RIPE NCC
RIPE NETWORK COORDINATION CENTER

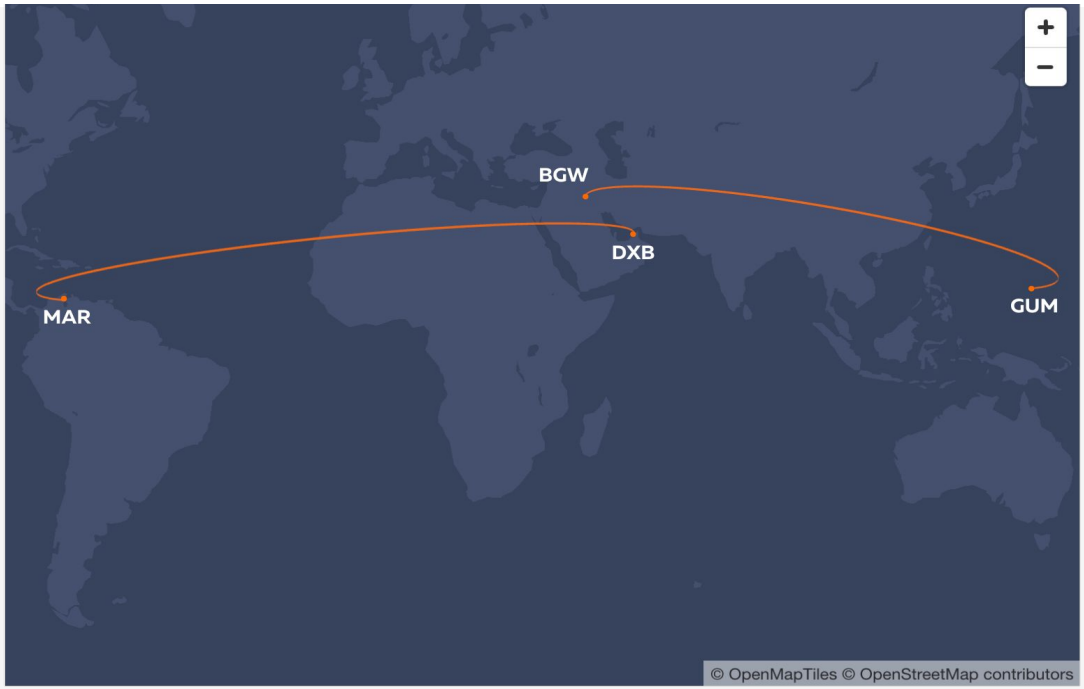
A Look at a Root Cause for DNS Latency

What frustrates Internet users most? Slow DNS

Lia Hestina | NPNOG 11| June 2025

The Problem

What Frustrates Internet Users Most?



High DNS latency

Due to routing, slowing down experiences

Traffic is not local

Slow response due to detour around the world

How Is RIPE NCC's AuthDNS Reached from Asia Pacific?

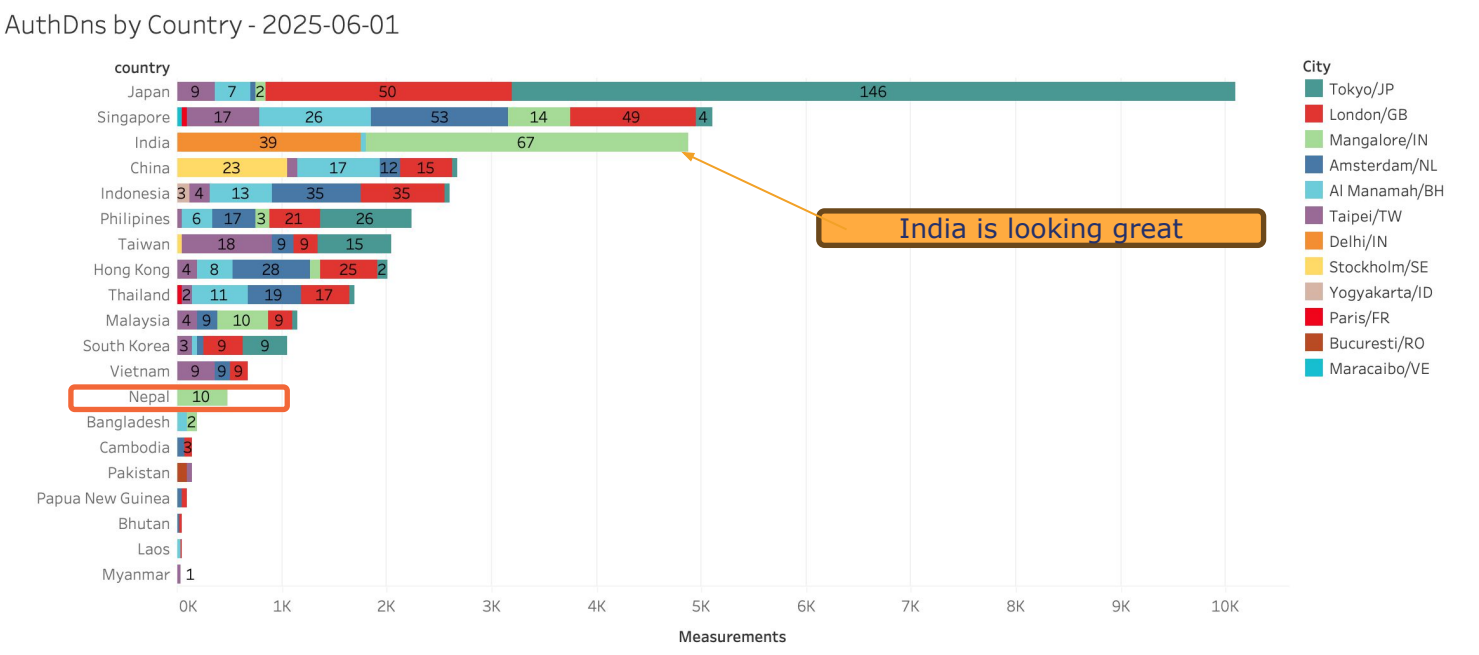
1.	Target: RIPE NCC AuthDNS service
2.	From 1481 probes in Asia Pacific
3.	DNS and NSID measurements
4.	We got replies from 1263 probes
5.	You can do this too!

msm-id	Region	Measurement period
81884795	PacificAndOceania	2024-11-11 14:01:21 2025-01-10 00:00:00
81884639	SouthEastAsia	2024-11-11 13:59:19 2025-01-10 00:00:00
81884620	SouthAsia	2024-11-11 13:59:06 2025-01-10 00:00:00
81884592	EastAsia	2024-11-11 13:58:46 2025-01-10 00:00:00
86051460	SouthEastAsia+Oceania	2025-01-12 23:01:41 2025-03-04 00:00:00
86051450	East-and-South-Asia	2025-01-12 22:58:42 2025-03-04 00:00:00

https://atlas.ripe.net/measurements/

Let’s Analyse:

Which node answered DNS queries from certain economies?

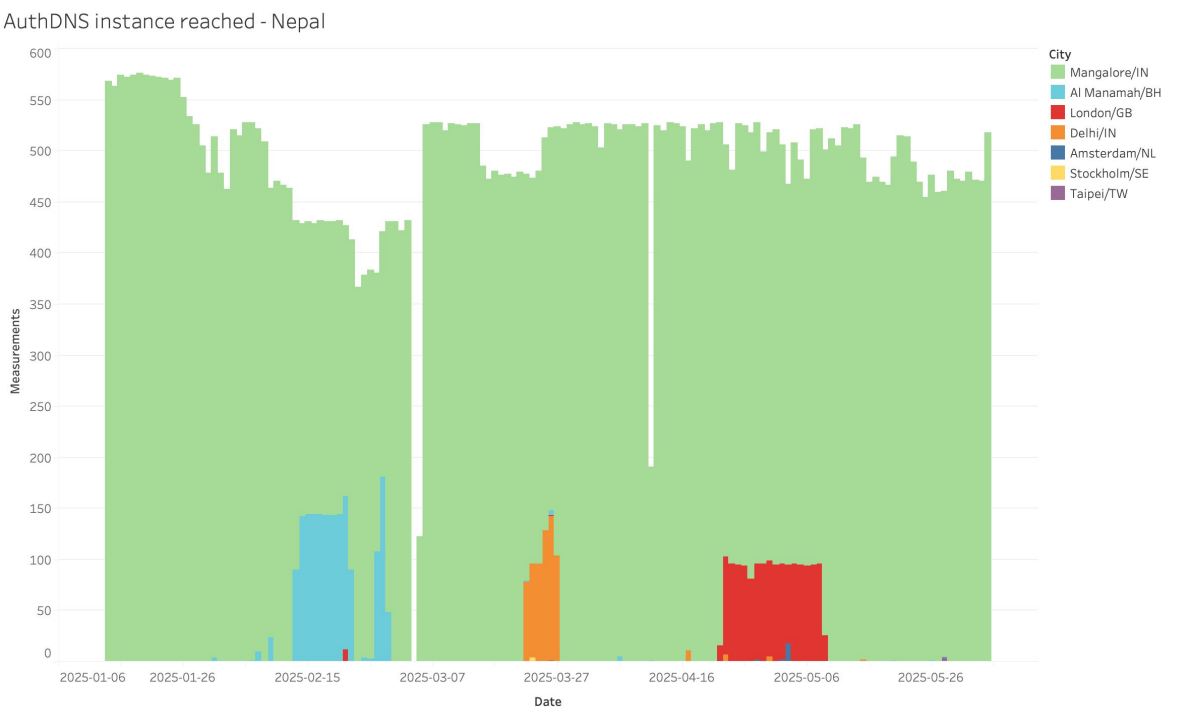


World tour

- Nepal: All the probes got answer from RIPE NCC’s AuthDNS nodes in India
- We have 2 nodes in Japan, some of the probes still prefer to go to London and Taiwan
- India: 2 local nodes in Delhi and Mangalore - 95% of the probes go answer locally

Let’s Take a Closer Look

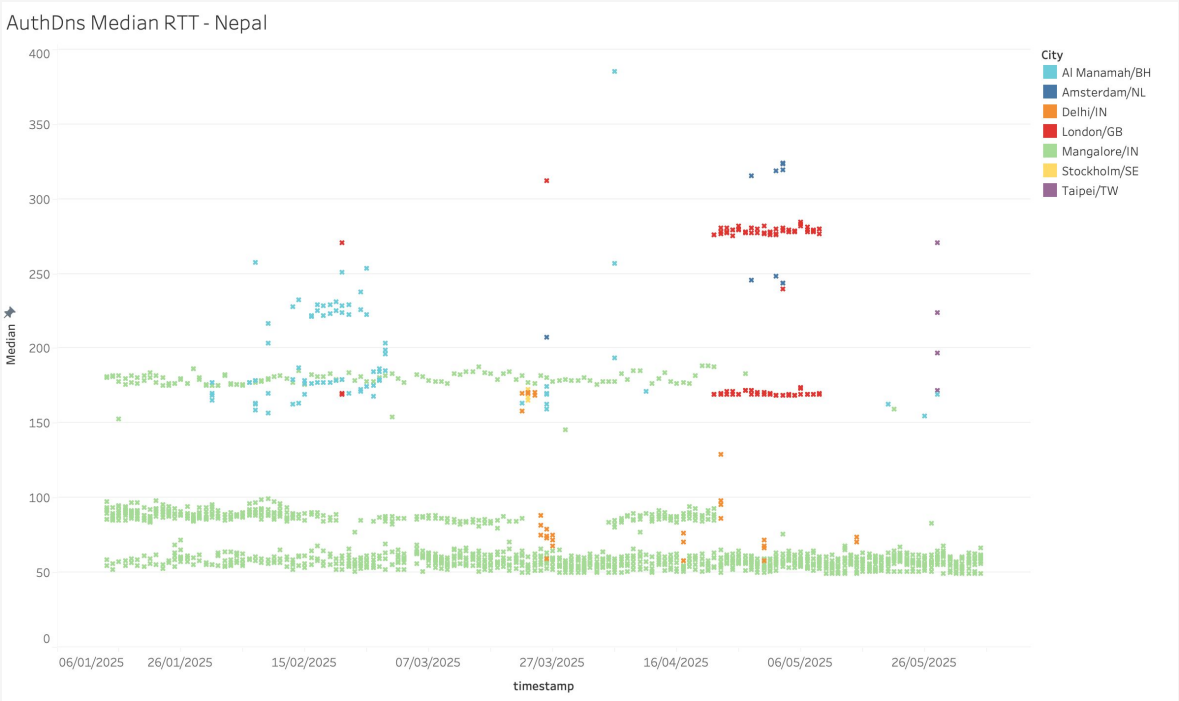
Which node gives the most answers? 01/06/25



Most queries from Nepal probes got answers from node in Mangalore (India), sometimes from the node in New Delhi, Great Britain and Bahrein.

Let's Analyse:

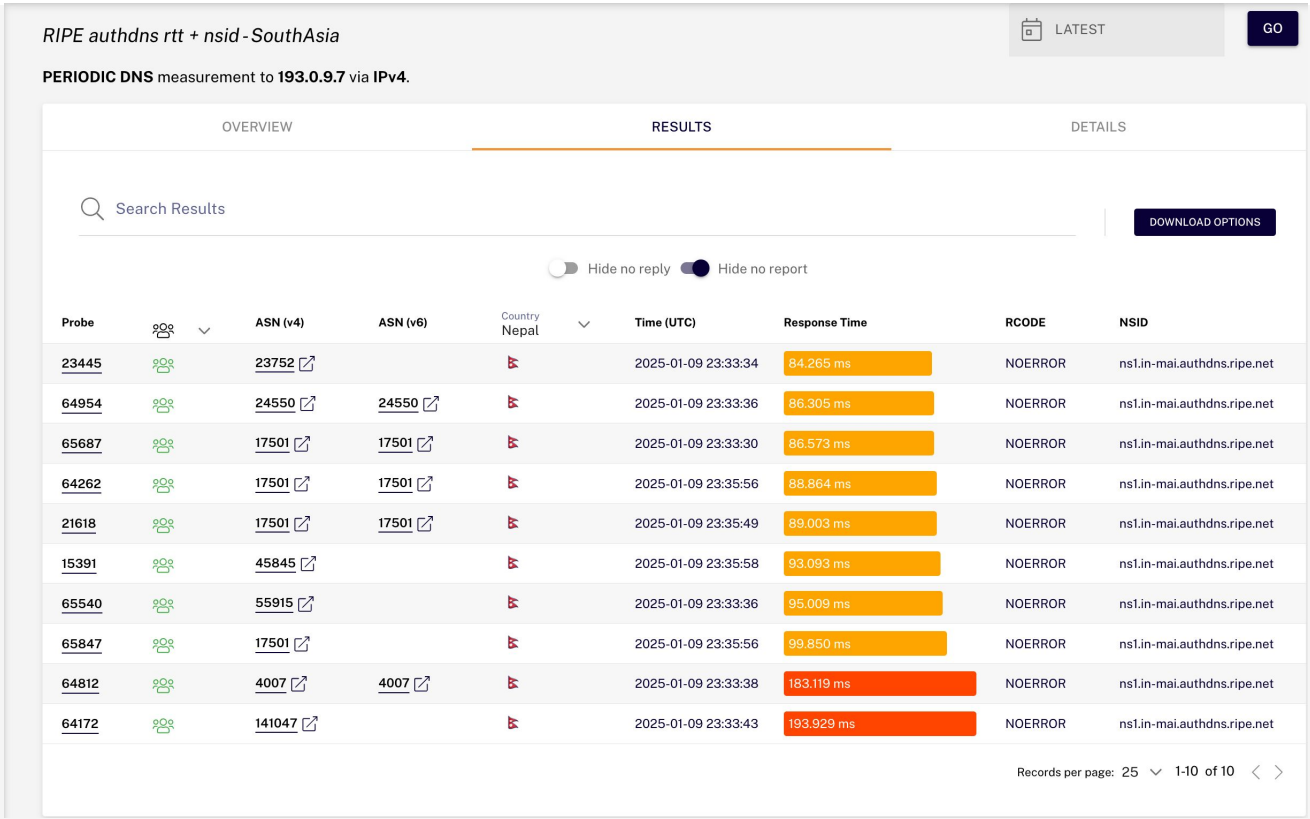
RTT answer from AuthDNS nodes in India and Europe on 01/06/25



Asia to Europe

- RTTs to Europe generally are in the 150ms-250ms range
- RTTs to Mangalore node is in range of 50-200ms

Let’s Zoom in Nepal:



RIPE authdns rtt + nsid - SouthAsia

LATEST GO

PERIODIC DNS measurement to **193.0.9.7** via **IPv4**.

OVERVIEW | RESULTS | DETAILS

Search Results

DOWNLOAD OPTIONS

Hide no reply Hide no report

Probe	ASN (v4)	ASN (v6)	Country: Nepal	Time (UTC)	Response Time	RCODE	NSID
23445	23752			2025-01-09 23:33:34	84.265 ms	NOERROR	ns1.in-mai.authdns.ripe.net
64954	24550	24550		2025-01-09 23:33:36	86.305 ms	NOERROR	ns1.in-mai.authdns.ripe.net
65687	17501	17501		2025-01-09 23:33:30	86.573 ms	NOERROR	ns1.in-mai.authdns.ripe.net
64262	17501	17501		2025-01-09 23:35:56	88.864 ms	NOERROR	ns1.in-mai.authdns.ripe.net
21618	17501	17501		2025-01-09 23:35:49	89.003 ms	NOERROR	ns1.in-mai.authdns.ripe.net
15391	45845			2025-01-09 23:35:58	93.093 ms	NOERROR	ns1.in-mai.authdns.ripe.net
65540	55915			2025-01-09 23:33:36	95.009 ms	NOERROR	ns1.in-mai.authdns.ripe.net
65847	17501			2025-01-09 23:35:56	99.850 ms	NOERROR	ns1.in-mai.authdns.ripe.net
64812	4007	4007		2025-01-09 23:33:38	183.119 ms	NOERROR	ns1.in-mai.authdns.ripe.net
64172	141047			2025-01-09 23:33:43	193.929 ms	NOERROR	ns1.in-mai.authdns.ripe.net

Records per page: 25 1-10 of 10

Minimum RTT

- Having a local node will help reduce the latency

The Solution

Keeping Traffic Local with AuthDNS

Anycast

Local DNS server reduces latency. More deployment increases resilience.

Contribution

Anycasted servers can be hosted in more networks.

Security

- Local AuthDNS is a machine that announces the AuthDNS prefixes.
- It helps reduce path lengths for your network and peers.

What is AuthDNS?

RIPE NCC's AuthDNS provides:

1. Reverse DNS zones for IP space allocated by RIPE NCC
2. Best-effort secondary name service to the other RIRs
3. Critical Internet zones (e.g. ripe.net)

Why Host an AuthDNS node?

For IXPs:

- Boost your visibility
- Attract more peers with added value services

For ISPs:

- Reduce dependency: resolve your own reverse DNS internally
- Improve email deliverability for your customers

We make it easy

We manage the server:

- Software updates
- Security patches
- Monitoring health and performance
- Restricted access

Designed with resilience in mind:

- Distributed nodes help mitigate risks from DDoS attacks
- You support a stronger Internet by simply hosting a node

Scan the
QR-code to learn more!

Requirements

A host may provide either a dedicated hardware server, or a virtual server

- Min CPUS=8, min RAM=20 GB, min storage=500 GB, 2 gigabit-ethernet network interfaces
- Dell PowerEdge
- iDRAC enterprise, for out-of-band access and OS installation
- Web-based out-of-band access

Hand-On Solution - Be Proactive with RIPE Atlas

Global network of sensors monitoring Internet paths in real time

Measurements

Run six types of measurements to **any** target, with **views** from **outside** your network

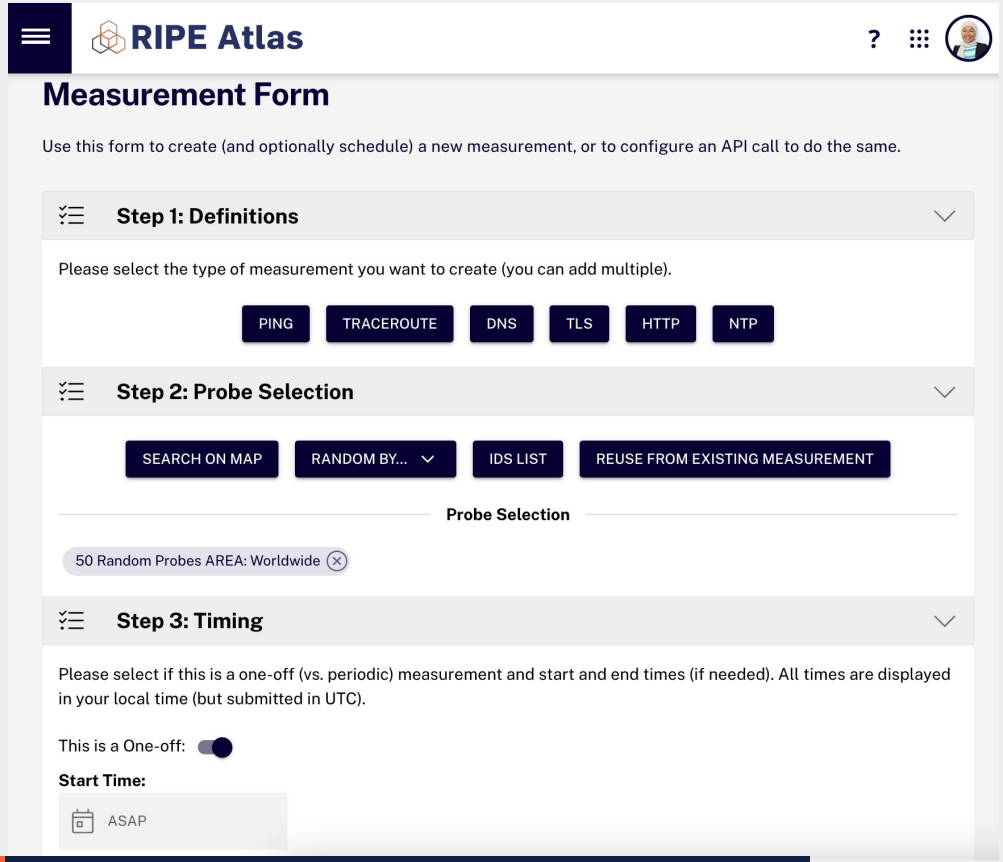
Coverage

Over 12K global probes, credit system and **trusted source**

Access

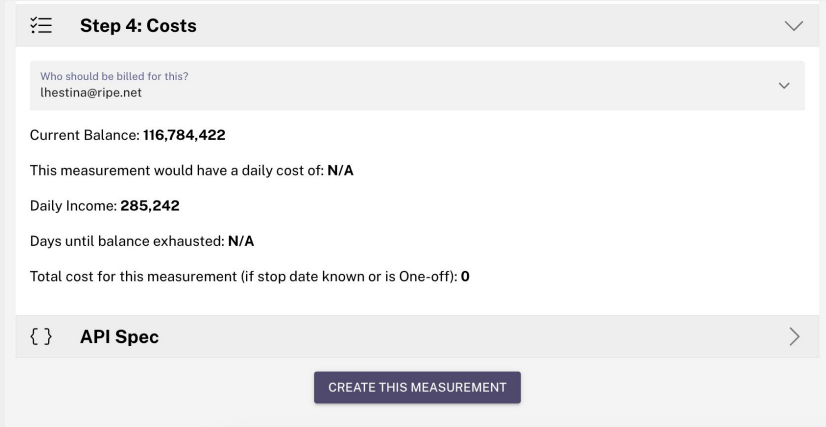
Accessible via WEB GUI, API, CLI tools. Can be the basis for your own tools

Try It Yourself: Create a Measurement



https://atlas.ripe.net/measurements/form/

1. Create a RIPE NCC SSO account
2. Redeem 200K credits **NPNOG11**
3. Get started:



Analysing Results

Measurement 81884620

RIPE authdns rtt + nsid - SouthAsia

LATEST GO

PERIODIC DNS measurement to **193.0.9.7** via **IPv4**.

OVERVIEW | RESULTS | DETAILS

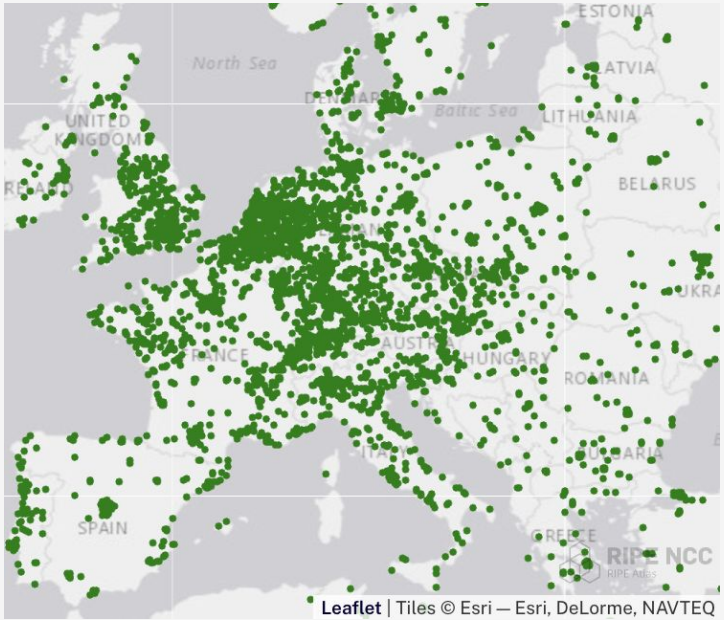
Search Results

DOWNLOAD OPTIONS

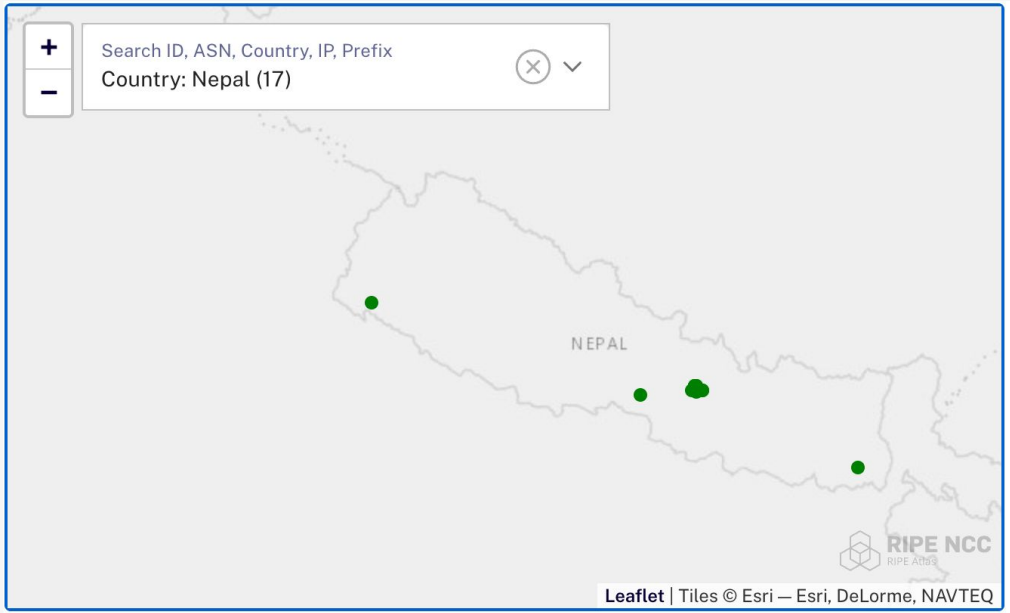
Hide no reply Hide no report

Probe		ASN (v4)	ASN (v6)	Country All	Time (UTC)	Response Time	RCODE	NSID
6575		45170	45170		2024-12-10 11:47	218.705 ms	NOERROR	ns1.bh-amh.authdns.ripe.net
6785		58717	58717		2024-12-11 06:17	170.069 ms	NOERROR	ns1.bh-amh.authdns.ripe.net
6953		12008	12008		2024-12-11 06:17	39.138 ms	NOERROR	ns1.in-mai.authdns.ripe.net
6954		12008	12008		2024-12-11 06:17	17.787 ms	NOERROR	ns1.in-mai.authdns.ripe.net
6968		14061	14061		2024-12-11 06:17	33.642 ms	NOERROR	ns1.in-mai.authdns.ripe.net
7077		132420			2024-12-11 06:17	40.578 ms	NOERROR	ns1.in-mai.authdns.ripe.net
7115		7642	7642		2024-12-11 06:17	183.938 ms	NOERROR	ns1.bh-amh.authdns.ripe.net
7269		45117	45117		2024-12-11 06:33	38.731 ms	NOERROR	ns1.in-del.authdns.ripe.net
7278		138322	138322		2024-12-11 06:33	156.511 ms	NOERROR	ns1.bh-amh.authdns.ripe.net
7375		138800	138800		2024-12-11 06:17	77.437 ms	NOERROR	ns1.in-mai.authdns.ripe.net
7405		152533	152533		2024-12-11 06:33	19.622 ms	NOERROR	ns1.in-mai.authdns.ripe.net
7407		149021	149021		2024-12-11 06:17	156.058 ms	NOERROR	ns1.bh-amh.authdns.ripe.net
11978		24560	24560		2024-12-11 06:33	19.784 ms	NOERROR	ns1.in-mai.authdns.ripe.net
13785		135817	135817		2024-12-11 06:35	9.459 ms	NOERROR	ns1.in-del.authdns.ripe.net

RIPE Atlas Coverage Density



Europe



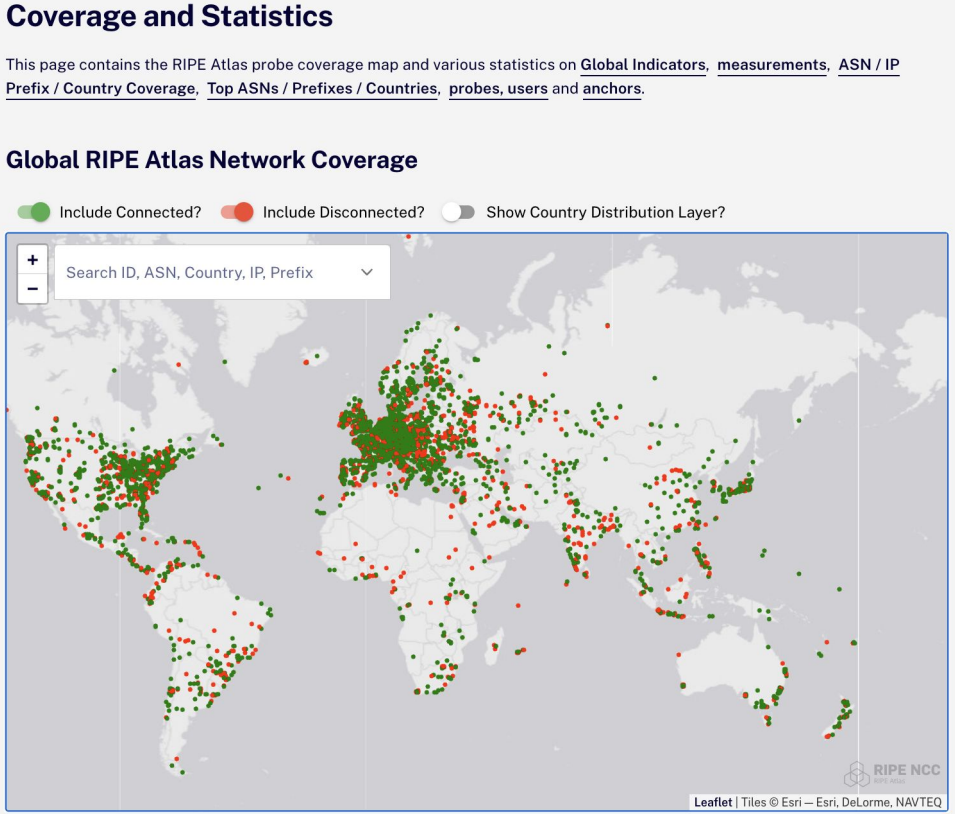
Nepal

RIPE Atlas in the Asia Pacific region

How you can help

Extremely low coverage in many economies, we need:

- More topological diversity. Especially: More diversity in network & type of location:
  - end user vs. core
  - More in eyeball networks
  - Paths via IXPs



Understanding how the internet is routed during Internet outages with RIPE Atlas Anchor

Don’t Just Be a Passive Client, Take Charge of Your Visibility

When incidents happen, **can you see how your network is affected?**
RIPE Atlas Anchors give you a **global, independent view**.

- Detect routing issues faster
- Understand impact from different regions
- Make informed, timely decisions

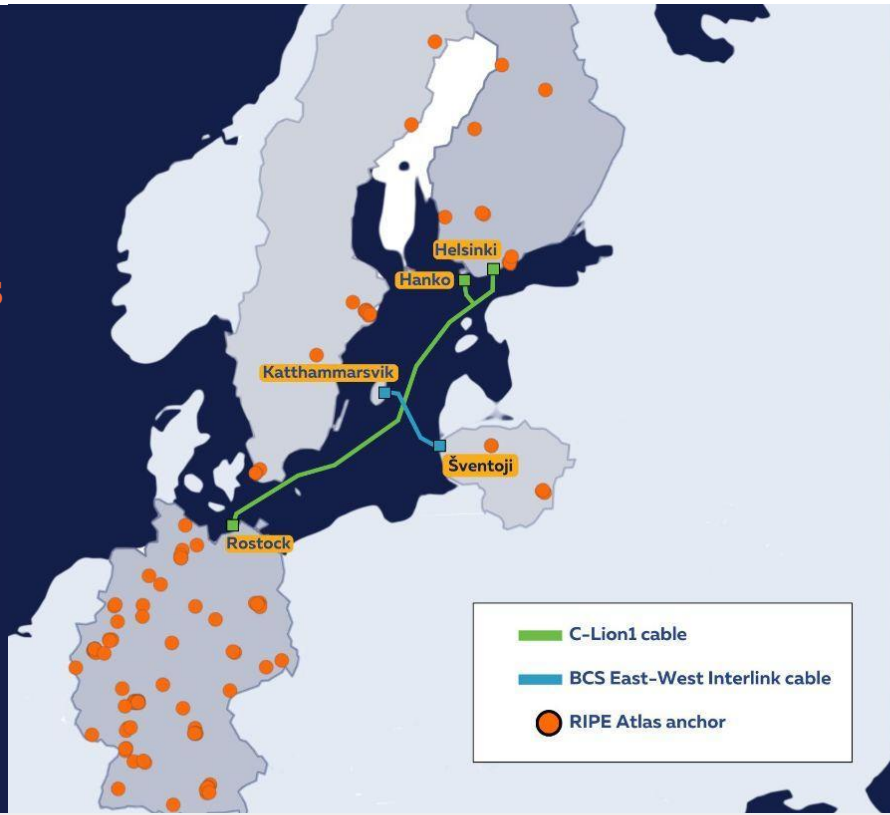
Preparation is your responsibility.
Visibility is your power.

Supporting RIPE NCC Research Reports on Internet events

RIPE NCC research into outages, hijacks, and events that damage the Internet

Recent analysis of **Baltic Sea cable cuts at end of 2024** drawing on data from RIPE Atlas anchors

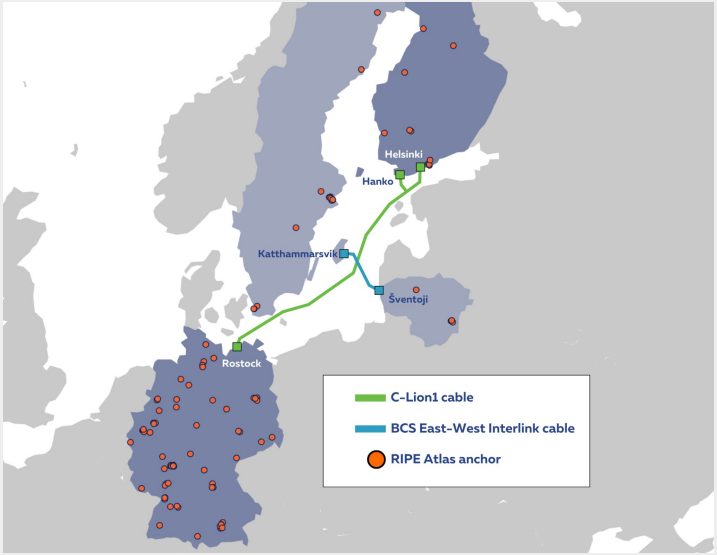
Read the full analysis on **RIPE Labs**



RIPE Atlas Anchors Use Case: Submarine Cable Cuts

Does the Internet route around damage?

- On 16 November a submarine cable got cut, on 17 November another one
- Did the Internet route around this damage?
- We used RIPE Atlas Anchors to investigate:
  - https://labs.ripe.net/author/emileaben/does-the-internet-route-around-damage-baltic-sea-cable-cuts/
- Findings:
  - No increased packet loss
  - 20-30% of paths had increased latency (0-20ms)



RIPE Atlas Anchor Deployment

Help us deploy RIPE Atlas Anchors!

The Baltic Sea Cable cuts analysis was possible because a sufficient number of RIPE Atlas Anchors was deployed in the region (on both sides of the cables).

We consider 5 RIPE Atlas Anchors in 3 cities and 3 networks will give enough diversity.

Check out this page to see if your country needs more anchors for this type of measurement:

https://sg-pub.ripe.net/emile/tmp/cc2anchor.csv

Network Requirements:

- Public, native IPv4 & IPv6
- Static, unfiltered IPs (no firewall)
- Same-prefix IPv4/IPv6 gateway or link-local IPv6
- Up to 10 Mbps bandwidth (typically less)

Virtual Machine Specifications

- x86_64-v2+ CPU
- 4 GB of RAM
- 50 GB of Disk Storage

Summary

- **Problem**: Slow DNS response times frustrate internet users
- **Cause**: High latency due to inefficient routing, with traffic often travel not locally
- **Solution**:
  - Keep DNS traffic local by hosting more AuthDNS (anycasted DNS servers)
  - Host more RIPE Atlas (anchor) in diverse location to provide real time view on the field
- **Benefit**: Local DNS reduces latency, improve user experience, Share the load during DDOS attack and enhances security by reducing paths lengths and hijack risks
- **Tools**: Use RIPE Atlas for measuring DNS latency and assessing route inefficiencies.

Sources

- RIPE Atlas Measurement Result: https://atlas.ripe.net/measurements/81446294/
- RIS – How far is Internet from our infrastructure: https://observablehq.com/@emileaben/what-peers-would-decrease-as-distance-to-ris-most
- Baltic Cable Cut: https://labs.ripe.net/author/emileaben/does-the-internet-route-around-damage-baltic-sea-cable-cuts/
- AuthDNS analysis: https://labs.ripe.net/author/anandb/reaching-authdns-a-ripe-atlas-analysis-by-region/

Questions & Comments

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THANK YOU!

AS path from AuthDNS side

AS-path from Guam IX AuthDNS node to Atlas Anchor #7009

```
ns1.gu-gum.authdns.ripe.net# show ip bgp 45.94.14.204
BGP routing table entry for 45.94.14.0/24, version 63919178
Paths: (1 available, best #1, table default)
  Not advertised to any peer
  152735 7131 701 3257 8895 8895 208520, (aggregated by 208520 45.94.12.1)
    103.142.153.1 from 103.142.153.1 (103.142.152.254)
      Origin IGP, valid, external, atomic-aggregate, best (First path
received)
      Community: 65000:7131
      Last update: Wed Nov 20 13:47:46 2024
```