

# Performance effects of DNSSEC validation

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2022-07-30

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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

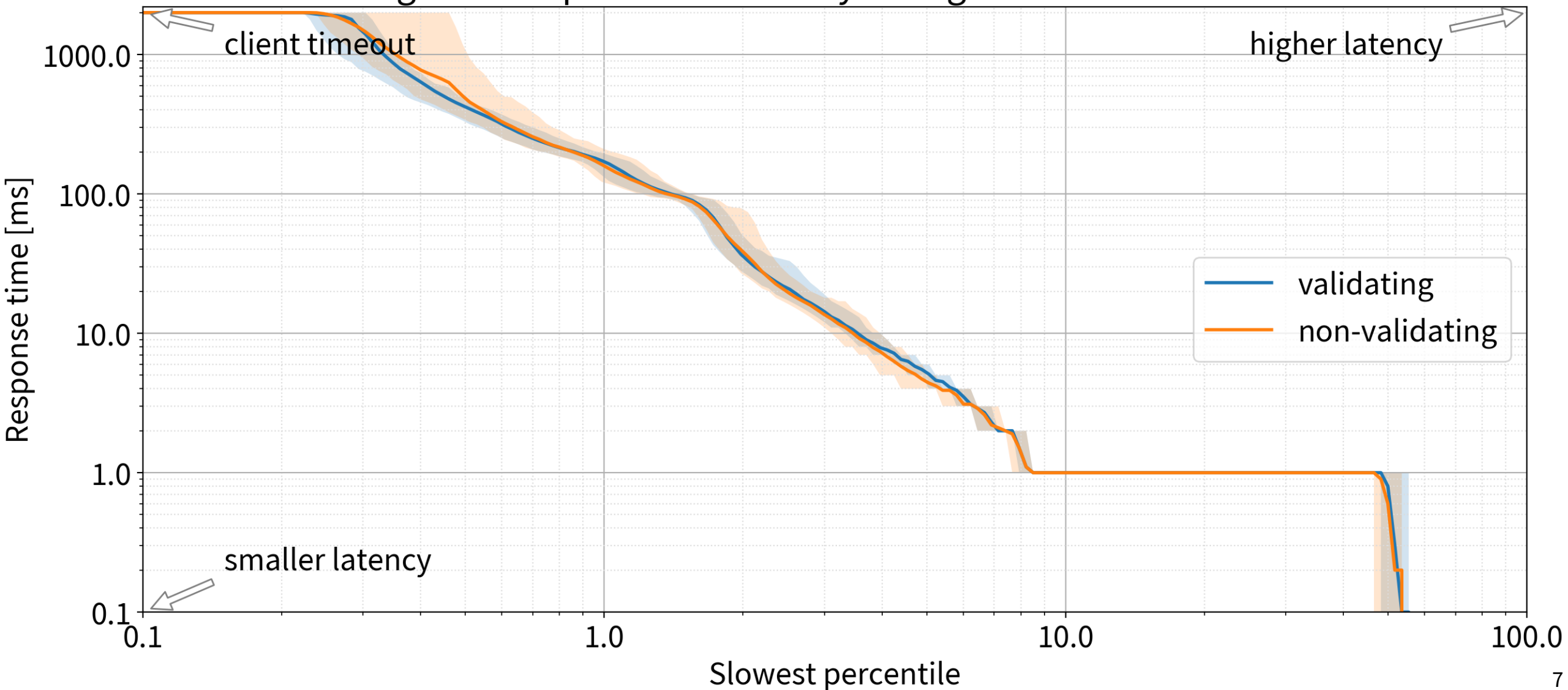
- Resolver: BIND 9.18.4
  - Empty cache, validation on/off
- Client simulator: DNS Shotgun
  - Keeps query timing/cache hit rate
- Live Internet
  - Measure, rinse, repeat: 10 times
- Custom resource monitoring

# Scenario # 1

9 k QPS

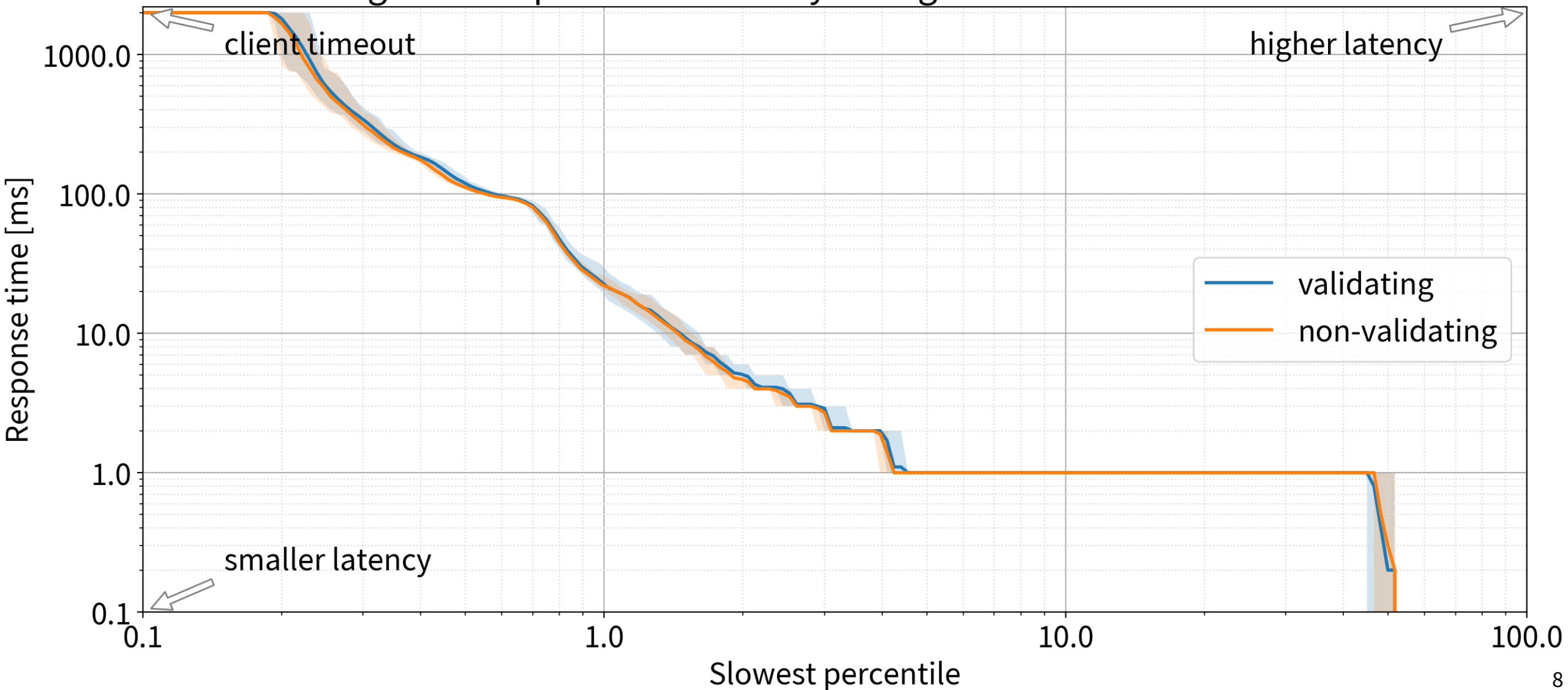
# 9 k QPS, Cold cache latency

Logarithmic percentile latency histogram: test time 0 - 60 s



# 9 k QPS, Hot cache latency

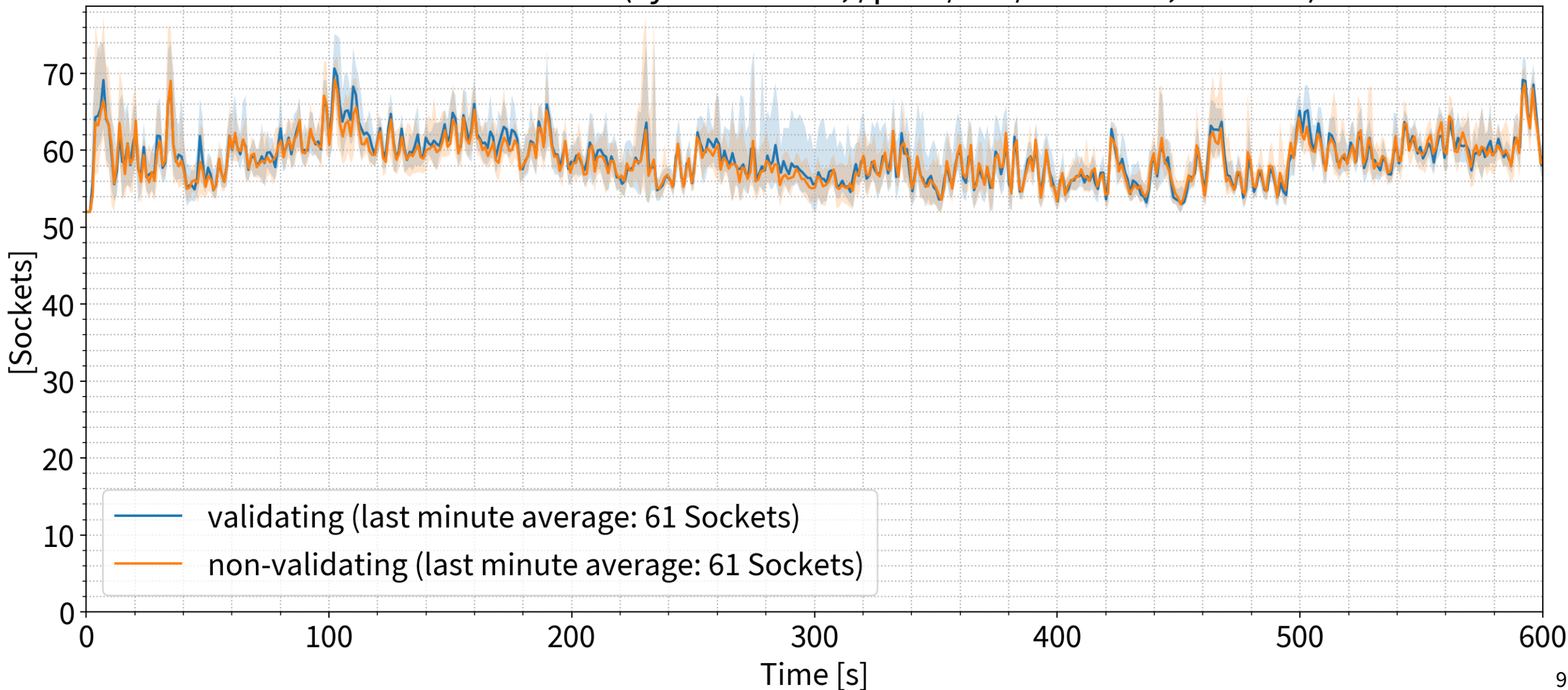
Logarithmic percentile latency histogram: test time 540 - 600 s





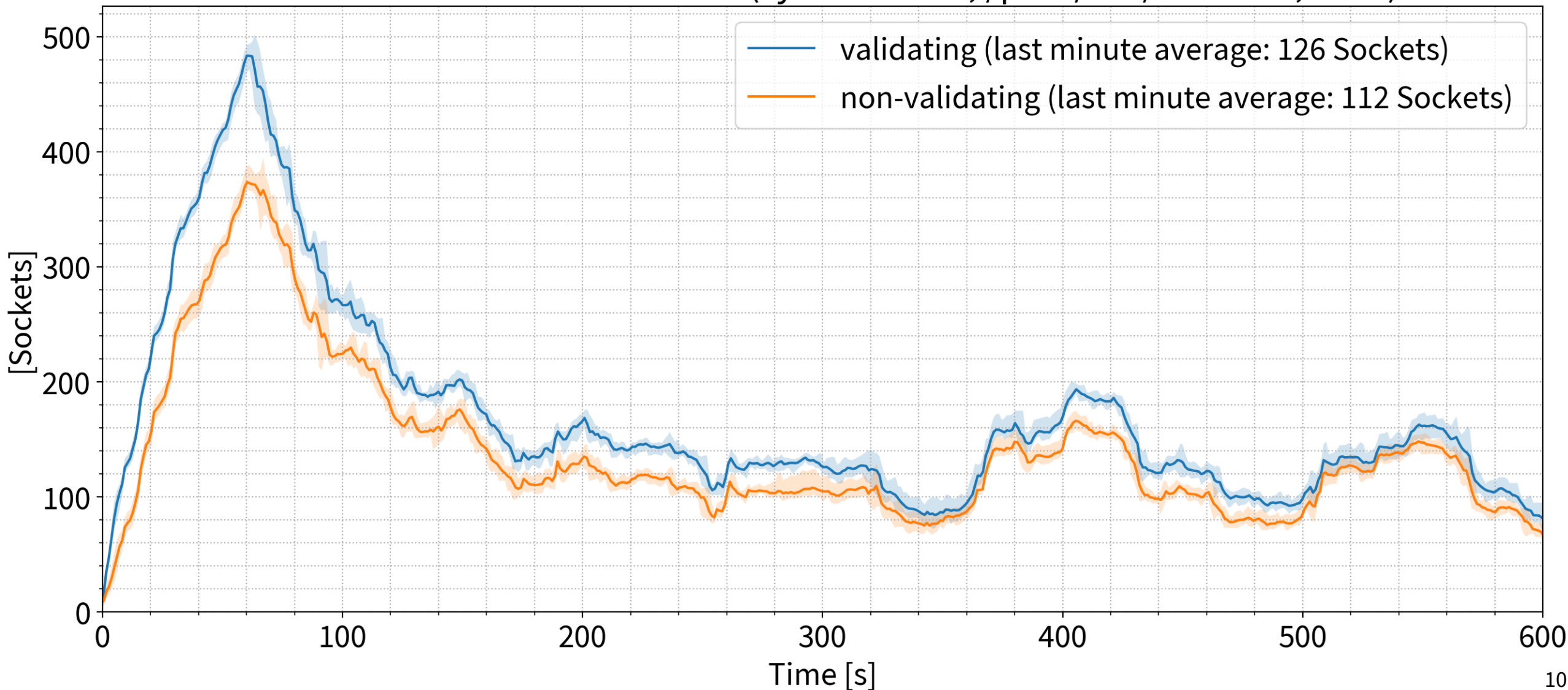
# 9 k QPS, TCP sockets

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



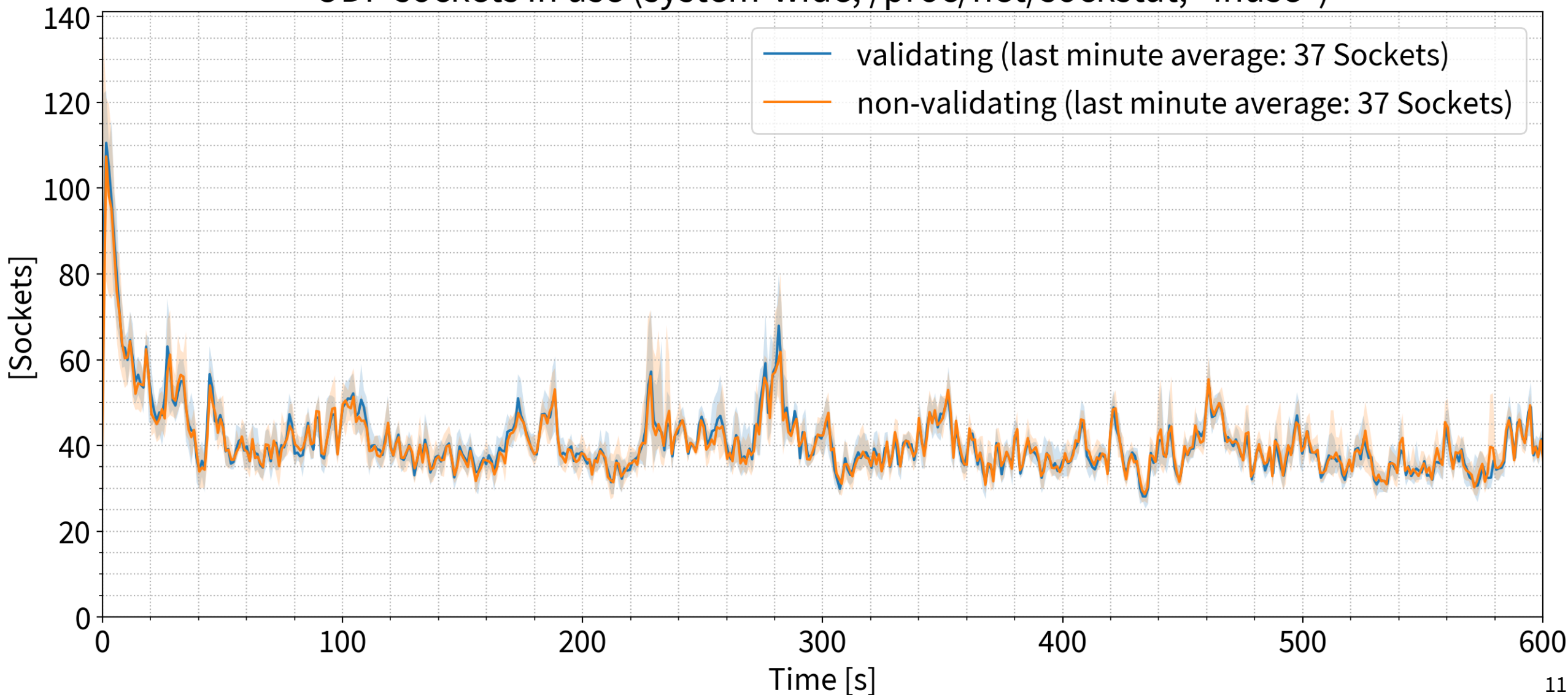
# 9 k QPS, TCP sockets

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



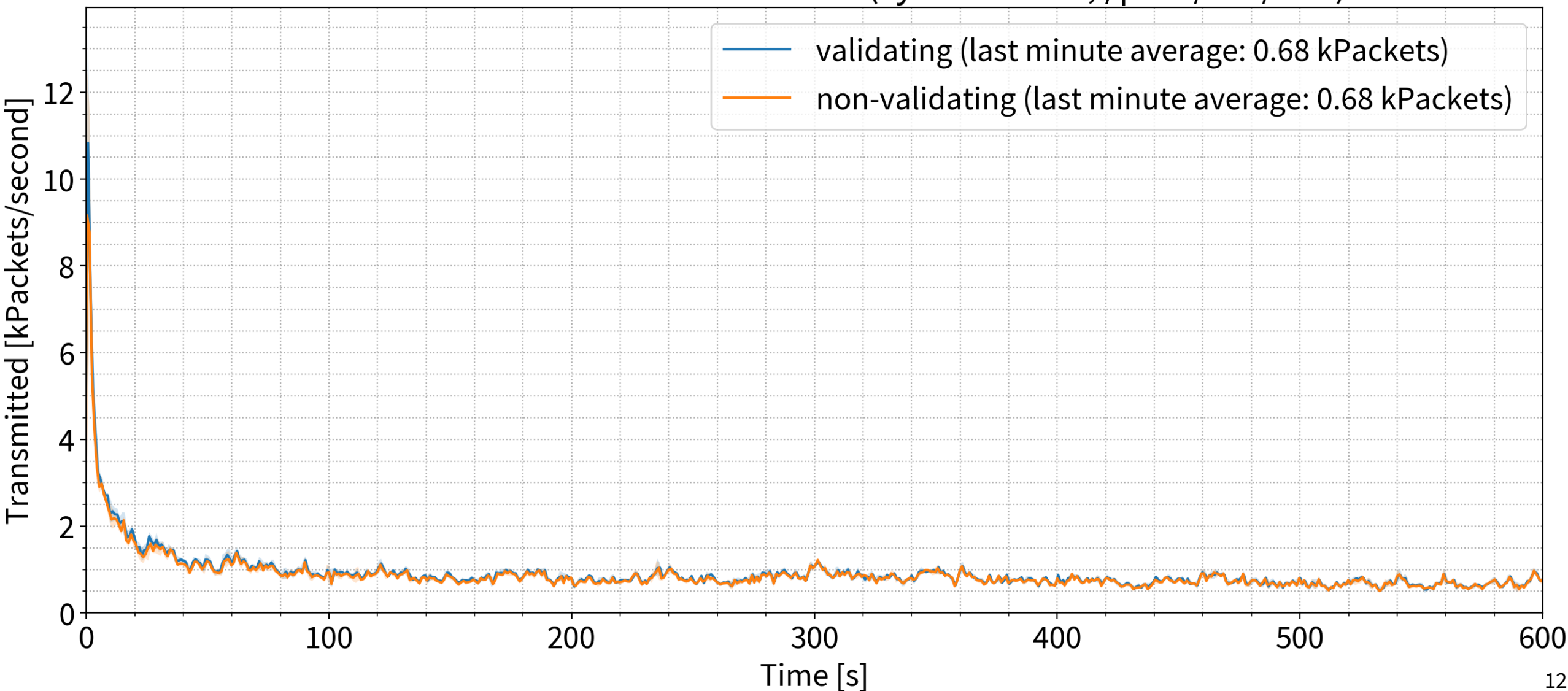
# 9 k QPS, UDP sockets

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



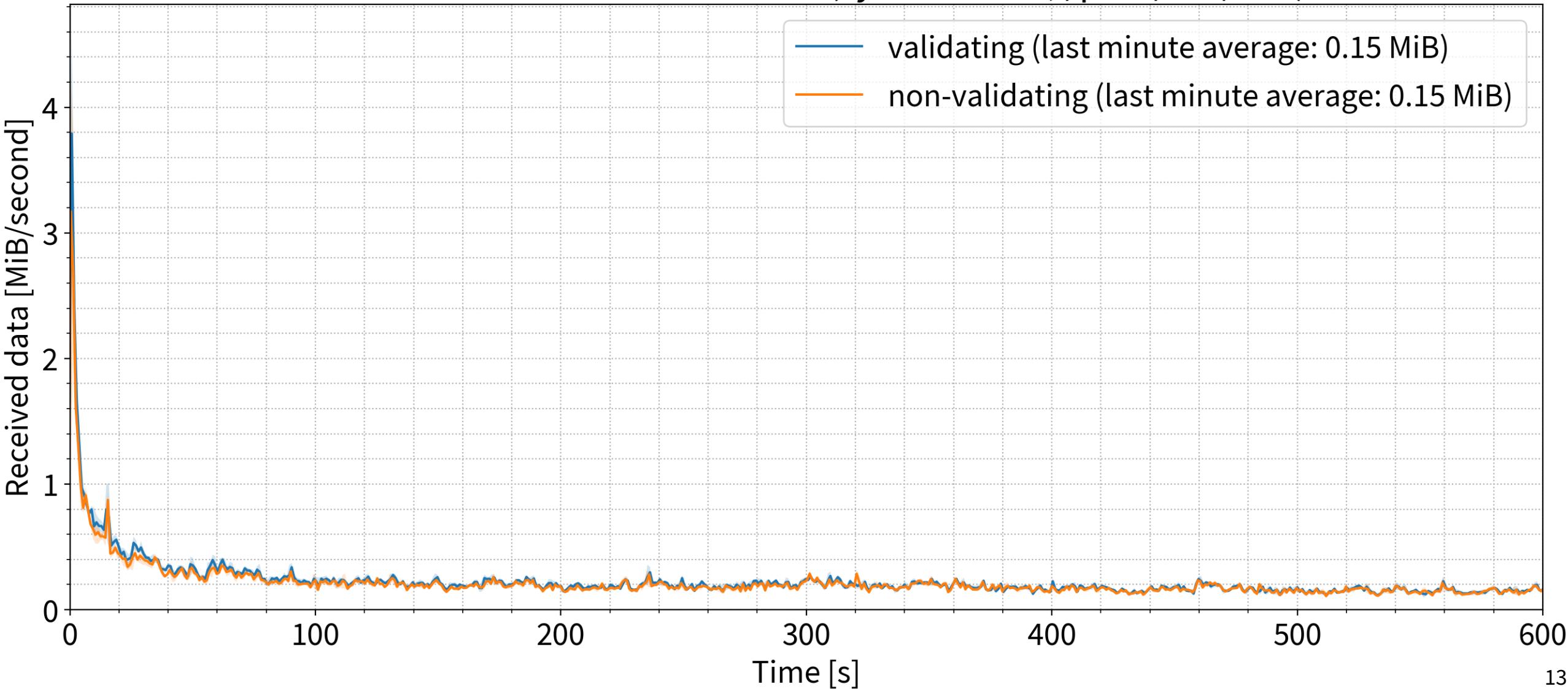
# 9 k QPS, packets out

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



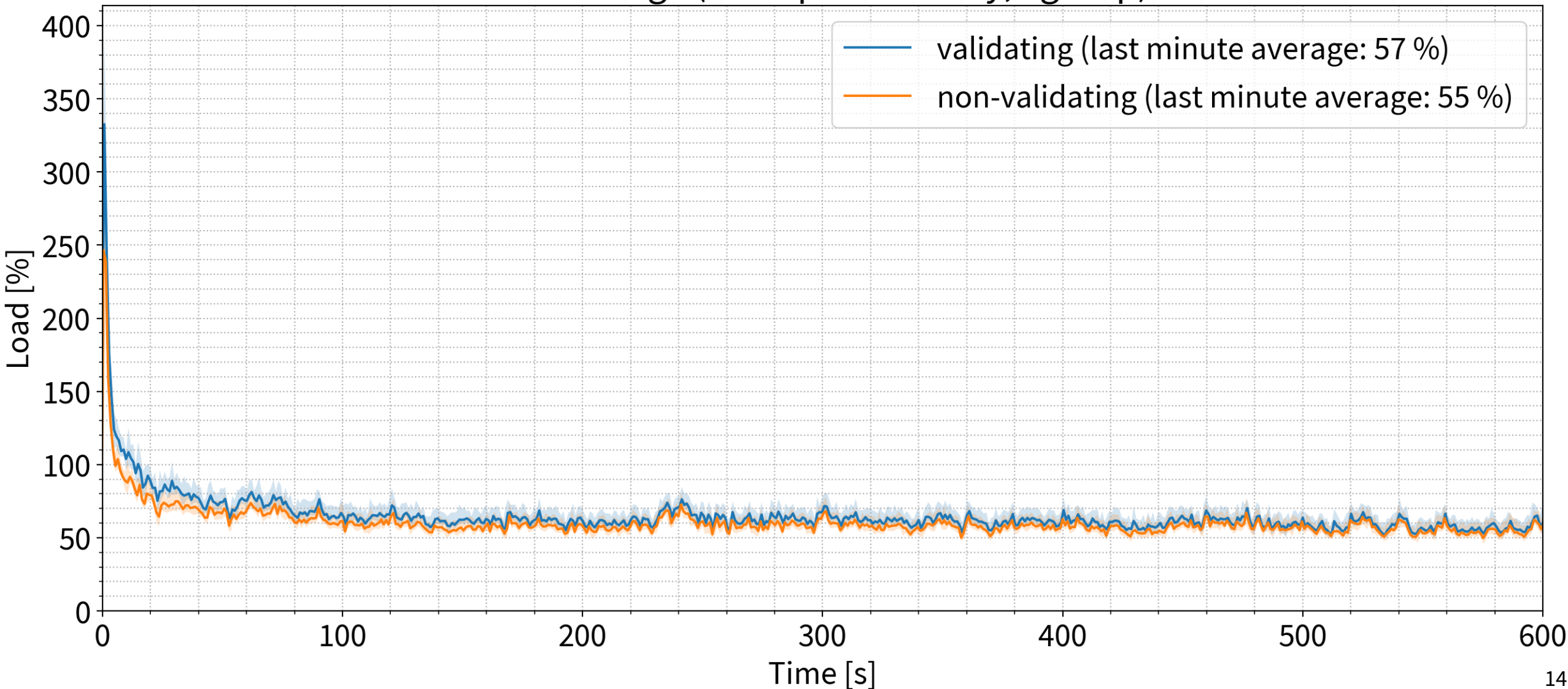
# 9 k QPS, bytes in

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



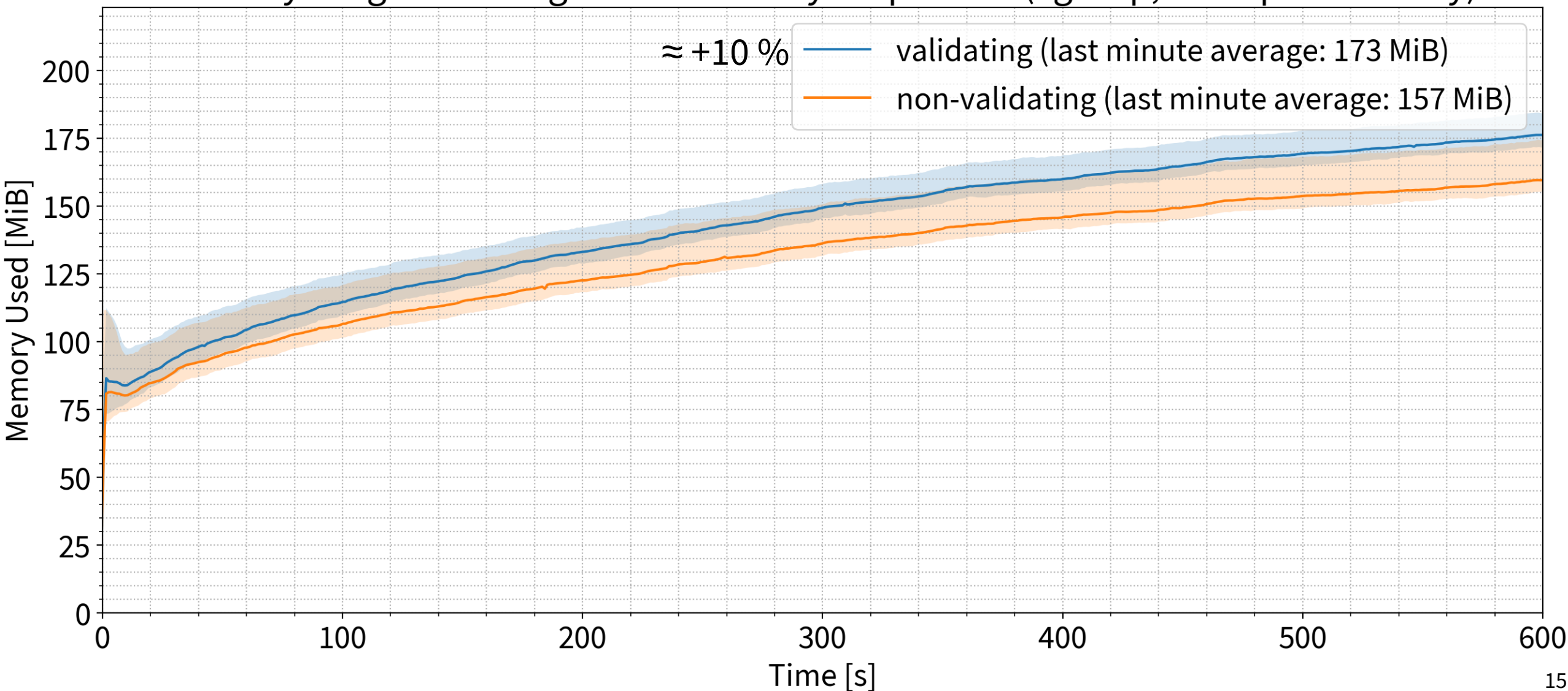
# 9 k QPS, CPU time

CPUs usage (BIND process only, cgroup)



# 9 k QPS, memory

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



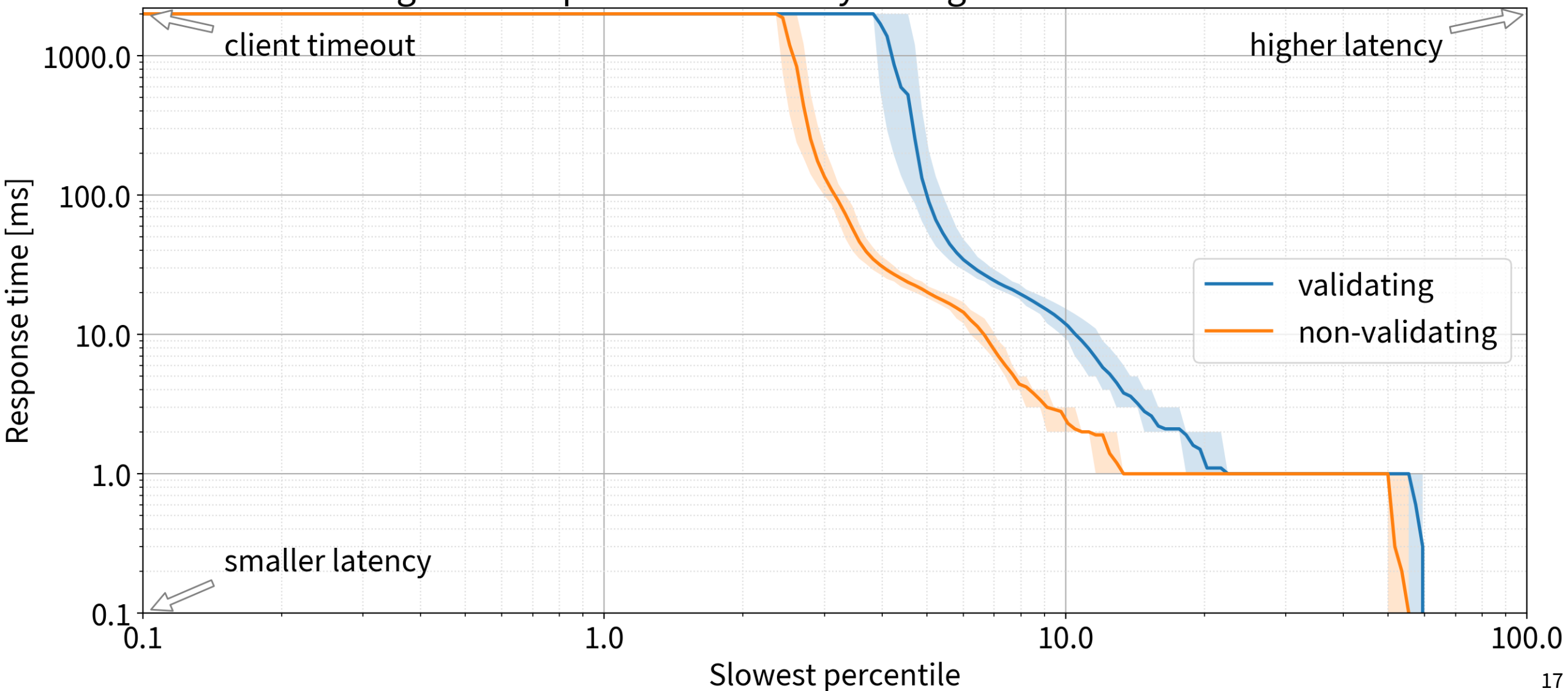
# Scenario # 2

135 k QPS



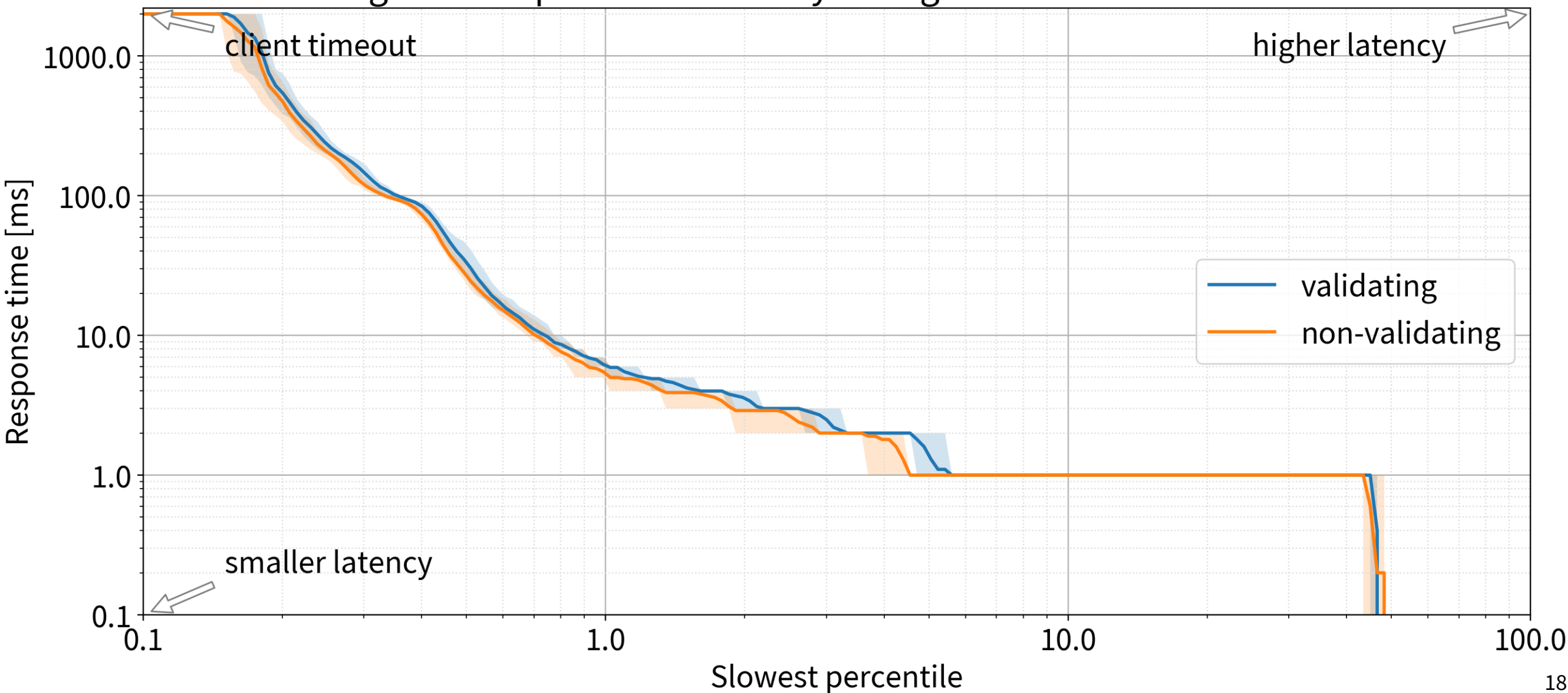
# 135 k QPS, Cold cache latency

Logarithmic percentile latency histogram: test time 0 - 60 s



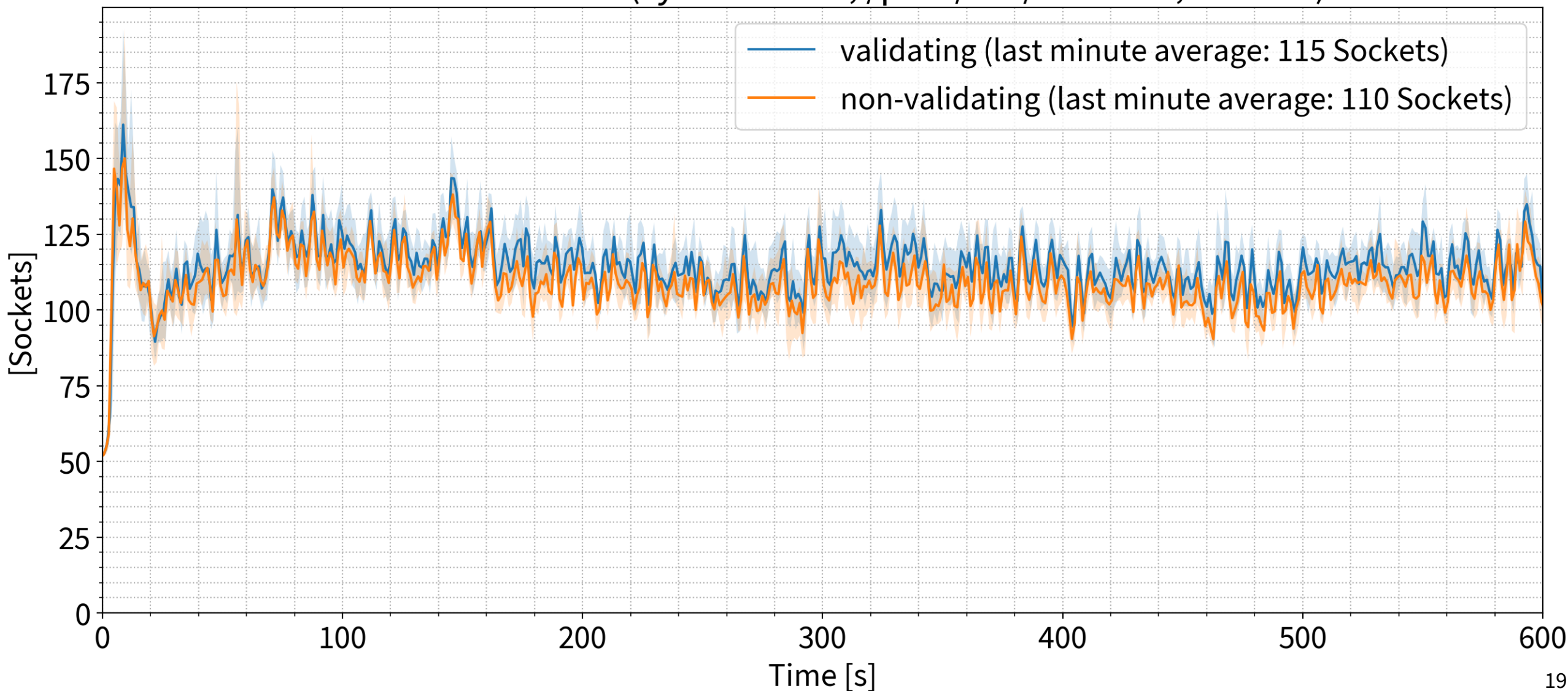
# 135 k QPS, Hot cache latency

Logarithmic percentile latency histogram: test time 540 - 600 s



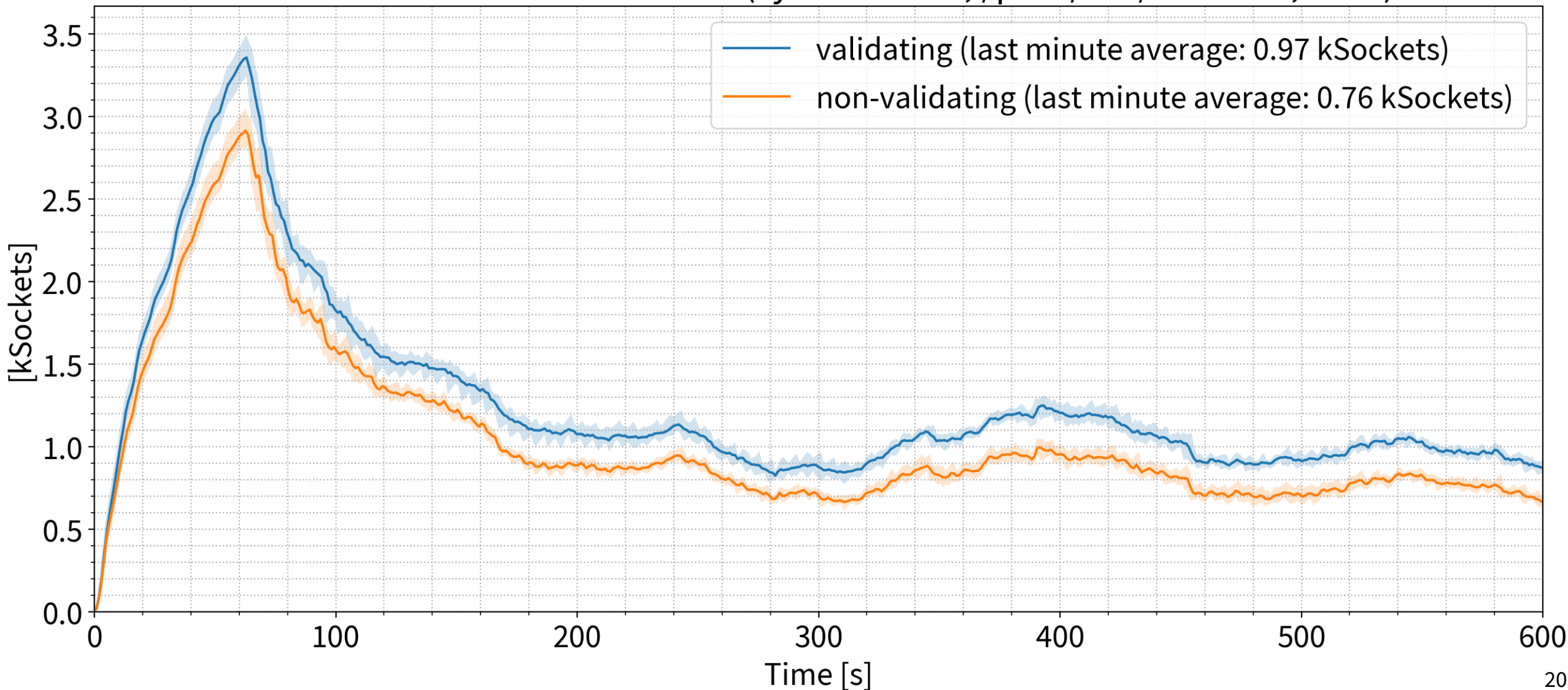
# 135 k QPS, TCP sockets

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



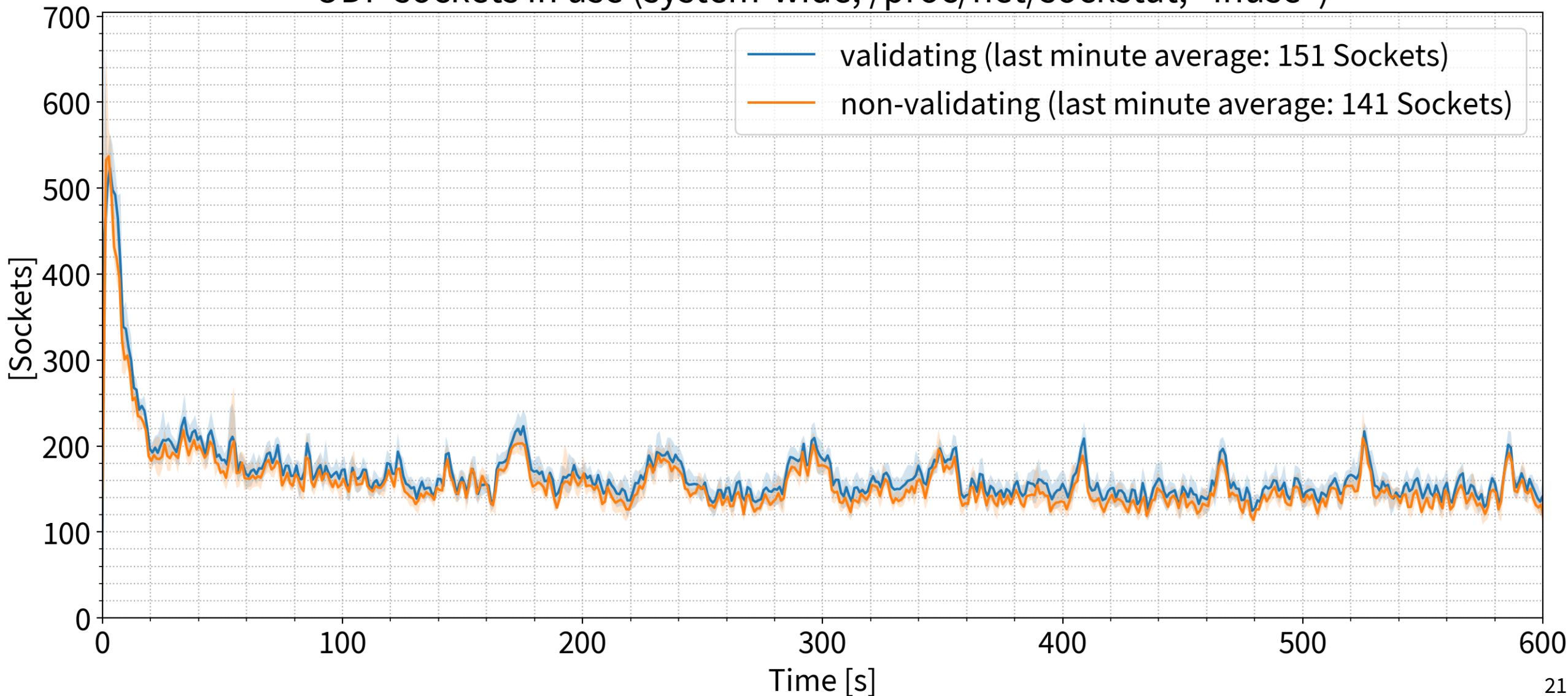
# 135 k QPS, TCP sockets

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



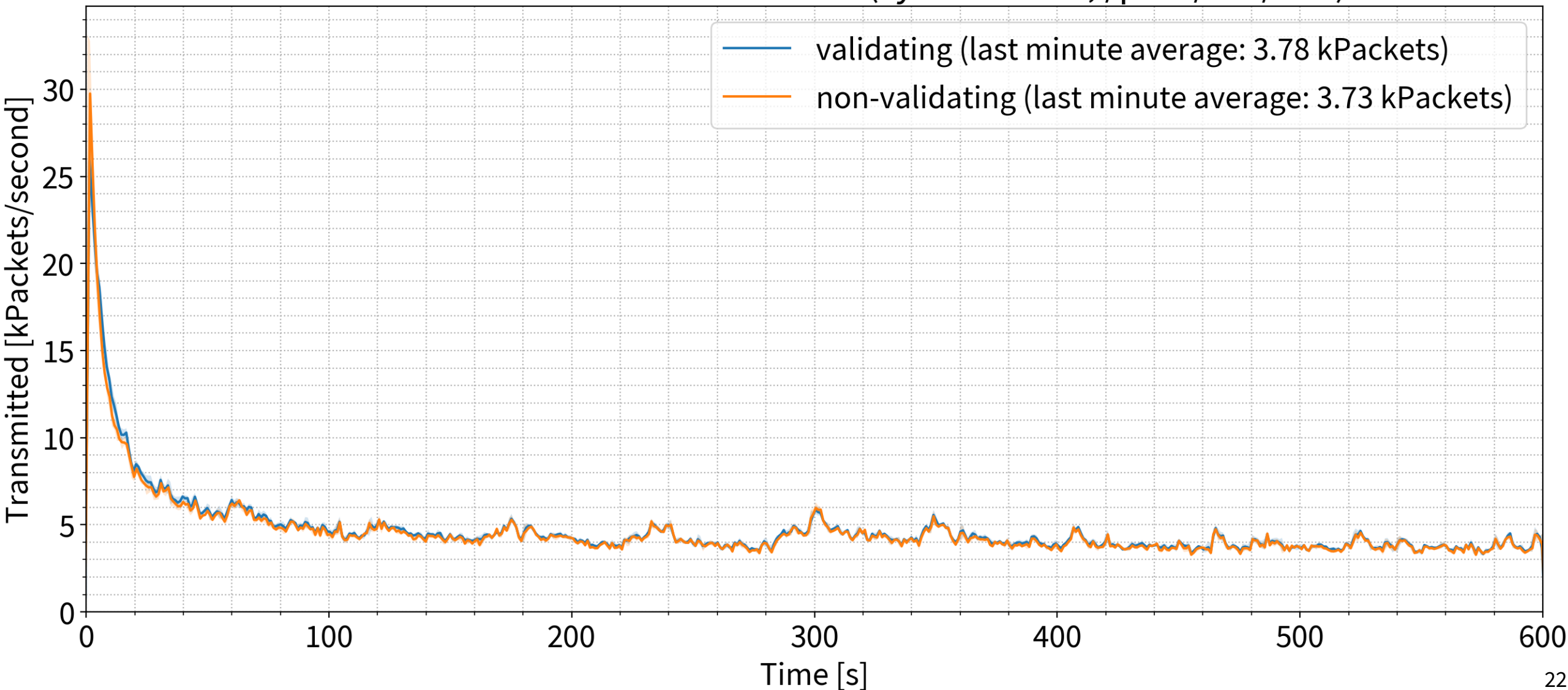
# 135 k QPS, UDP sockets

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



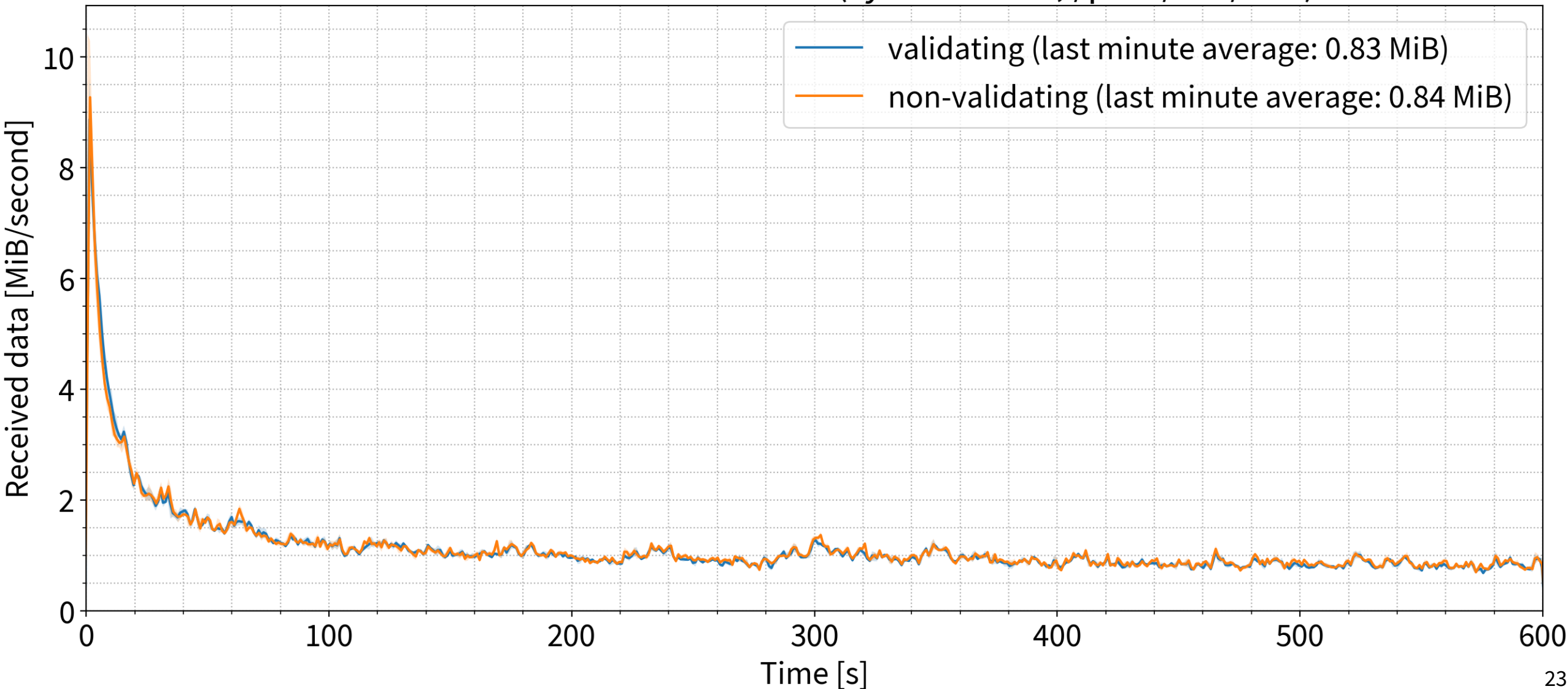
# 135 k QPS, packets out

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



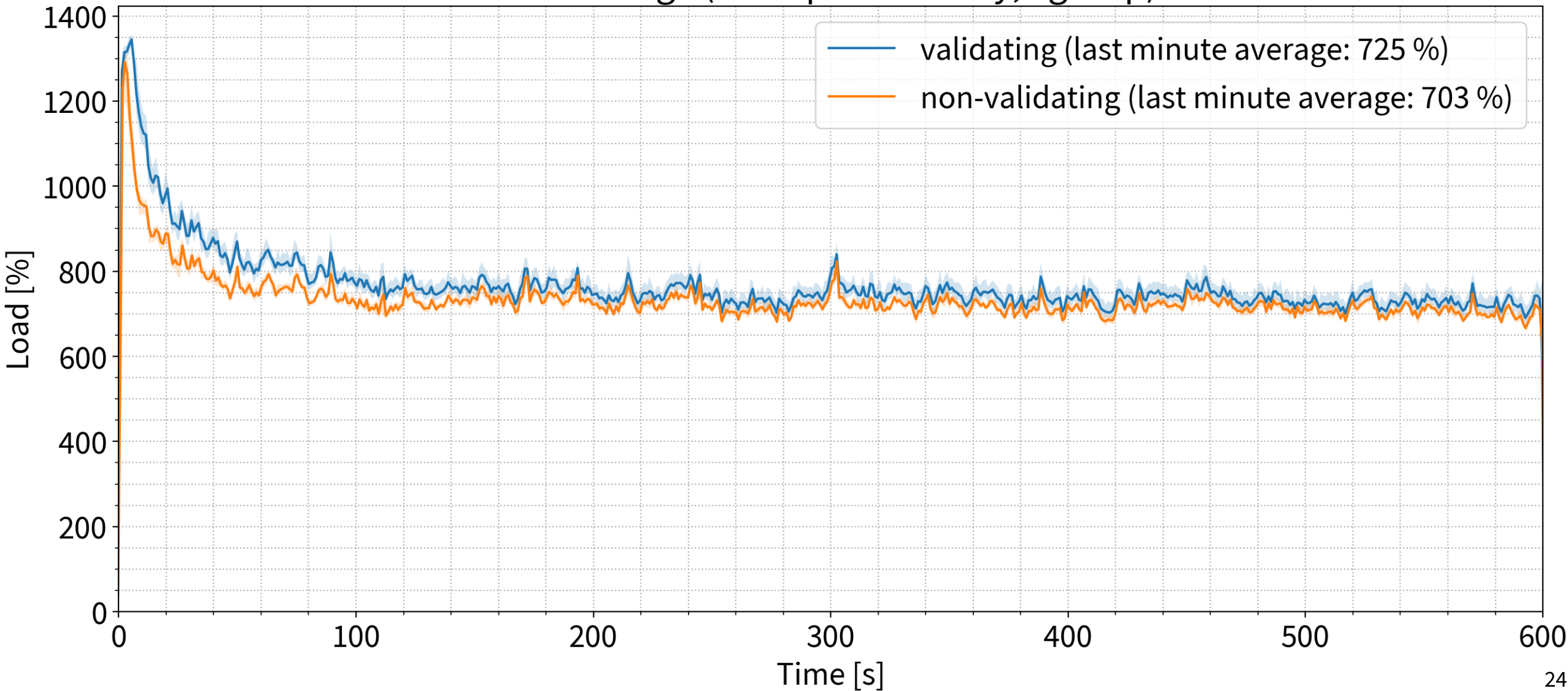
# 135 k QPS, bytes in

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



# 135 k QPS, CPU time

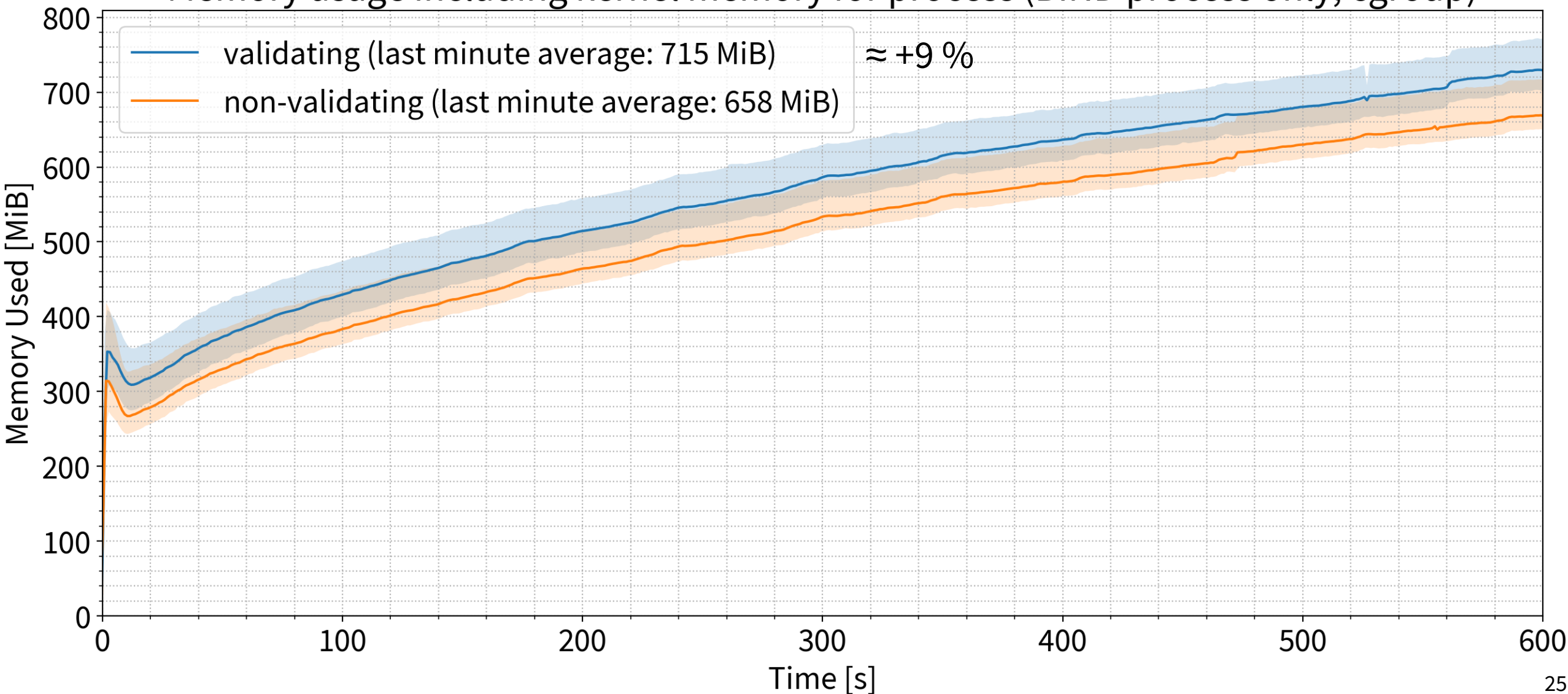
CPUs usage (BIND process only, cgroup)





# 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>