

Performance effects of DNSSEC validation

Petr Špaček

2022-07-30

pspacek@isc.org

<https://www.isc.org>



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

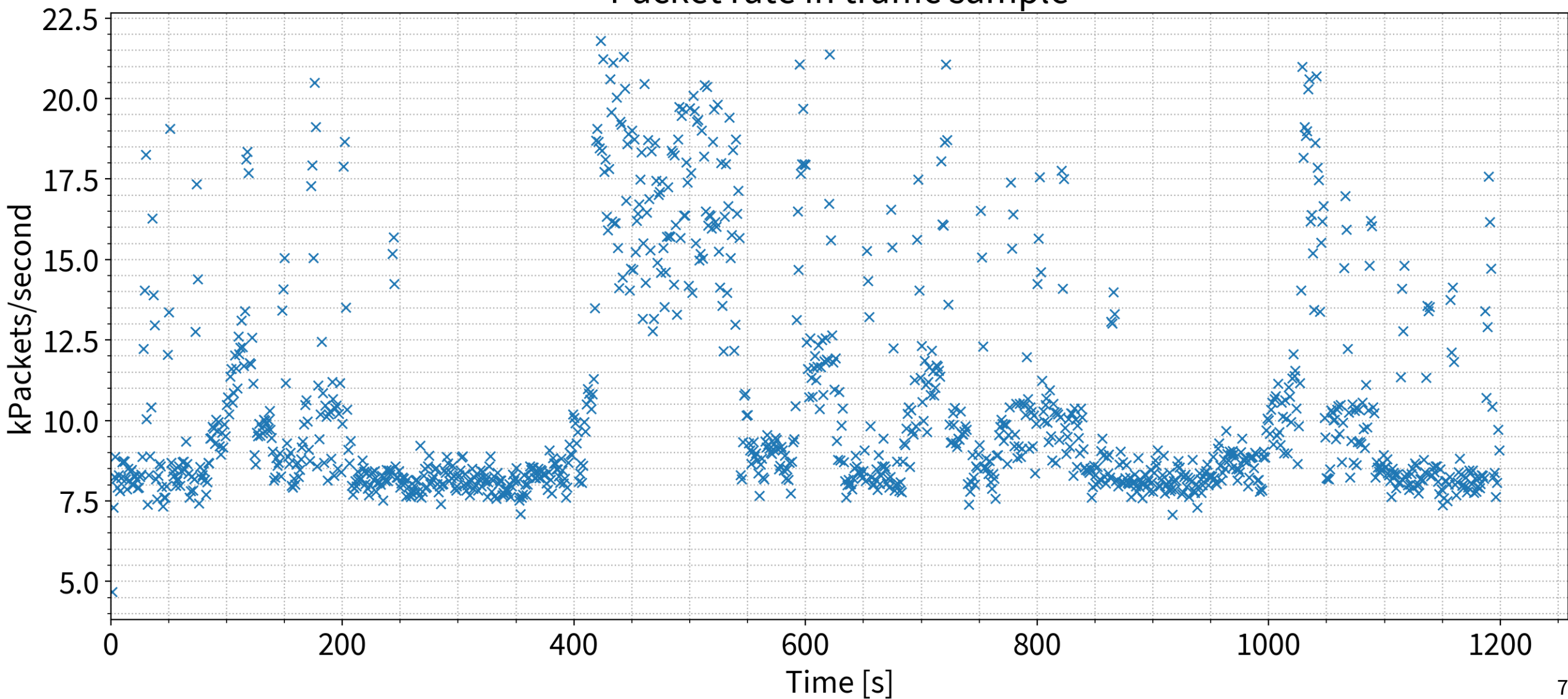
- Resolver: BIND 9.18.4
 - Empty cache, validation on/off
- Client simulator: DNS Shotgun
 - Keeps query timing/cache hit rate
- Live Internet
 - Measure, rinse, repeat: 10 times
- Custom resource monitoring

Scenario # 1

9 k QPS

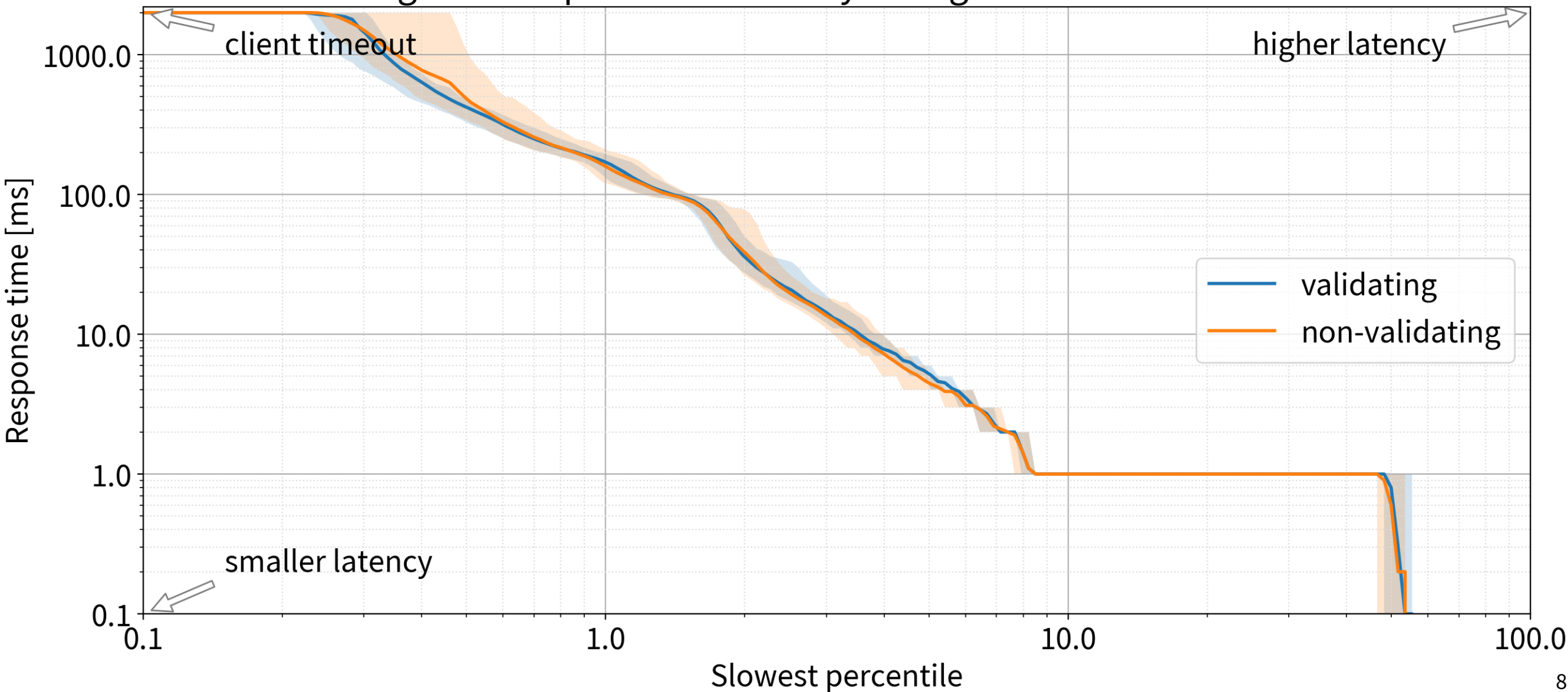
9 k QPS ???

Packet rate in traffic sample



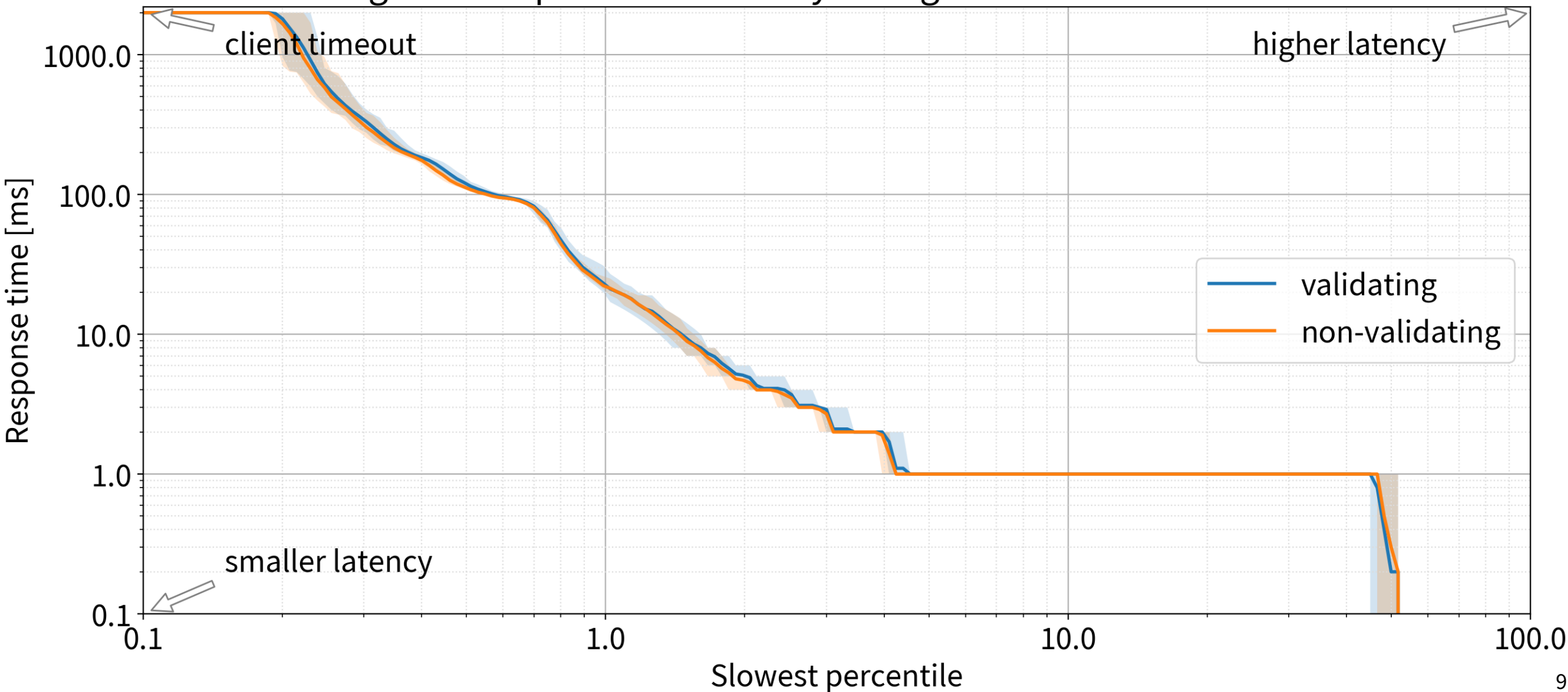
9 k QPS, Cold cache latency

Logarithmic percentile latency histogram: test time 0 - 60 s



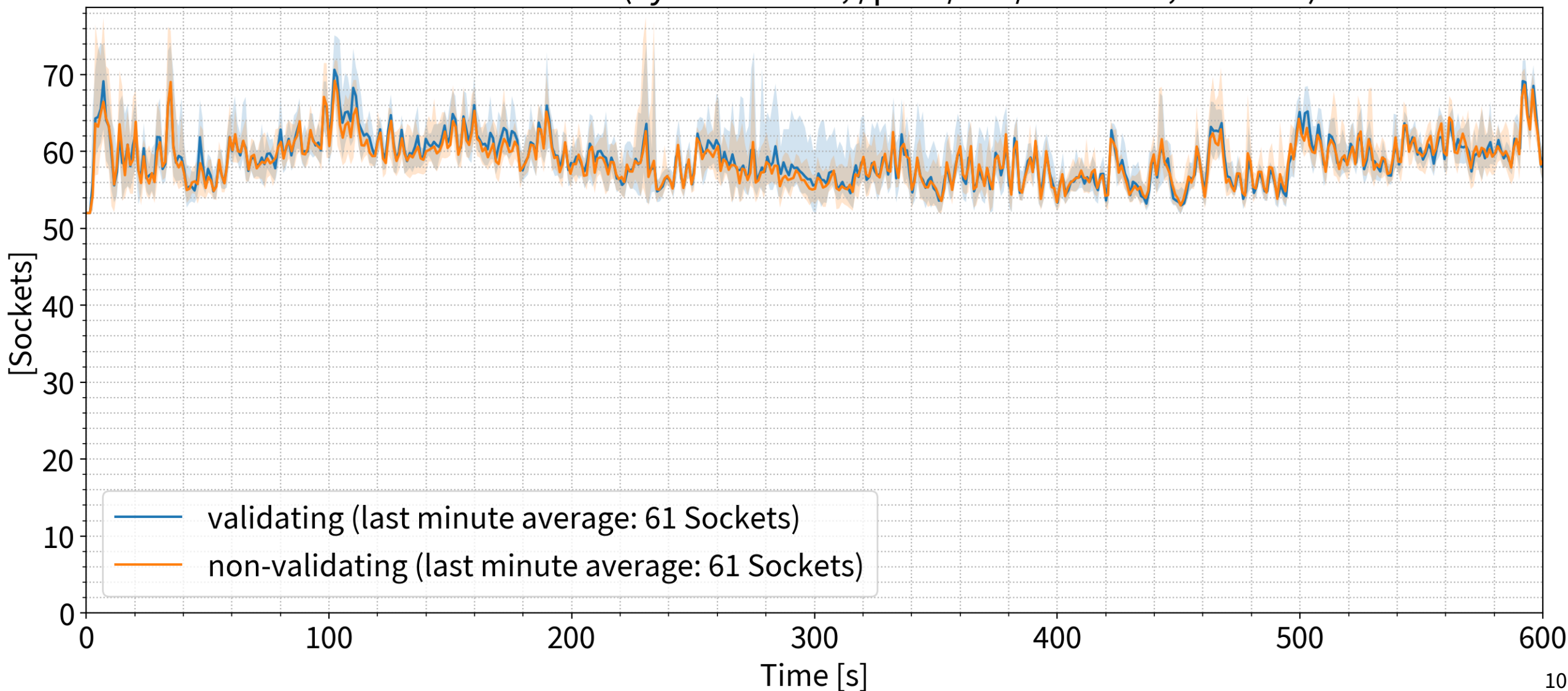
9 k QPS, Hot cache latency

Logarithmic percentile latency histogram: test time 540 - 600 s



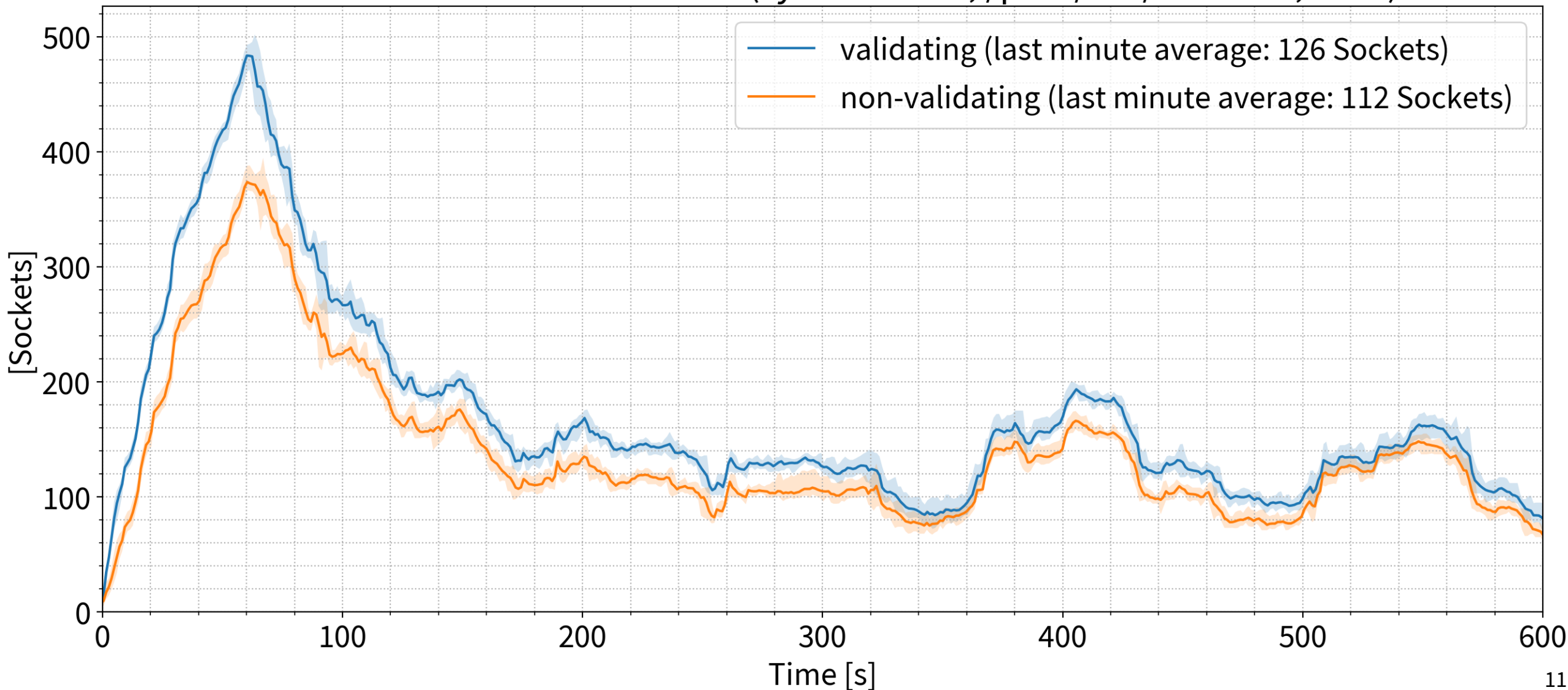
9 k QPS, TCP sockets

TCP sockets in use (system-wide, /proc/net/sockstat, "inuse")



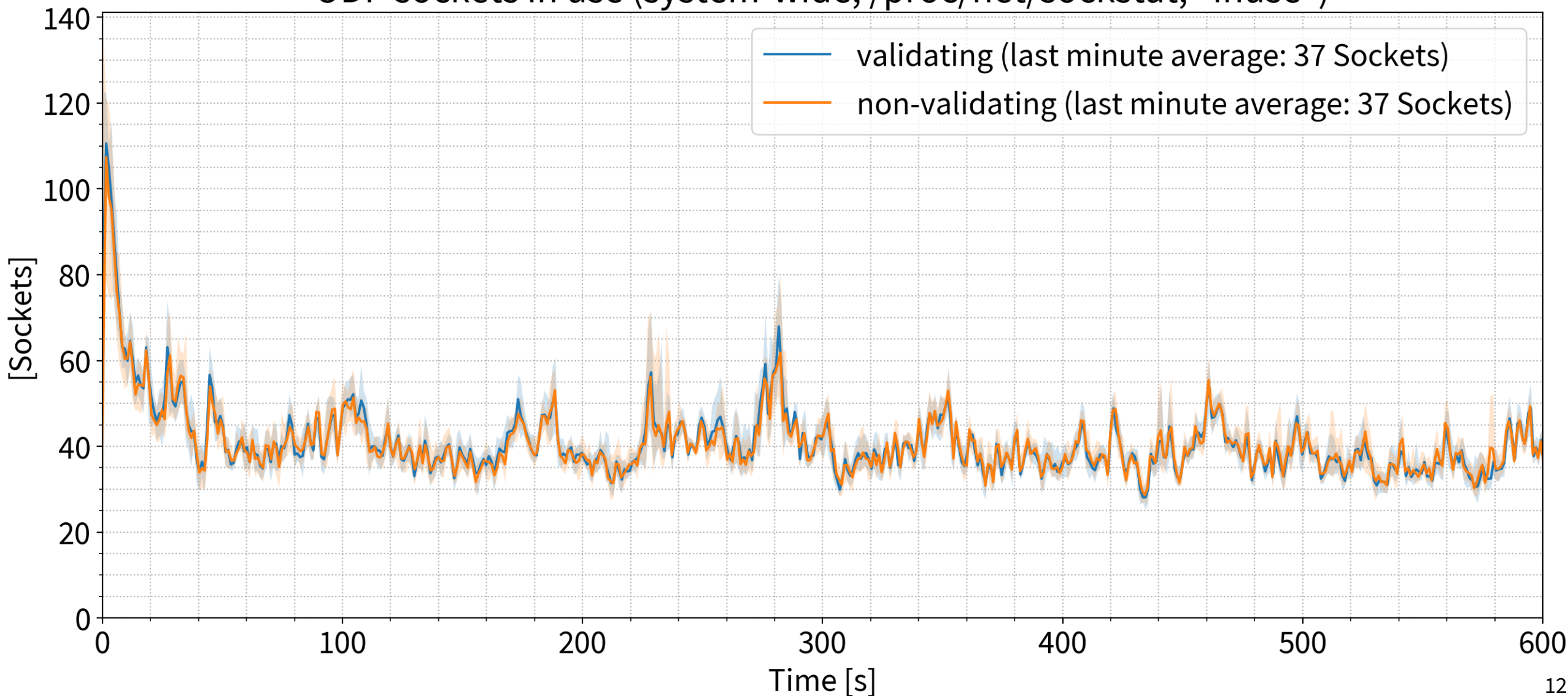
9 k QPS, TCP sockets

TCP sockets in time-wait state (system-wide, /proc/net/sockstat, "tw")



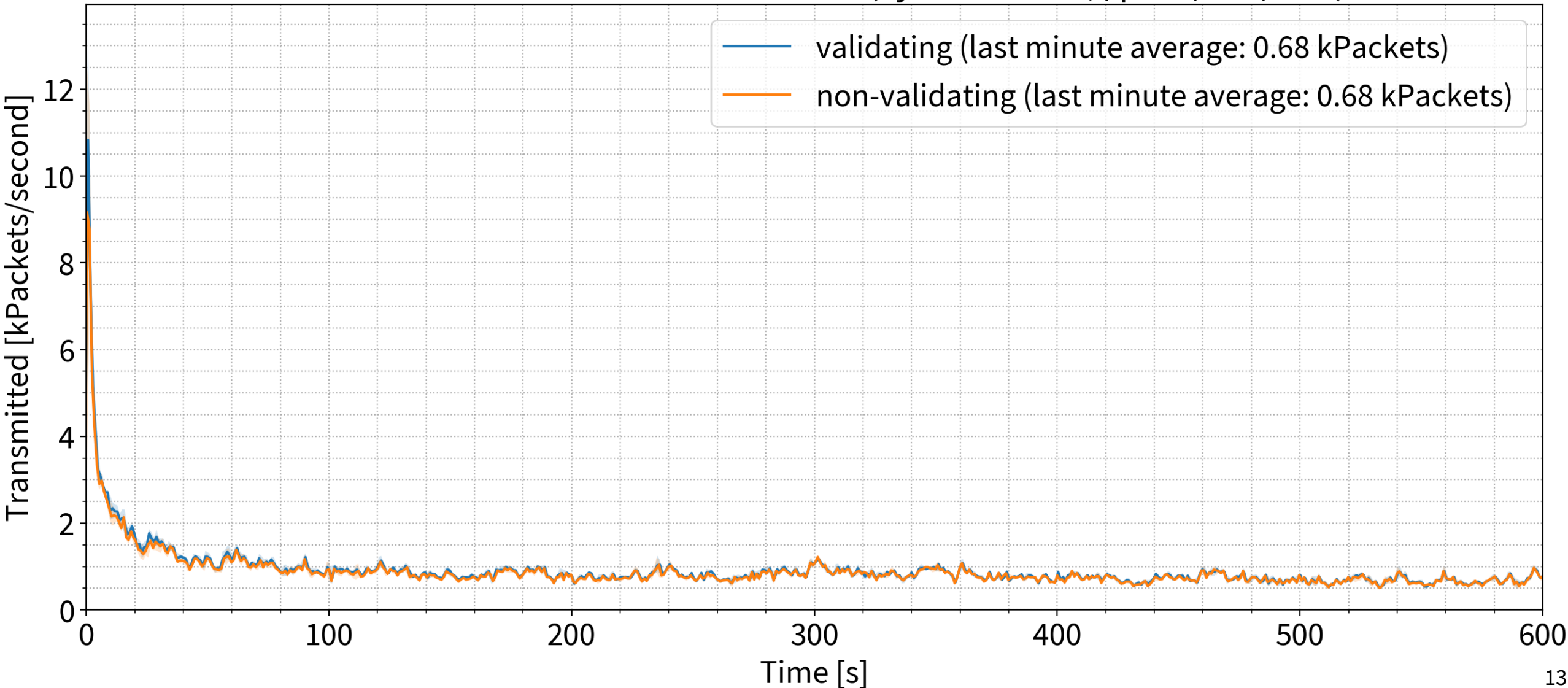
9 k QPS, UDP sockets

UDP sockets in use (system-wide, /proc/net/sockstat, "inuse")



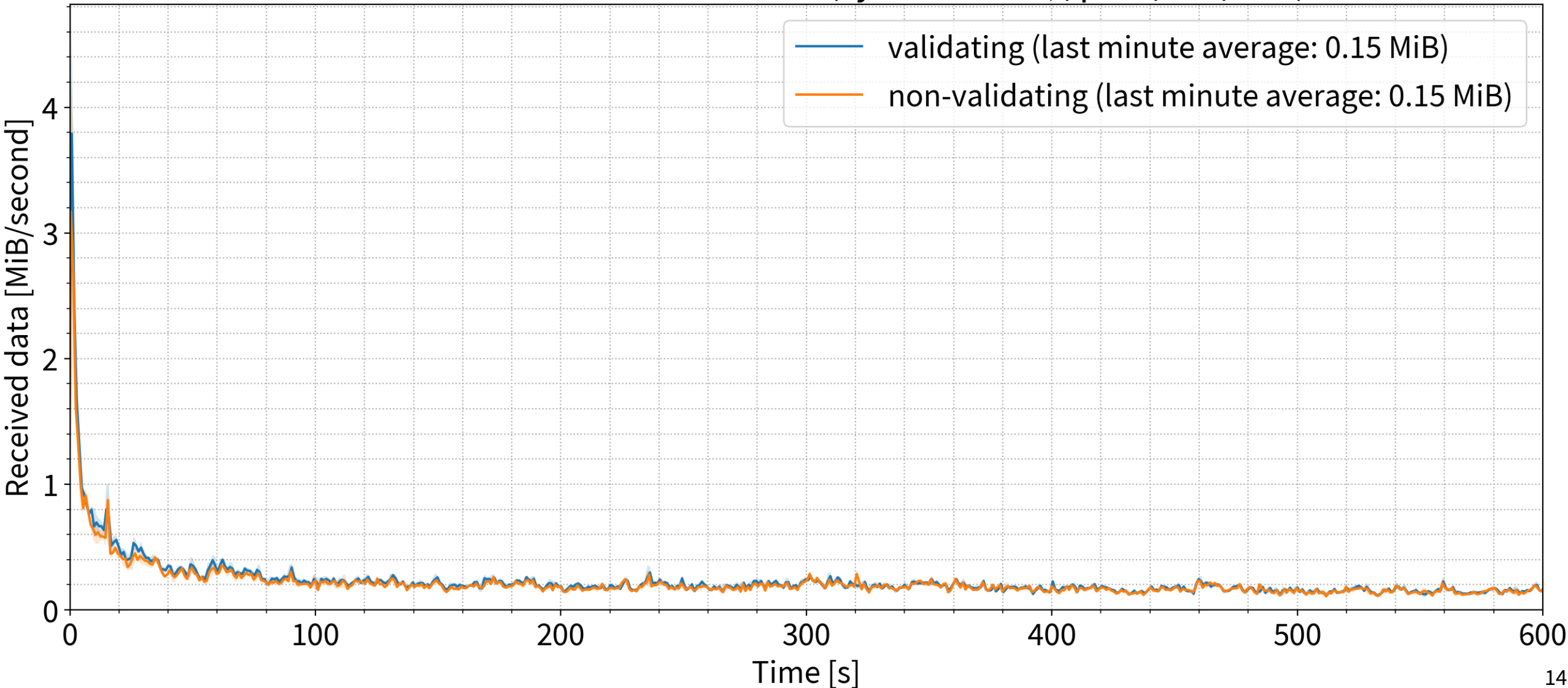
9 k QPS, packets out

Packets transmitted to the Internet (system-wide, /proc/net/dev)



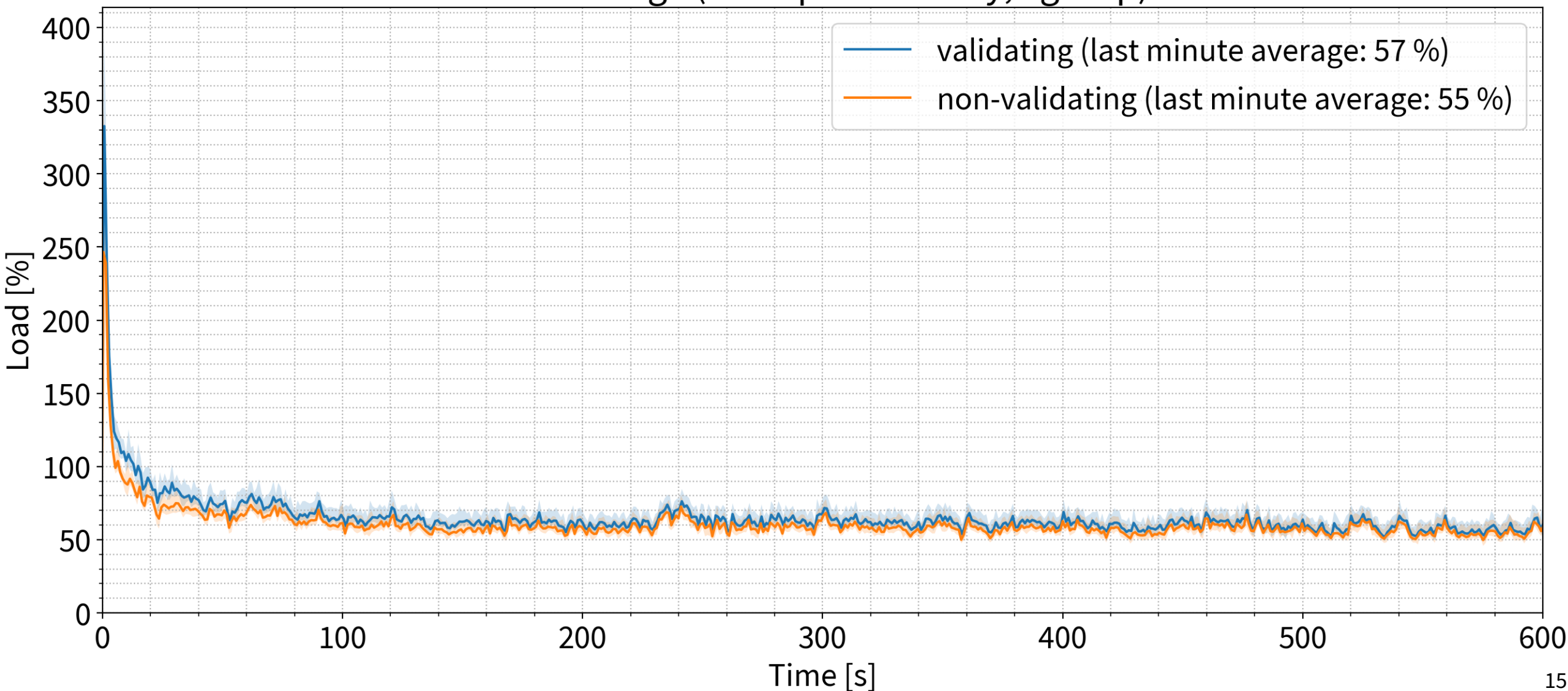
9 k QPS, bytes in

Data received from the Internet (system-wide, /proc/net/dev)



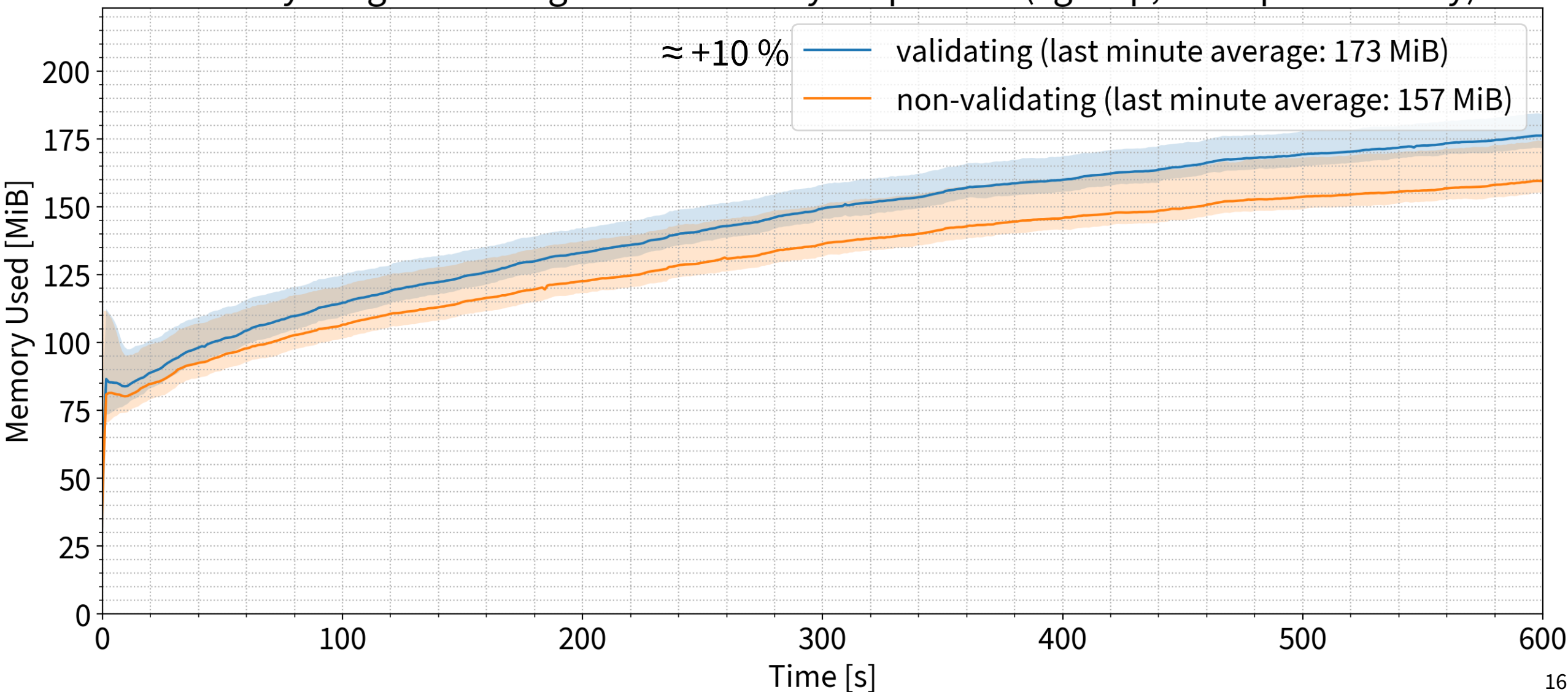
9 k QPS, CPU time

CPUs usage (BIND process only, cgroup)



9 k QPS, memory

Memory usage including kernel memory for process (cgroup, BIND process only)

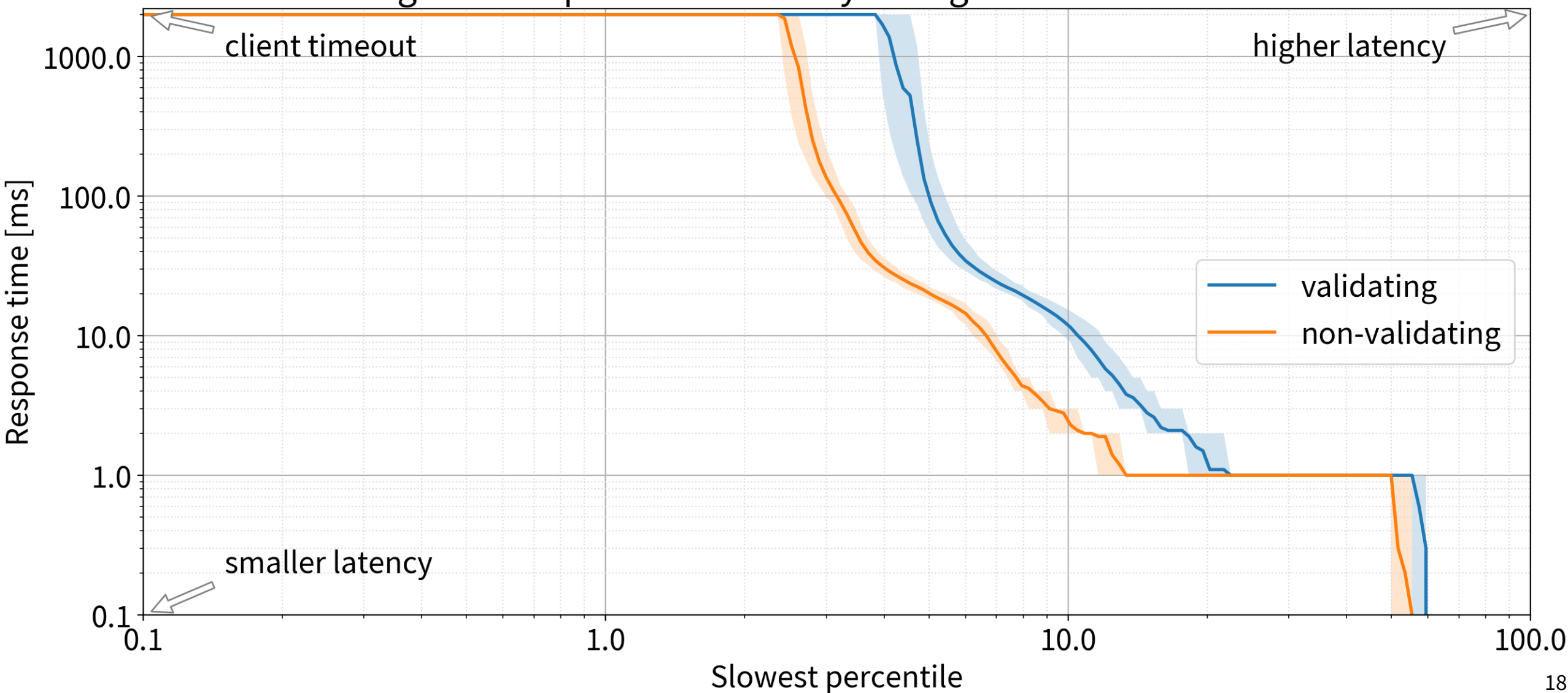


Scenario # 2

135 k QPS

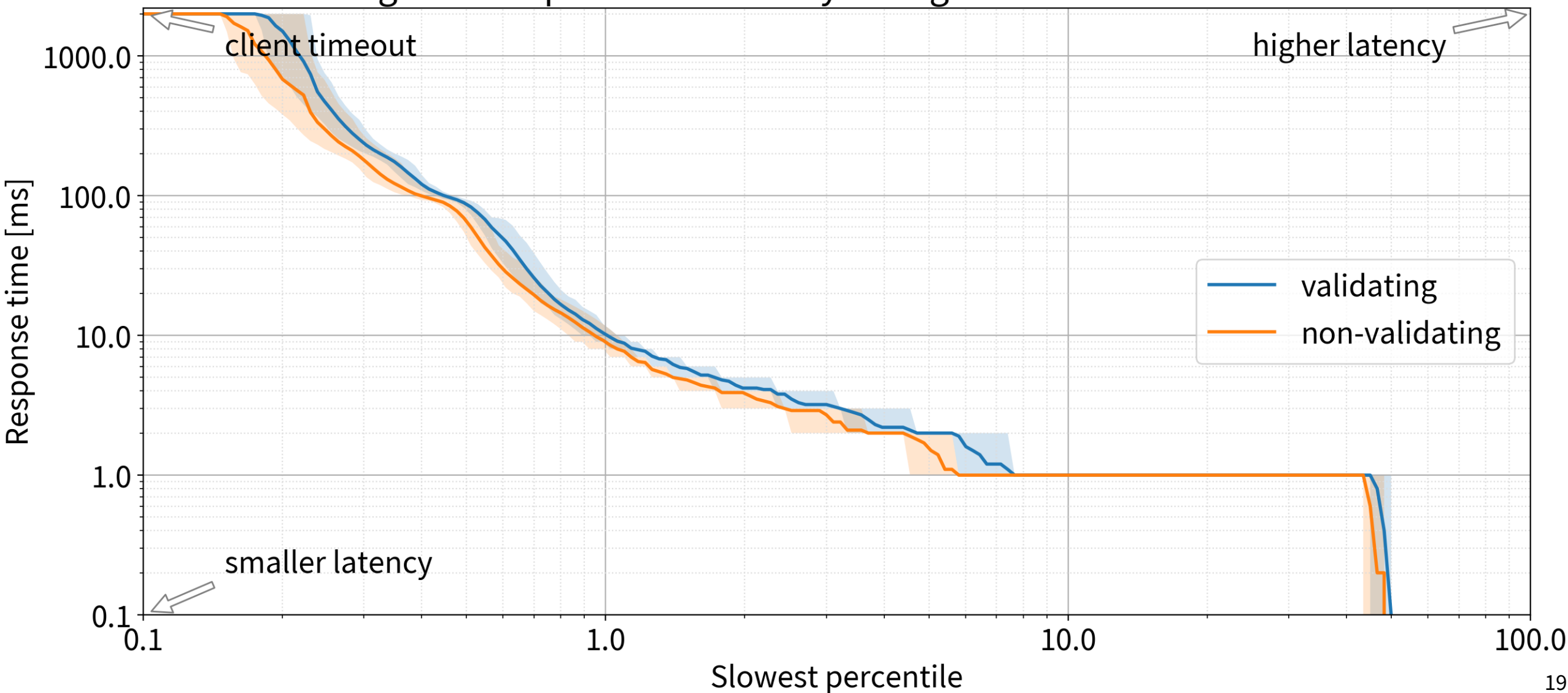
135 k QPS, Cold cache latency

Logarithmic percentile latency histogram: test time 0 - 60 s



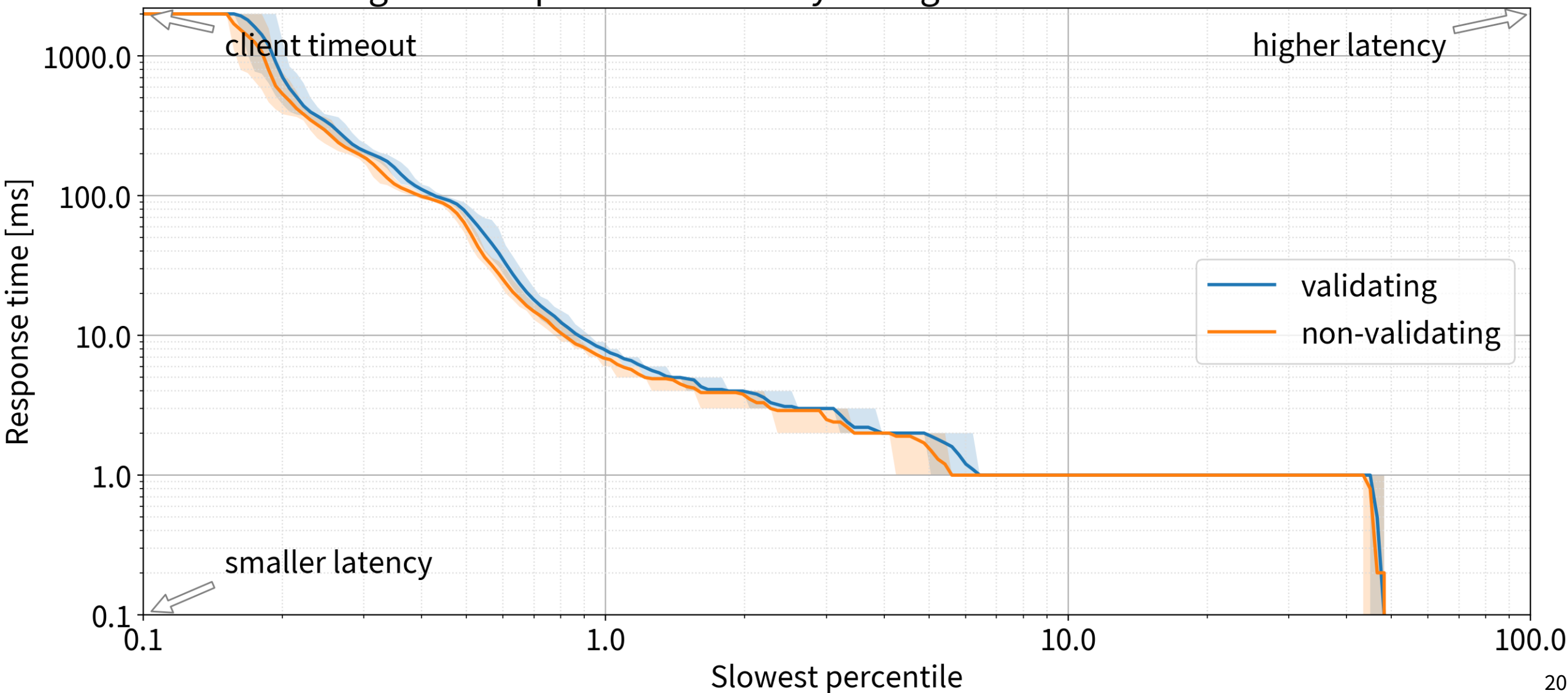
135 k QPS, Latency, second minute

Logarithmic percentile latency histogram: test time 60 - 120 s



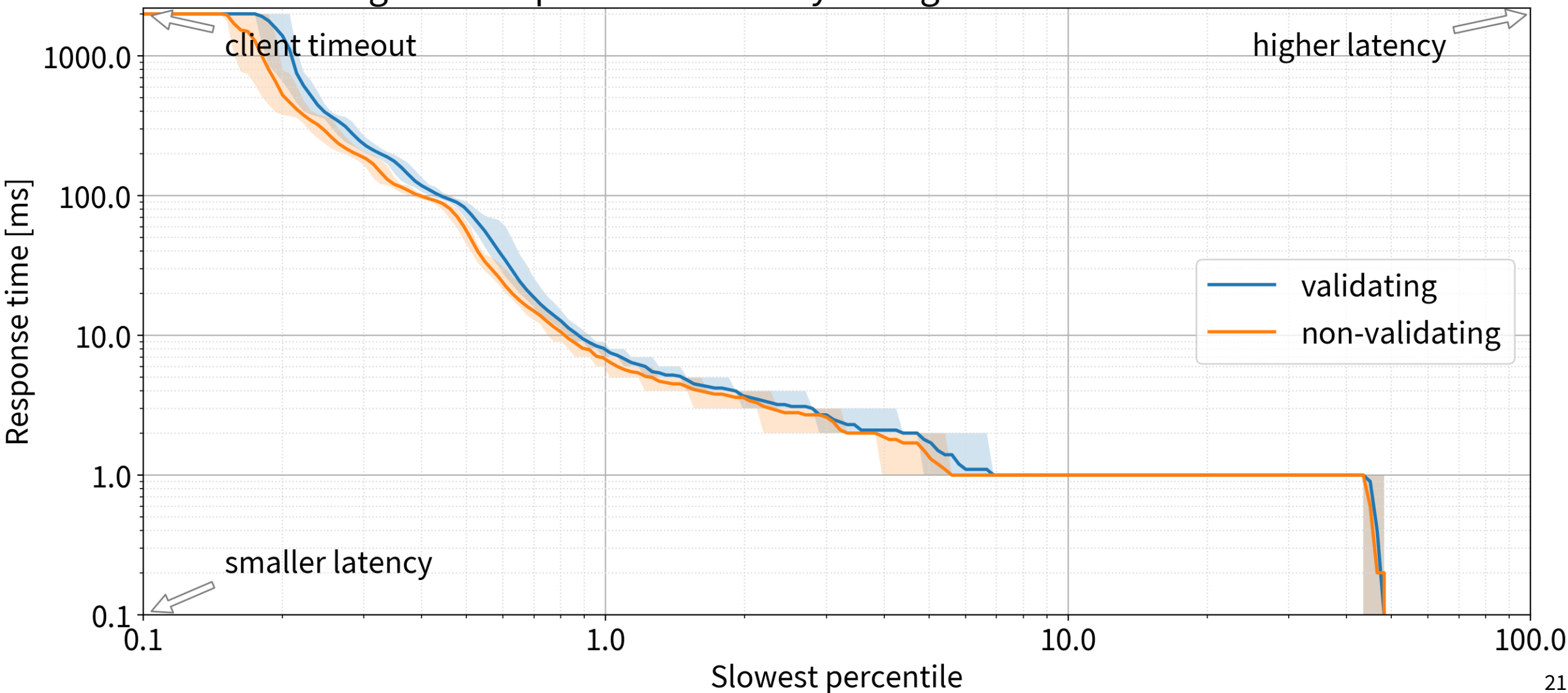
135 k QPS, Latency, third minute

Logarithmic percentile latency histogram: test time 120 - 180 s



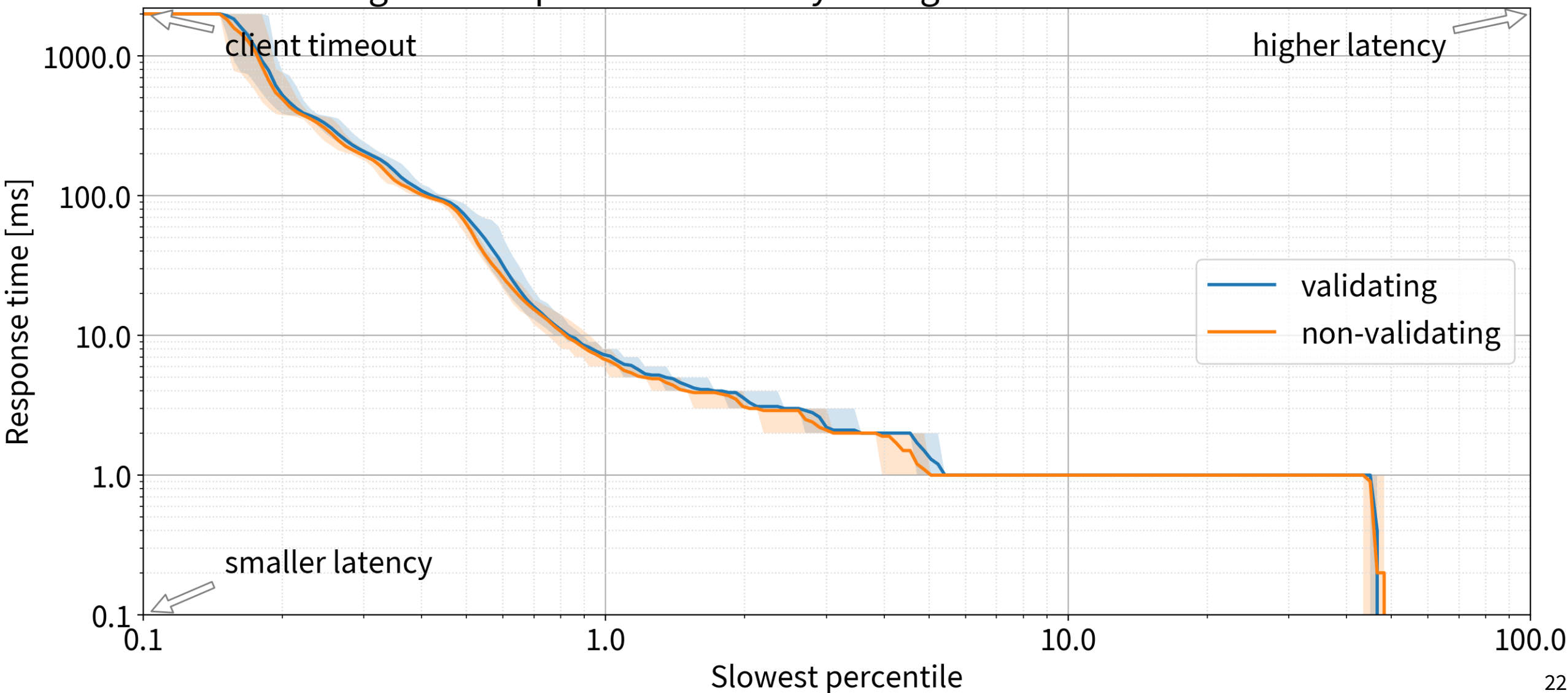
135 k QPS, Latency, fourth minute

Logarithmic percentile latency histogram: test time 180 - 240 s



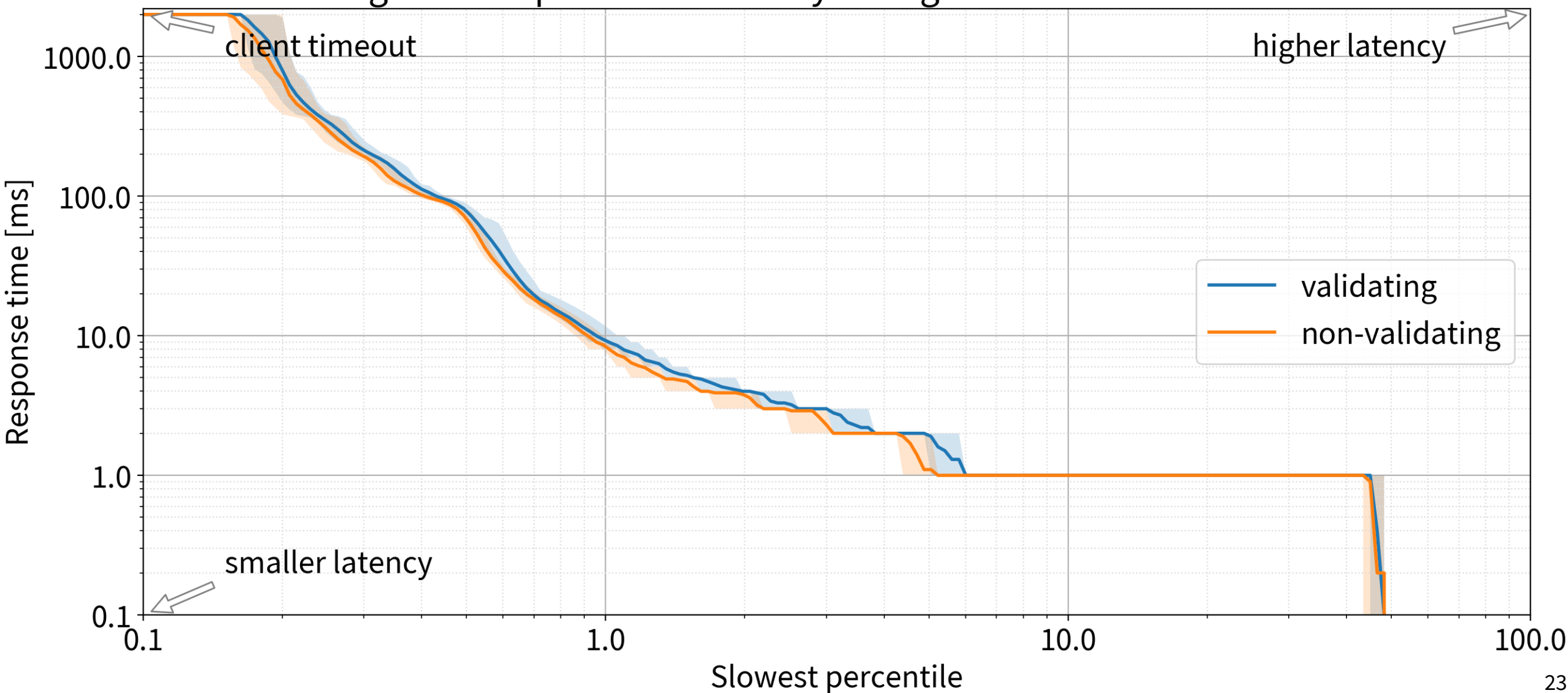
135 k QPS, Latency, fifth minute

Logarithmic percentile latency histogram: test time 240 - 300 s



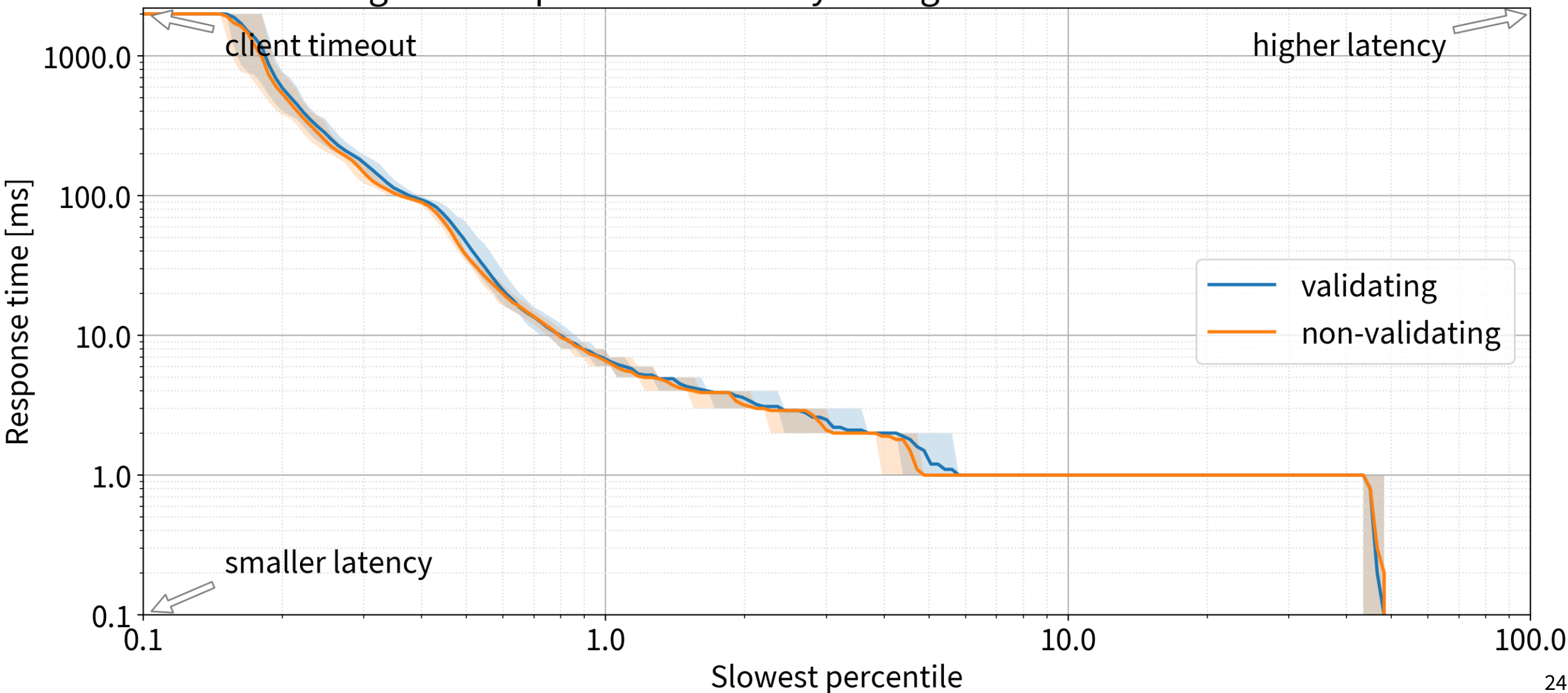
135 k QPS, Latency, sixth minute

Logarithmic percentile latency histogram: test time 300 - 360 s



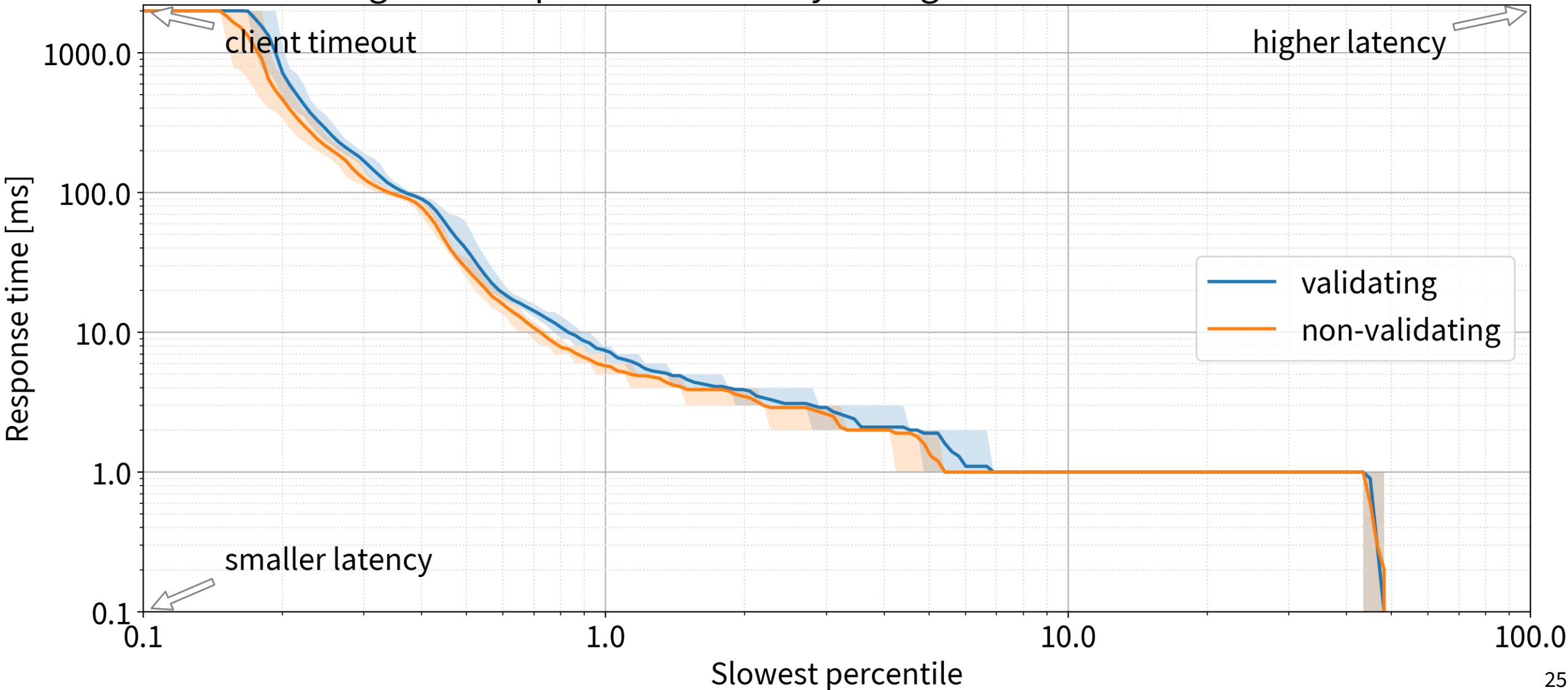
135 k QPS, Latency, seventh minute

Logarithmic percentile latency histogram: test time 360 - 420 s



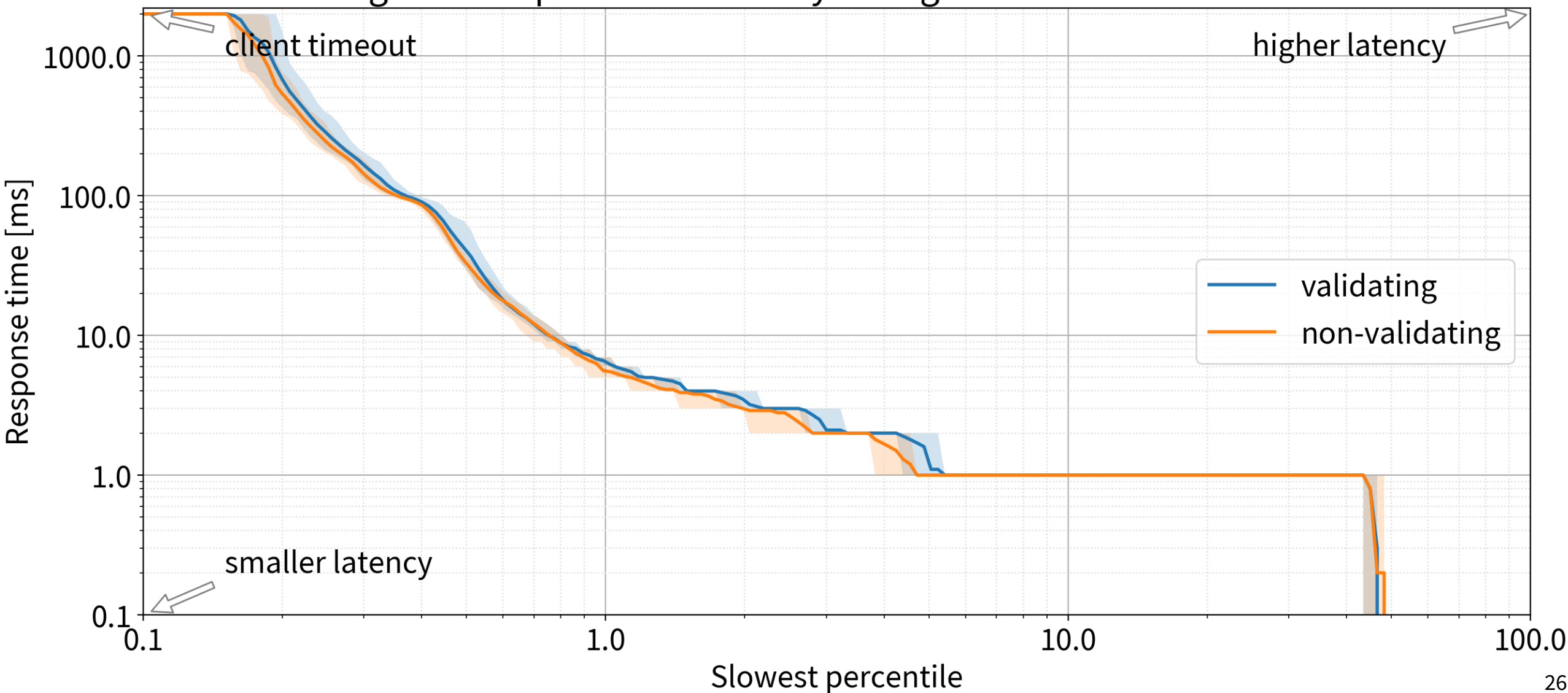
135 k QPS, Latency, eight minute

Logarithmic percentile latency histogram: test time 420 - 480 s



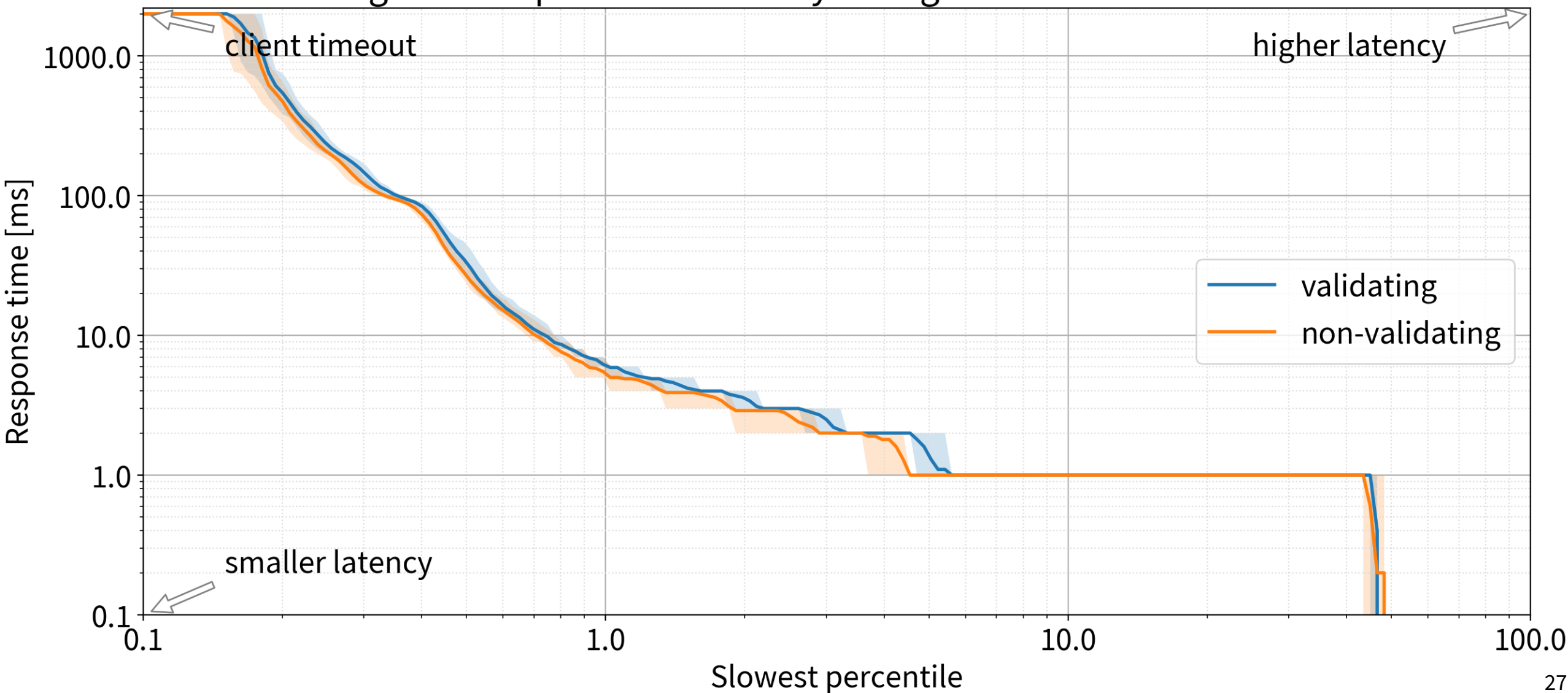
135 k QPS, Latency, ninth minute

Logarithmic percentile latency histogram: test time 480 - 540 s



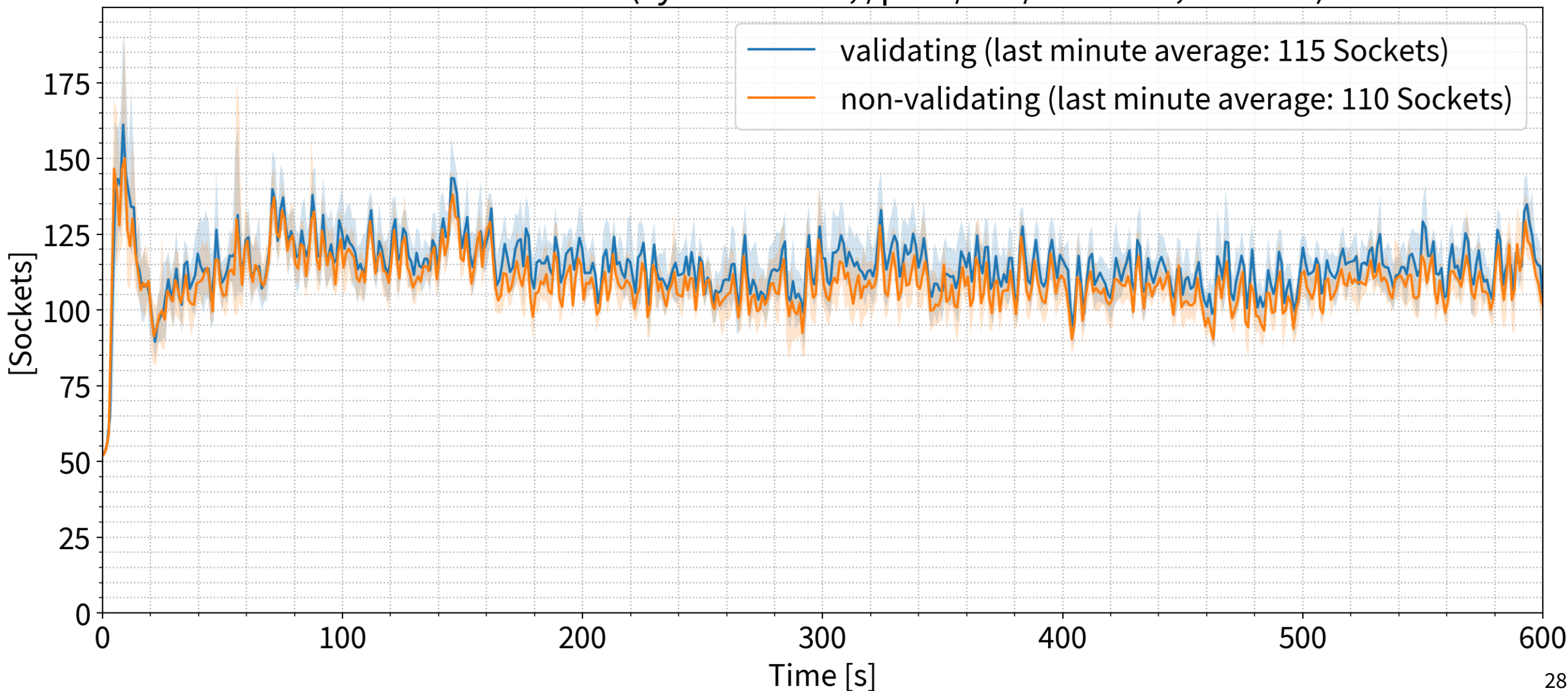
135 k QPS, Hot cache latency

Logarithmic percentile latency histogram: test time 540 - 600 s



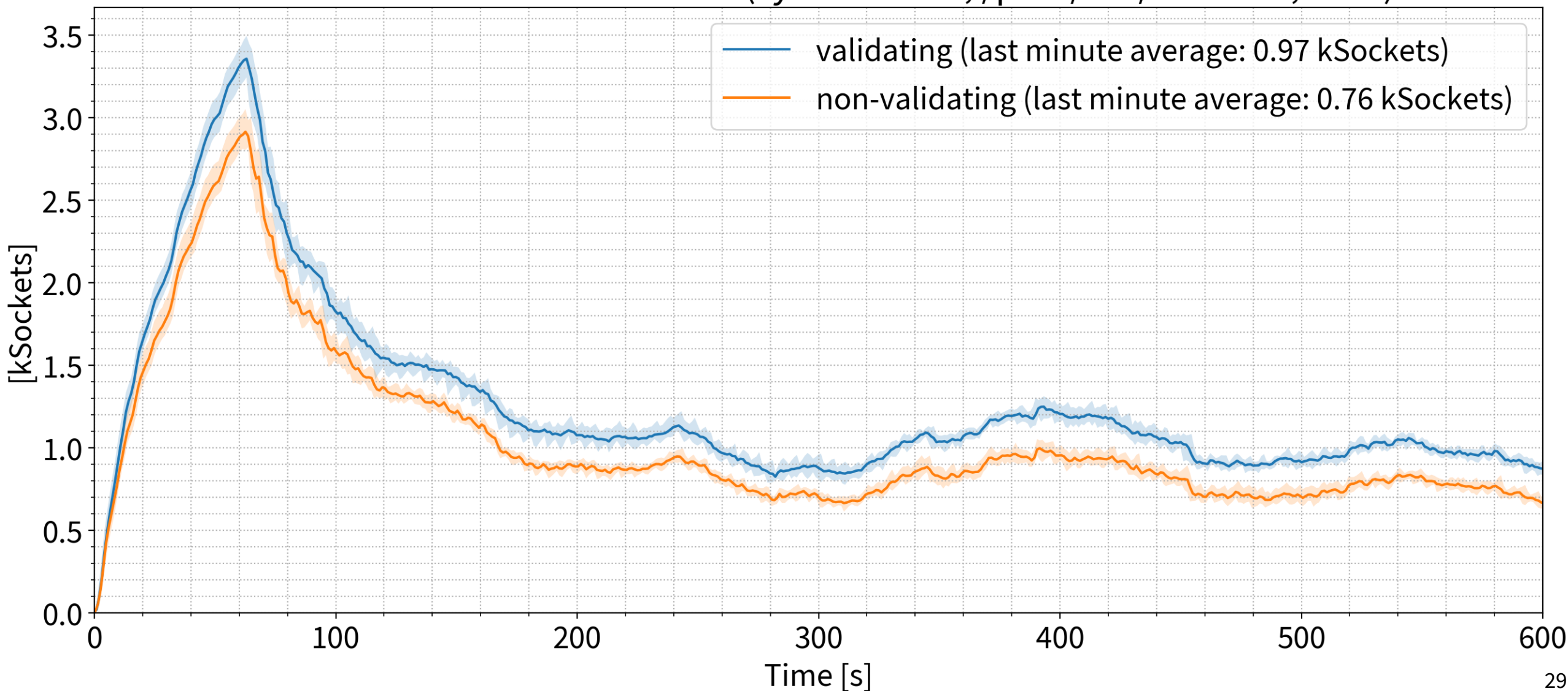
135 k QPS, TCP sockets

TCP sockets in use (system-wide, /proc/net/sockstat, "inuse")



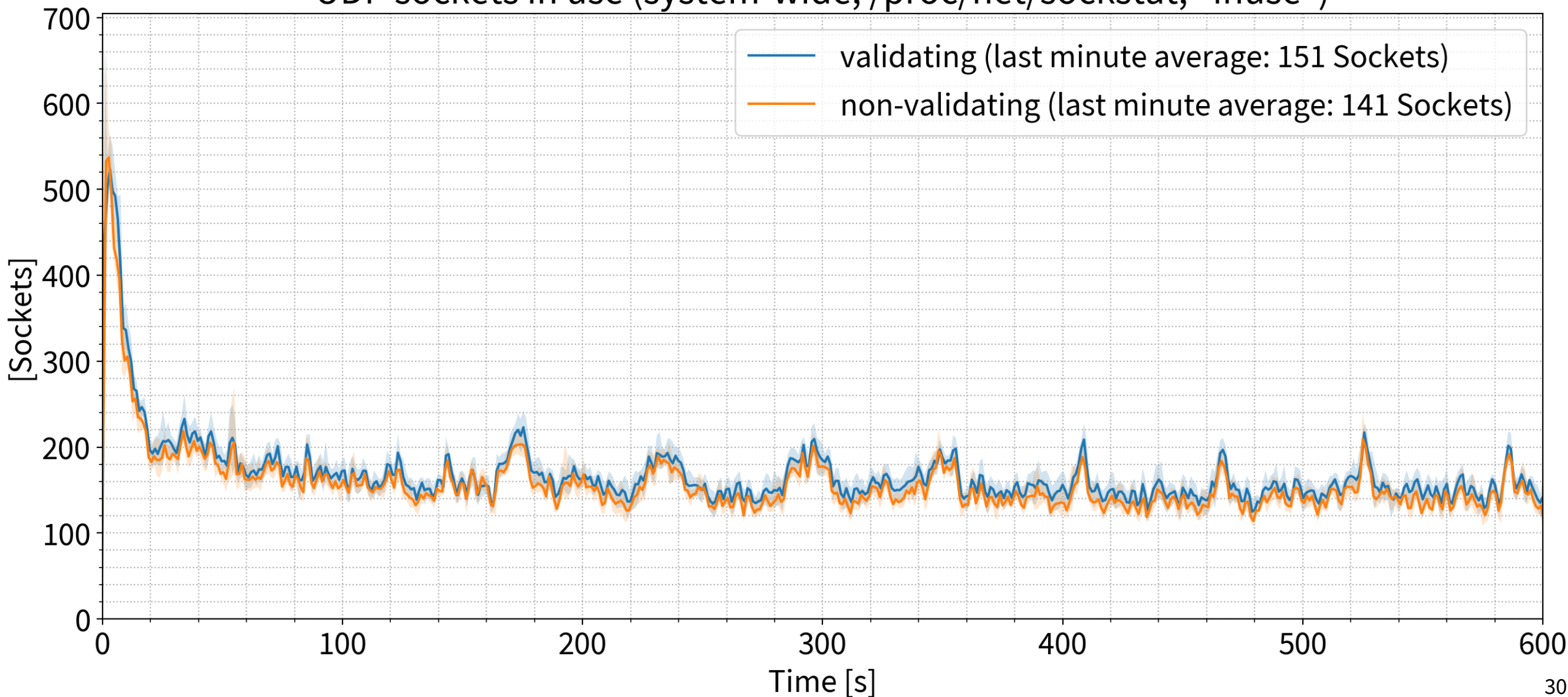
135 k QPS, TCP sockets

TCP sockets in time-wait state (system-wide, /proc/net/sockstat, "tw")



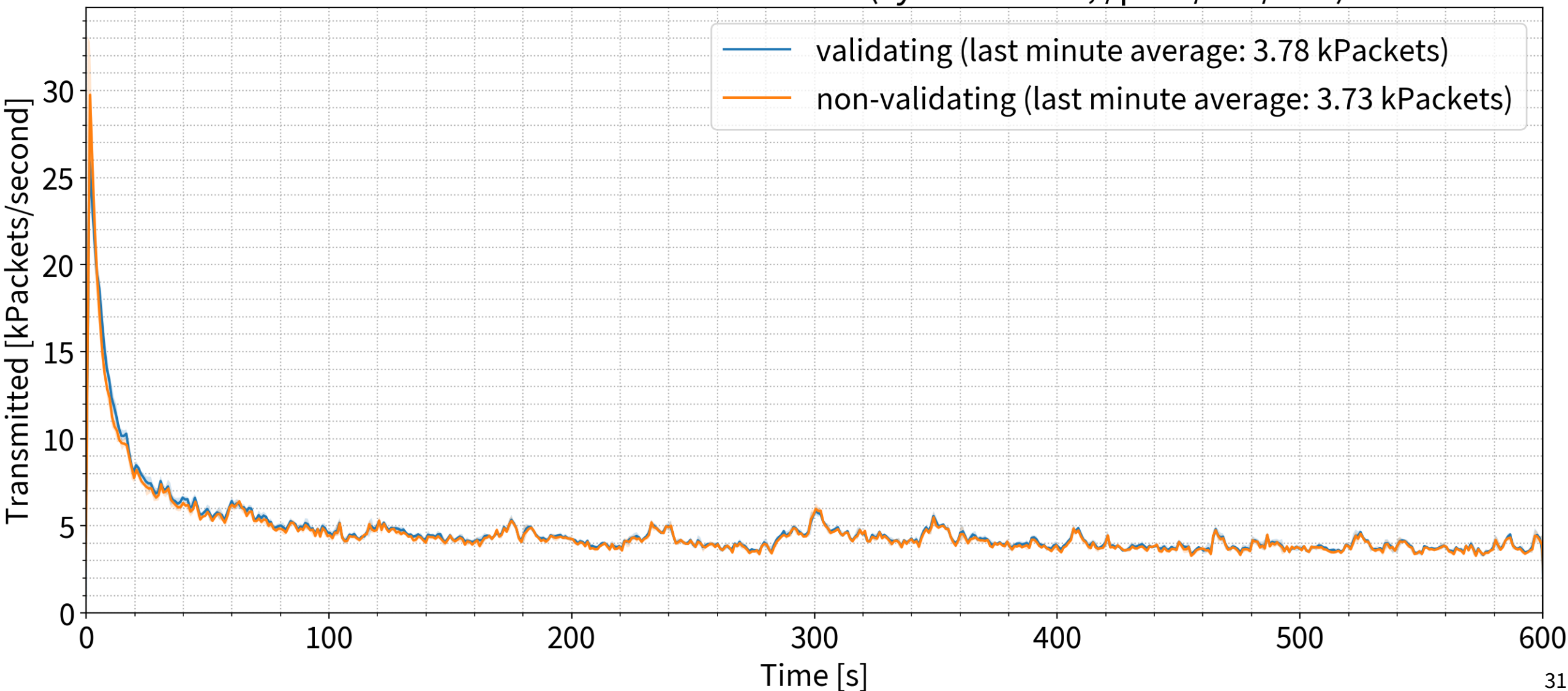
135 k QPS, UDP sockets

UDP sockets in use (system-wide, /proc/net/sockstat, "inuse")



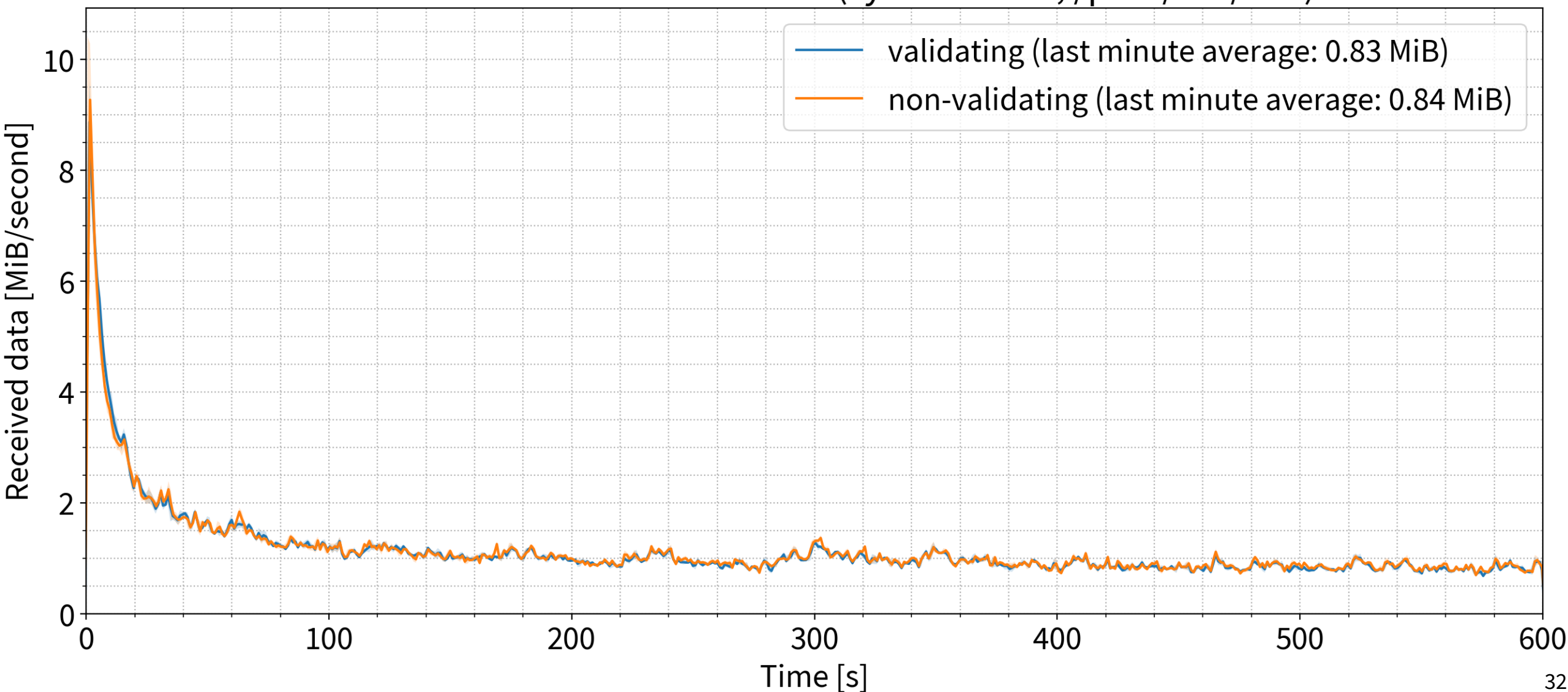
135 k QPS, packets out

Packets transmitted to the Internet (system-wide, /proc/net/dev)



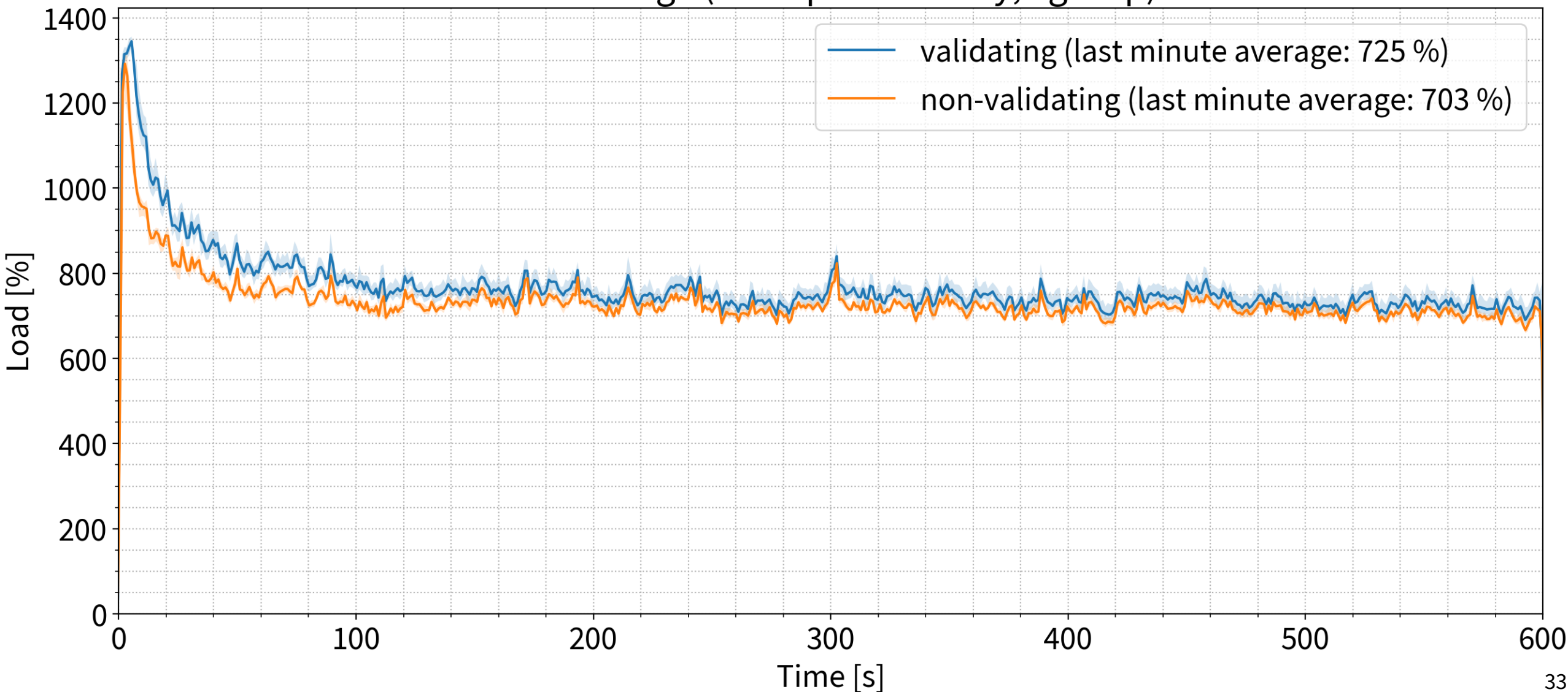
135 k QPS, bytes in

Data received from the Internet (system-wide, /proc/net/dev)



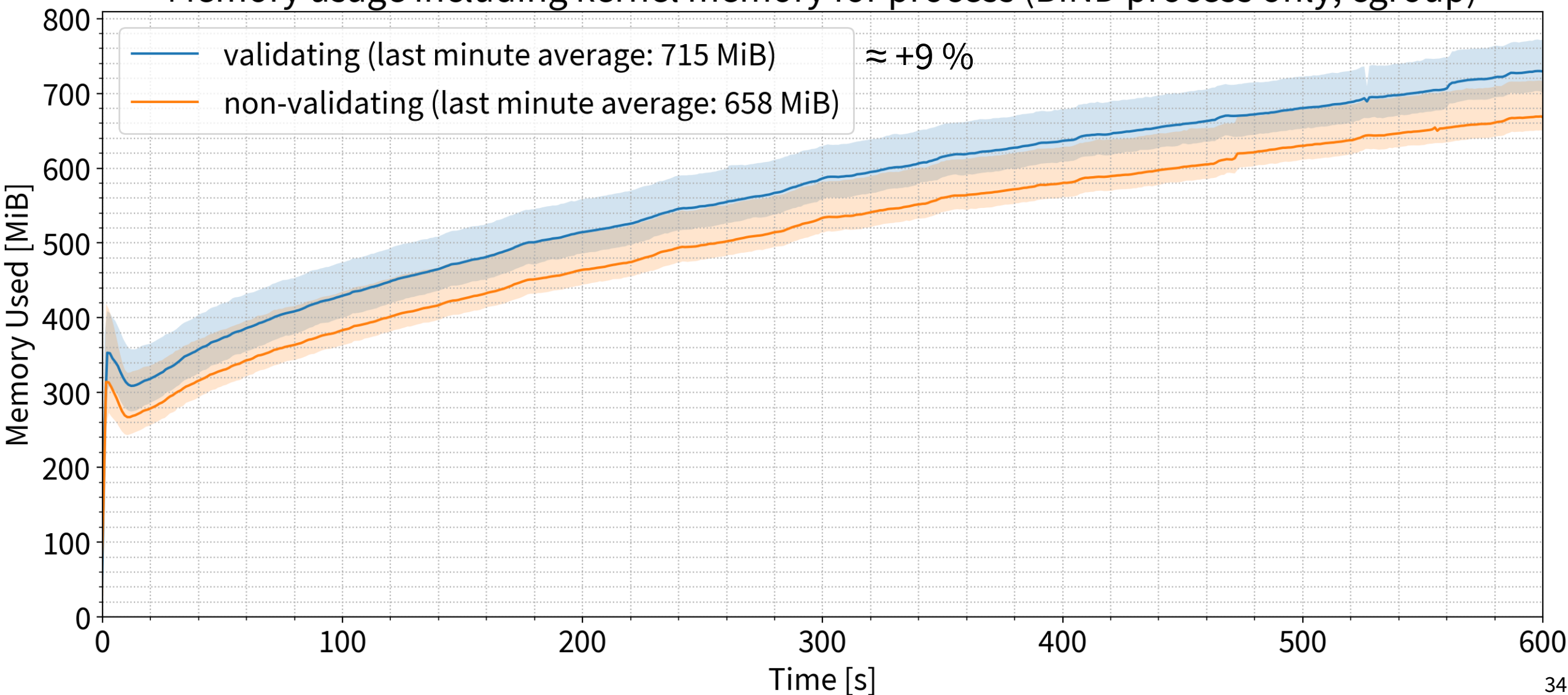
135 k QPS, CPU time

CPUs usage (BIND process only, cgroup)



135 k QPS, memory

Memory usage including kernel memory for process (BIND process only, cgroup)



Performance effects of DNSSEC validation

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

Thank you!

- Main website: <https://www.isc.org>
- Software downloads:
<https://www.isc.org/download> or
<https://downloads.isc.org>
- Presentations: <https://www.isc.org/presentations>
- Main GitLab: <https://gitlab.isc.org>