DNS Shotgun

Realistic DNS benchmarking

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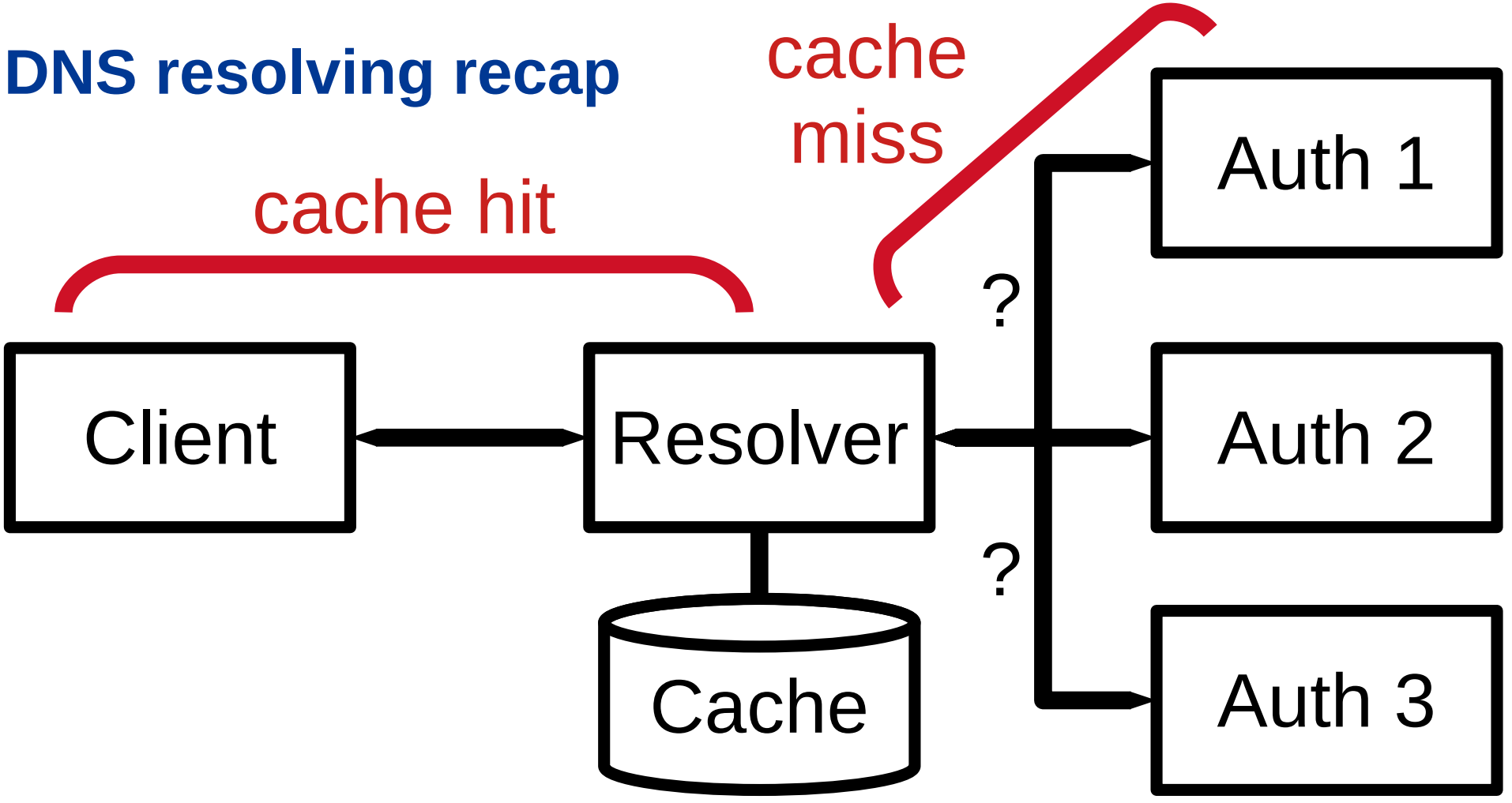
KNOT RESOLVER

cz.nic | CZ DOMAIN REGISTRY

Motivation

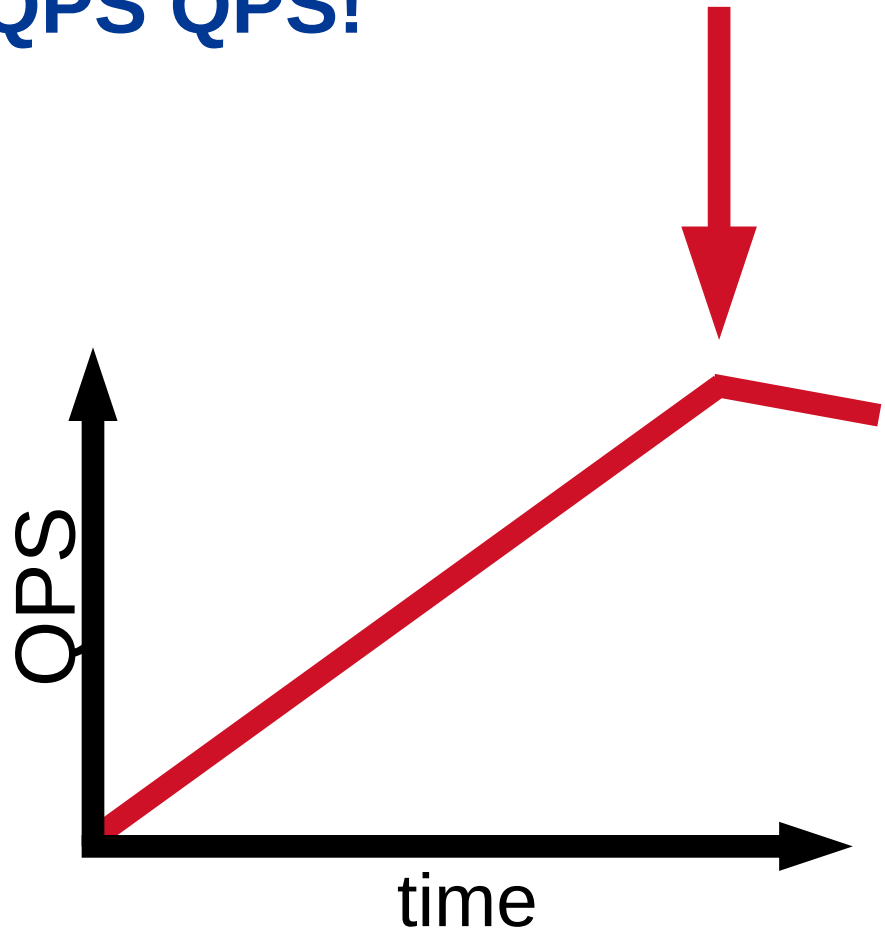
- Running DNS resolver ⇒ power, cooling
- Power, cooling ⇒ €€€
- Benchmarking ⇔ optimization
  - ⇒ cost reduction

DNS resolving recap



Classic benchmarking: QPS QPS QPS!

- `$ man resperf`
- Query list: tcpdump => text
- Ramp-up query traffic
- Find max QPS
  - Response rate drops



Classic pitfalls

- No query timing
  - Ignores TTL ⇒ **unrealistic cache hit rate**
- QPS ramp-up
  - Waits for cache hit rate increase ⇒ **unrealistic**
  - Resolver restart!
- **Over-focuses on QPS!**

DNS Shotgun: Client-based approach

- **How many clients can the resolver handle?**

- Result depends on clients!
  - IoT, mobile, desktop, mail server, …

DNS Shotgun: Introduction

- Realistic DNS benchmarking
- New toolset
  - Based on `dnsjit` by DNS-OARC
  - https://www.dns-oarc.net/tools/dnsjit
- Open-source
  - https://gitlab.labs.nic.cz/knot/shotgun/
- Very much work-in-progress!

DNS Shotgun: Principle

- Phase 1: Data preparation
- Phase 2: Traffic replay
- Phase 3: Drawing pretty charts

DNS Shotgun: Data preparation

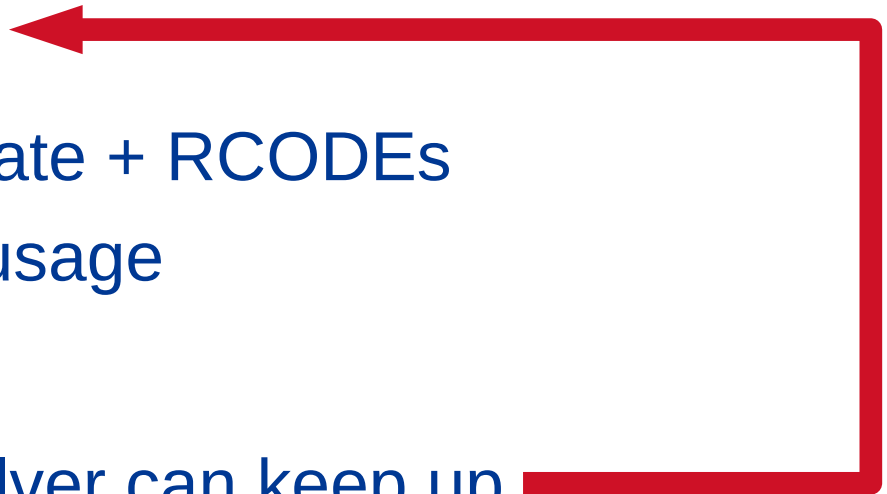
- Analyze PCAP
- Pre-generate traffic for ***N*** clients
  - 100k
  - 200k
  - 300k
  - …

DNS Shotgun: Client simulation

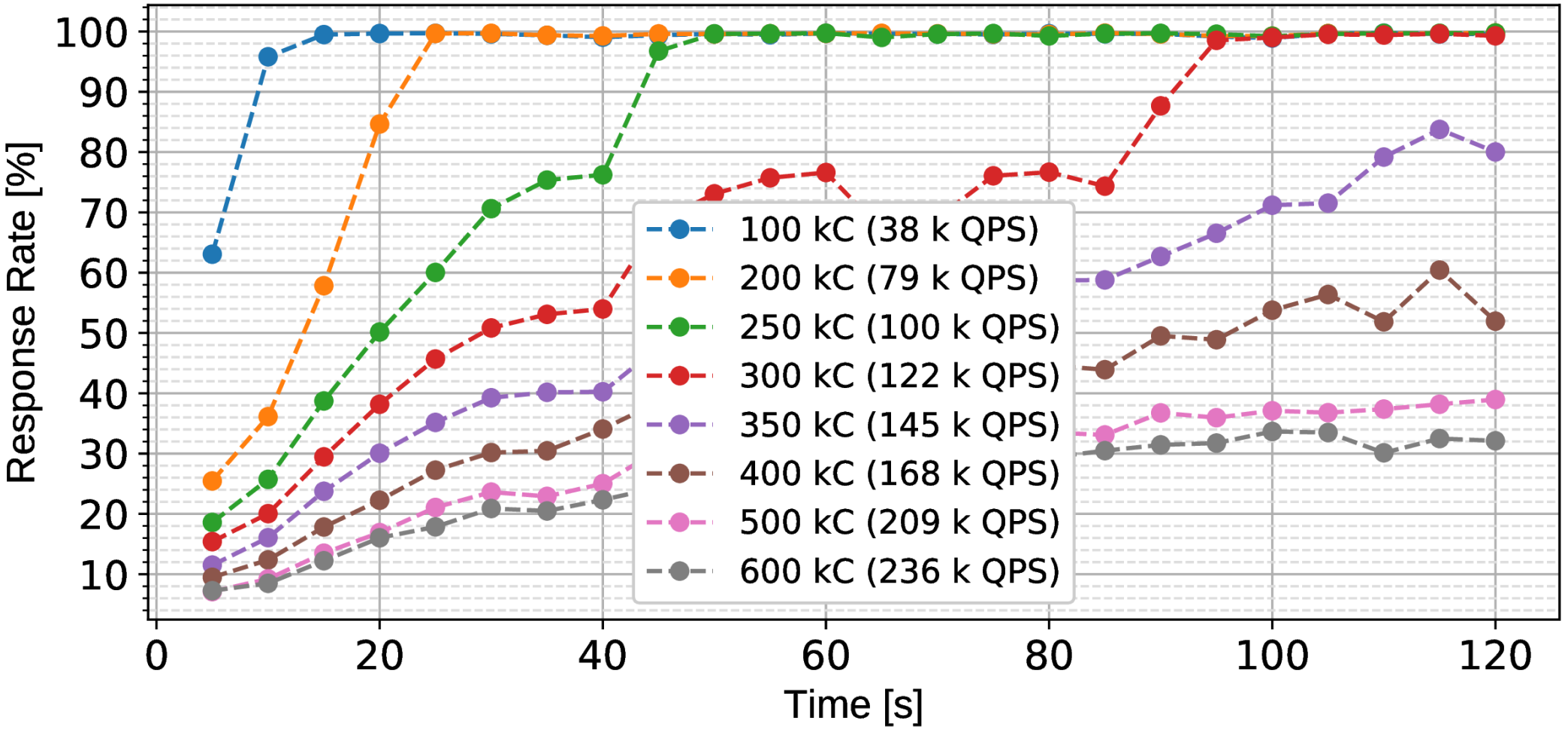
- Replay pre-generated traffic
  - Keep ± 1 second query timing
    - Realistic cache hit rate
    - ⇒ QPS varies over time
- Want higher "QPS"? Add clients!

DNS Shotgun: Performance testing

- Simulate ***N*** clients
  - Analyze respose rate + RCODEs
  - Monitor resource usage
- Increase ***N***
  - … as long as resolver can keep up
- ***N*** = maximum # of clients
  - for given input PCAP & connection parameters



PowerDNS Recursor 4.2.0 with defaults



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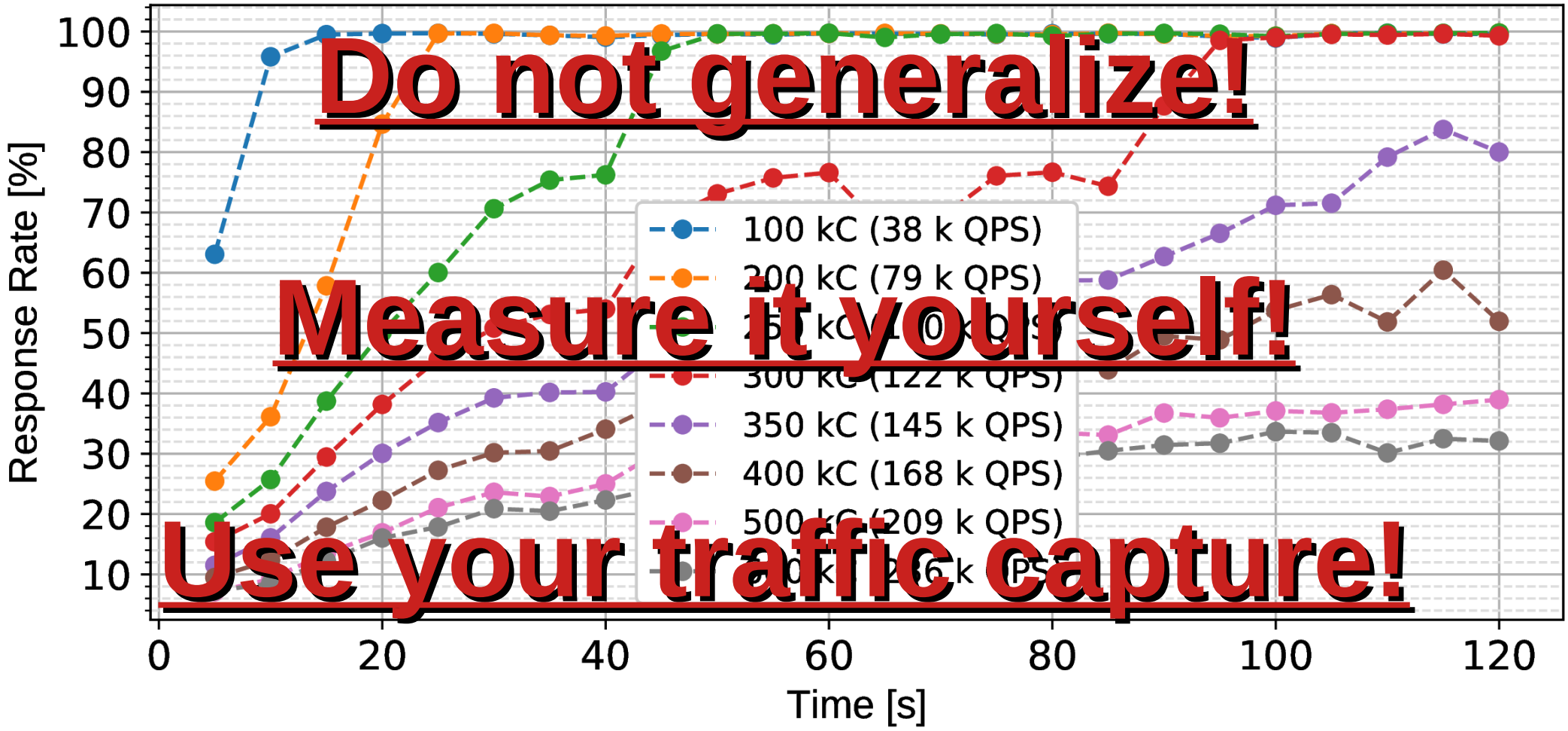
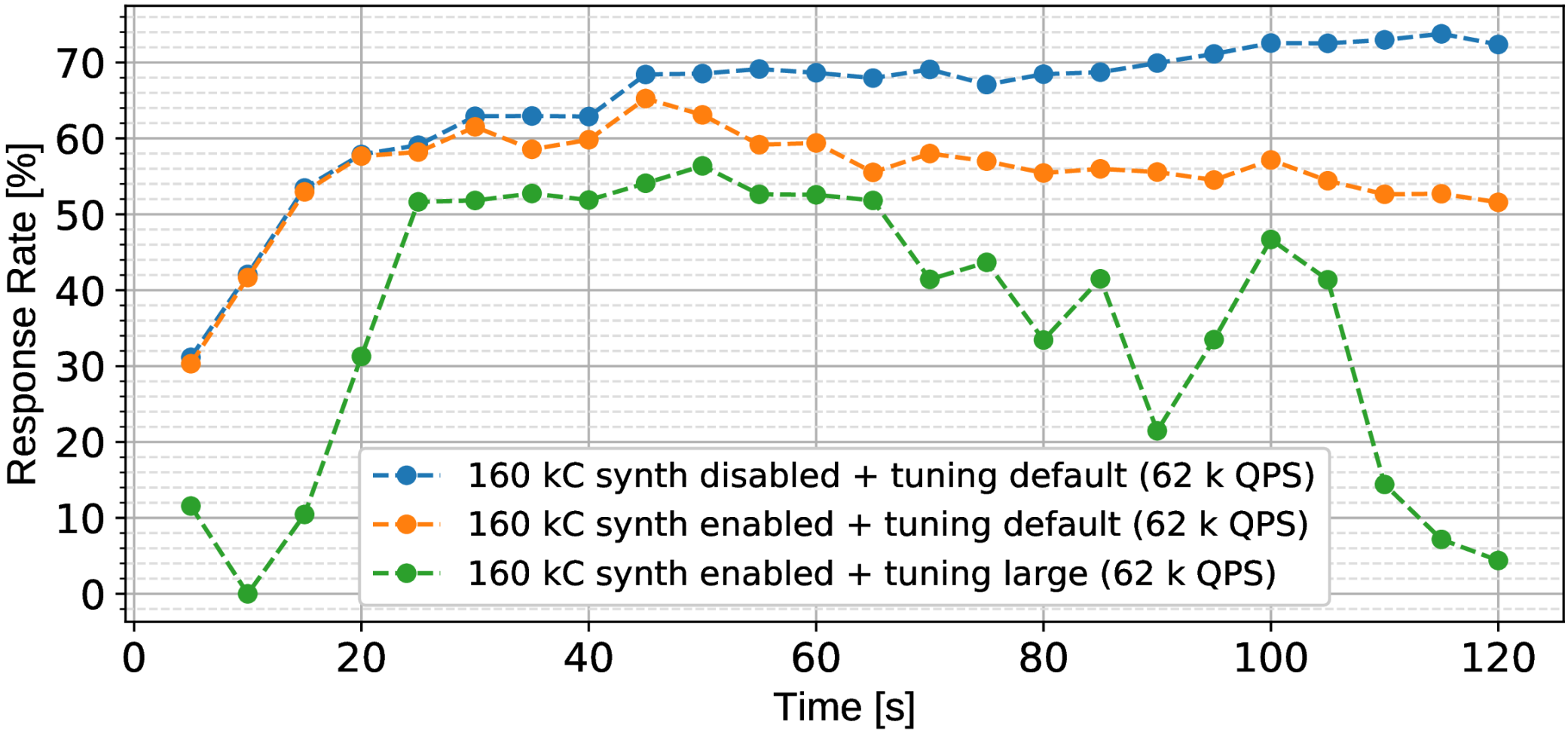


BIND 9.14.6: synth-from-dnssec? tuning?



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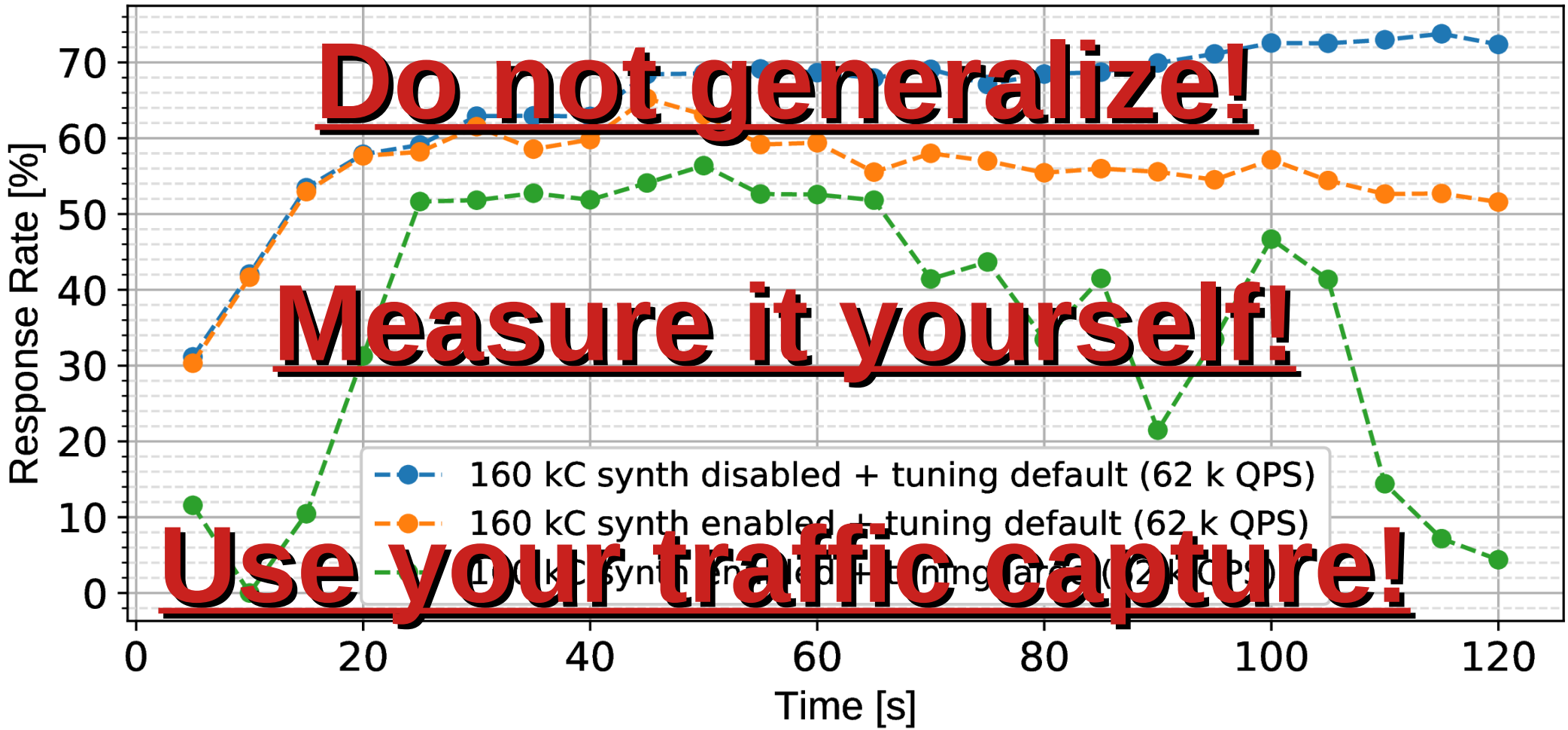
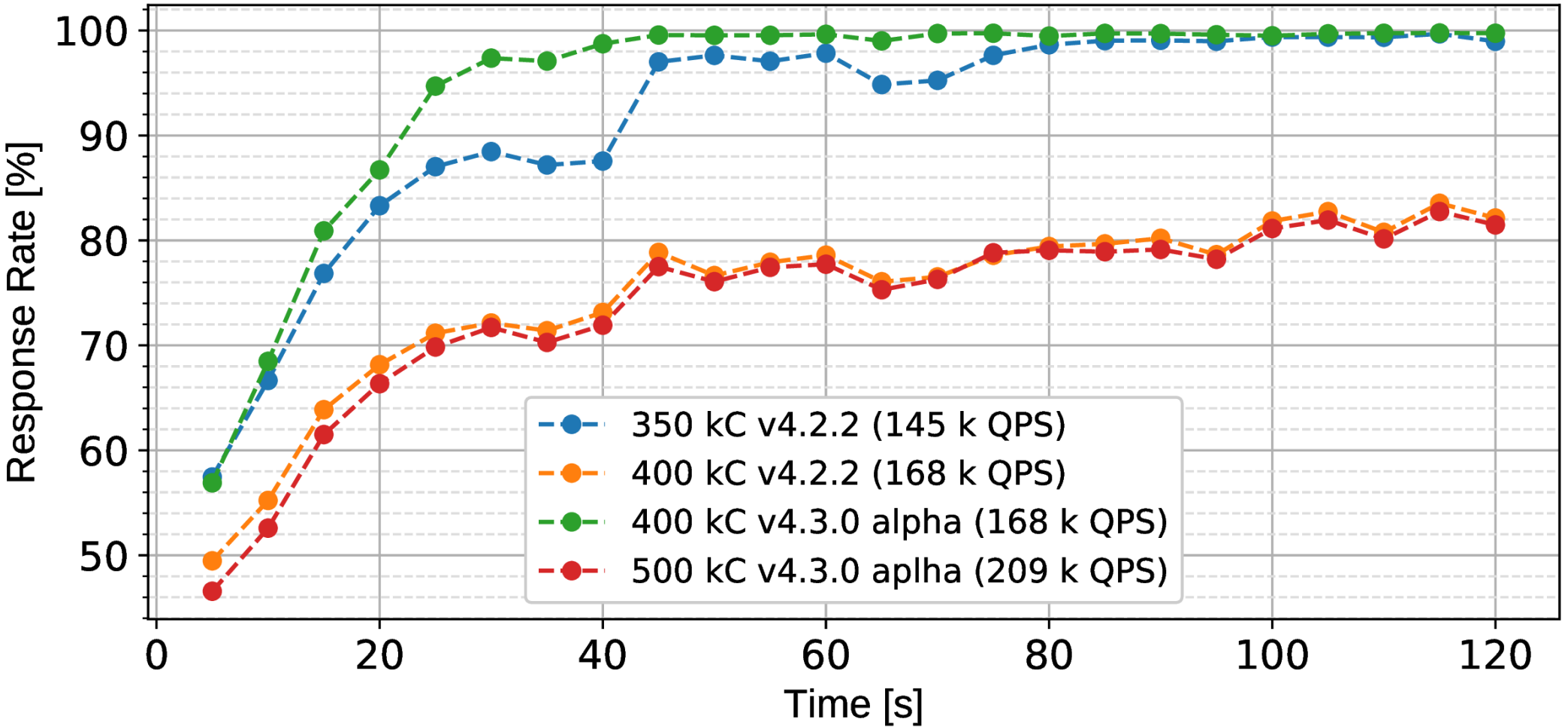


Knot Resolver 4.2.2 vs. to-be-4.3.0



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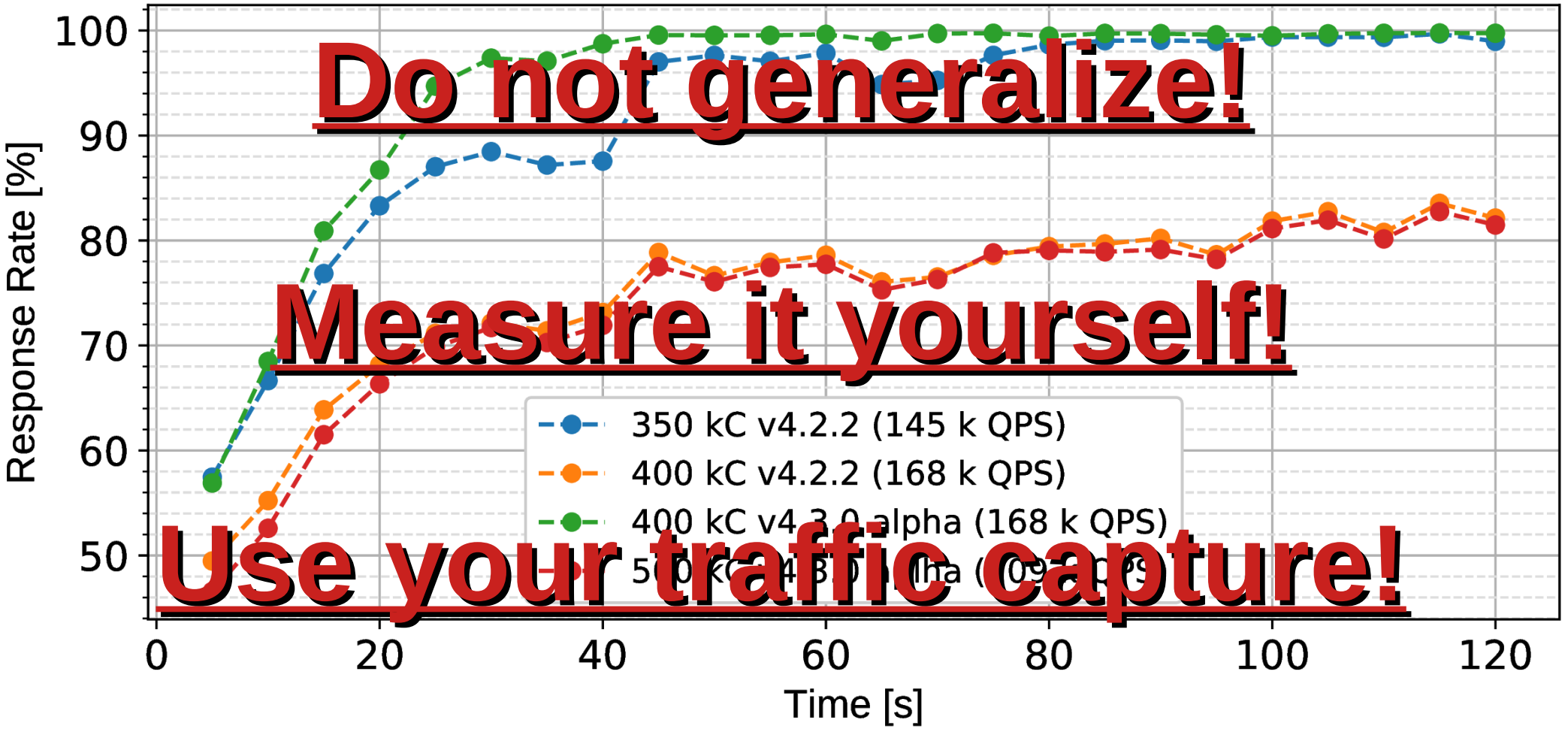
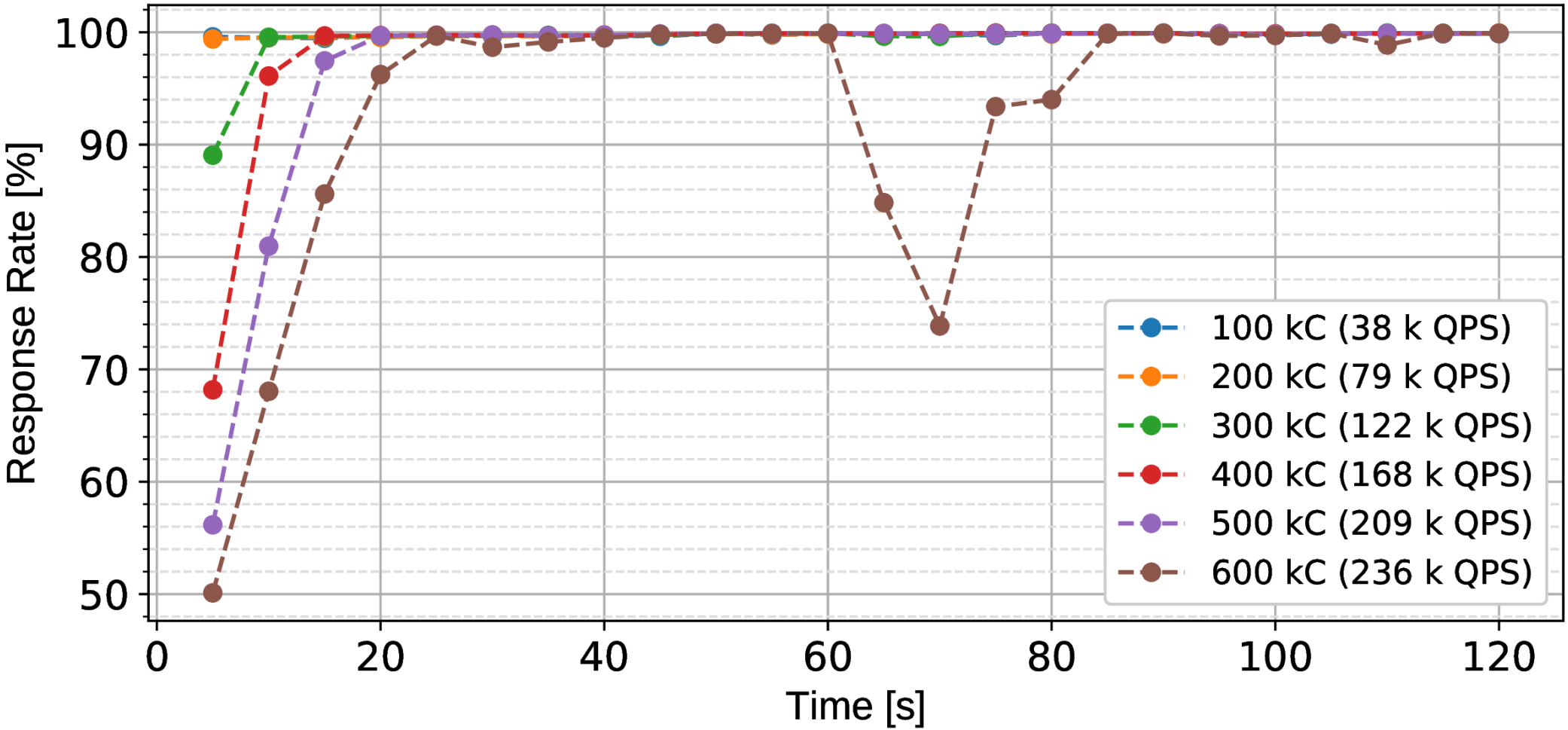
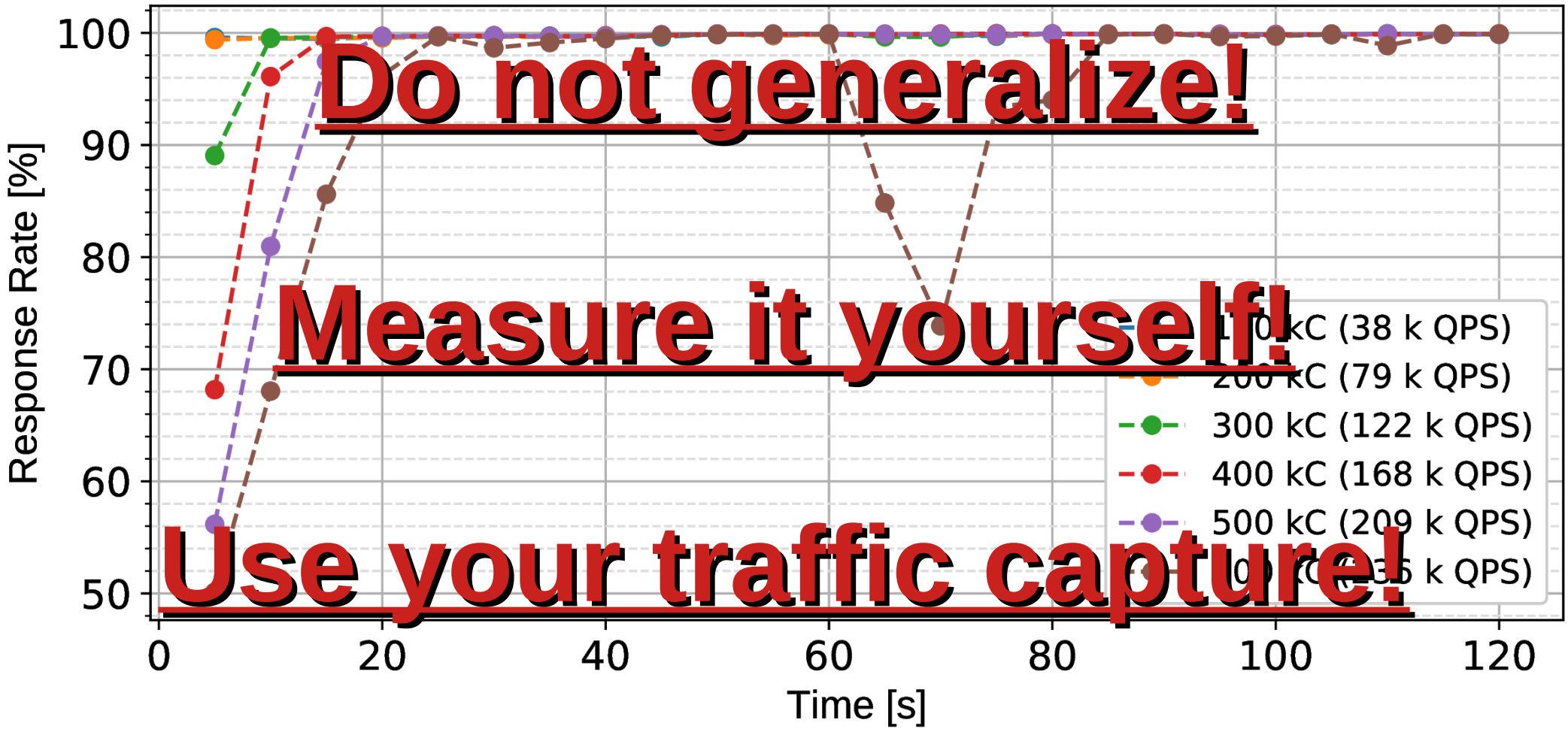


Unbound 1.9.4


Response Rate [%]
100
90
80
70
60
50
0
20
40
60
80
100
120
Time [s]
100 kC (38 k QPS)
200 kC (79 k QPS)
300 kC (122 k QPS)
400 kC (168 k QPS)
500 kC (209 k QPS)
600 kC (236 k QPS)

Unbound 1.9.4


Do not generalize!
Measure it yourself!
Use your traffic capture!
Response Rate [%]
100
90
80
70
60
50
0
20
40
60
80
100
120
Time [s]
200 kC (79 k QPS)
300 kC (122 k QPS)
400 kC (168 k QPS)
500 kC (209 k QPS)

DNS Shotgun: Try it

- Very much work-in-progress
  - Here be dragons! :-)
- Try it anyway
  - https://gitlab.labs.nic.cz/knot/shotgun
- **Sponsors needed!**
  - TCP/TLS/DoH support
  - Configurable connection reuse (pipelining, keepalive)

Closing remarks

- DNS micro-benchmarks do not reflect real world
- HW & OS changes invalidate results
- Generalization is hard
  - Compare using **your config** and **your traffic**
- Interested in benchmarking?
  - See full version of the talk!
  - https://ripe79.ripe.net/programme/meeting-plan/dns-wg/