Resolver Data Prefetch

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To develop Open Source Software and Open Standards for the benefit of the Internet.

Paraphrased Article 1 of the Foundations Charter

Introduction

- Draft-wkumari-dnsop-hammer-00
- Premise: fetch data that is about to expire so that client does not get spike in latency when lookup needs to be redone when TTL expires on data.
  - Expected DNS cache response latency:
    local ISP roundtrip
  - Expected DNS re-lookup latency:
    local ISP roundtrip + authority server roundtrip
- Implementation: prefetch data that is about to expire. Give clients cached previous result and start prefetch.

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Unbound Implementation

- Not the same as draft-hammer
- Differences:
  - Lookup in last 10% of TTL (not in last x seconds).
  - Only needs one query in last of 10% TTL to start lookup.
  - Strange cache policy during prefetch.
  - No prefetch for OriginalMessageTTL <= 9 sec
  - '10%' not configurable (compiled constant).

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Real Data

- Kindly provided by SURFnet.
- Data from prefetch in a production resolver.
  - Statistics have been graphed with cacti
- With Unbound, "prefetch: yes" in unbound.conf
- The graphs are one-week runs.
- Num.prefetch is 1.5% of total qps, 39 of 2689.6 qps. (cache hit rate is 84.9%).
- Very little difference

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Prefetch:no Prefetch:yes
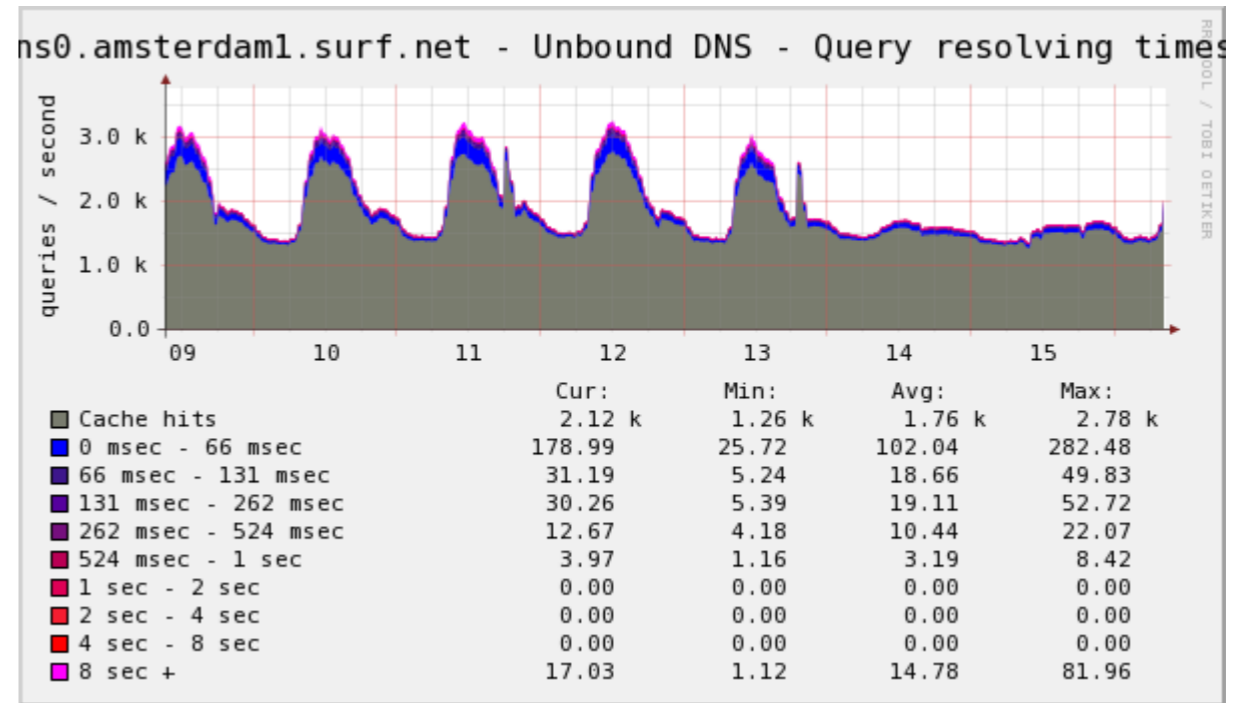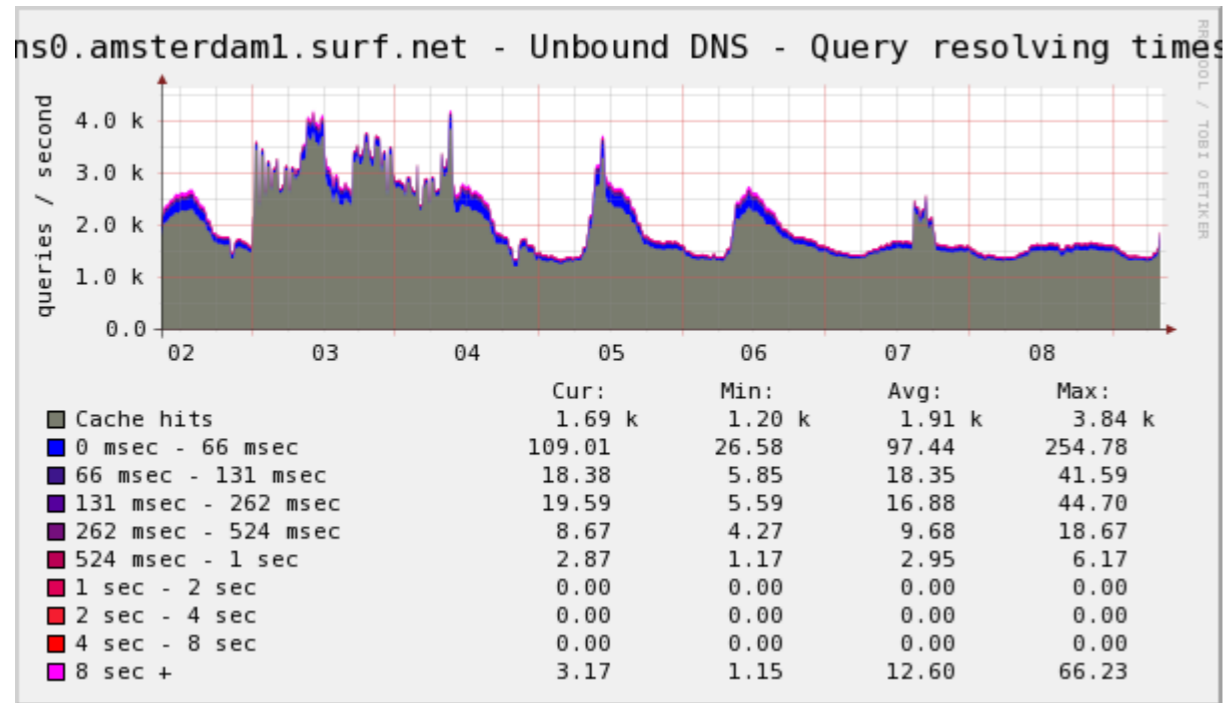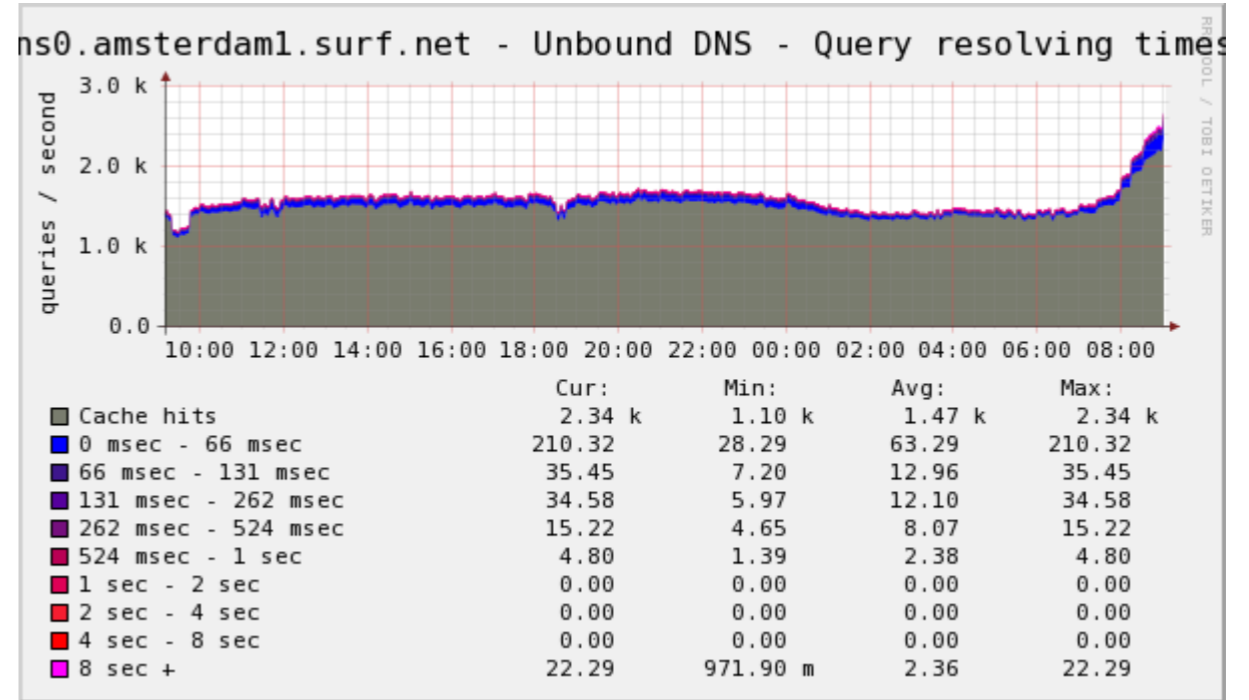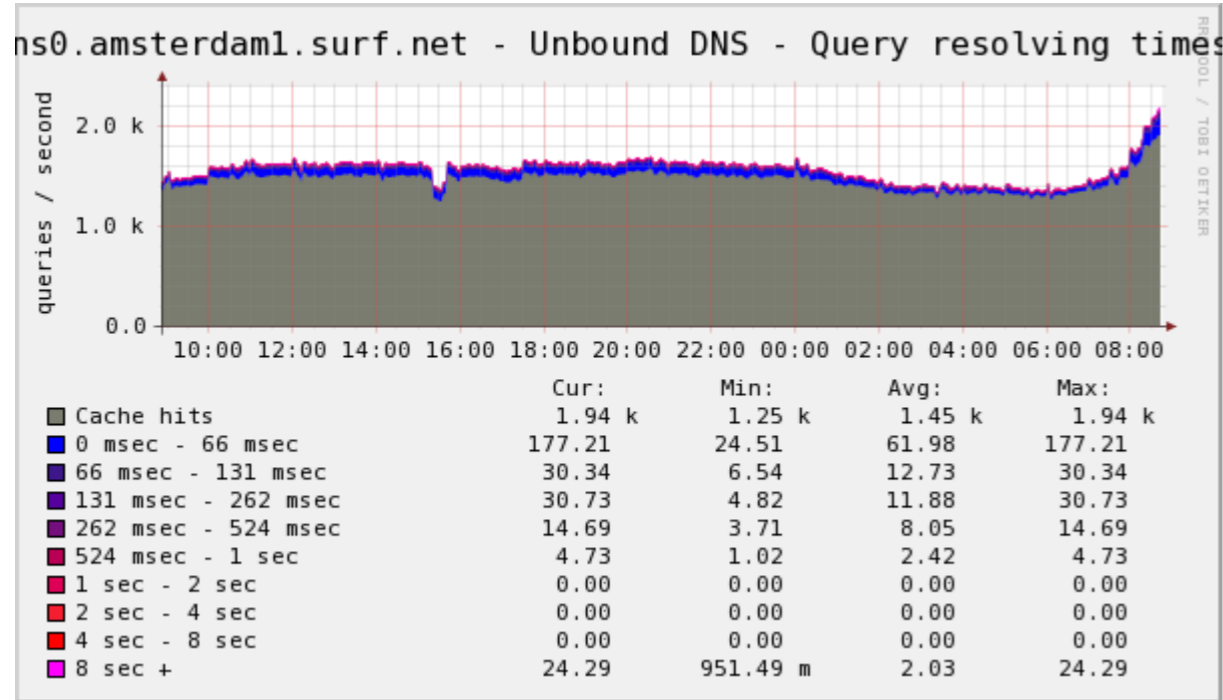
Design Decisions

- Keep load off authority servers
  - 10% shorter TTL means +10% qps
- Keep load off local resolver
  - 10% shorter TTLs thus max +10% work
  - Not configurable 10% because clients shouldn't burden authorities too much
- Do not prefetch unless there is real interest by clients
  - Wait for client query
  - Hammer has a similar design
- No 'sticky resolver': domain transfer do not stick to old
- Prefetch 'popular domains' but calculation what 'popular' means is strange.

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'Popular'

- With N queries in the RR-TTL interval, and $N/TTL >$ threshold 0.1, it is popular
- Also 'less popular but high TTL' answers can be prefetched
- The authority owner can influence prefetch by changing the TTLs
- Unbound does not measure N/TTL
  - query in last 10% is seen as indication that the expected value for N/TTL (assuming semi-flat qps graph) exceeds threshold.
  - Authority owners can double the TTL from 10/qps to also get prefetched in 'standard deviation' cases.

Cache Policy

- Relative prime numbers in the cache update policy
  - If you only update RRsets that are about to expire (as unbound does)
    then the TTL that remains creates a relative-prime-number seeking algorithm with repeated prefetches
  - Because the relative prime number may be very low, also update other RRsets to increase result TTL; 60s leeway in unbound.
- If you prefetch data 'pretend' that cached nameserver information that is about to expire is not available when the prefetch lookup is performed

Questions
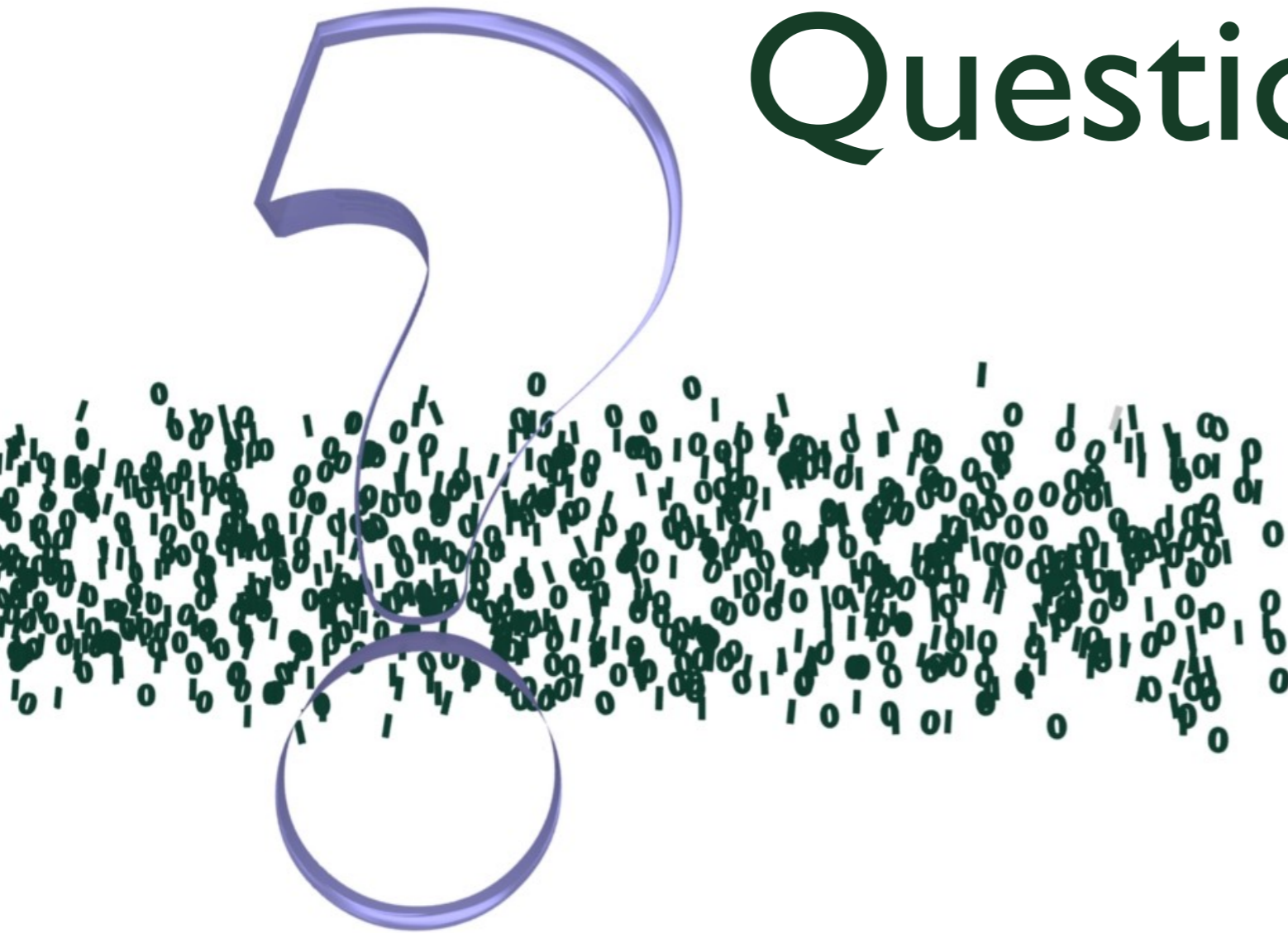
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