Discovery Method for a Validating Stub Resolver

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Final Thesis at SNE MSc

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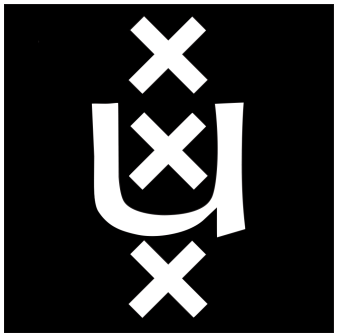


whoami

- **Former student of the SNE Msc at the Universiteit van Amsterdam.**
- **Did this research project as my final thesis, working with NLnet Labs.**

Motivation

When things go wrong, sometimes fingers are pointed in the wrong direction. Seems to happen a lot with DNSSEC.

- **NASA.gov blocked by Comcast when implementing DNSSEC (2012)(bit.ly/1GOrHxR).**
- **.gov zones not resolving due DNSSEC misconfiguration (2014) (bit.ly/1gbP7aP).**
- **HBO NOW blocked due invalid signatures (2015)(bit.ly/1GoasVi).**

Objectives

- **Measure the current state of DNSSEC deployment, from different points of view.**
- **Can we improve it without drastic changes?**

Tools used

- **Python scripts**
- **Classes provided by NLnet Labs to ease the task of parsing DNS data.**
- **The RIPE ATLAS probes!**

Study case #1 results

- **The vast majority of probes queried could successfully perform DNS queries (95%+).**
- **However, (regular) DNSSEC queries were successful only in 64% of the cases:**

Received RR	Percentage
No RR	7.94%
DNSKEY (x2)	28.34%
DNSKEY (x2)+RRSIG	63.71%

Study case #1 results

- **Things got worse when querying non-existing domains (both NSEC and NSEC3):**

Received RR	Percentage
No RR	22.27%
Only SOA	21.49%
SOA + NSEC + RRSIG(x2)	56.23%

Received RR	Percentage
No RR	12.44%
Only SOA	27.68%
SOA + RRSIG	3.62%
SOA + NSEC3(x2) + RSIG(x3)	0.58%
SOA + NSEC3(x3) + RSIG(x3)	55.67%

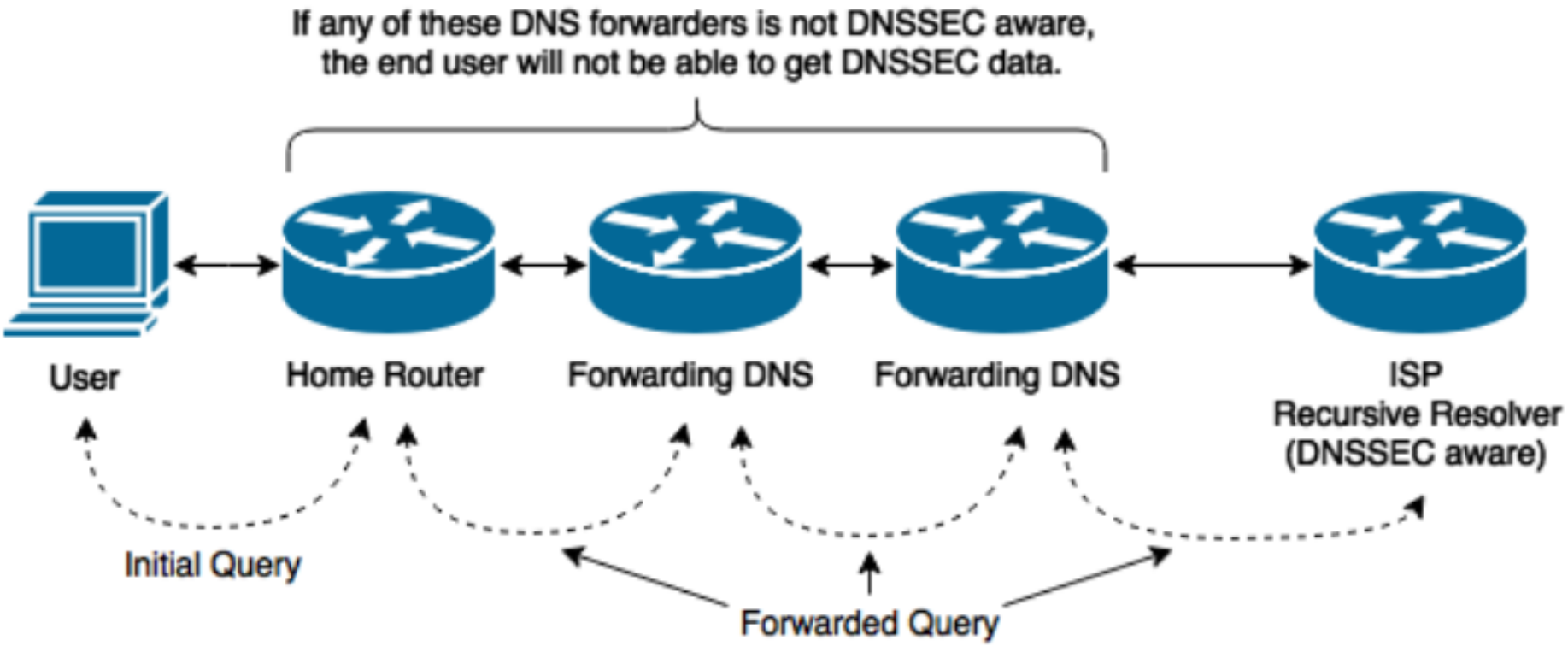
Study case #1 results

- **With wildcard domain queries, retrieved responses were valid only in 40% of the cases.**

Study case #1 conclusions

- **Seems as if, the harder the query, the worse the results. But who is the culprit?**
- **We attempted to run these queries again, but using the probes' ISP resolver, instead of the resolver predefined on them.**

Study case #2 definition



Study case #2 results

- **The majority of probes could query their ISP resolvers directly.**
- **A small percentage didn't manage to do so.**
- **But, did this change affect the results?**

Study case #2 results

- **The number of successful DNSSEC queries raised from 64% to almost 80%.**
- **Valid NXDOMAIN answers increased from 56% to 75%.**
- **Wildcard queries were properly answered in 60% of the cases, from the previous 40%.**

- **All around, we observed a 20 points increase on the successful results.**

Study case #2 conclusions

- **The benefits of directly querying the ISP resolvers were quite noticeable and consistent.**
- **Individual reasons for this may vary, but we attribute this difference, mostly, to cheap hardware at the end points (home routers).**

Other remarks

- **Thanks to the people working at RIPE ATLAS, we got a new feature within 2 weeks!**

Subject **Re: Feature request: set CD bit on atlas DNS measurements**

To Willem Toorop, Me <xavier.torrentgorjon@os3.nl>

Cc Robert Kisteleki <robert@ripe.net>, Philip Homburg <philip.homburg@ripe.net>,

```
Dear Willem,

As of today you can include the following parameter in the JSON definition:

"cd": true

This isn't officially documented yet, but once it is working for you I
will also document it and we will consider adding it to the web UI.

Kind regards,
Chris
```

Other remarks

- **Querying dnssec-failed.org., with and without the CD bit, we observed that only 26% of the resolvers were validating the data.**
- **Additionally, we saw no substantial differences on the resolving rate with probes that had more than one resolver defined.**

Defining a Discovery Method

- **In the best case scenario, the probe will get a proper answer from its default resolvers.**
- **When that fails, querying the ISP's DNS server directly helps with the issue in a considerable number of cases.**
- **Users can as well attempt to query public DNS servers (p.e. Google, among others)**
- **As a last resort possibility, do full recursion from a stub resolver.**

Conclusions & wrapping up

- **As with many other “new” protocols (hello IPv6), the adoption of DNSSEC is really slow.**
- **Until things go wrong, users do not really experiment a benefit, so they do not care.**
- **It is quite difficult to spot where the errors happen in each individual case.**

Q&A

Thanks for your attention!