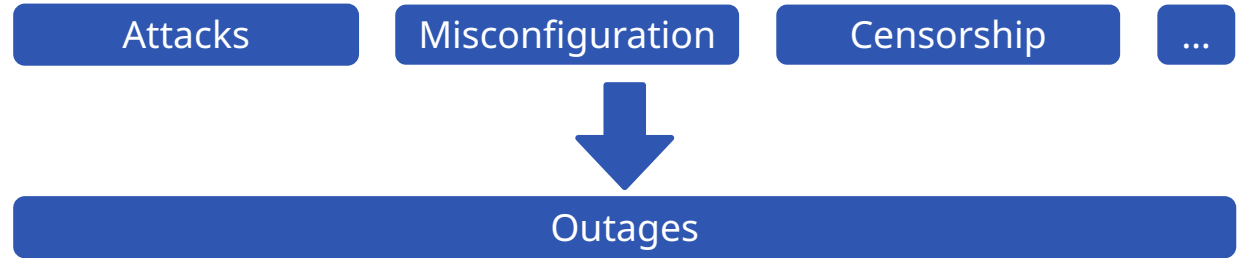


Maynard Koch, Amreesh Phokeer, Philip Paeps, Matthias Wählisch

Measuring Resilience of Recursive DNS Resolvers

Resilience is challenged by multiple incidents



Resilience is challenged by multiple incidents



Resilience is challenged by multiple incidents



Withstands

Attacks

Misconfiguration

Censorship

...



Outages

Mitigation techniques

DNSSEC

Anycast

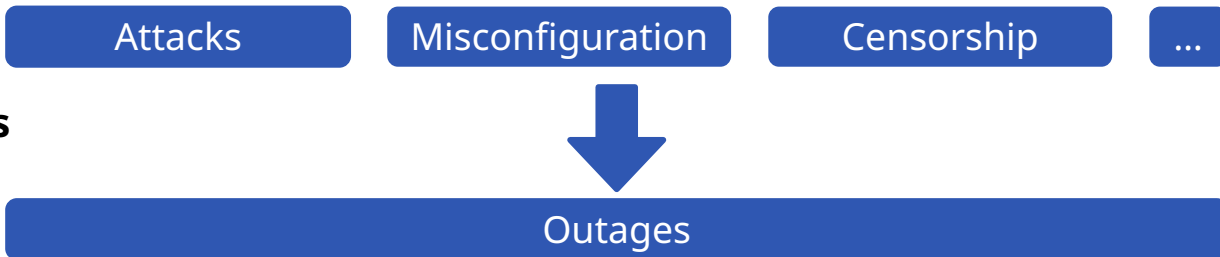
BCP38

...

Resilience is challenged by multiple incidents



Withstands



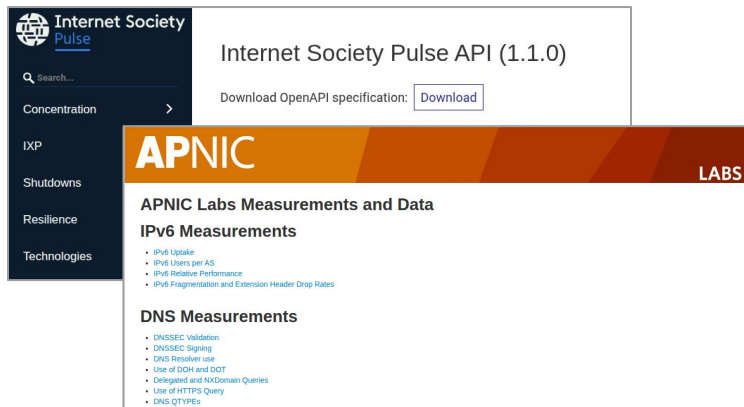
Mitigation techniques



Goal: Improve resilience of recursive resolvers by measurement-driven insights

- Understand
- Assess

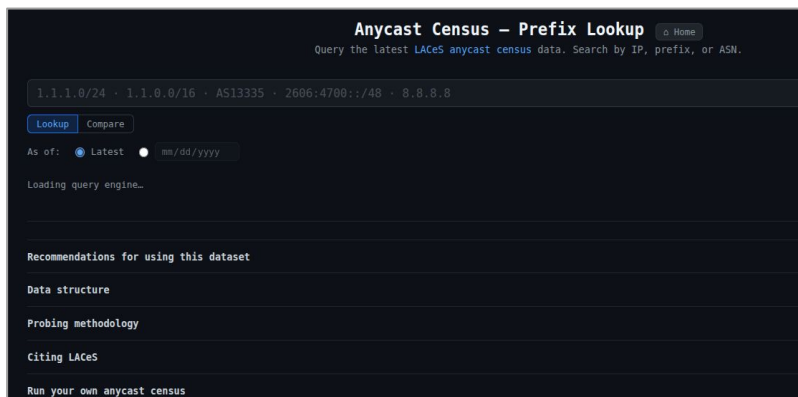
Use of public data sources for resilience assessment



The screenshot shows two web pages. The top page is the Internet Society Pulse API (1.1.0) interface, featuring a search bar and a 'Download OpenAPI specification' button. The bottom page is the APNIC Labs Measurements and Data page, which lists various measurement categories: IPv6 Measurements (including IPv6 Uptake, IPv6 Users per AS, IPv6 Relative Performance, and IPv6 Fragmentation and Extension Header Drop Rates) and DNS Measurements (including DNSSEC Validation, DNSSEC Signing, DNS Resolver use, Use of DoH and DoT, Delegated and NXDomain Queries, Use of HTTPS Query, and DNS QTYPEs).



Use of public data sources for resilience assessment



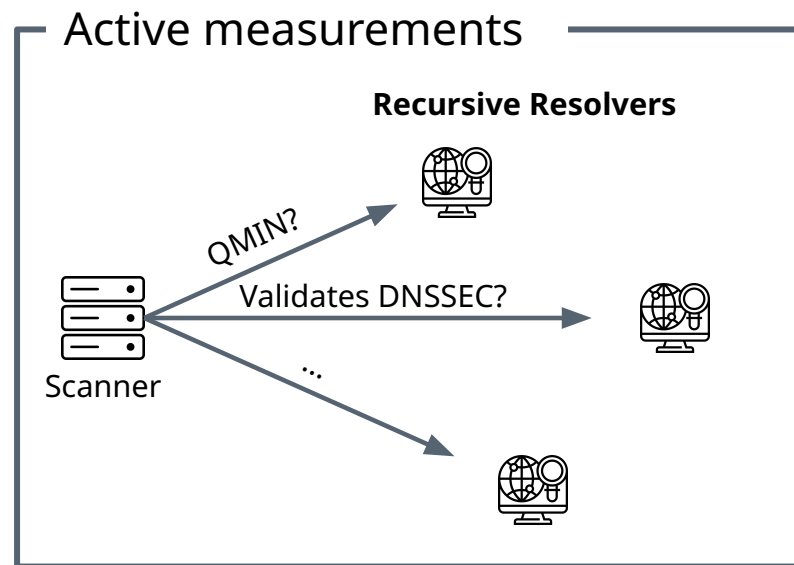
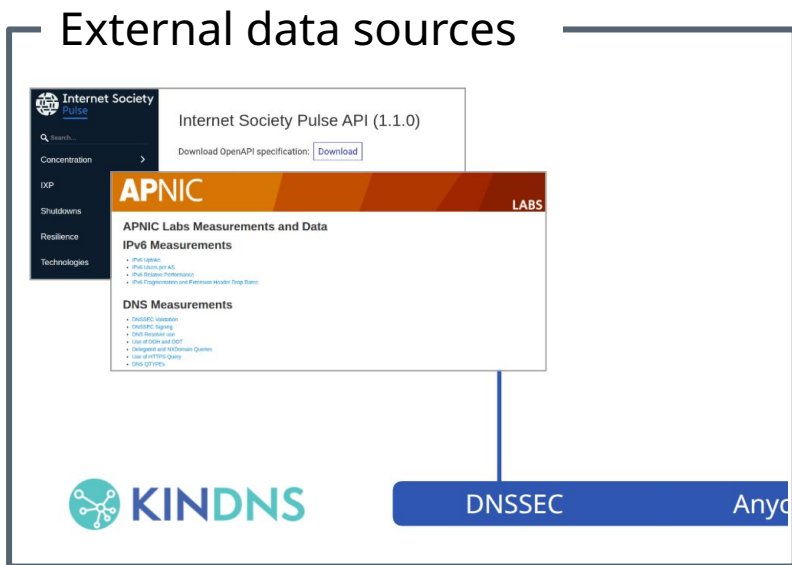
Use of public data sources for resilience assessment

The image shows a composite of three elements: a Spoofer API interface, a 'SECNOW!' warning box, and an Open DNS (ODNS) API documentation page. The Spoofer API interface includes sections for 'Session' and 'Models', with endpoints like `GET /sessions` and `GET /sessions/{id}`. The 'SECNOW!' box contains a 'News' section with three entries: '2025-11-25: Removed access to deprecated version 1.0. API version 2.0 is fully backwards compatible.', '2025-07-31: Released API version 2.0.', and '2025-05-01: Released API version 1.0.'. The ODNS API documentation includes a 'News' section and an 'Open DNS API' section describing the service's purpose and providing a citation link: [10.1145/3485983.3494872](https://doi.org/10.1145/3485983.3494872). A blue line connects the ODNS API documentation to a navigation bar at the bottom containing 'DNSSEC', 'Anycast', 'BCP38', and an ellipsis.



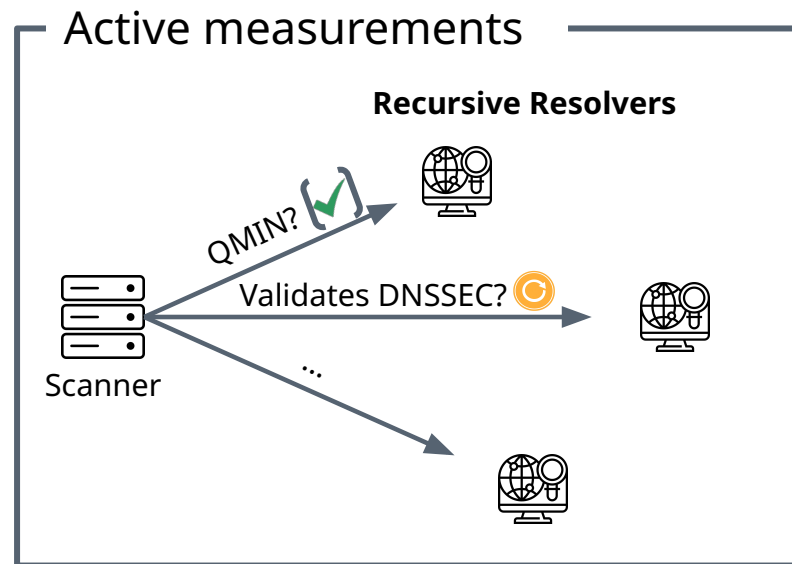
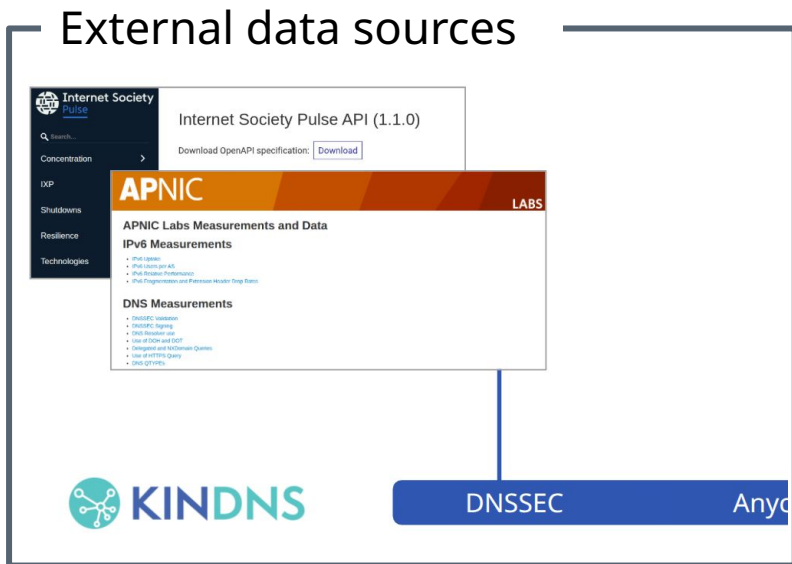
Understanding the resolver ecosystem

Our approach



Understanding the resolver ecosystem

Our approach



A glimpse into first results

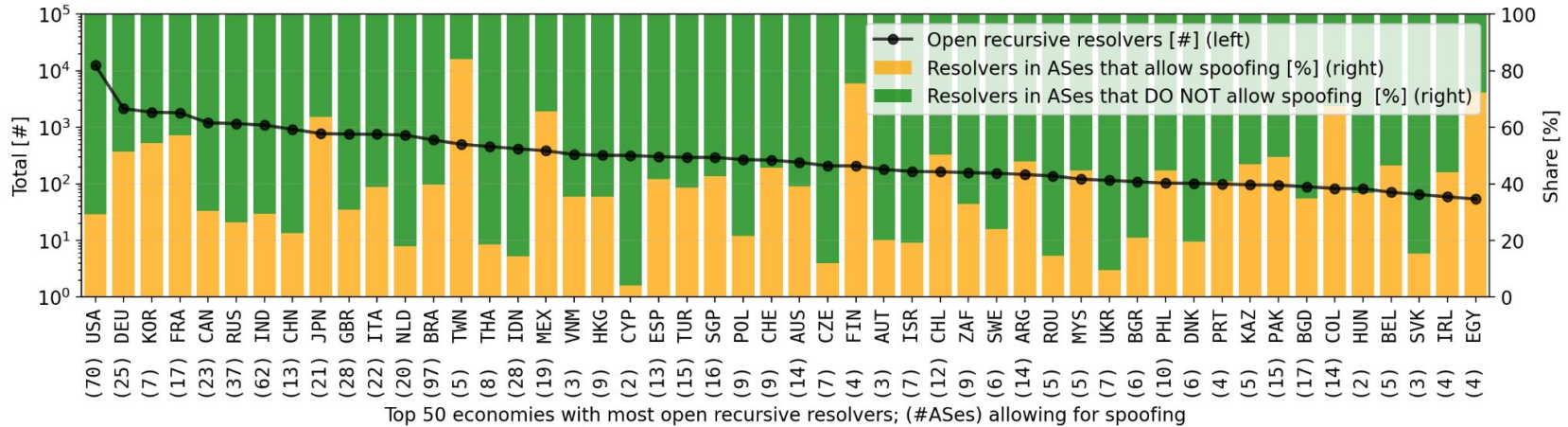
Resolver coverage

35k
open resolvers in
5.2k ASes

69k
non-public resolvers
in 8.6k ASes

A glimpse into first results

Open resolvers in spoofing environments



Of the **35k open resolvers** in our current dataset,
36% are deployed in networks that appear to allow spoofing.

Discussion

1. **How would you define and assess resilience of DNS?**
2. **If you want to contribute data, talk to us!**



Image credits

- [1] <https://kindns.org>
- [2] <https://www.flaticon.com/free-icons/server> Server icons created by Elias Bikbulatov - Flaticon
- [3] <https://www.flaticon.com/free-icons/dns> Dns icons created by Eucalyp - Flaticon