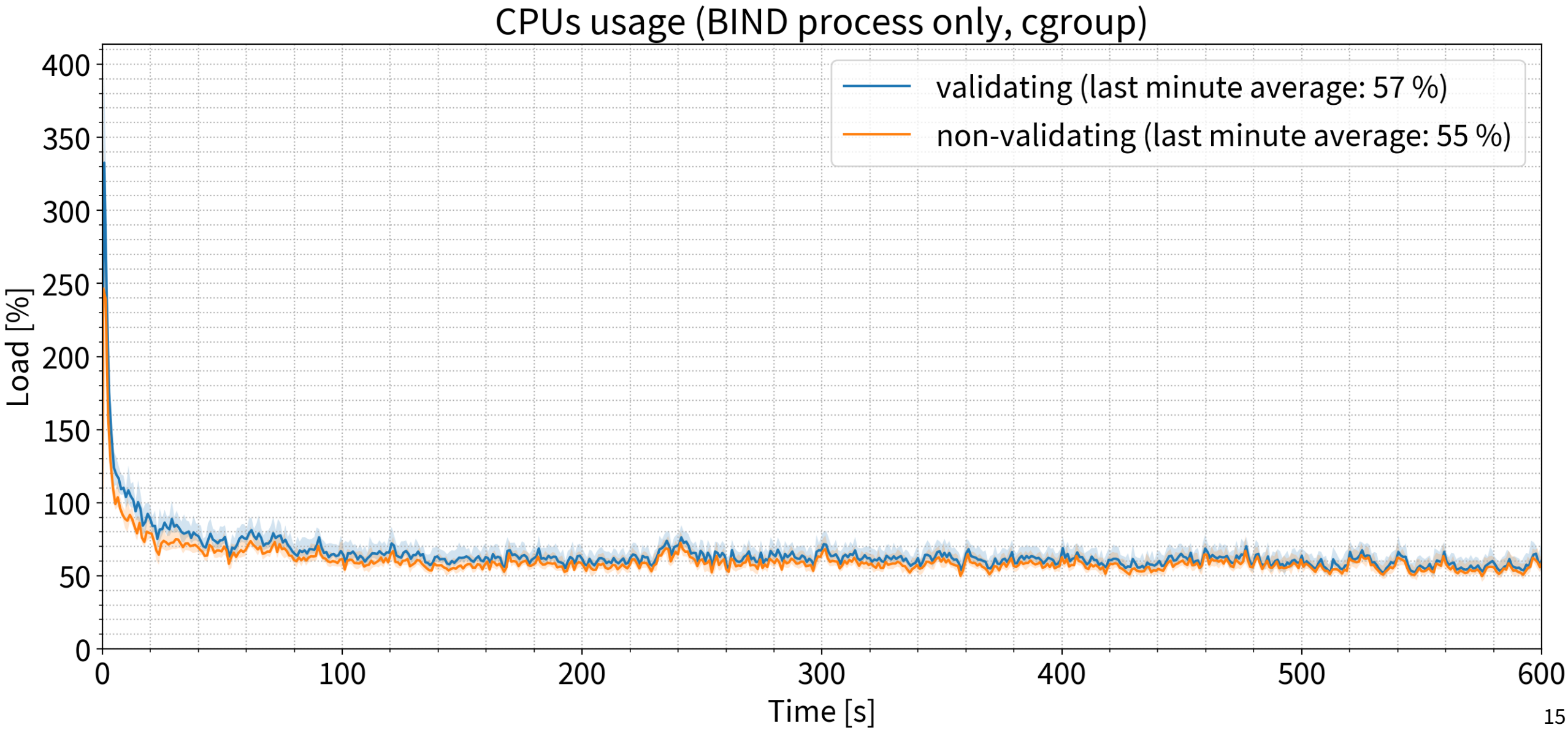
9 k QPS, packets out



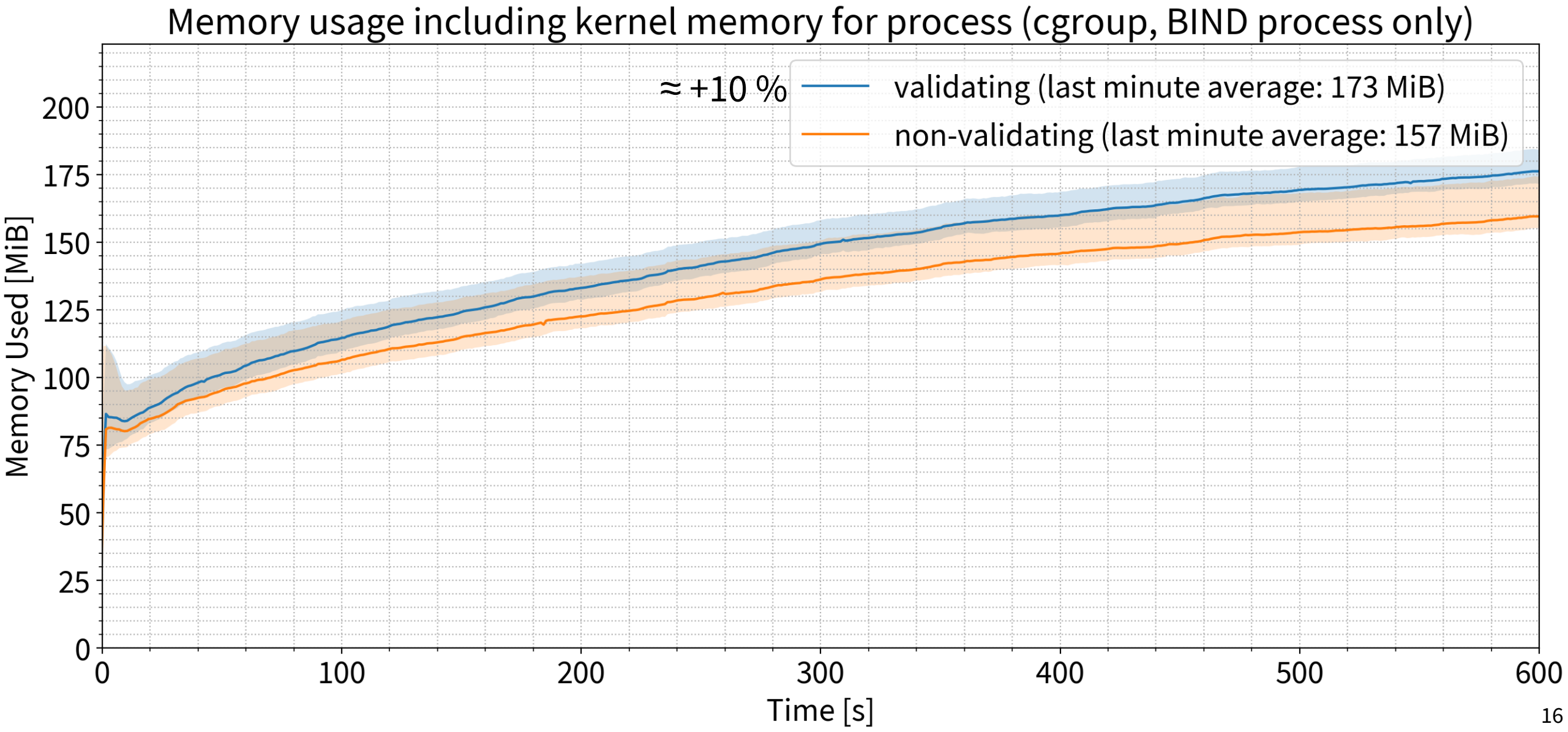
9 k QPS, bytes in



9 k QPS, CPU time



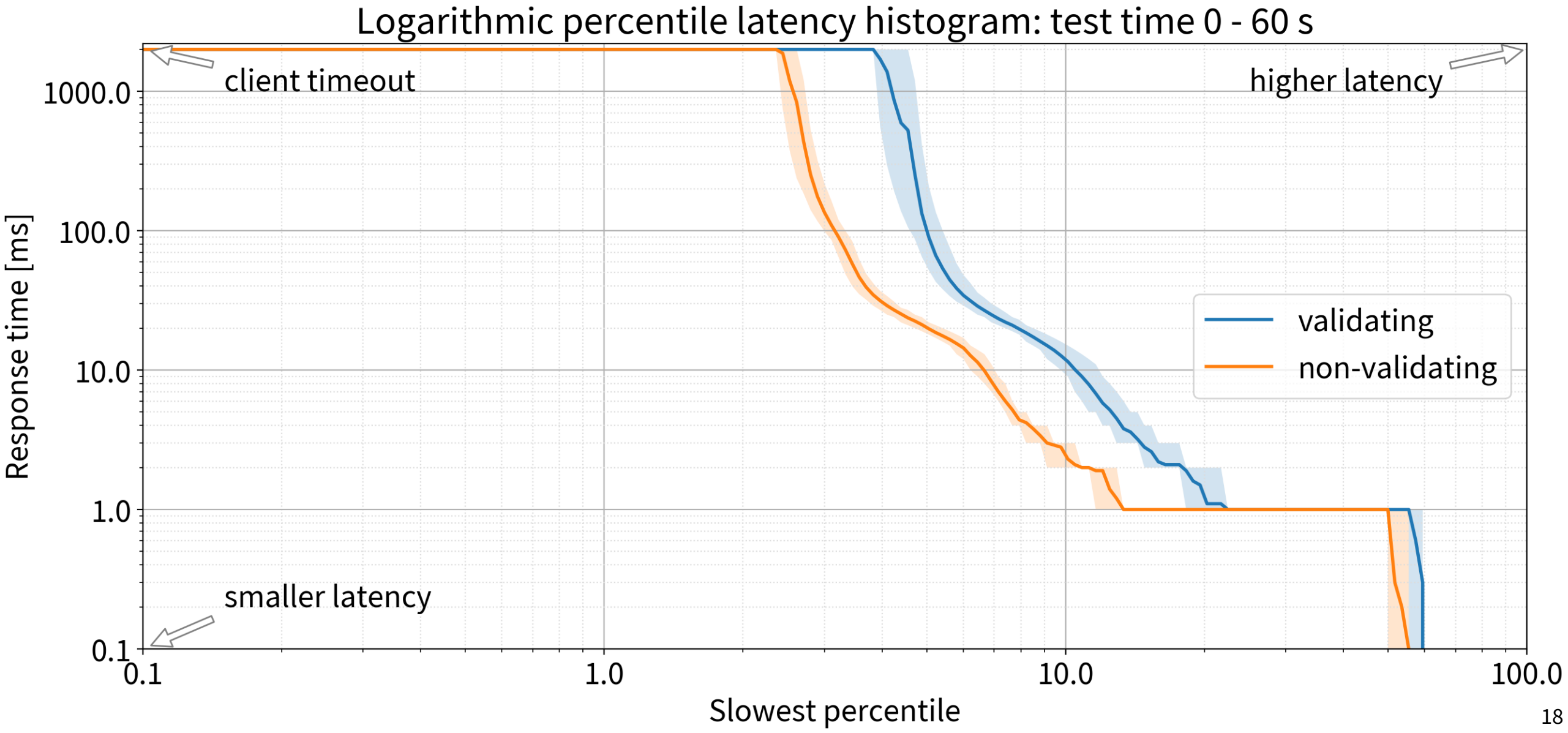
9 k QPS, memory



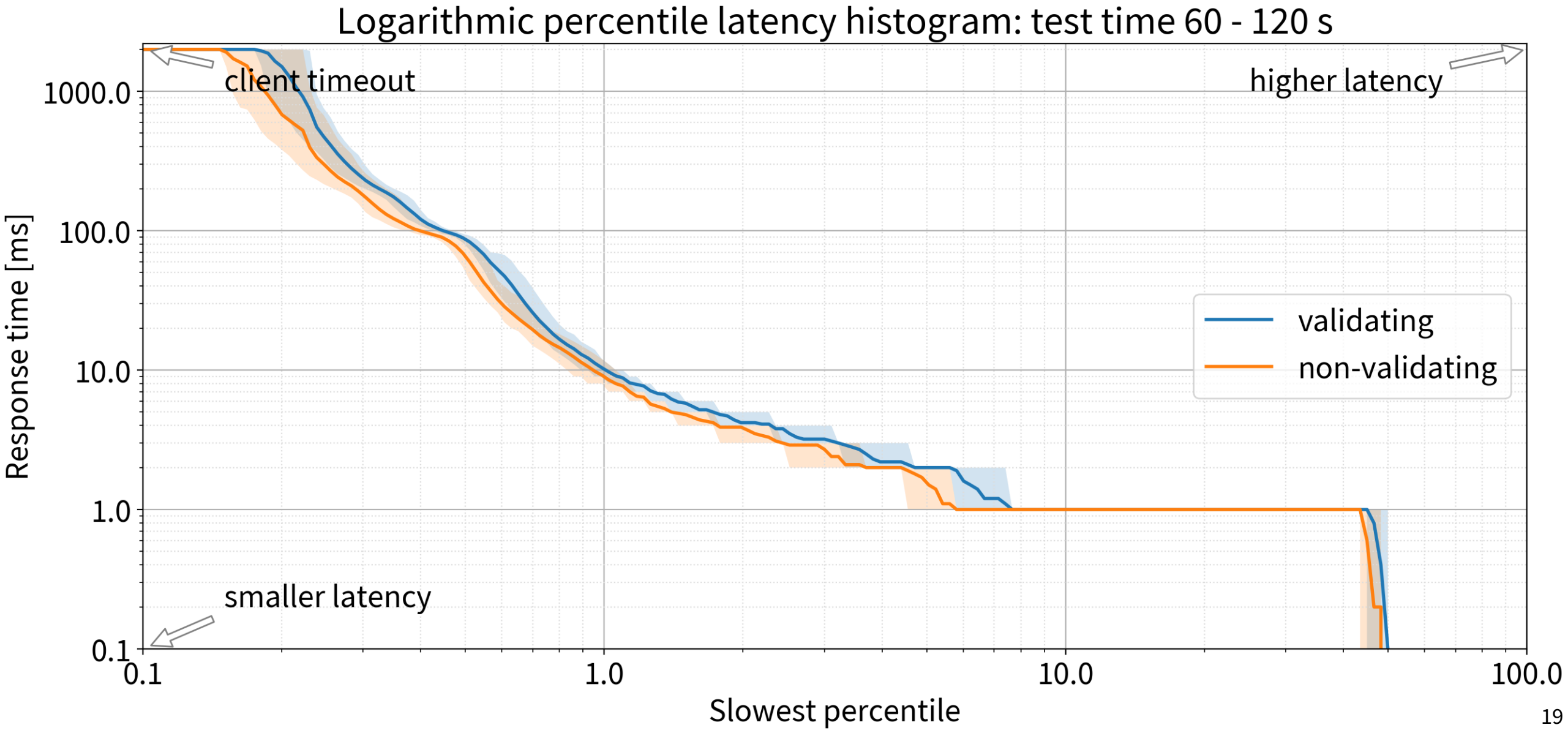
Scenario # 2

135 k QPS

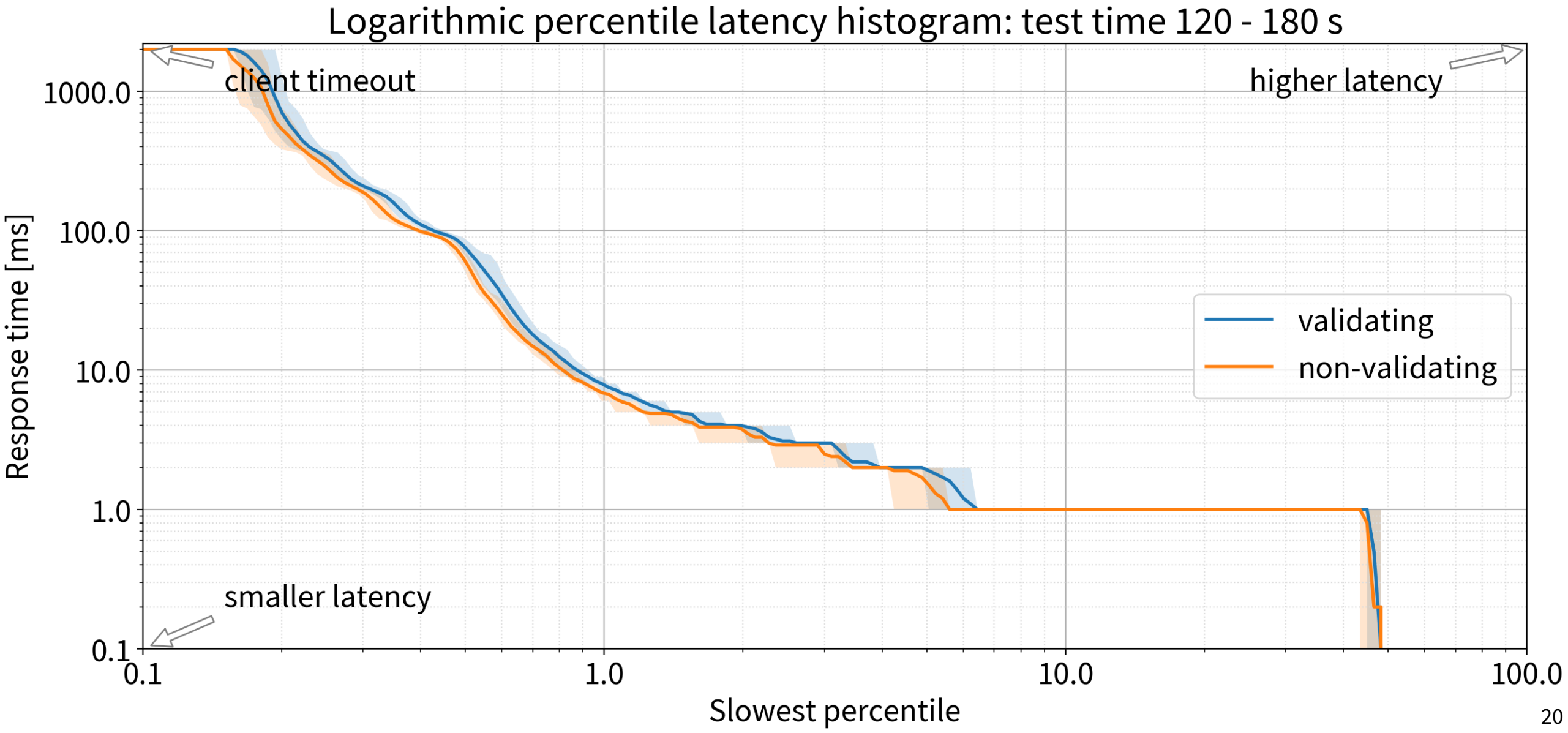
135 k QPS, Cold cache latency



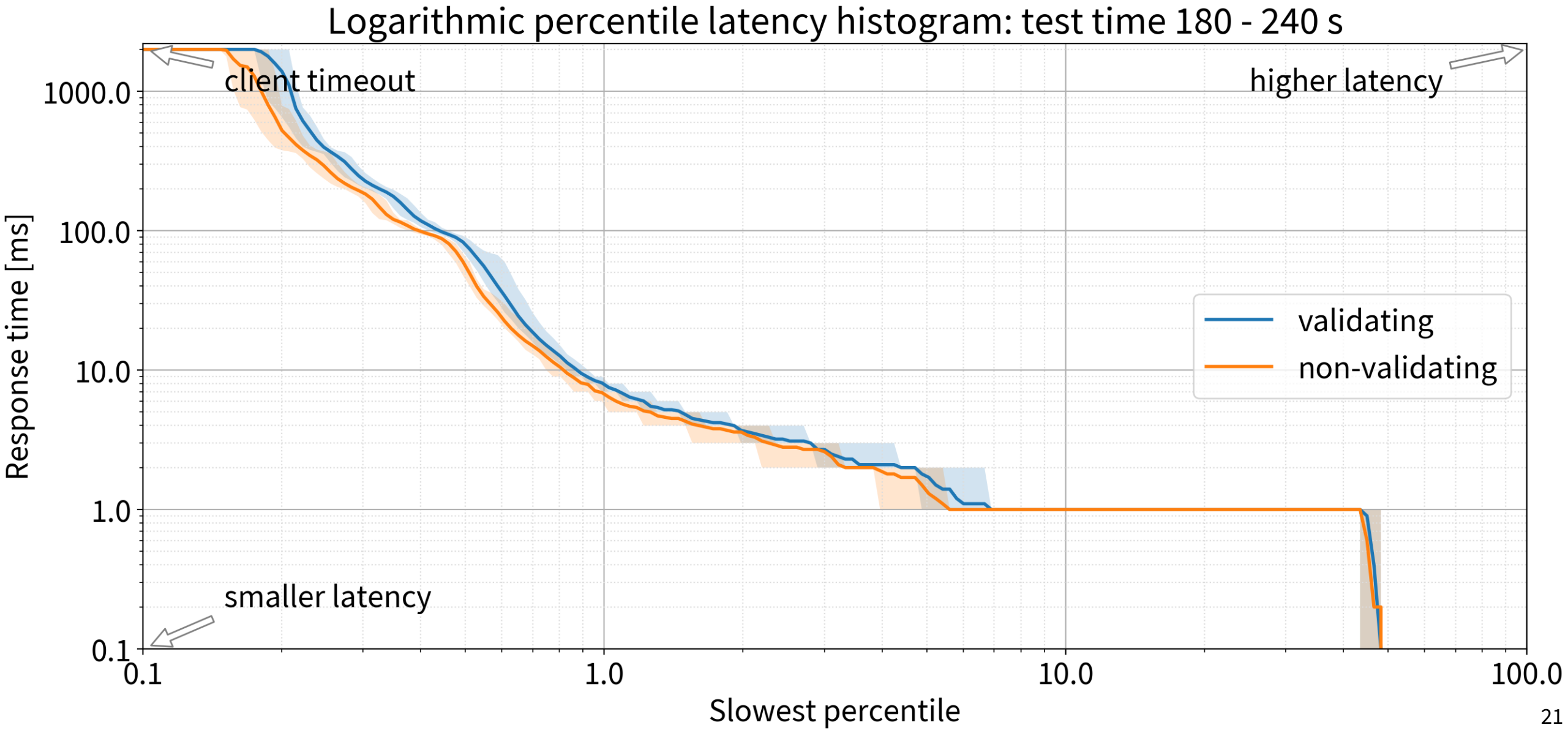
135 k QPS, Latency, second minute



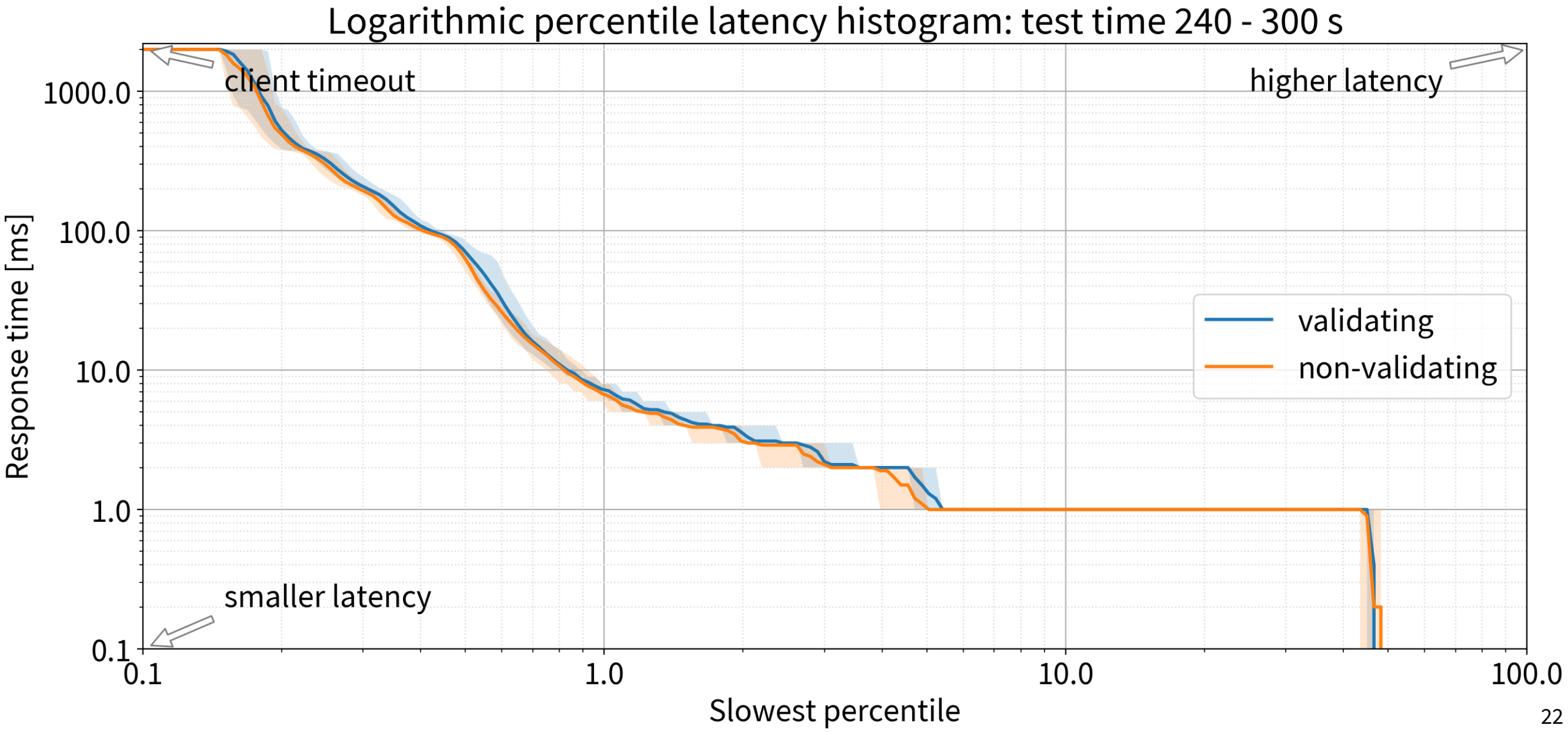
135 k QPS, Latency, third minute



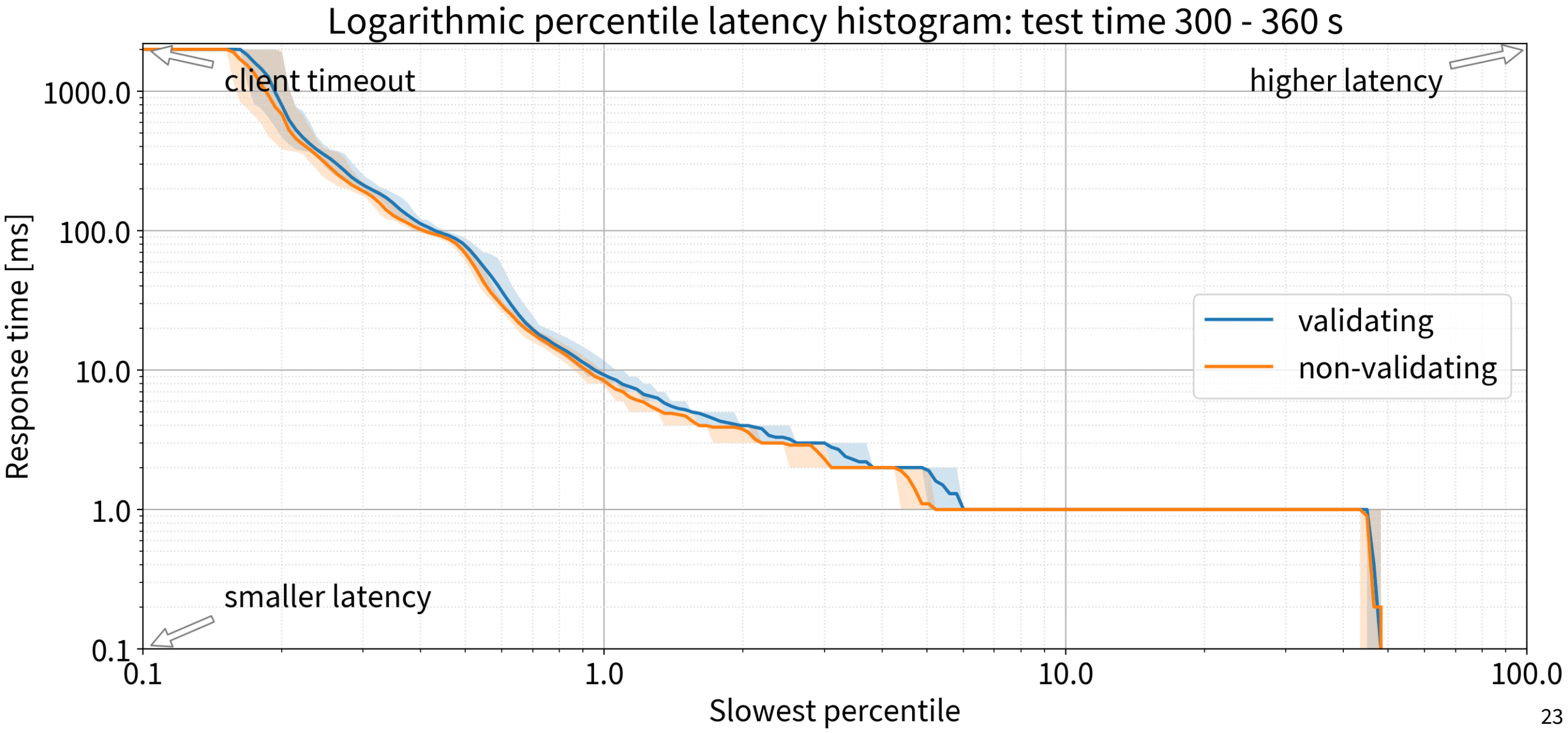
135 k QPS, Latency, fourth minute



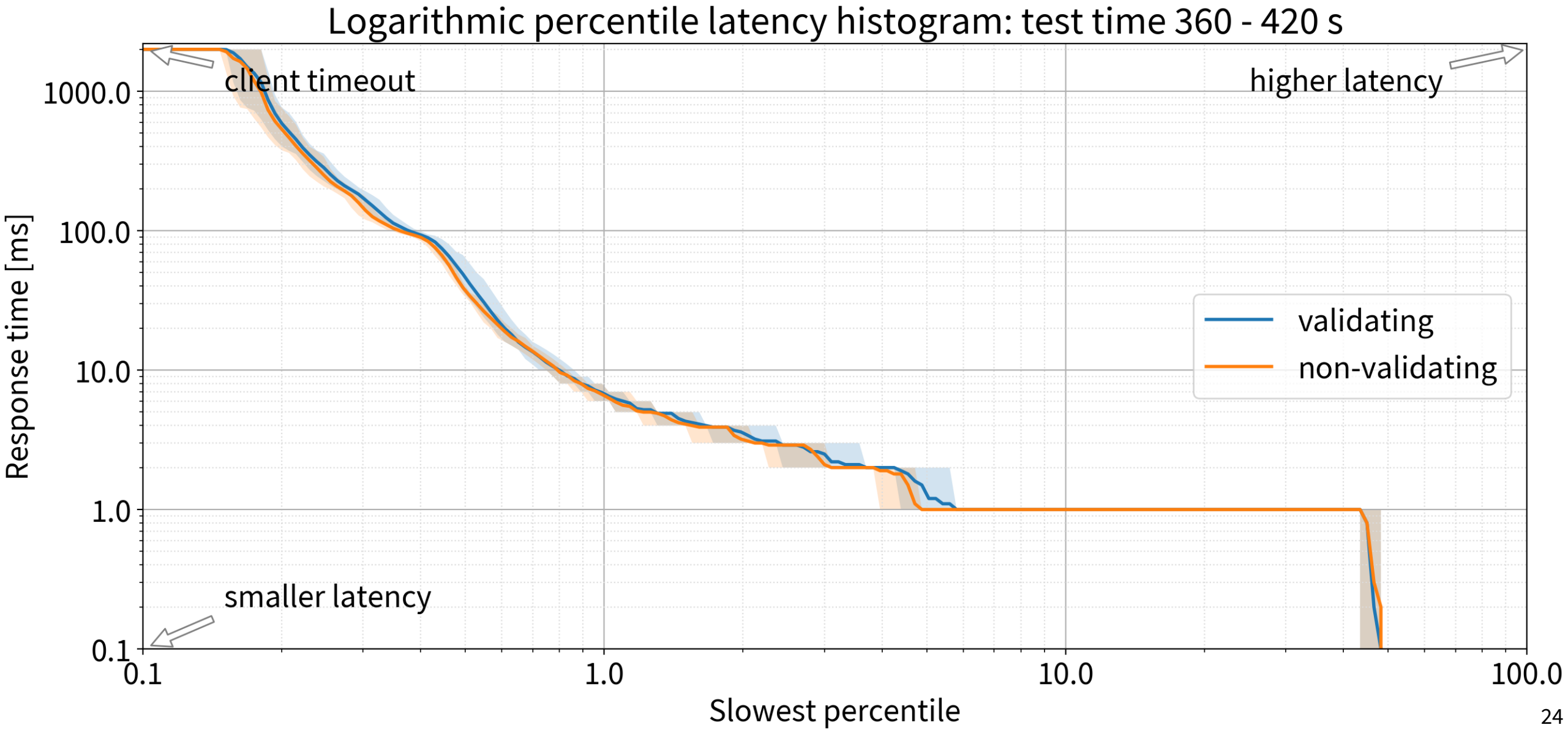
135 k QPS, Latency, fifth minute



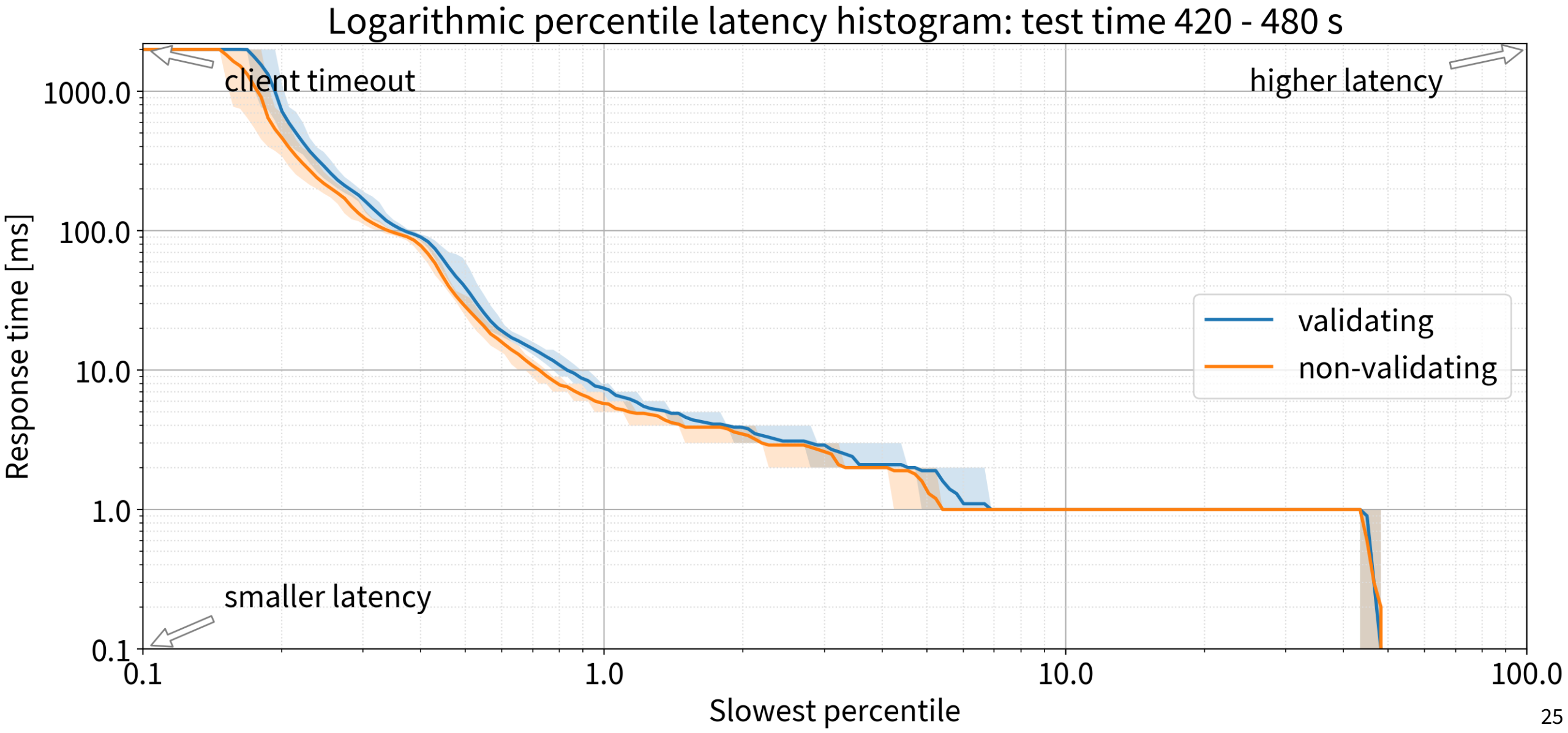
135 k QPS, Latency, sixth minute



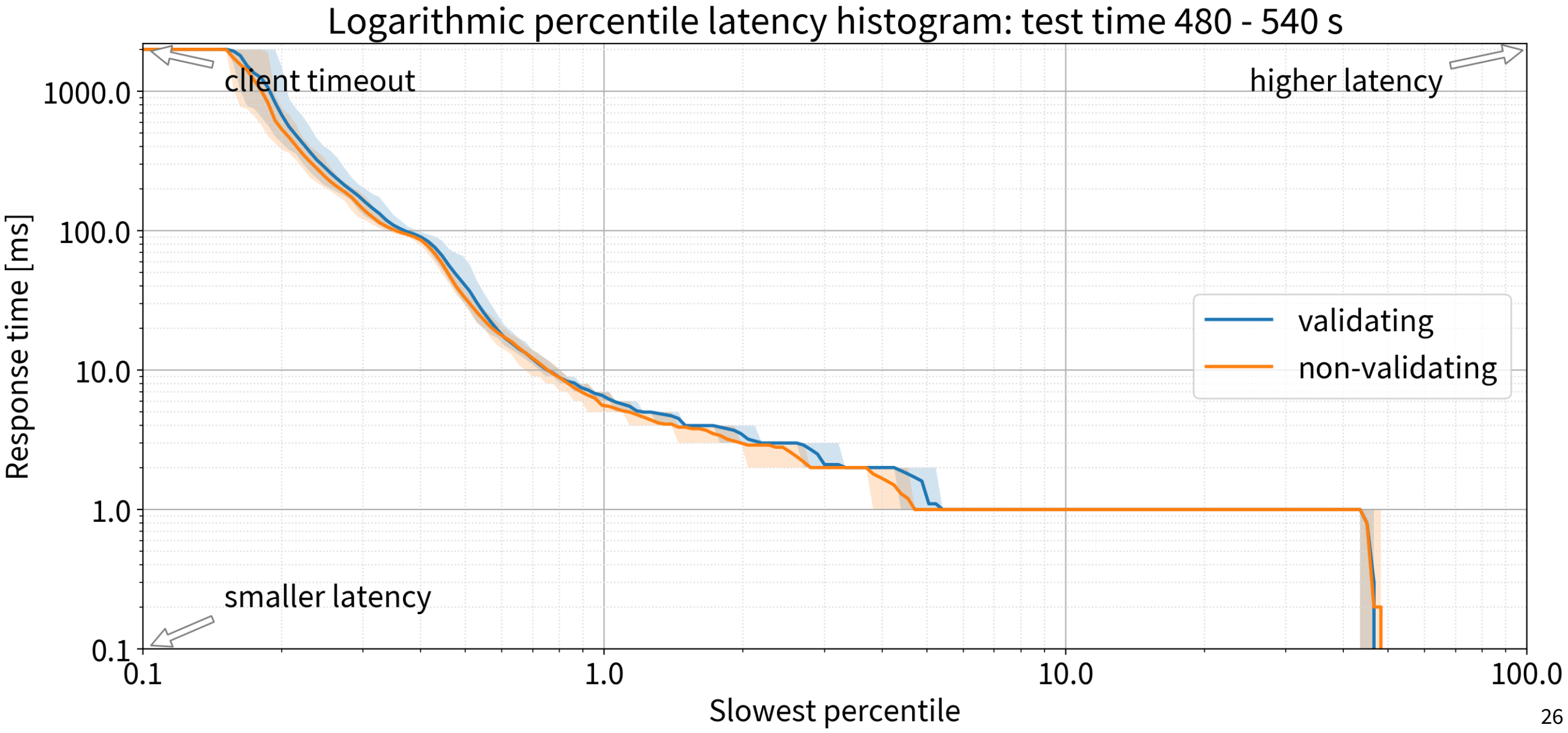
135 k QPS, Latency, seventh minute



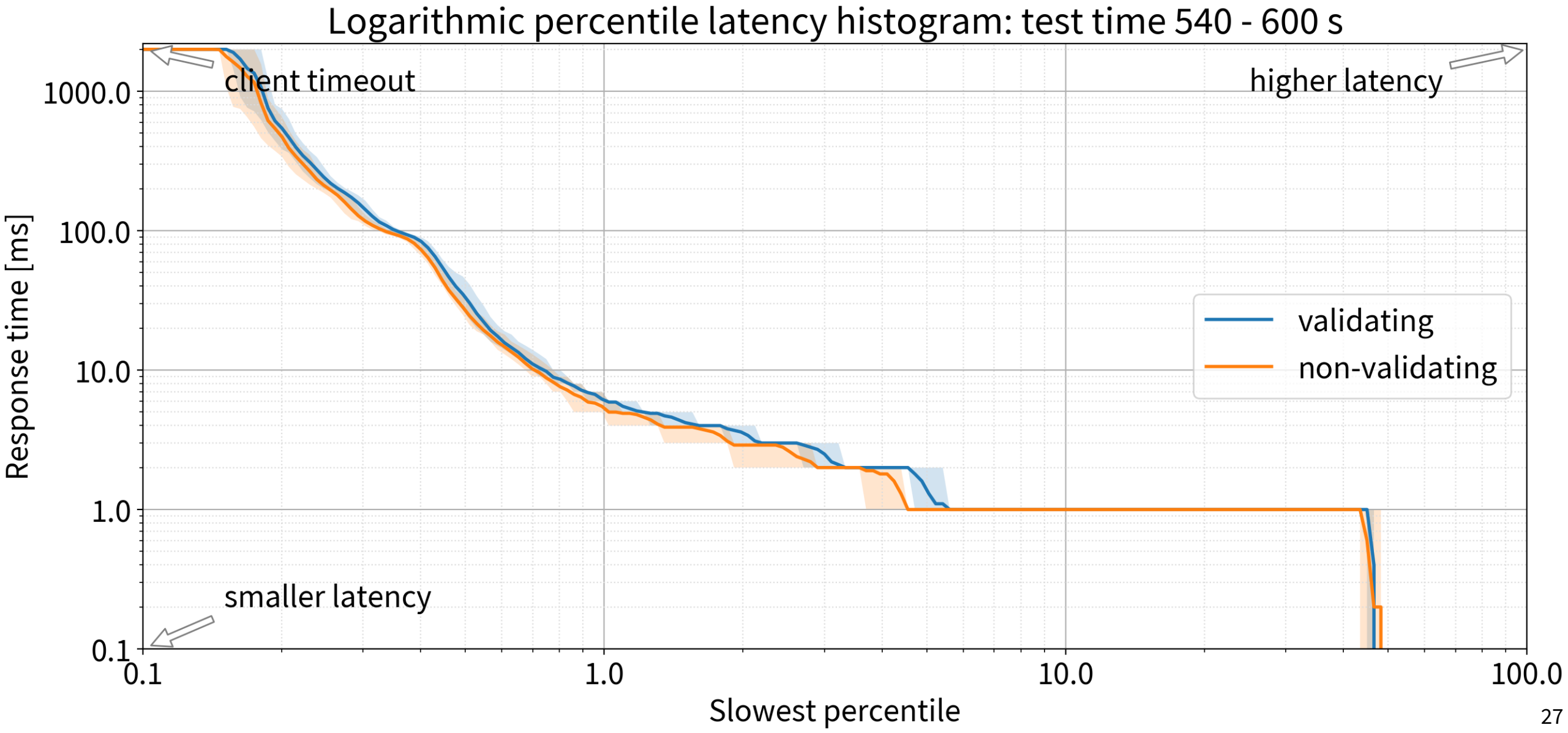
135 k QPS, Latency, eight minute



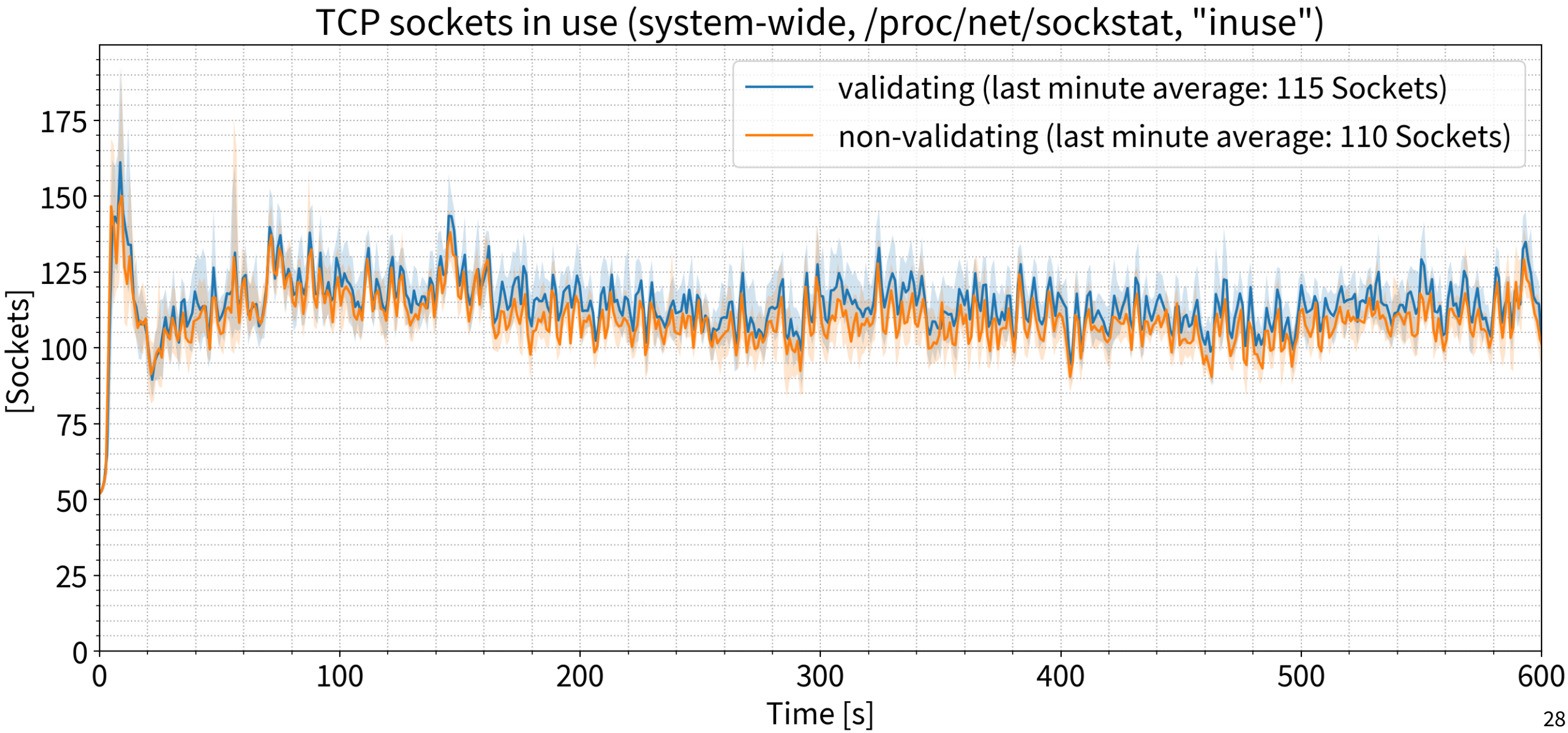
135 k QPS, Latency, ninth minute



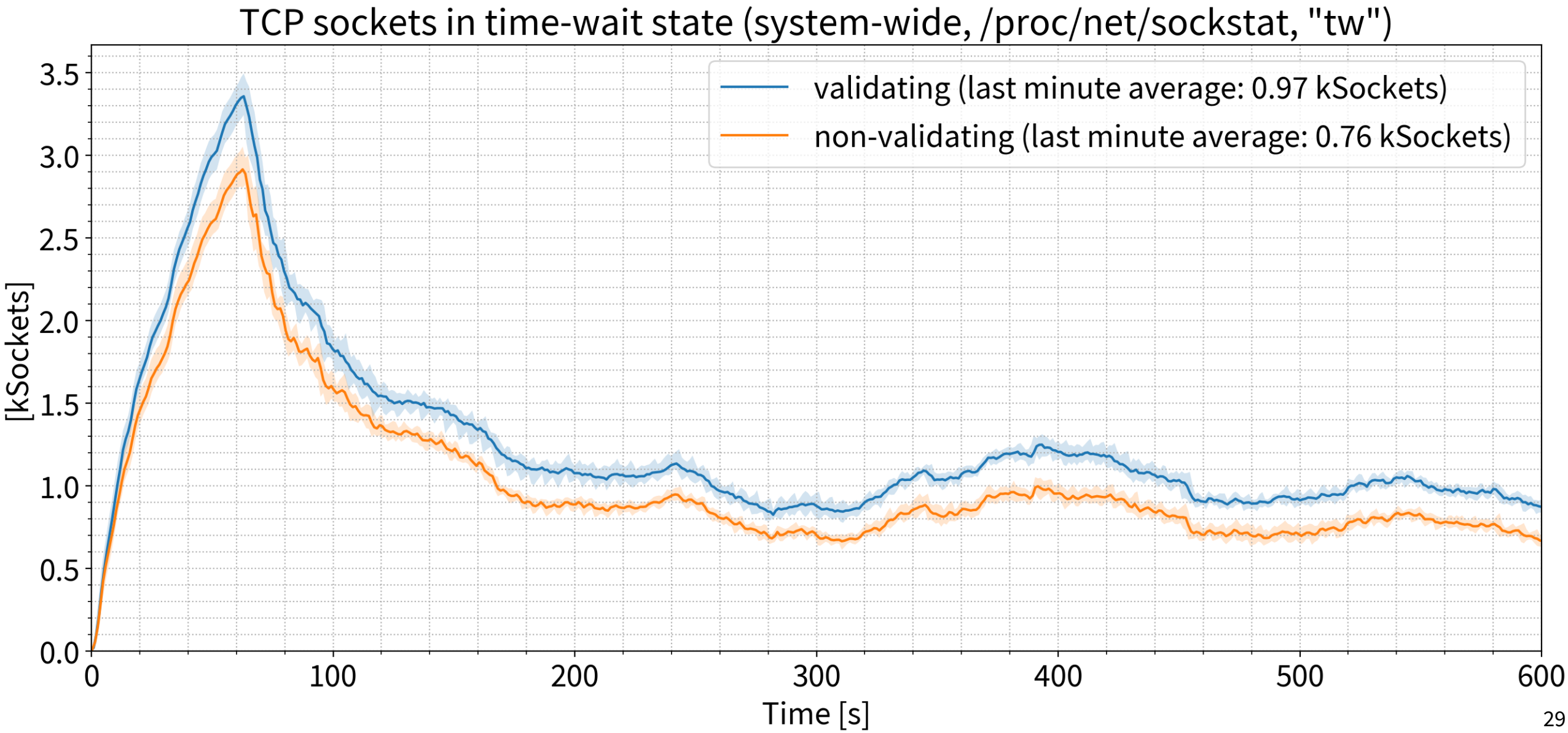
135 k QPS, Hot cache latency



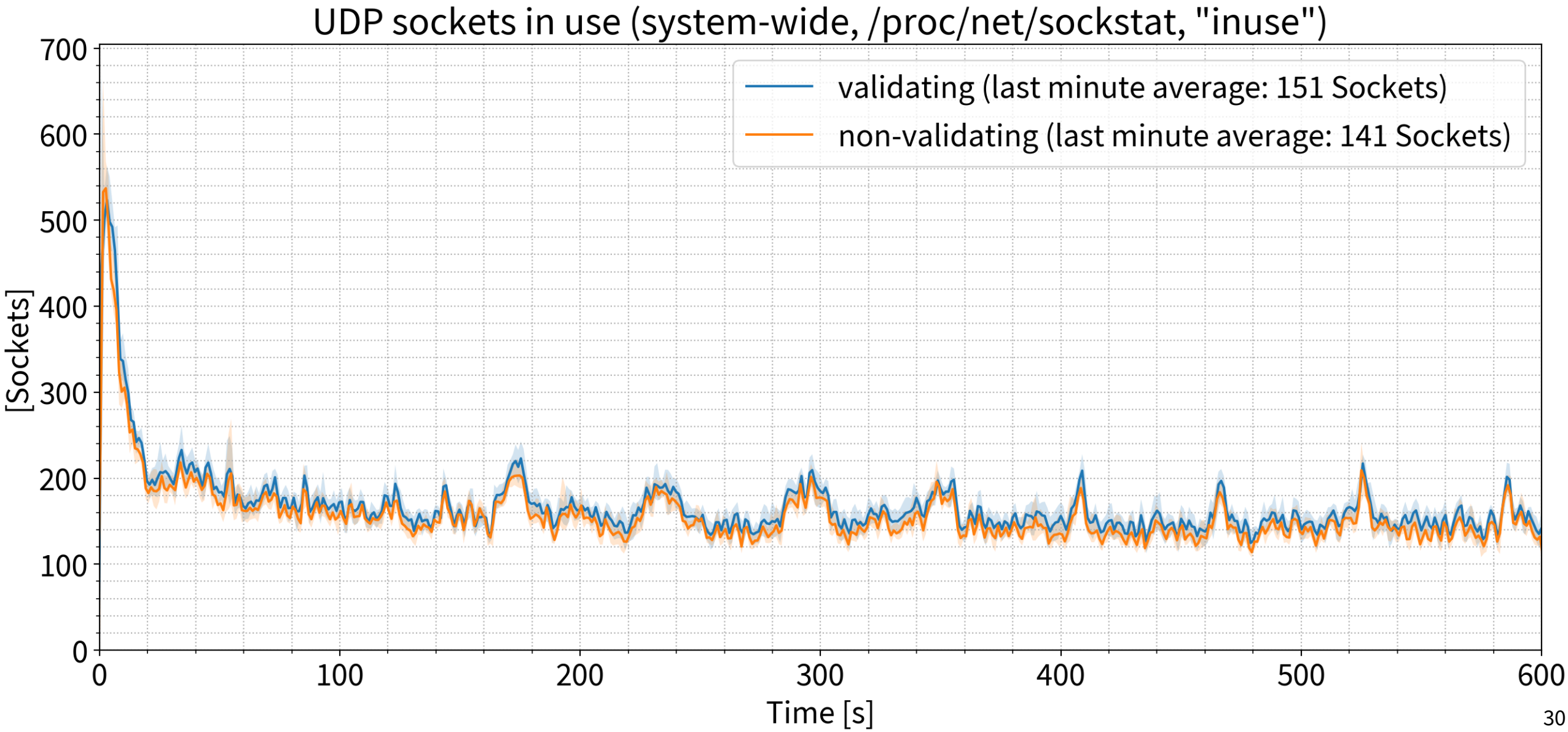
135 k QPS, TCP sockets



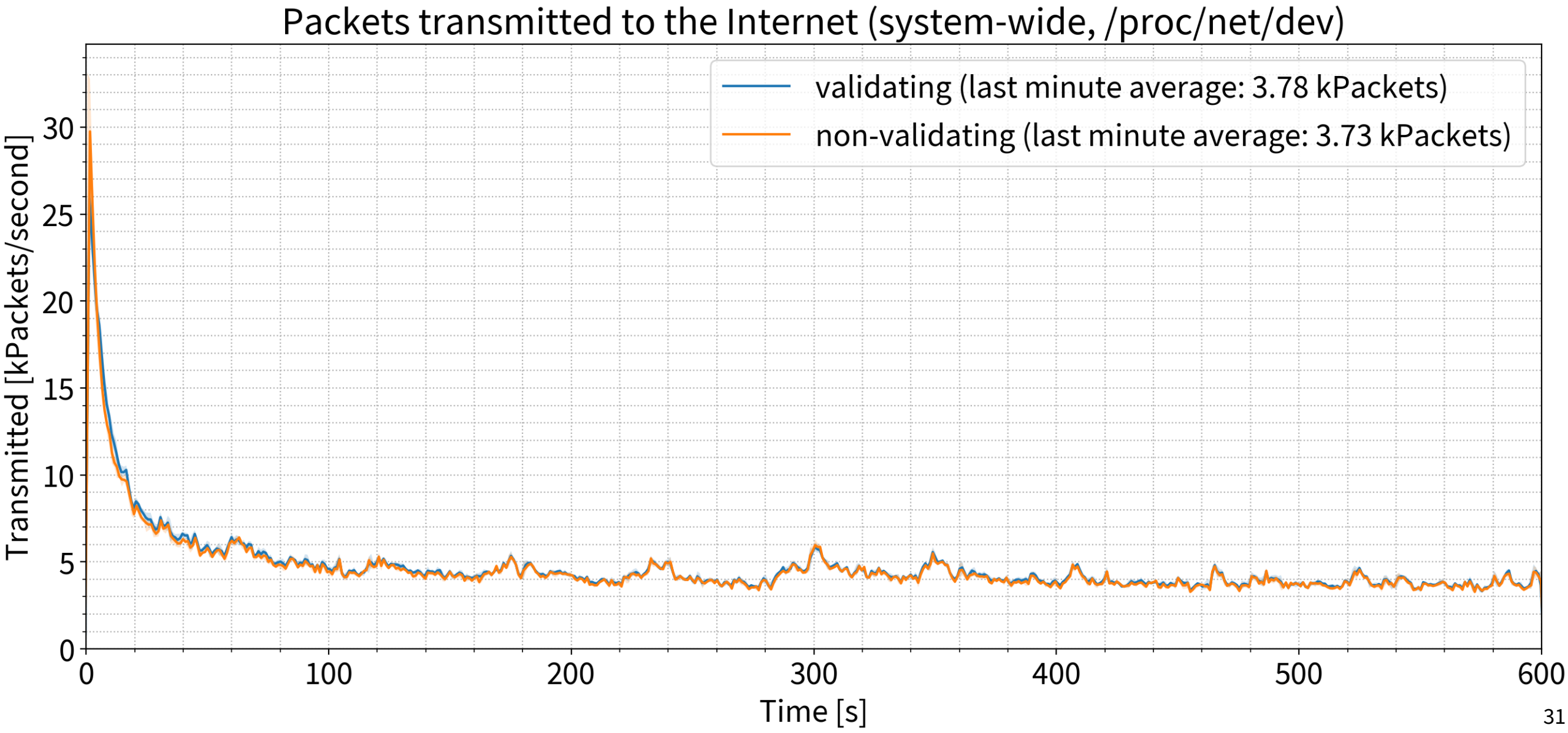
135 k QPS, TCP sockets



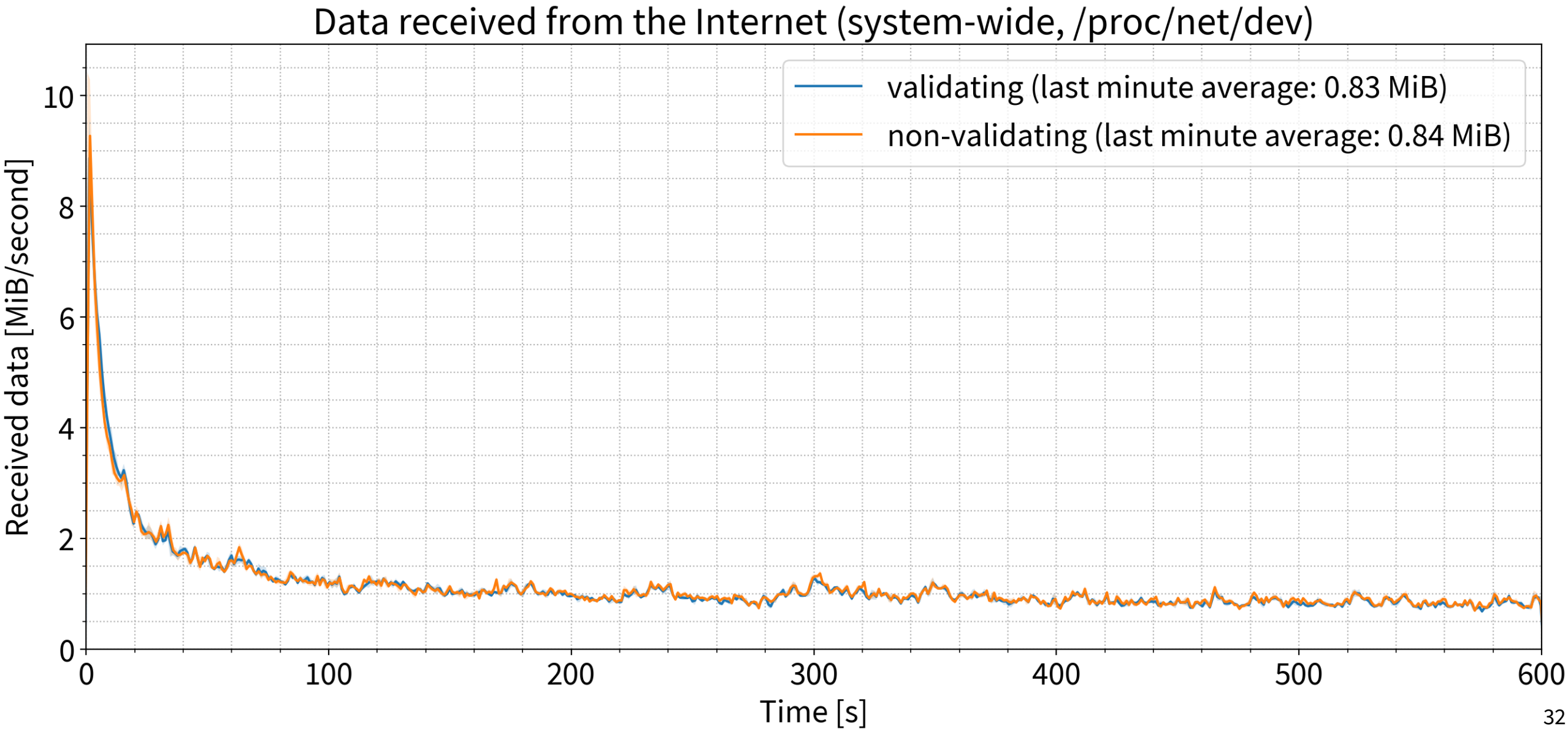
135 k QPS, UDP sockets



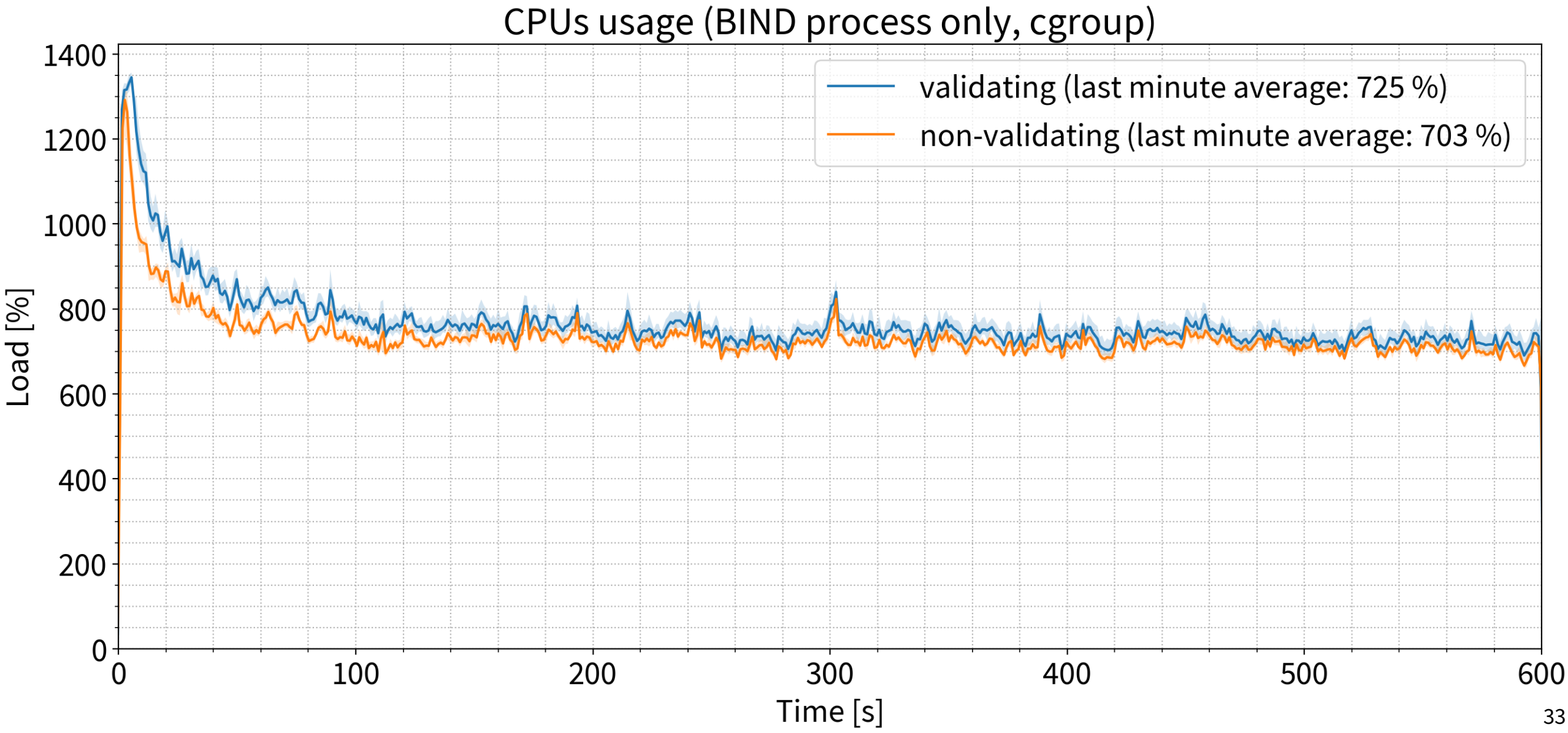
135 k QPS, packets out



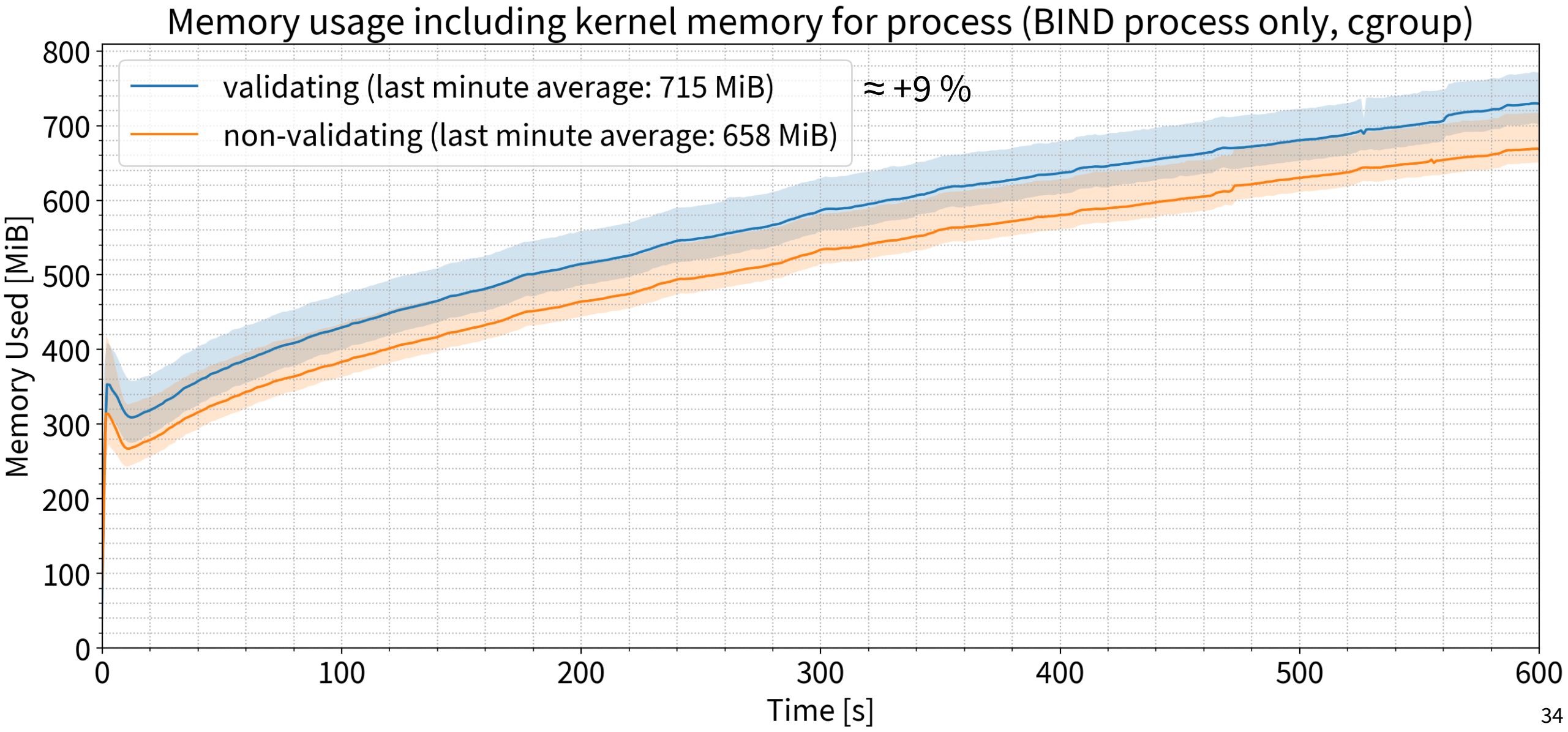
135 k QPS, bytes in



135 k QPS, CPU time



135 k QPS, memory



Performance effects of DNSSEC validation

- Negligible impact on
  - Latency
  - Bandwidth
  - CPU consumption
  - OS sockets
- Memory consumption increase ≈ +10 %
- Questions?
  https://lists.isc.org/pipermail/bind-users/

Thank you!

- Main website: https://www.isc.org
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- Main GitLab: https://gitlab.isc.org