# Modifying NSD for DNSSEC: Design, Implementation, Performance

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# What is NSD?

- NSD is an RFC compliant, authoritative only name server:
  - Simple
  - High Performance
- Adding DNSSEC support was not hard, but required some fundamental changes to NSD:
  - NSD 1.x pre-encodes all possible answers using the zone compiler.
  - NSD 2.x pre-encodes all RRsets and encodes answers at run-time.

# Advantages of NSD 1.x approach

- Complexity moved from server to zone compiler:
  - Determining RRsets to be included in the answer
  - Pre-compute name compression
- High performance, simple server algorithm:
  - Analyze query
  - Find answer in database
  - Update compression pointers
  - Send answer to client

# Advantages of NSD 2.x approach

- Smaller database and less memory usage:
  - .nl database size: From 126 to 46 Megabytes
  - .nl memory usage: From 155 to 109 Megabytes
- More flexibility in determining contents of answer based or query.
  - Important for DNSSEC.
- Lower overall complexity.

# Why modify the pre-encoding of answers for DNSSEC

- DNSSEC increases the zone size, mainly due to the presence of NSEC and RRSIG.
  - ~5 times for .nl signed with a single 1024-bit RSA key.
- DNSSEC requires additional answers to be stored in the database:
  - DO bit set/not set
  - Answers for DS, NSEC, and RRSIG queries
  - Answers for NXDOMAIN and NODATA responses

# Estimated answer database size

- Assuming answers grow ~5 times in size and we need to store ~2 - ~4 times more answers.
- Estimate: database size increases ~10 - ~20 times.
  - .nl database from 126 Megabytes to ~1.2 - ~2.5 Gigabytes.
- Runs into 32-bit memory limit.

# NSD 2.0.0 DNSSEC Memory Usage

- .nl zone signed with a single 1024-bit RSA key.
- .nl database size:
  - Unsigned: 46 Megabytes
  - Signed: 251 Megabytes
- .nl memory usage:
  - Unsigned: 109 Megabytes
  - Signed: 388 Megabytes

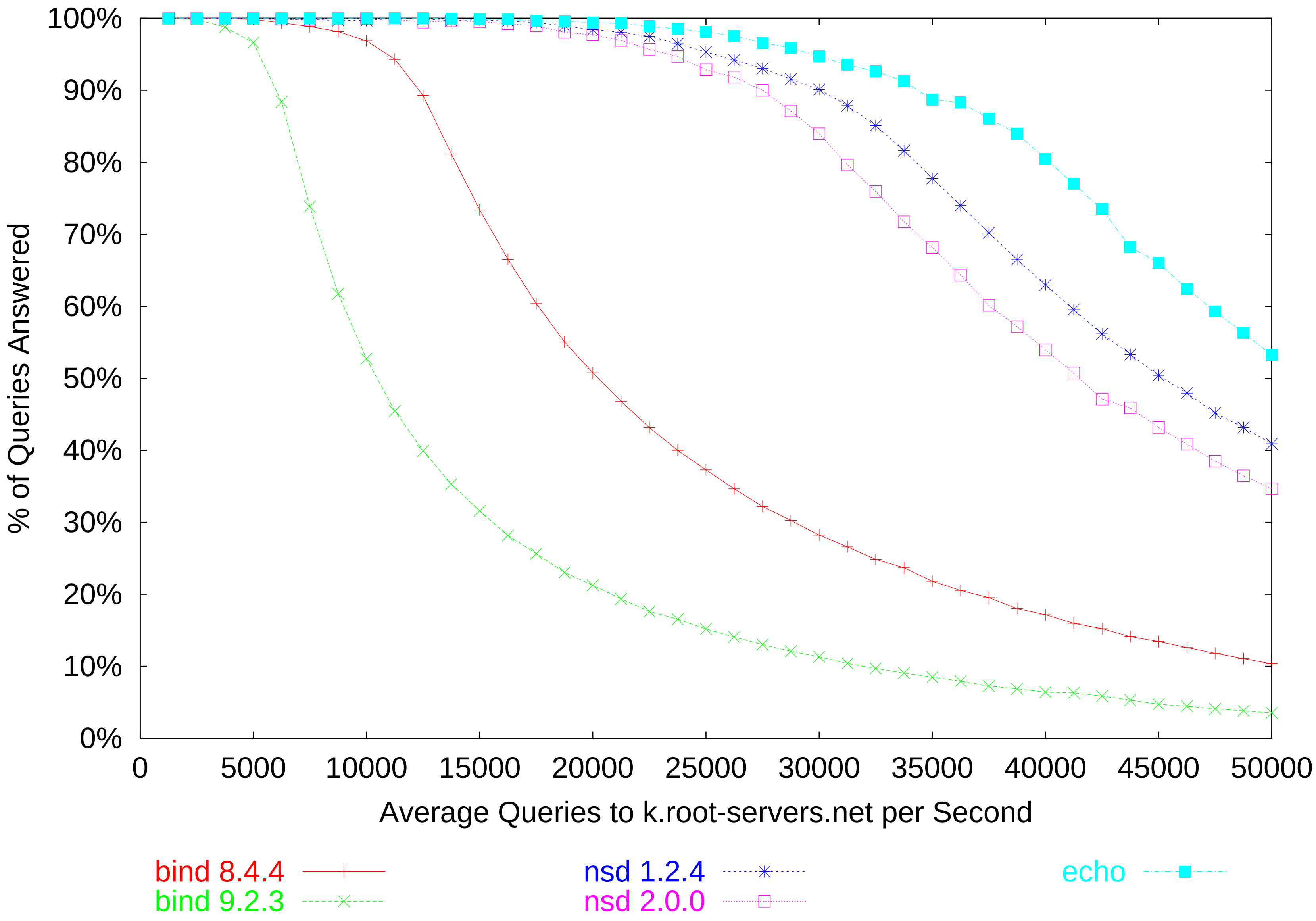
# Performance Comparison

- NSD 2.x server algorithm:
  - Analyze query
  - Lookup information about query name
  - Determine RRsets to include
  - Encode RRsets and perform name compression
  - Send answer to client
- What happened to performance?
  - Slightly less, but still very fast.

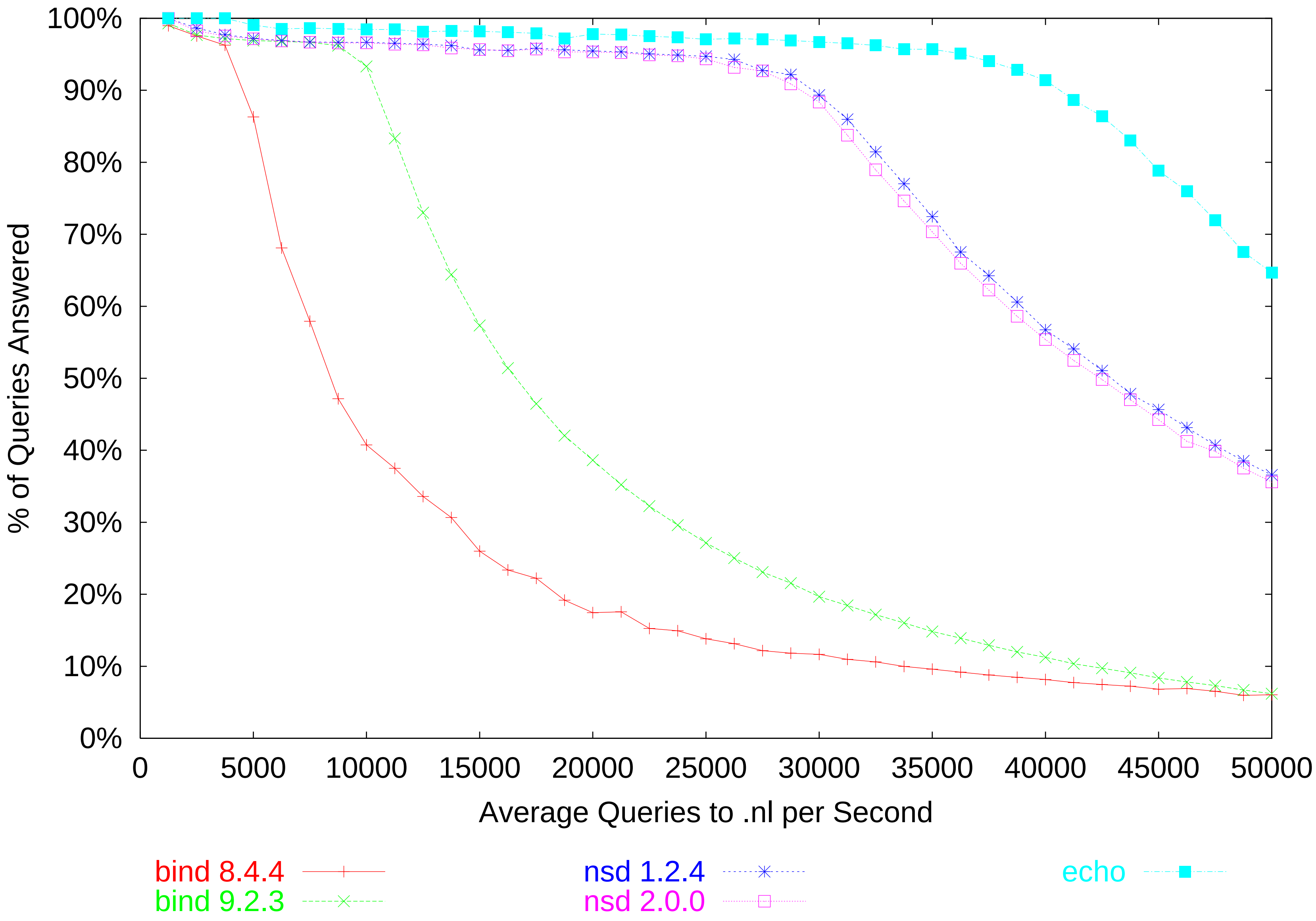
# Performance Comparison (continued)

- DNS servers: bind 8.4.4, bind 9.2.3, nsd 1.2.4, nsd 2.0.0
- "echo" server: modified nsd 2.0.0 that simply echoes the query back to the client
  - Used to measure network and OS overhead
- Server hardware:
  - Off the shelf AMD Athlon XP 2400+ PC
  - 1 Gigabyte main memory
  - 3COM 3C905B-TX Fast Etherlink 10/100 PCI TX NIC

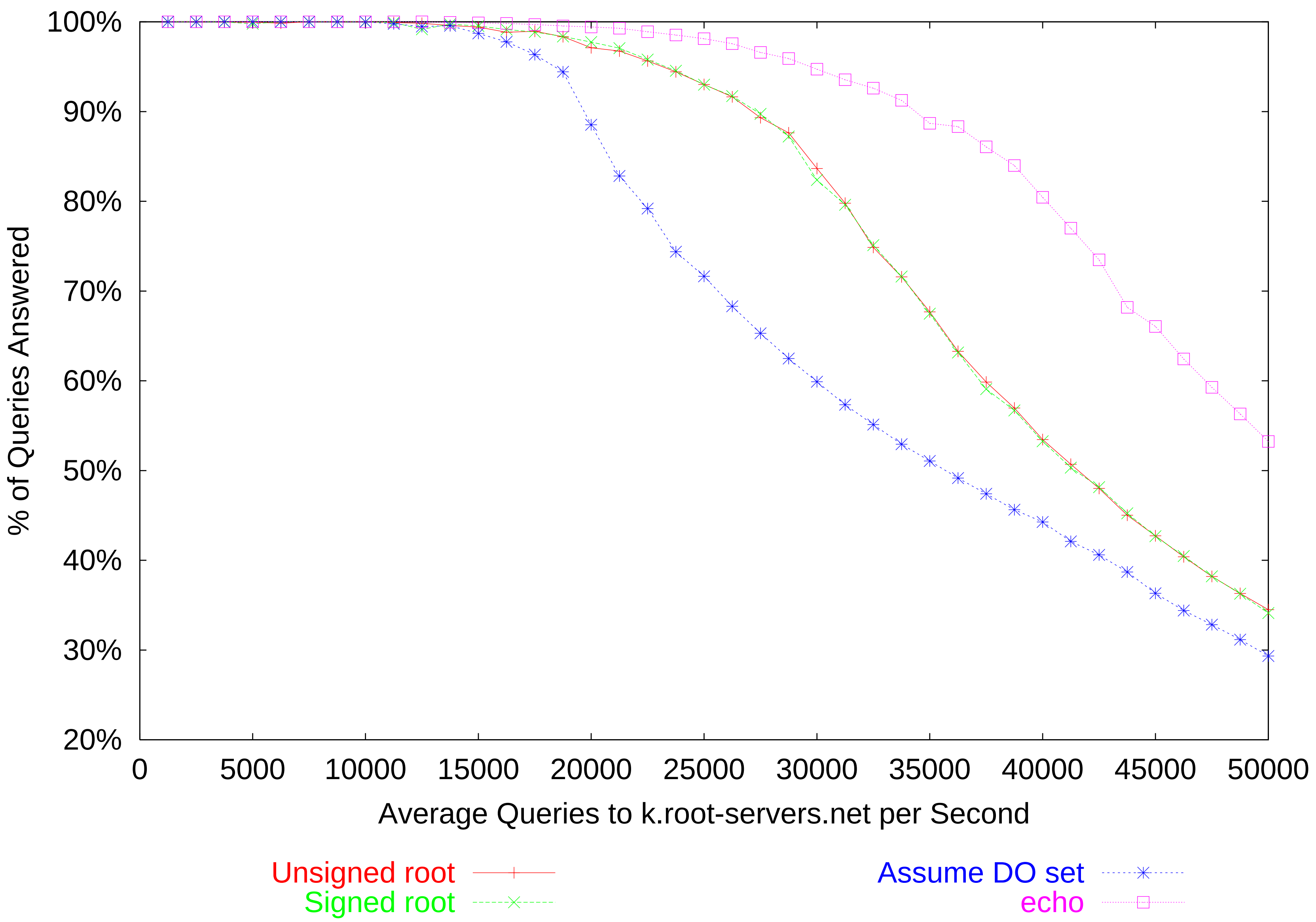
# Performance Comparison: k.root-servers.net



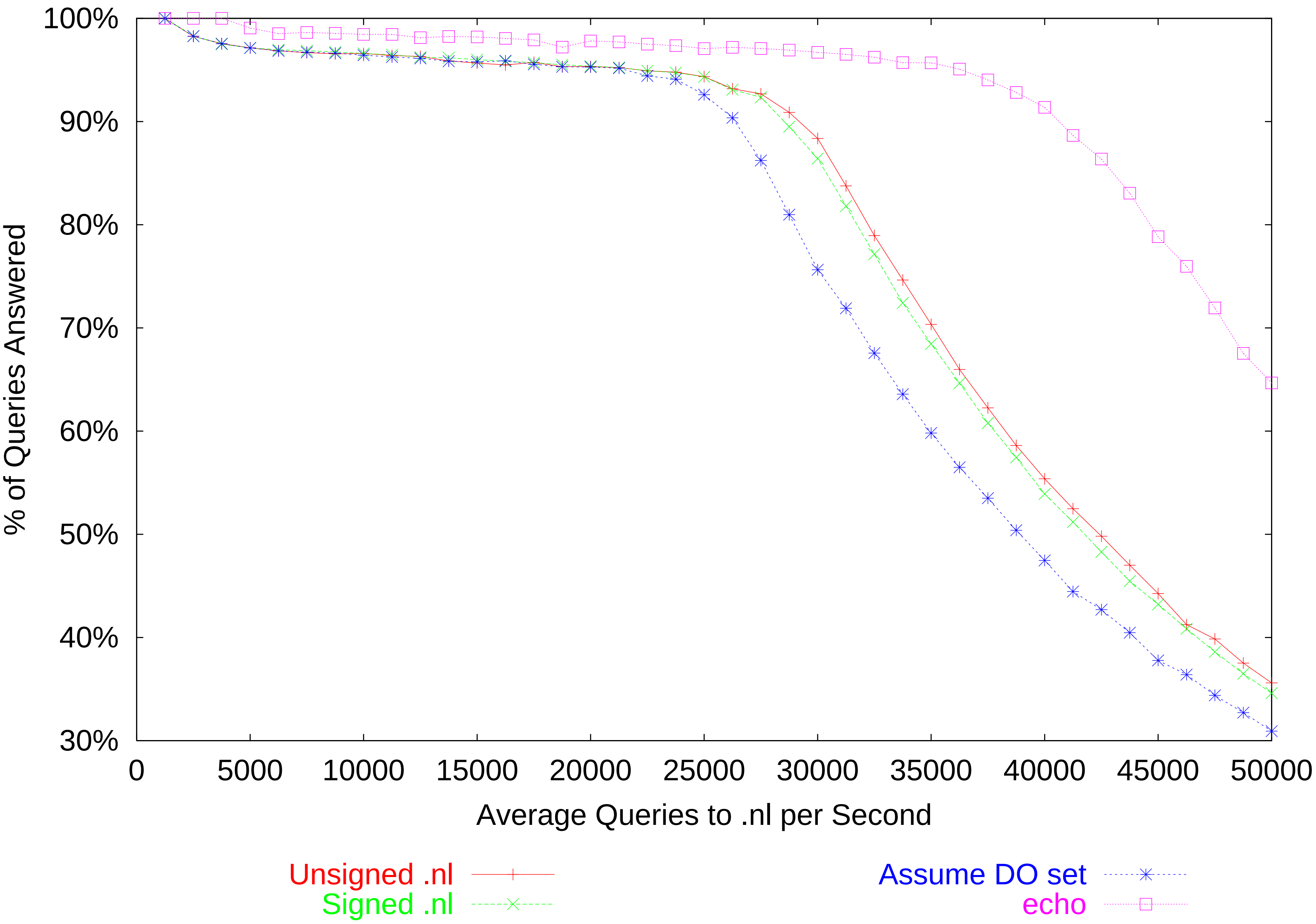
# Performance Comparison: .nl



# NSD 2.0.0 DNSSEC Performance: k.root-servers.net



# NSD 2.0.0 DNSSEC Performance: .nl



# Conclusion and Next Steps

- Conclusion: NSD 2.0.0 performs very well, with or without DNSSEC.
- Next Steps: Release NSD 2.0.0 next month with DNSSEC disabled by default.
- Next Steps: Release NSD 2.x with DNSSEC enabled as soon as DNSSEC is standardized.
- Wanted: Complicated zones and tcpdump query traces to perform more regression testing against bind.

# Questions?

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