Dresden University of Technology

Internet Society Pulse

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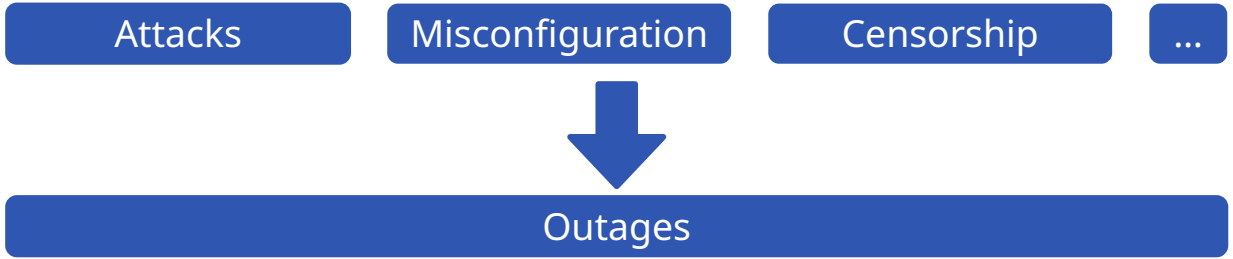
Measuring Resilience of Recursive DNS Resolvers

First insights on the global deployment of measurable KINDNS practices and beyond.

OARC47, Vancouver // November 8-11, 2026

Resilience is challenged by multiple incidents
Recap



Resilience is challenged by multiple incidents
Recap



Resilient Domain Name System

Withstands

Attacks | Misconfiguration | Censorship | ...

↓

Outages

Resilience is challenged by multiple incidents
Recap



Resilient Domain Name System

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Outages

Mitigation techniques

DNSSEC | Anycast | BCP38 | ...

Resilience is challenged by multiple incidents

Recap



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Withstands

Attacks | Misconfiguration | Censorship | ...

Outages

Mitigation techniques

KINDNS

DNSSEC | Anycast | BCP38 | ...

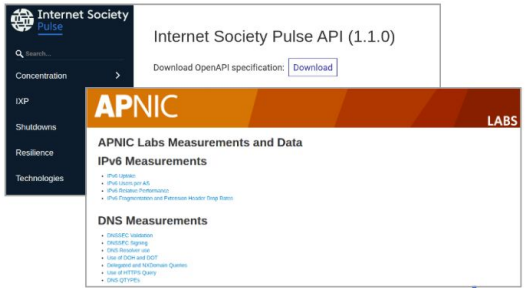
Goal: Improve resilience of recursive resolvers by measurement-driven insights

Understand

Assess

Analyzing the deployment of measurable KINDNS practices
Our approach

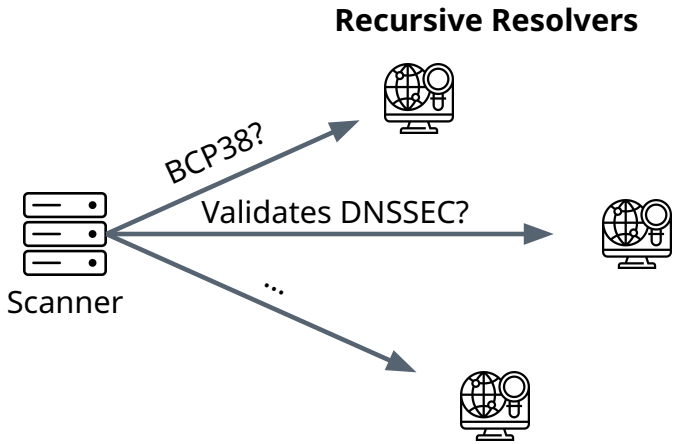
External data sources



KINDNS

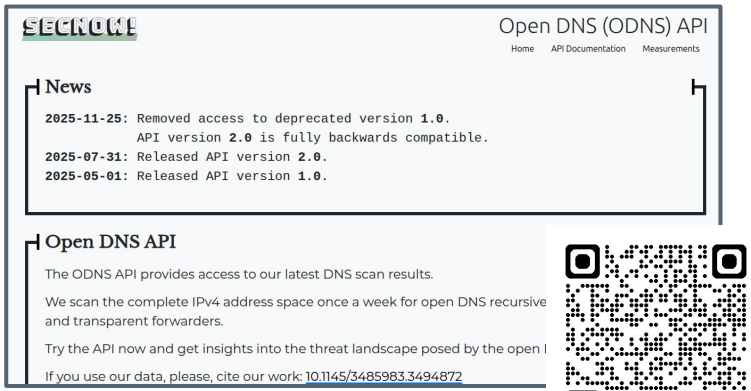
DNSSEC Anyc

Active measurements



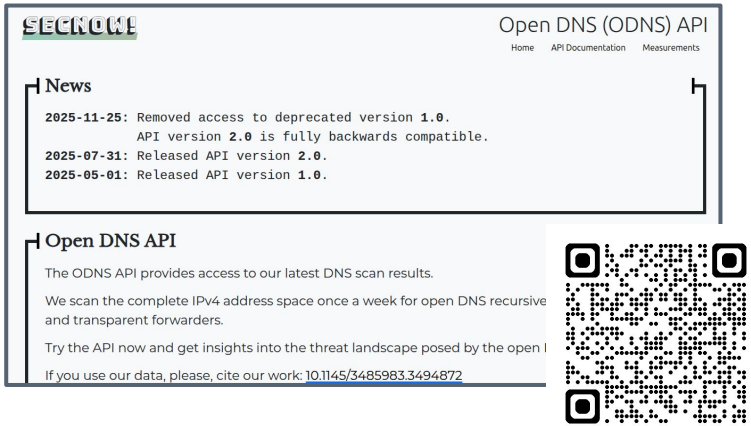
Collecting recursive DNS resolvers
Active measurements

Weekly IPv4 wide scans, publicly accessible via our API under odns-data.netd.cs.tu-dresden.de



Collecting recursive DNS resolvers
Active measurements and scraping public sources

Weekly IPv4 wide scans, publicly accessible via our API under odns-data.netd.cs.tu-dresden.de



ZDNS

We run SVCB and PTR record lookups on all observed DNS resolvers to check for alternative IPv4 or IPv6 resolver addresses.

Open resolver lists from github repositories, e.g., trickest/resolvers or OpenResolversFoundation/openresolvers

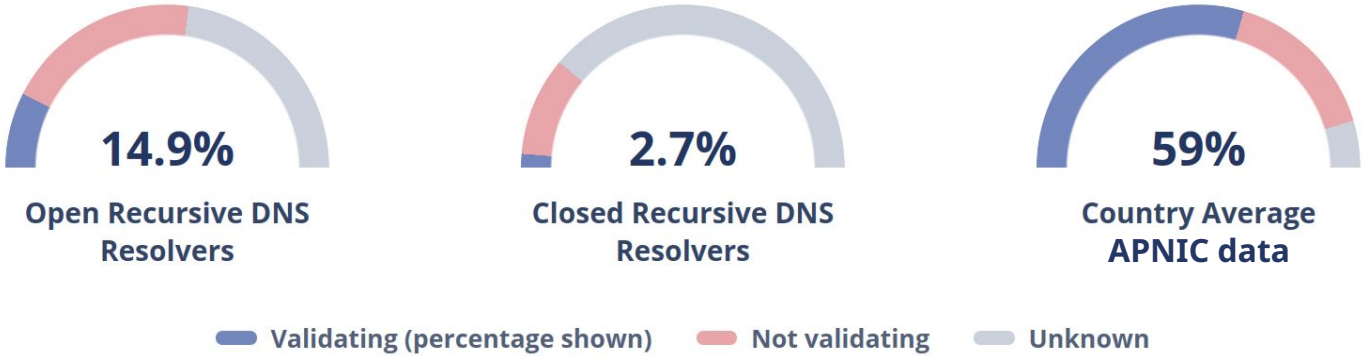
Technical University of Munich

TU Munich IPv6 hitlist for IPv6 resolver measurements.

DNS Observatory
Overview of currently measured/monitored practices

Practice	Granularity	Method
DNSSEC validation	Individual resolvers	ZDNS measurements against `dnssec-failed.org`
	AS/Country level	APNIC labs DNSSEC measurements
QMIN support	Individual resolvers	Custom measurement tool and setup
BCP38 compliance	AS/Prefix level	CAIDA Spoofer data and transparent forwarder data from ODNS-API
MANRS compliance	AS level	MANRS readiness scores from the MANRS observatory
Anycast enabled	Resolver level	Manycast API
Dual stack and protocols	Resolver level	ZDNS queries of SVCB records for resolvers (Work in progress!)

A glimpse into first results
DNSSEC validation



A glimpse into first results
QMIN support



A glimpse into first results
QMIN support



A glimpse into first results
Anycast



A glimpse into first results
Anycast



Open Recursive DNS Resolvers



Closed Recursive DNS Resolvers

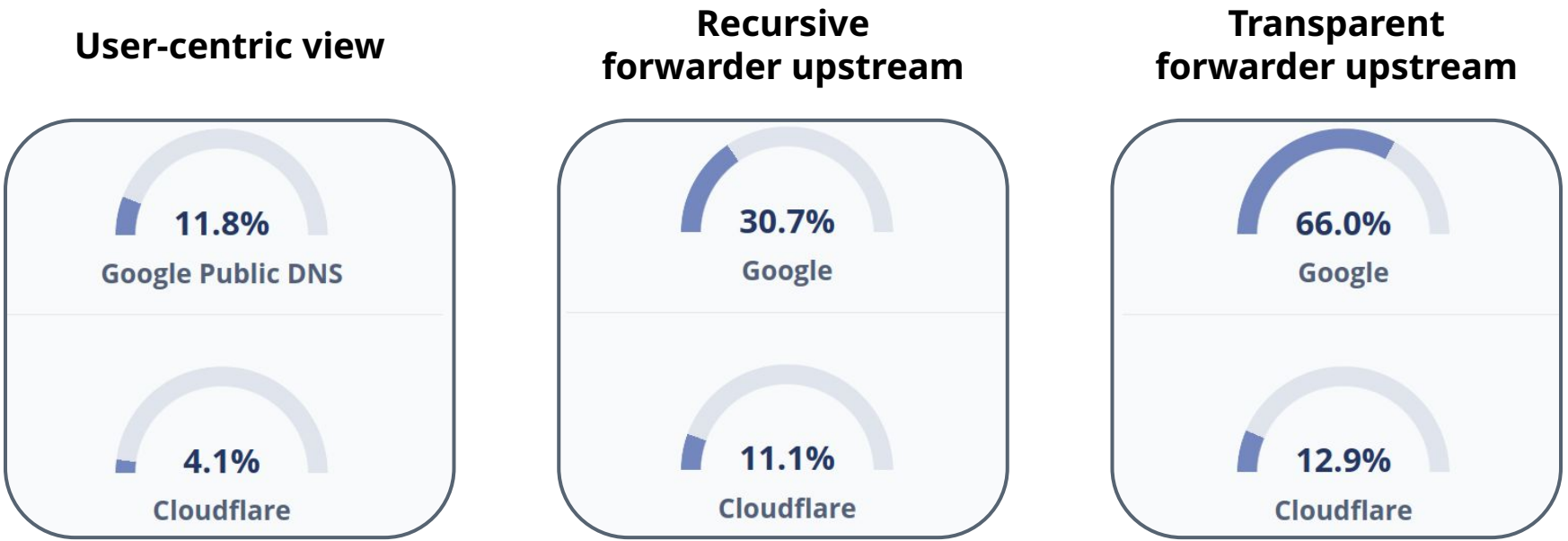
Anycast enabled No anycast

Top 5 Anycast IP addresses

RANK	IP ADDRESS	COMPANY	SITES [#]	COUNTRIES [#]
1	8.8.8.8	Google	6,683	97
2	8.8.4.4	Google	1,209	60
3	1.1.1.1	Cloudflare	1,030	77
4	1.1.1.2	Cloudflare	1,030	77
5	1.1.1.3	Cloudflare	1,030	77

A glimpse into first results

User-centric view (APNIC) vs forwarder-centric view (ODNS-API) for Google and Cloudflare



DNS Observatory
Explore the webpage and leave feedback!



https://dns-observatory.netd.cs.tu-dresden.de

Call for action

1. **Explore the webpage and leave some feedback ;)**

2. **If you want to contribute data, talk to us!**



Image credits

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