



RIPE NCC
RIPE NETWORK COORDINATION CENTER

How does the Internet route around **Cable Damage**?

Internet event analysis with **RIPE Atlas**



Featured article

SEE 13: Advancing Internet Technologies in South East Europe

ripe

ipv6

ripe

routing

country

security

Qasim Lone

— 3 Apr 2025

18 min read

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9

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Following up on our series of regional reports, we present developments in routing security and IPv6 uptake in South East Europe (SEE). We look into the changes in RPKI deployment and IPv6 capability for networks in the region ahead of the upcoming SEE 13 meeting that will take place in Sofia, Bulg...

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Latest articles



Hands-On the Network: Our Experience with RouterLab

Tiago Heinrich • 3 Apr 2025 • 8 min read

Traditionally, computer network courses focus on introducing students to the various concepts of the Internet's architecture and its protocols. While such courses equip students with a theoretical foundation on how the Internet works, they often fail to cover the practical and operational aspects o...

routing training competition +1

28 0 0 0 0



Unlocking UX: A User-Centred Journey for RIPEstat

Antonella De Bellis • 26 Mar 2025 • 5 min read

User experience design is not about trends, it's about solving real problems. The team behind the RIPEstat talk in depth about the design journey they undertook to create the latest iteration of the UI.

ripestat operational

93 0 0 0 0



Low-Latency Hardware-Assisted Virtual Networking

Florian Wiedner • 27 Mar 2025 • 6 min read

Virtualisation can help optimise resource sharing, providing improved support for low-latency applications when compared to bare-metal systems. But achieving ultra-low latency on cost-effective hardware requires strategic planning.

cloud research measurements

15 0 0 0 0



The RIPE Labs Article Competition - RIPE 90

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Latest Podcasts



Emile Aben: How the Internet Routed Around Damage in the Baltic Sea

Alun Davies

31 Mar 2025

2 min read



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3 Feb 2025

2 min read

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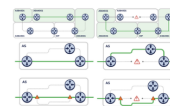
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A Deep Dive Into the Baltic Sea Cable Cuts

Emile Aben • 19 Dec 2024 • 25 min read

With last month's cuts in two major Baltic Sea Internet cables now successfully repaired, and another cut having occurred in the meantime, we analyse these events and delve deeper into the question of how exactly the Internet has remained resilient.

atlas outages research +2

65 0 0 0 0



Does the Internet Route Around Damage? - Baltic Sea Cable Cuts

Emile Aben • 20 Nov 2024 • 10 min read

This week's Internet cable cuts in the Baltic Sea have been widely reported, even as attempts to understand their cause and impact continue. We turn to RIPE Atlas to provide a preliminary analysis of these events and ask to what extent the Internet in the region has been resilient to them.

atlas outages research +3

210 2 0 0 0



Emile Aben: How the Internet Routed Around Damage in the Baltic Sea

Alun Davies • 31 Mar 2025 • 2 min read

When two Internet cables in the Baltic Sea were reported as broken last November, we turned to RIPE Atlas to examine the damage. In this episode, Emile Aben discusses what his analysis uncovered about the impact of these and similar incidents, and how the Internet remained resilient.

atlas podcast outages measurements



Read more on RIPE Labs:



Emile Aben

105

Articles

886

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About the author

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Based in [Amsterdam, NL](#)

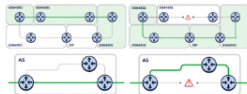
I'm a data scientist at the RIPE NCC. I'm a chemist by training, but have been working since 1998 on Internet related things, as a sysadmin, security consultant, web developer and researcher. I am interested in technology changes (like IPv6 deployment), Internet measurement, data analysis, data visualisation, sustainability and security. I'd like to bring research and operations closer together, ie. do research that is operationally relevant. When I'm not working I like to make music (electric guitar, bass and drums), do sports (swimming, (inline) skating, bouldering, soccer), and try to be a good parent.

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A Deep Dive Into the Baltic Sea Cable Cuts



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With last month's cuts in two major Baltic Sea Internet cables now successfully repaired, and another cut having occurred in the meantime, we analyse these events and delve deeper into the question of how

Baltic Sea cable damage



Partial timeline (initial events we analysed)

- 17 Nov 2024: BCS East-West outage
- 18 Nov 2024: C-LION1 outage
- 27 Nov 2024: BCS East-West restored
- 28 Nov 2024: C-LION1 restored
- 25 Dec 2024: C-LION1 outage
- 06 Jan 2025: C-LION1 restored
- 26 Jan 2025: LVRTC outage
- 28 Feb 2025: LVRTC restored



Measuring damage with RIPE Atlas



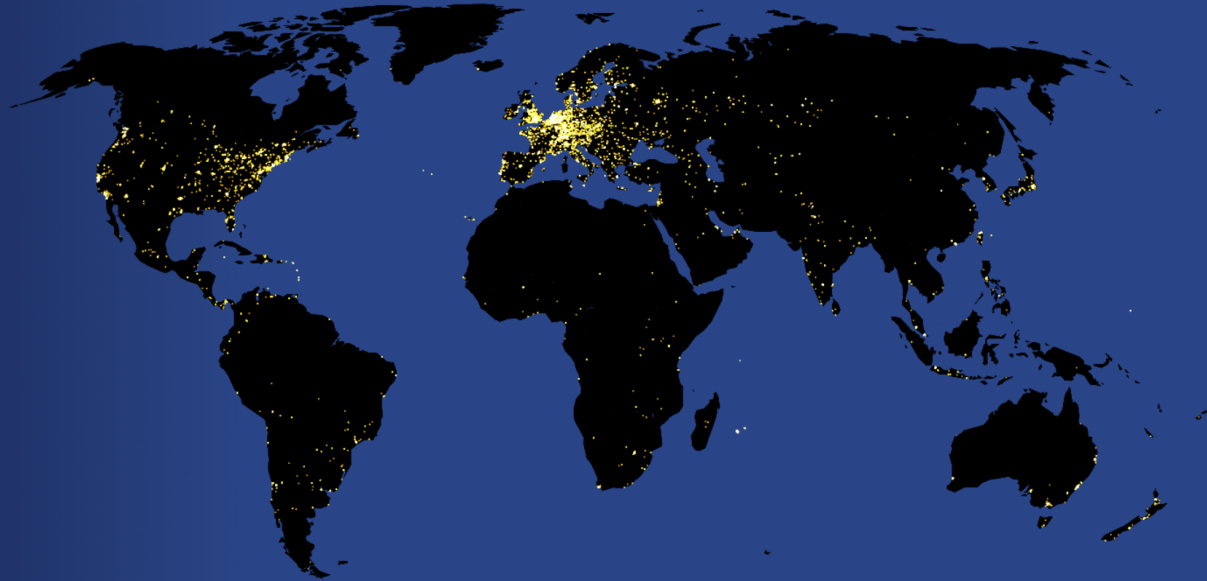
RIPE Atlas

A global network of probes measuring the Internet in real time

13,400+ probes connected

900+ anchors deployed

35,000+ daily measurements on average (both user-defined and built-in)



Measuring damage with RIPE Atlas

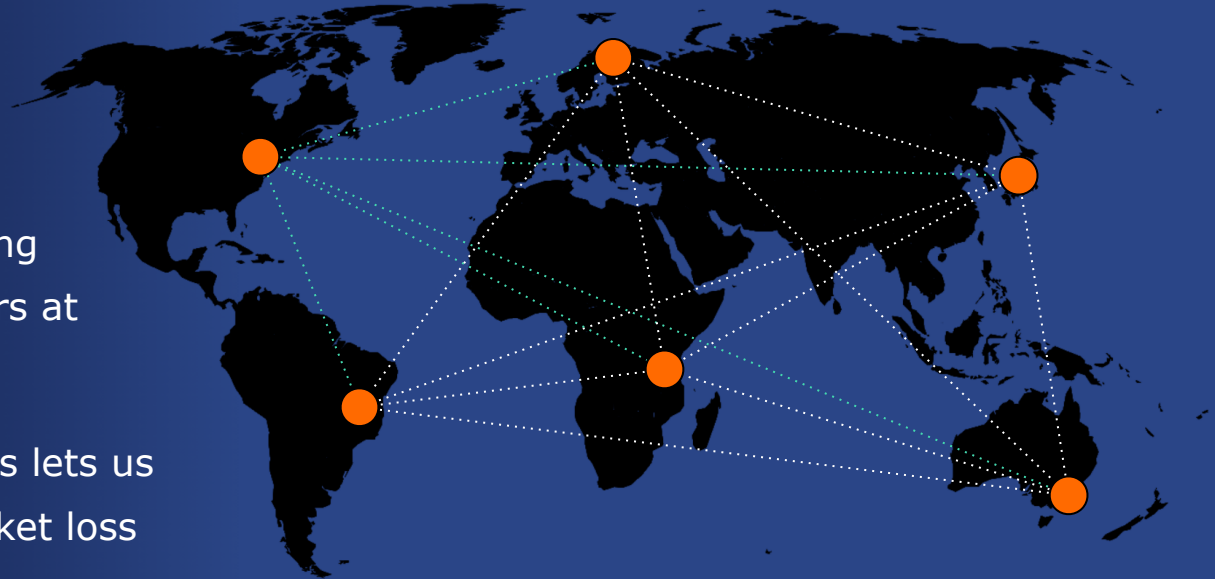


Anchor mesh

RIPE Atlas anchors support ping, traceroute, DNS, HTTP/S measurements

Each anchor performs ongoing ping measurements to all other anchors at four-minute intervals

Resulting 'mesh' of measurements lets us observe latency changes and packet loss between anchors



First look



17-18 November

BCS East-West: Sweden-Lithuania

C-LION1: Germany-Finland

We looked at results in the RIPE Atlas anchor mesh between these countries around reported time of the event

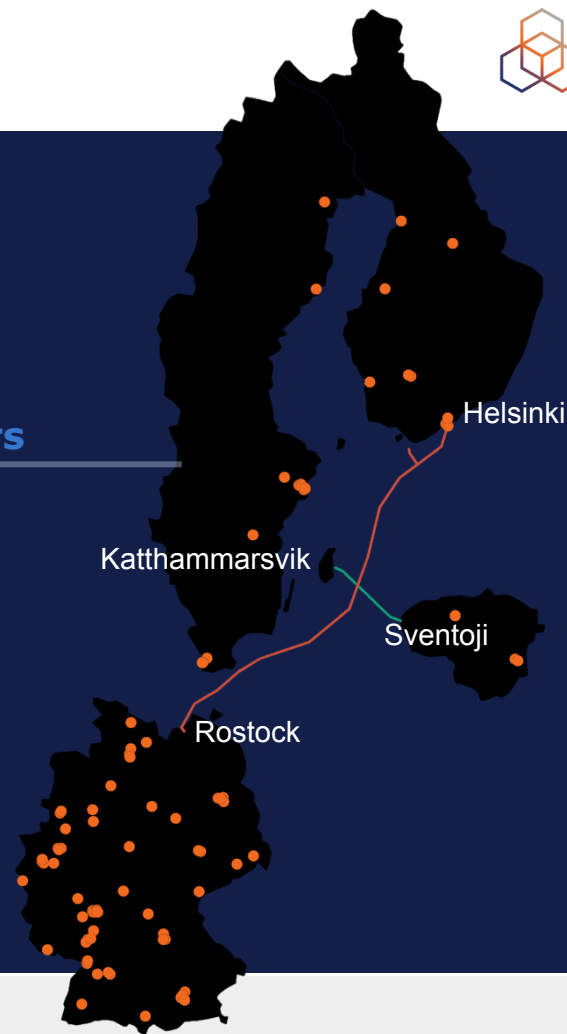
Country	# anchors
---------	-----------

Germany:	100
----------	-----

Sweden:	15
---------	----

Finland:	12
----------	----

Lithuania:	5
------------	---

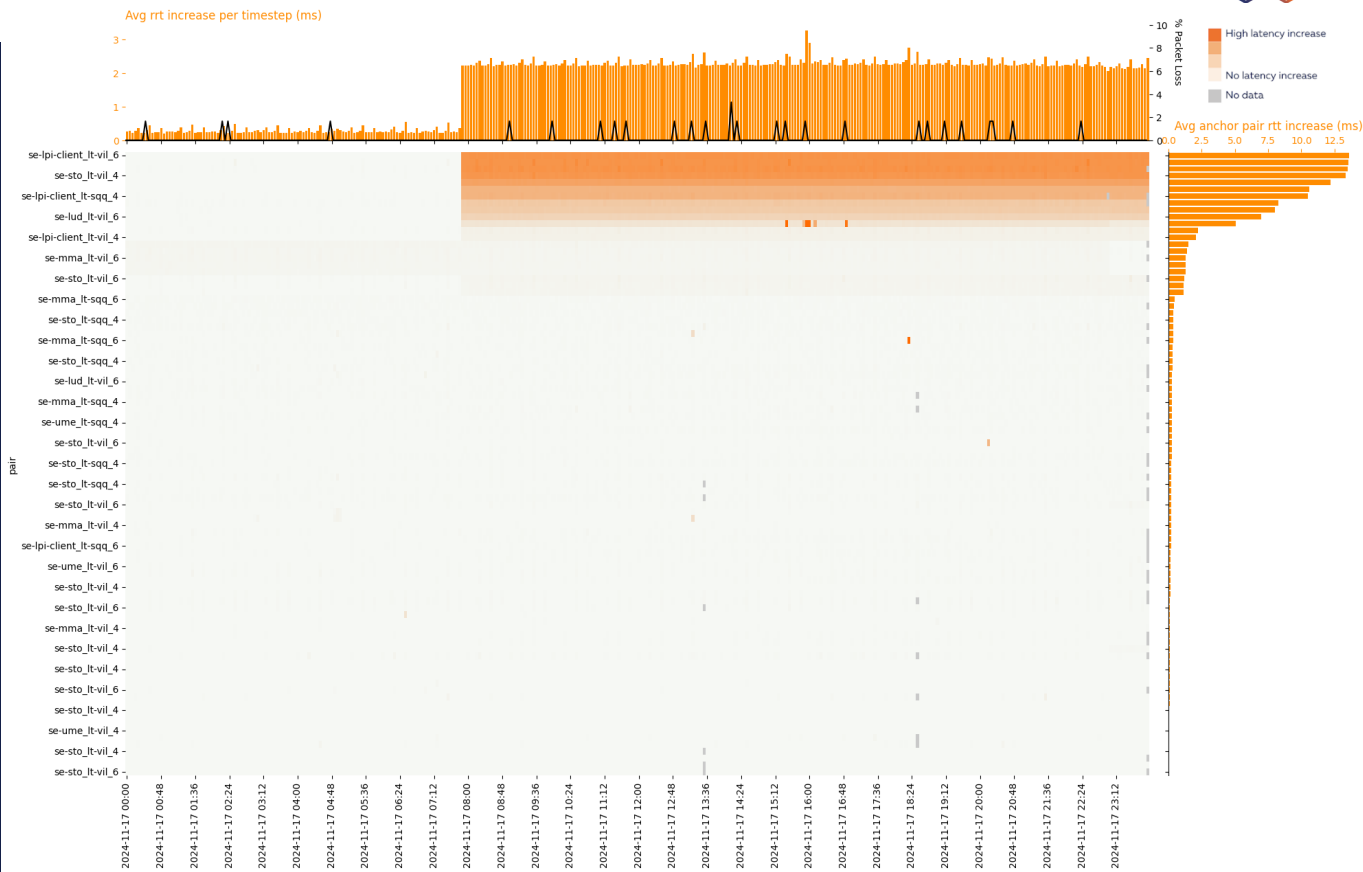


Latency shift

View of paths between anchors in Sweden and Lithuania, 12 hours before/after time of event

Latency increase of approx 10-20 ms shortly before 08:00 UTC on 17 November

**We subtract the minimum latency for a path during our observation period to make the latency jumps comparable*

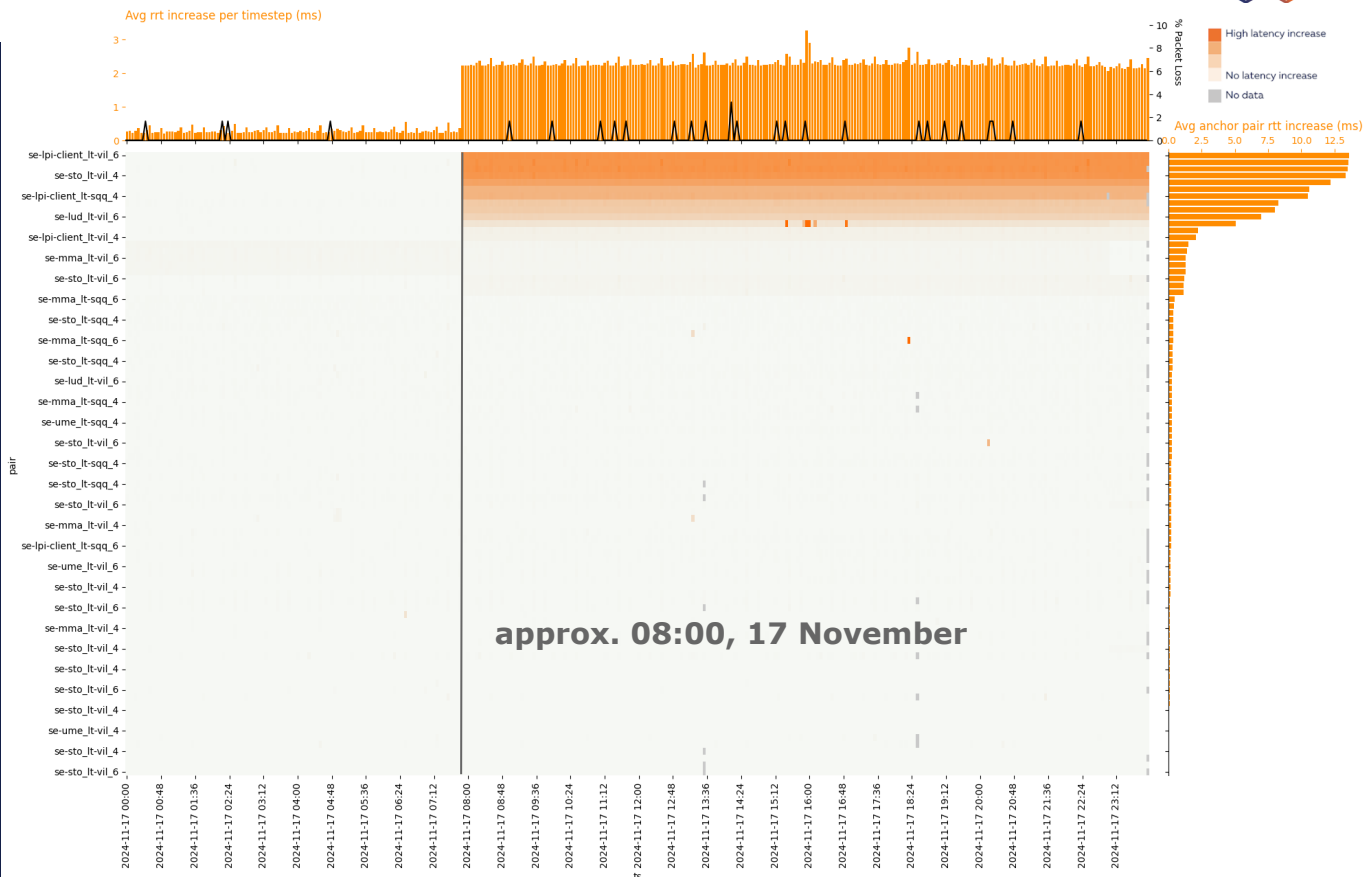


Latency shift

View of paths between anchors in Sweden and Lithuania, 12 hours before/after time of event

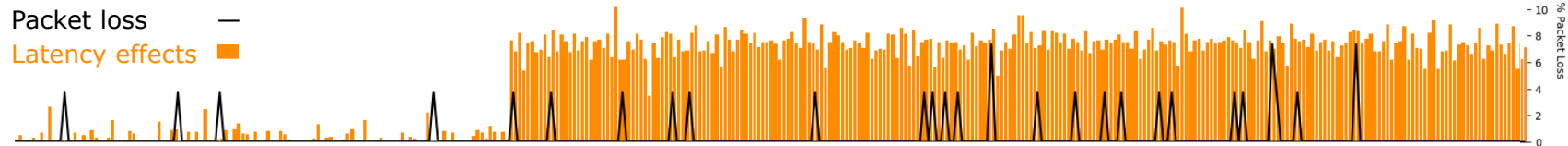
Latency increase of approx 10-20 ms shortly before 08:00 UTC on 17 November

**We subtract the minimum latency for a path during our observation period to make the latency jumps comparable*



Packet loss

Baseline of 0% packet loss
(with occasional spikes)



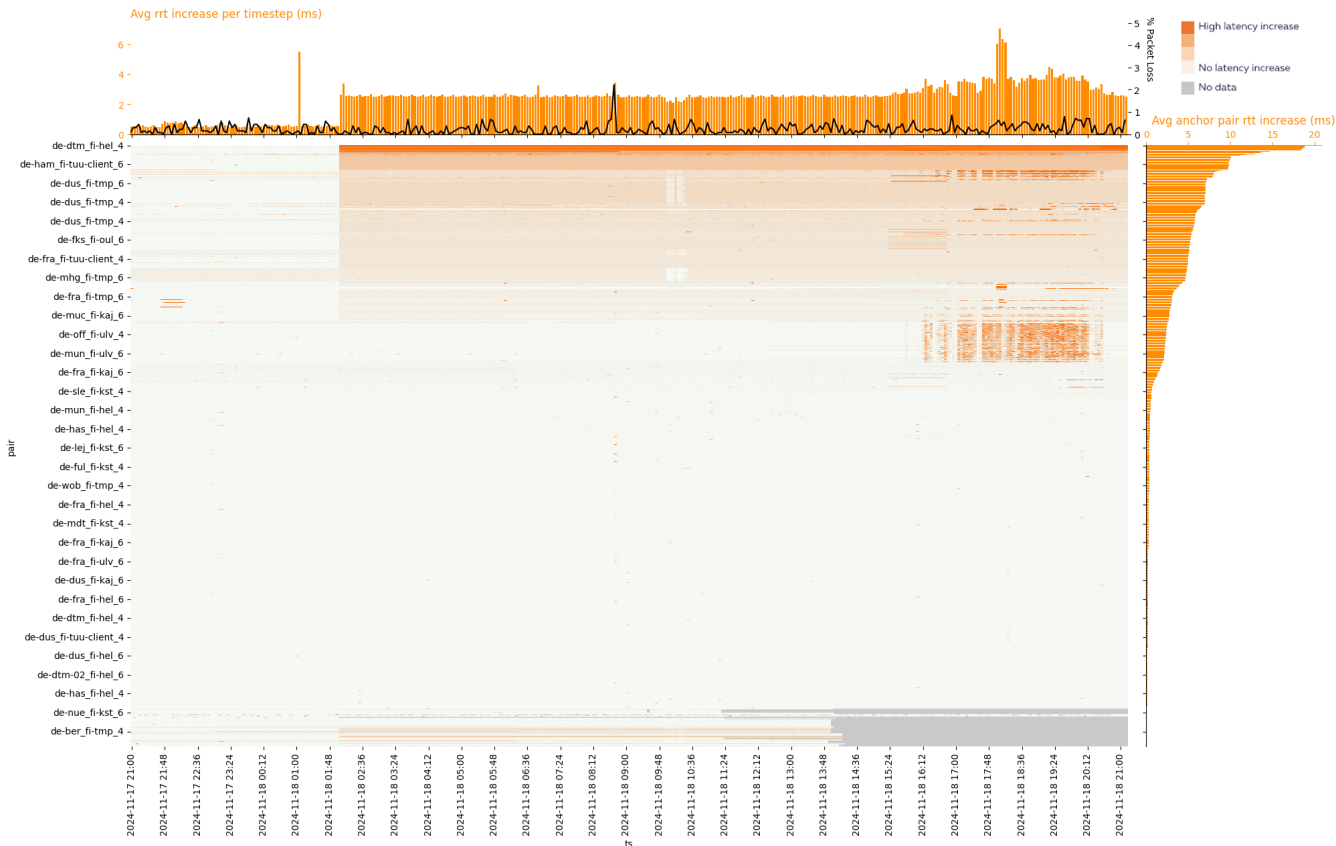
No significant increase in packet loss at time of the cable outage (shortly before 08:00 UTC)

Latency shift

View of paths between anchors in Germany and Finland, 12 hours before/after time of event

Latency increase of approx 5ms a little after 02:00 UTC on 18 November

Again: **no significant increase in packet loss**



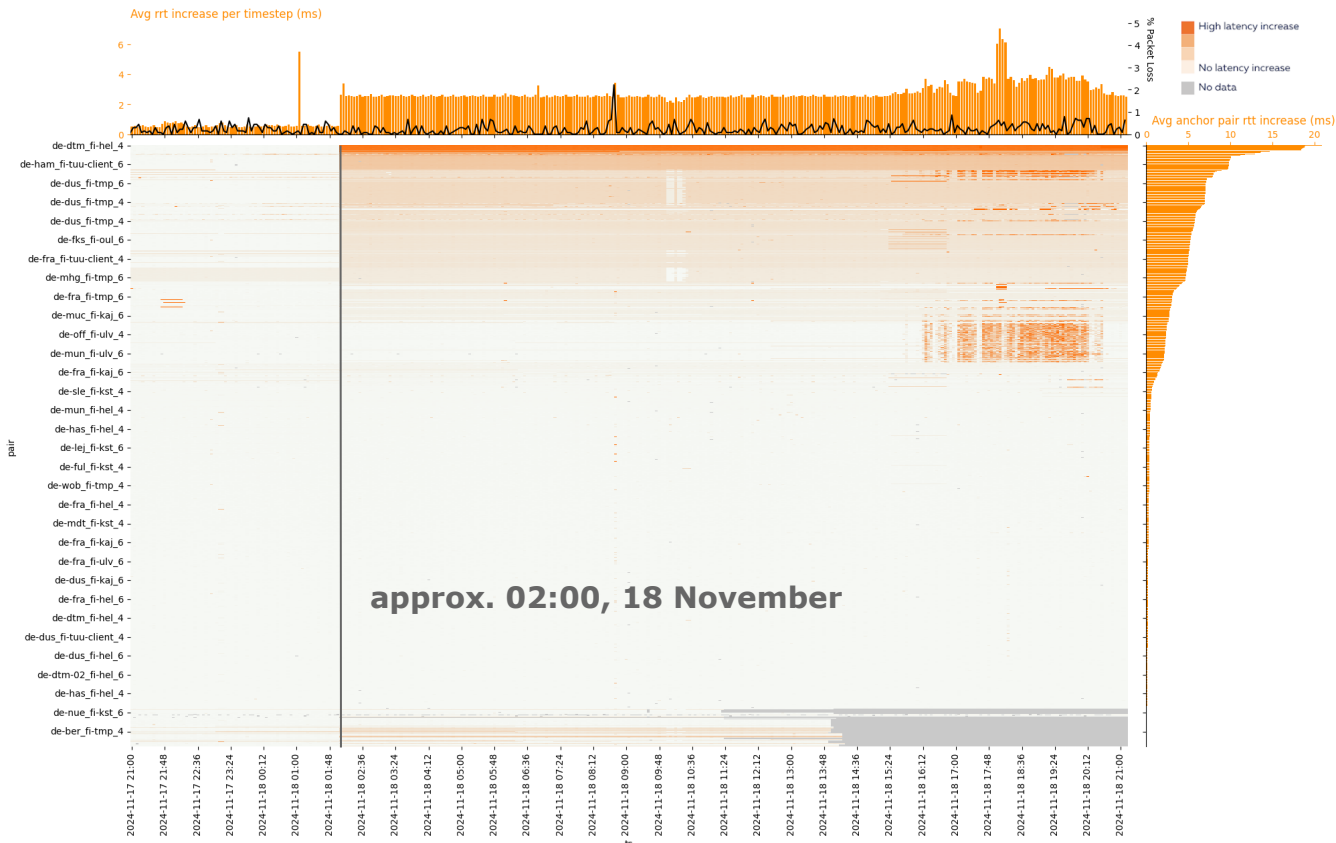


Latency shift

View of paths between anchors in Germany and Finland, 12 hours before/after time of event

Latency increase of approx 5ms a little after 02:00 UTC on 18 November

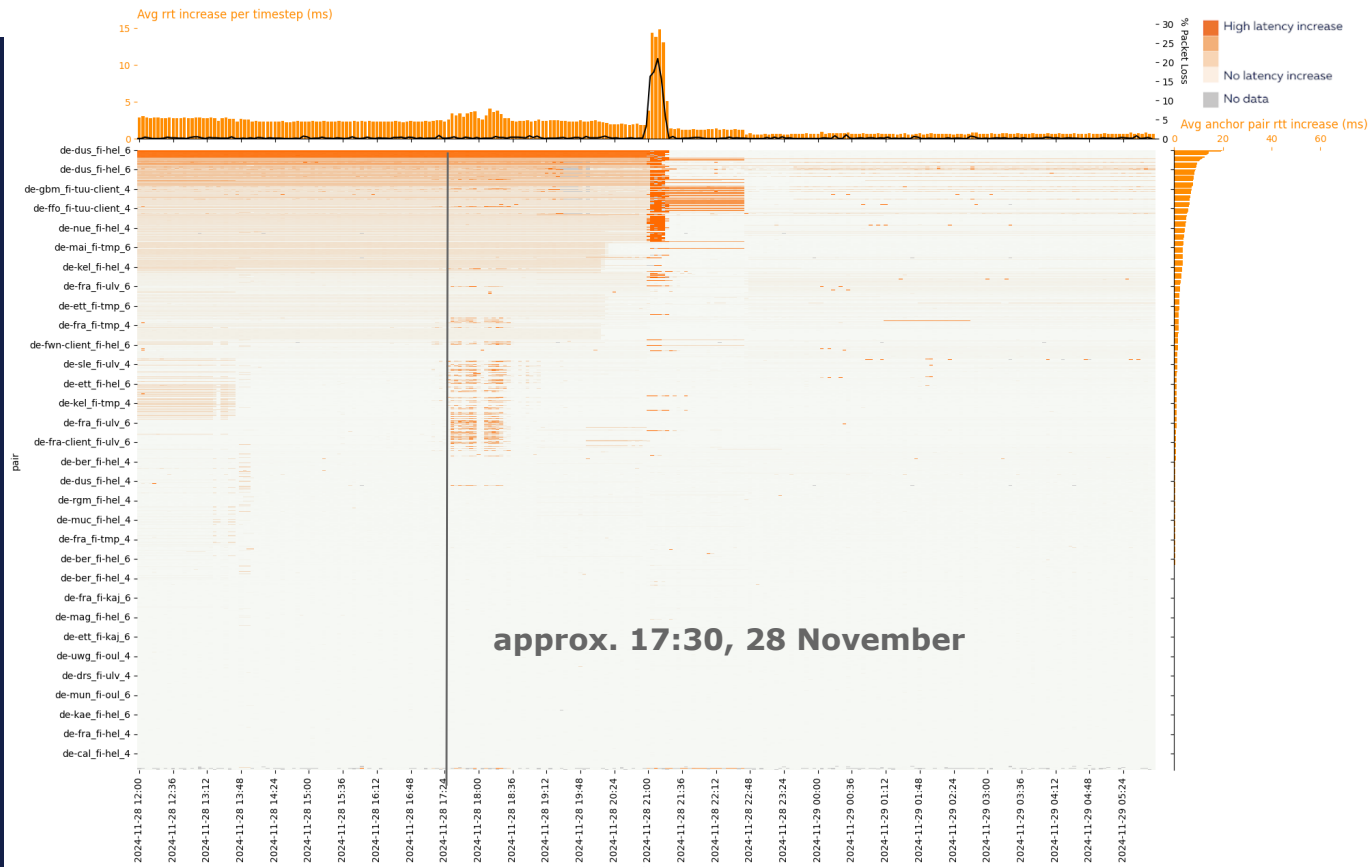
Again: **no significant increase in packet loss**



C-LION1 repair

28 November (17:30 UTC): C-Lion1 cable repair ship reported leaving the area after successful repair

Unclear exactly what caused these latency effects and the temporary increase in packet loss...

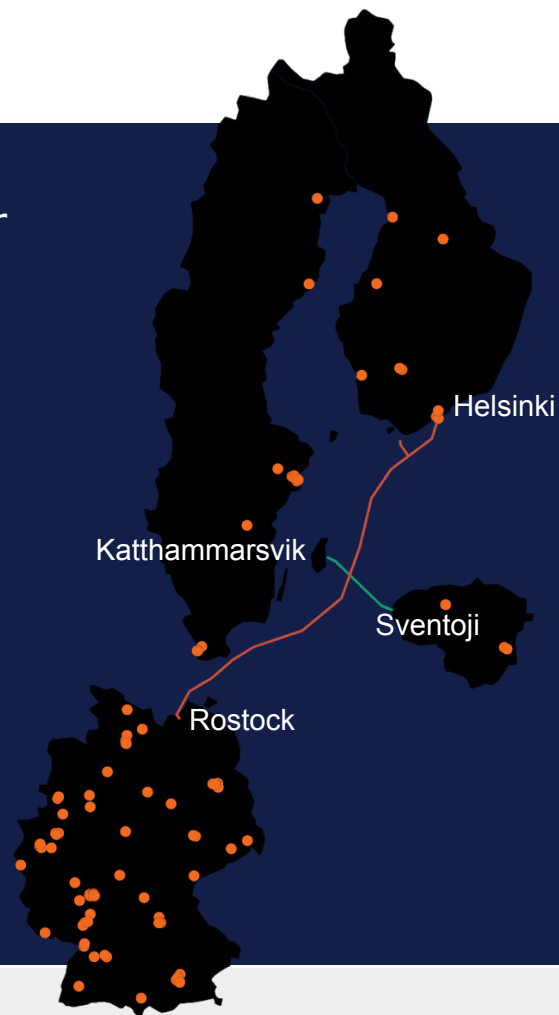


Summing up



There was a relatively minor but visible shift in latency for around 20-30% of paths between observed anchors

But there was no concurrent increase in packet loss



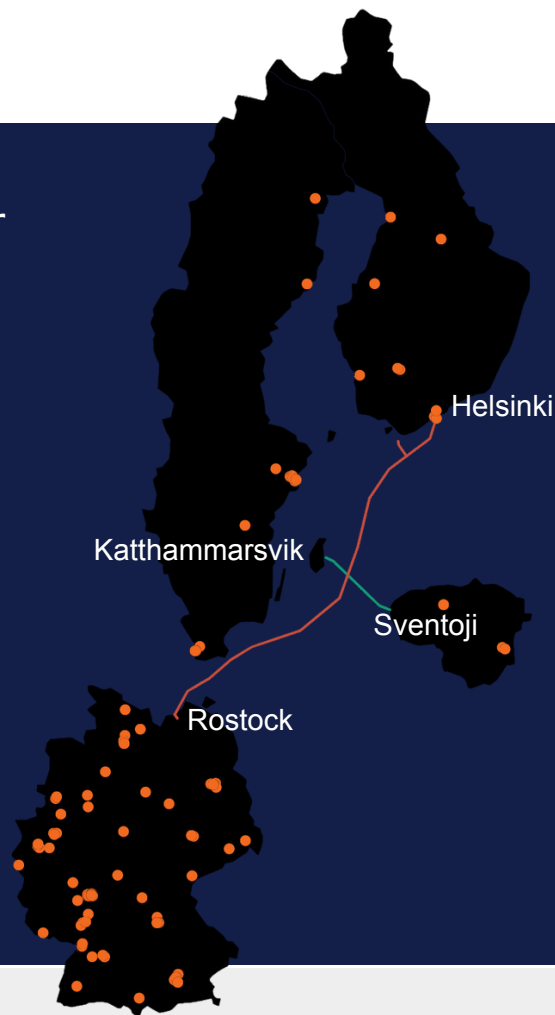
Summing up



There was a relatively minor but visible shift in latency for around 20-30% of paths between observed anchors

But there was no concurrent increase in packet loss

The Internet routed around damage!



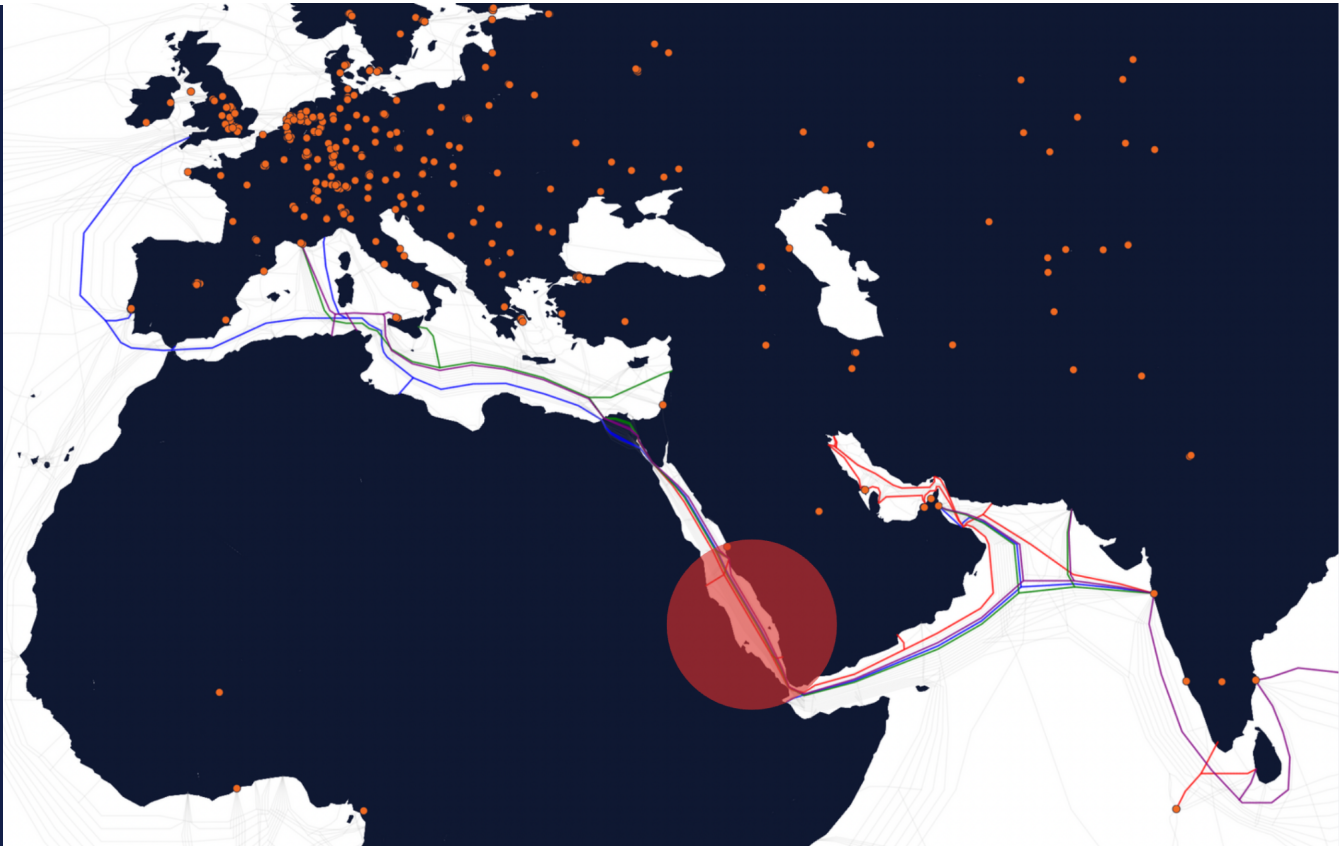
Resilience is not guaranteed: Red Sea, 2025



Cable damage in the Red Sea

5 September 2025:
Reports emerge of
cable outages in the
Red Sea affecting:

- **FALCON**
- **SeaMeWe-4**
- **IMEWE**
- **Europe India Gateway (EIG)**



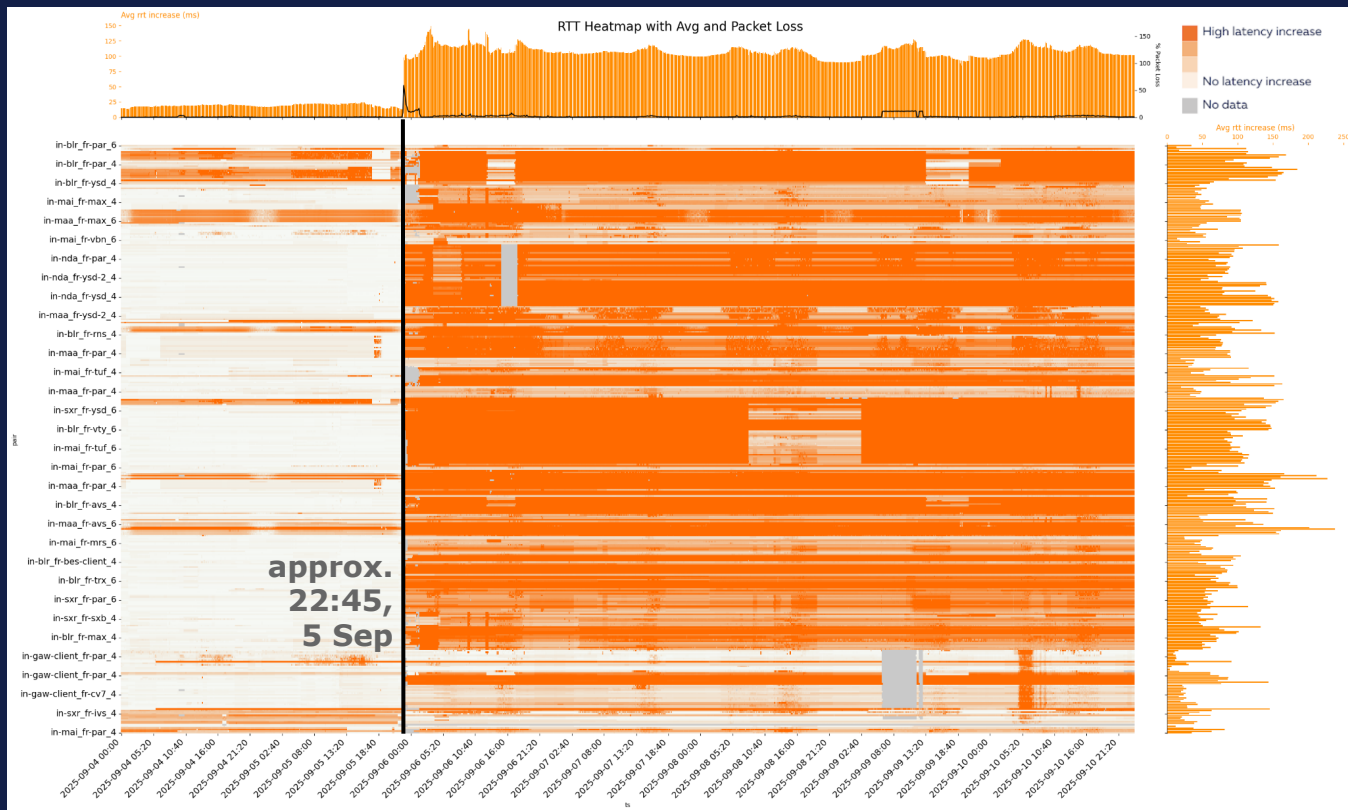
Resilience is not guaranteed: Red Sea, 2025



Latency shift with packet loss

View of paths between
anchors in France and
India.

Latency increases of
approx 100 ms
accompanied by
concurrent increase in
packet loss

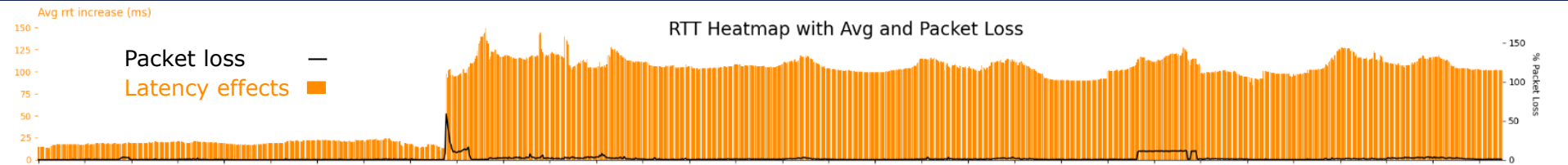


Resilience is not guaranteed: Red Sea, 2025



Packet loss

Up to 50% increase in packet loss



Significant increase (up to 50%) in packet loss at time of the initial cable outage followed by ongoing loss over next 24 hours.

Note: the right hand y-axis (associated with the black line indicating packet loss) is of a higher scale here compared to previous plots: 0-150 ms

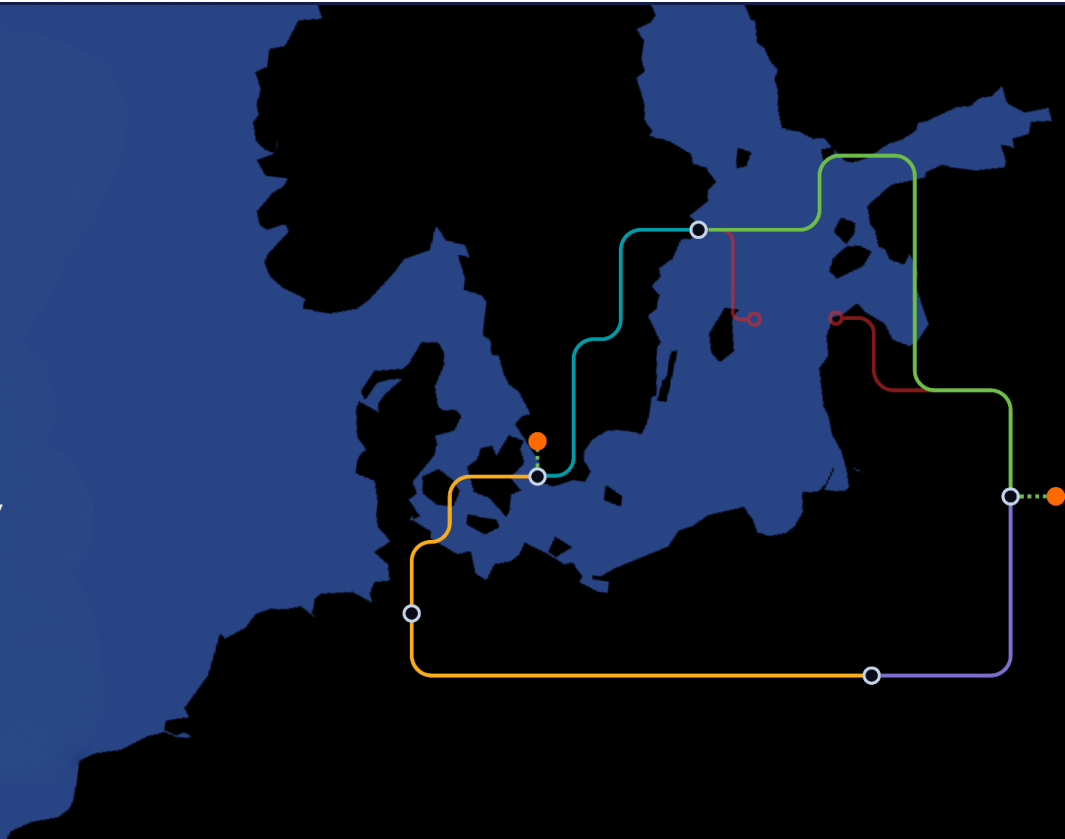
Deeper dive



Initial analysis was based on ping (end-to-end latency) data

We followed this up with in depth analysis using traceroute data

Aim: to examine how the paths actually changed while end-to-end connectivity was maintained

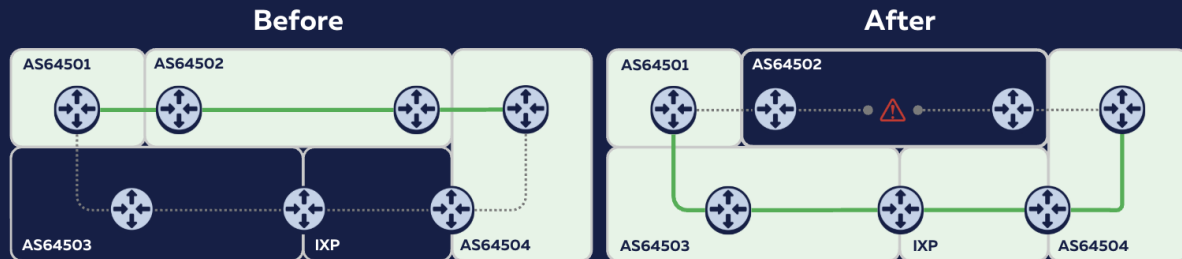


Levels of resilience



Inter-domain rerouting:

Traffic rerouted through alternative ASes/IXPs (eBGP routing protocol)



Intra-domain rerouting:

Rerouting *within* networks over alternative paths (IGP: OSPF, IS-IS)



Circuit-level rerouting:

Rerouting along alternative circuit-level connections between routers (same IP address!)



Levels of resilience



Of the 2,141 paths between anchors in Germany and Finland used for our original analysis of cable outages in the Baltic Sea, we saw rerouting at all three levels:

Inter-domain rerouting 637 paths

Intra-domain rerouting 1,044 paths

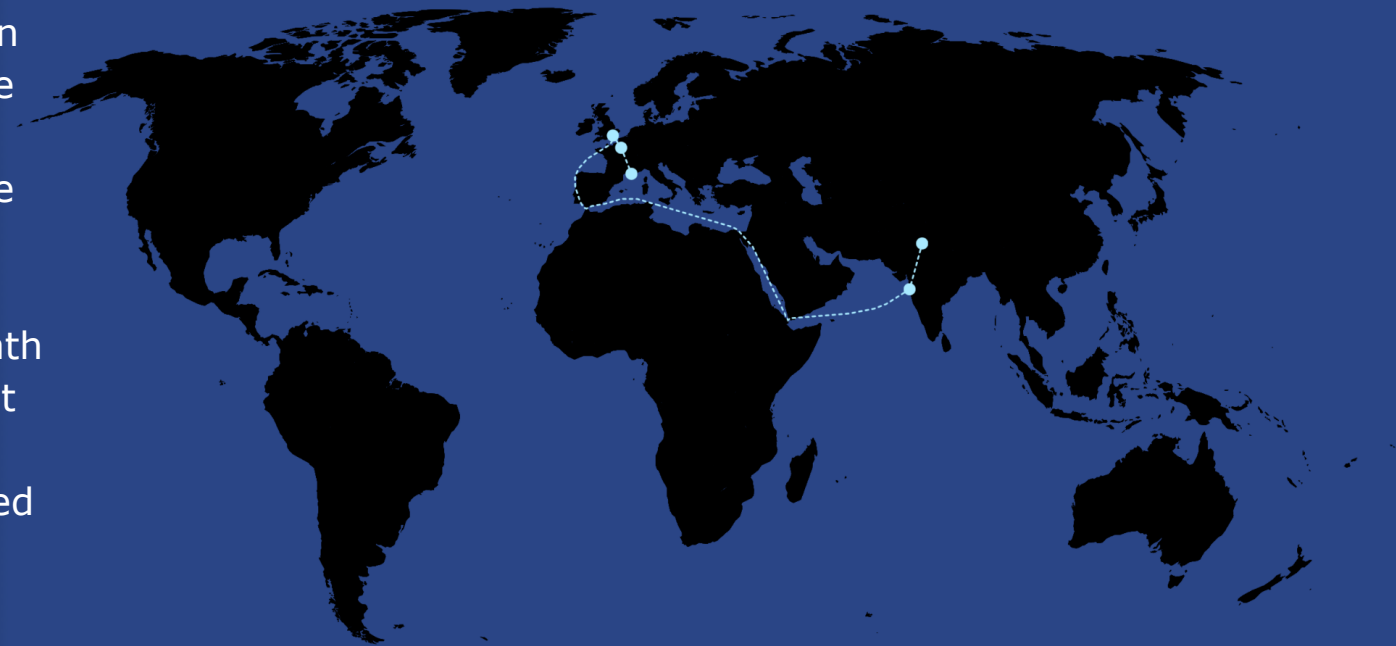
Circuit-level rerouting 460 paths

Levels of resilience



Focus on a path between
RIPE Atlas anchors - one
in India, one in France -
before the Red sea cable
outages

We can infer that the path
travelled the middle east
corridor - very likely on
one of the cables affected
by the outage



Levels of resilience



After the outage, we can infer that packets took the Mumbai-US-Europe path instead

Detours like these suggest possible gap in redundancy - missed business opportunities with regards affordable capacity in this area



Conclusions



In the Baltic Sea:

- “The Internet routed around damage”
- Internet resilience depends on multiple levels of redundancy
 - Redundancy between networks
 - Redundancy within networks (circuit and routing)

Conclusions



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But resilience is not guaranteed



In the Baltic Sea:

- “The Internet routed around damage”
- Internet resilience depends on multiple levels of redundancy
 - Redundancy between networks
 - Redundancy within networks (circuit and routing)

But resilience is not guaranteed

We have to keep monitoring, measuring, understanding



Dashboard



Probes



Anchors



Measurements



Internet Maps



Statistics



Use Cases

Domain Monitoring

Monitor DNS health

Path Analysis

Visualise traceroute paths

Reachability Testing

Check host reachability

Probe Connectivity

Check probe status over time

Anchor Mesh Performance

Monitor anchor connectivity

Member Resources

View your LIR resources



About RIPE Atlas



Documentation



Preferences

Settings and Prefs



Feedback

Tell us what you think

1 hour

6 hours

24 hours

Custom

Both

Country pairs

Manual pairs

Manual anchor pair selection

Source anchor

Target anchor

☐ Add both directions

ADD PAIR

Selected pairs (5/10)

Maxeville → Surathkal (v6)

Maxeville → Surathkal (v4)

Noida → Saint-Denis (v4)

Bangalore → Rennes (v4)

Bangalore → Rennes (v6)

UPDATE VISUALISATION

Latency inflation heatmap

Cells show Δ RTT versus a rolling baseline for each anchor pair; bucket size adapts to the selected range. Click a cell to open detailed diagnostics for that segment.

Legend: ≤ +25% +25-75% +75-125% ≥ +125% >20% loss

Bucket size: 1 hour

Range: 2025-09-05 21:05:00.000 UTC → 2025-09-06 15:05:00.000 UTC

ANCHOR PAIR

09-05 21:00

09-05 22:00

09-05 23:00

09-06 00:00

09-06 01:00

09-06 02:00

09-06 03:00

09-06 04:00

09-06 05:00

09-06 06:00

09-06 07:00

09-06 08:00

Maxeville → Surathkal (v6)

IDs: #6443 → #7405 · Max Δ RTT: +85%

+1%

171.2 ms

+1%

171.0 ms

+77%

299.7 ms

+77%

299.7 ms

+77%

299.7 ms

+77%

299.7 ms

+77%

299.1 ms

+84%

311.1 ms

+84%

311.3 ms

+85%

312.4 ms

+85%

312.8 ms

+78%

300.5 ms

Maxeville → Surathkal (v4)

IDs: #6443 → #7405 · Max Δ RTT: +152%

+7%

185.1 ms

+5%

182.1 ms

100% Loss

100% Loss

100% Loss

100% Loss

+78%

308.4 ms

+78%

308.5 ms

+78%

307.8 ms

+76%

305.7 ms

+43%

248.3 ms

+43%

247.0 ms

+43%

247.1 ms

+45%

251.9 ms

Noida → Saint-Denis (v4)

IDs: #7077 → #7067 · Max Δ RTT: +244%

+6%

152.0 ms

+6%

152.3 ms

+157%

370.2 ms

+157%

370.3 ms

+157%

370.6 ms

+157%

370.7 ms

+210%

445.8 ms

+141%

347.1 ms

+141%

347.1 ms

+141%

347.2 ms

+141%

347.6 ms

+175%

395.7 ms

Bangalore → Rennes (v4)

IDs: #6968 → #6494 · Max Δ RTT: +101%

+1%

151.7 ms

-1%

148.8 ms

+75%

262.2 ms

+75%

262.2 ms

+75%

262.2 ms

+75%

262.2 ms

+75%

262.2 ms

+75%

262.2 ms

+75%

262.2 ms

+75%

262.4 ms

+77%

265.3 ms

+80%

269.6 ms

Bangalore → Rennes (v6)

IDs: #6968 → #6494 · Max Δ RTT: +79%

+1%

157.8 ms

+1%

157.6 ms

+79%

280.5 ms

+65%

257.8 ms

+65%

257.7 ms

+65%

257.9 ms

+65%

257.8 ms

+65%

257.9 ms

+65%

257.7 ms

+65%

257.7 ms

+65%

257.6 ms

+64%

257.5 ms

Maxeville (#6443) → Surathkal (#7405) · V6

Sep 5, 2025 22:00 UTC



CURRENT RTT

171.0 ms

Baseline: 169.1 ms

Δ RTT VS BASELINE

+1%

Relative change against rolling baseline

PACKET LOSS

20%

Packet loss for the bucketed interval

What makes RIPE Atlas stand out



- **Global Reach** – not just cloud servers, but *real user networks*
- **Real-World Insight** – see your network from various others across the globe
- **Customised Measurements** – set your targets as you like when you like
- **Open and Trusted** – community-driven, vendor-neutral, all data publicly available
- **Cost-Effective** – free to use, fair credits model
- **Network Level** – observation on Level 3 only, RIPE Atlas does not measure Layer 2 level

RIPE Atlas is built on thousands of live probes around the world — giving you a unique view of the state of the Internet from the ground up.

RIPE Atlas coverage in the Middle East - how far can we see?



Country code	Nr of anchor	Nr of cities ...	Nr of ASNs ...	landings
SA	3	2	3	5
AE	7	2	7	7
OM	0	0	0	14
QA	0	0	0	4
JO	0	0	0	1
BH	0	0	0	3
YE	0	0	0	3
KW	0	0	0	2
LB	0	0	0	4
IQ	1	1	1	1
SY	0	0	0	1
PS	0	0	0	0

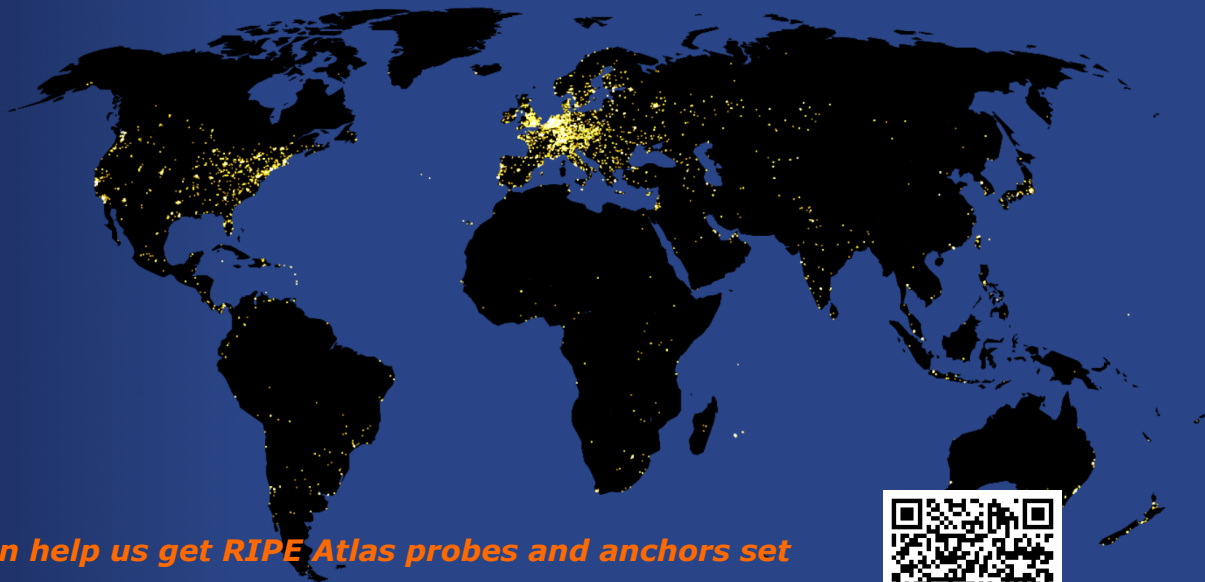
RIPE Atlas coverage - how far can we see?



RIPE NCC is a neutral source of Internet measurement data

To gain visibility into Internet events, we need vantage points

Coverage is key!



We are actively seeking hosts who can help us get RIPE Atlas probes and anchors set up in locations where they can shed light on the state of the Internet. Learn more:





Questions & Comments



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THANK YOU!