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RIPE NETWORK COORDINATION CENTER

How the Internet routed around **Cable Damage in the Baltic Sea**

Internet event analysis with **RIPE Atlas**



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Qasim Lone

— 3 Apr 2025

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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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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...

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Antonella De Bellis • 26 Mar 2025 • 5 min read

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Florian Wiedner • 27 Mar 2025 • 6 min read

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cloud research measurements

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

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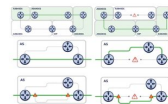
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A Deep Dive Into the Baltic Sea Cable Cuts

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.



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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



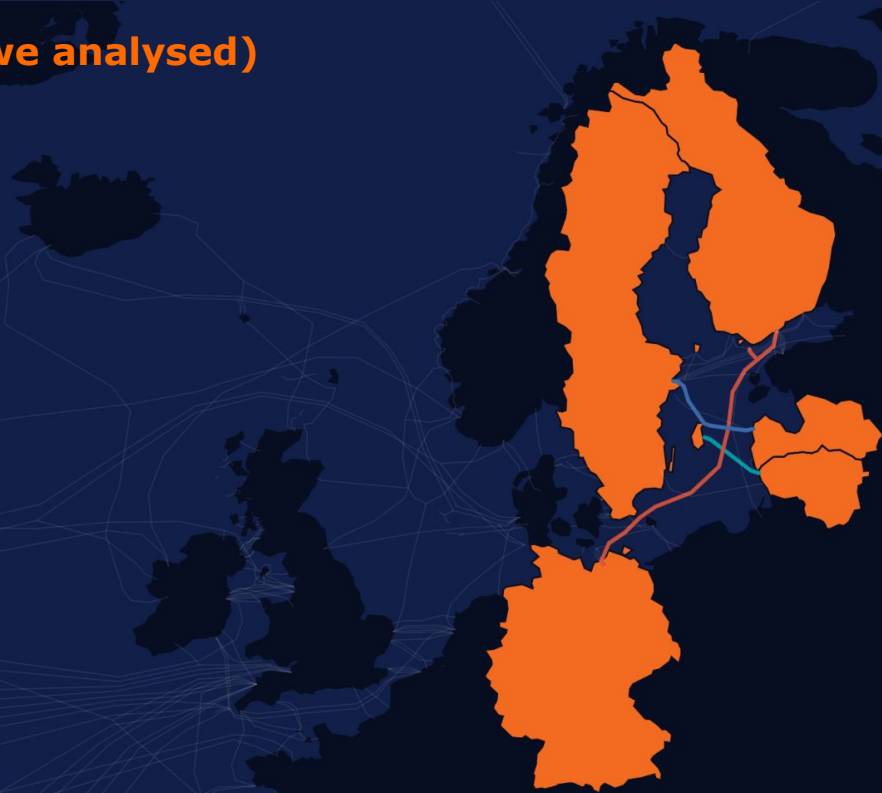
Read more on RIPE Labs:

Baltic Sea cable damage



Partial timeline (focus on 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



Baltic Sea cable damage



Media coverage

Two Baltic Sea cables disrupted – is this 'hybrid warfare'?

By **Annie Turner** - 19 November 2024

European governments point finger at Russia over Baltic cable cuts

Investigations are underway into two subsea cable breaches in the Baltic and European governments are starting to suggest that Russia is behind



Mary Lennihan
November 20, 2024

3 Min Read



Damaged cables appear to be accident, Finland says

3 December 2024

George Wright
BBC News



Sweden opens inquiry into damaged undersea cable as Nato deploys ships

A vessel has been seized at optic line, probably due to

December 31, 2024

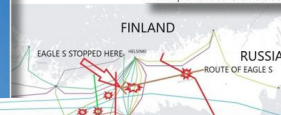
Christmas Day Cable Cuts in the Baltic Sea

Written by [Alexander Lott](#)

marine telecommunication cables in the Baltic Sea, an... Lithuania, Russia, and... In addition, an undersea cable was cut by a ship anchor. The... involving a foreign cable... over a hundred kilometers.

Incident occurred in October 2024, and the... indicated on the map by... infrastructure located in the New... electricity cable and... its decisive intervention

ical offshore infrastructure and the Eagle S incident



Sweden Investigates New Cable Break Under Baltic Sea

Authorities are looking into possible damage to an undersea cable east of Gotland island. NATO has stepped up its surveillance in the region.

Baltic subsea cable damage was accidental, not sabotage - US and European officials

Refutes all claims of Russian sabotage

January 20, 2025 By: Niva Yadav Have your say



Subsea cable damage in the Baltic Sea in recent months was likely the result of maritime accidents, not Russian sabotage, according to several US and European intelligence officials.

As reported by [The Washington Post](#), US and European officials have gathered evidence - including intercepted communications - which have concluded that anchors were dragged across the seabed accidentally because of inexperienced crews aboard poorly maintained



Swedish Coast Guard vessel in the Baltic Sea. Sweden also investigated the severing

Baltic Sea cable damage



Fri 27 Dec 2024 13:48
0 knots

It then carried on across four undersea fibreoptic cables, three of which registered failures around the time the ship crossed them. The ship was suspected by Finnish authorities of having dragged its anchor to damage the cables and was escorted into custody.



Sources: OpenStreetMap, Esri, Telegeography, Marine

Measuring damage with RIPE Atlas



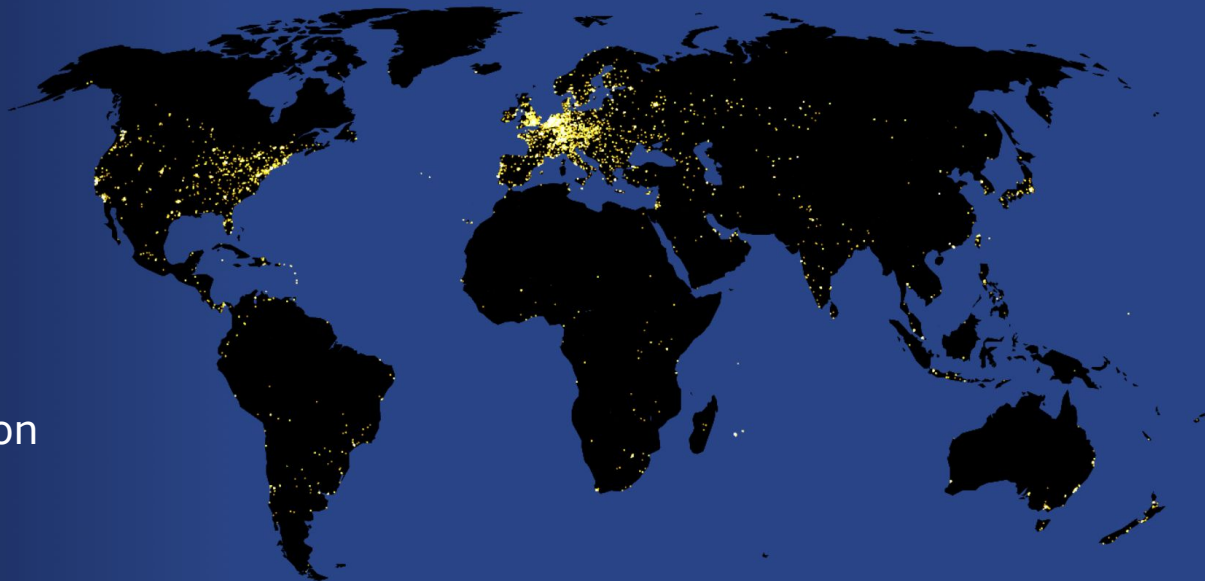
RIPE Atlas

A global network of probes measuring the Internet in real time

13,400+ probes connected

800+ anchors deployed

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



Measuring damage with RIPE Atlas

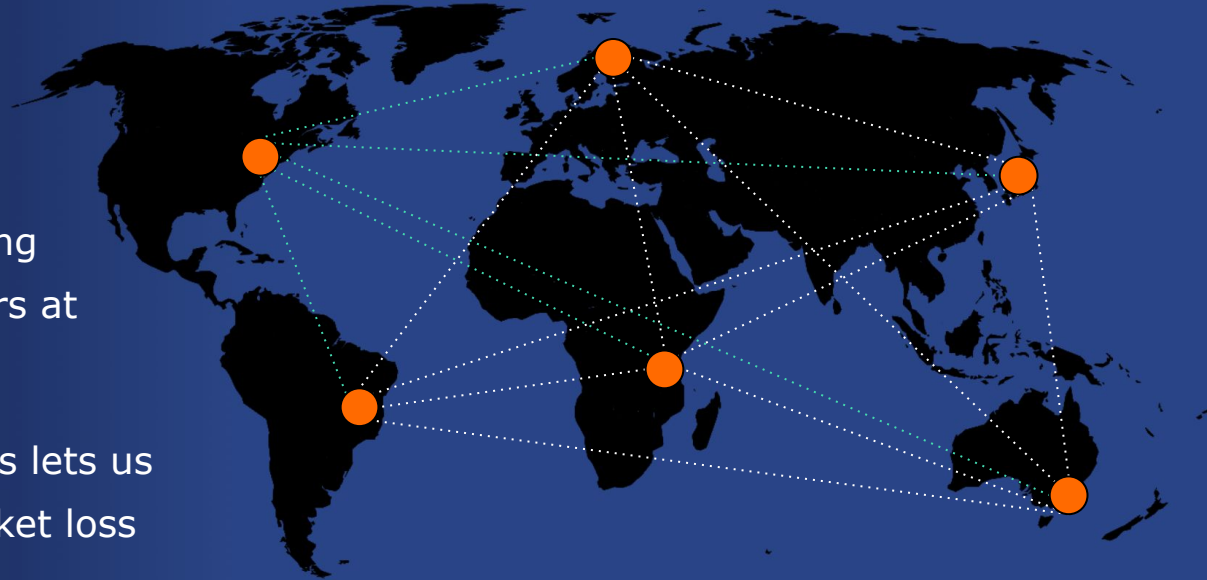


Anchor mesh

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

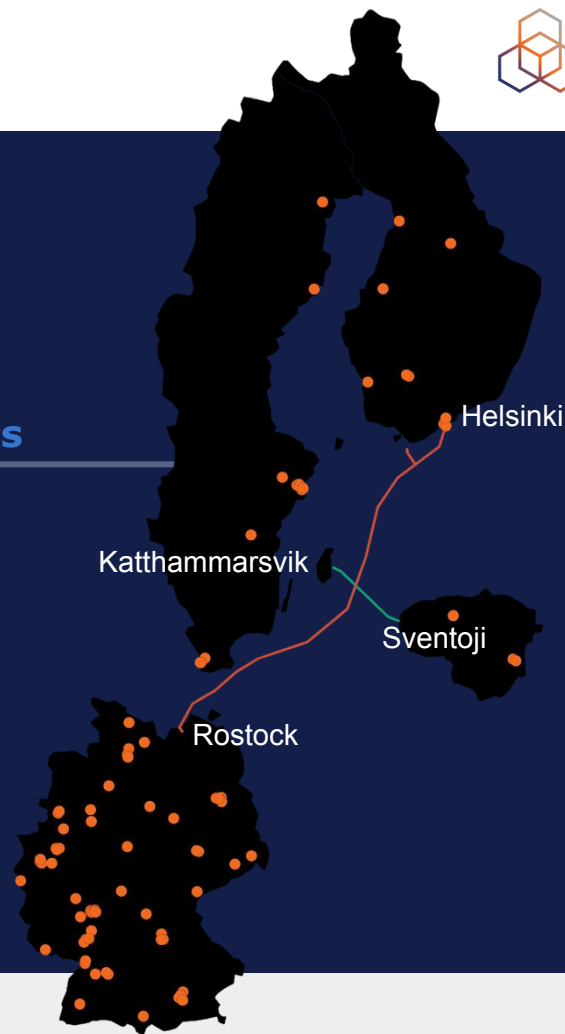
Country	# anchors
---------	-----------

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

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

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

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

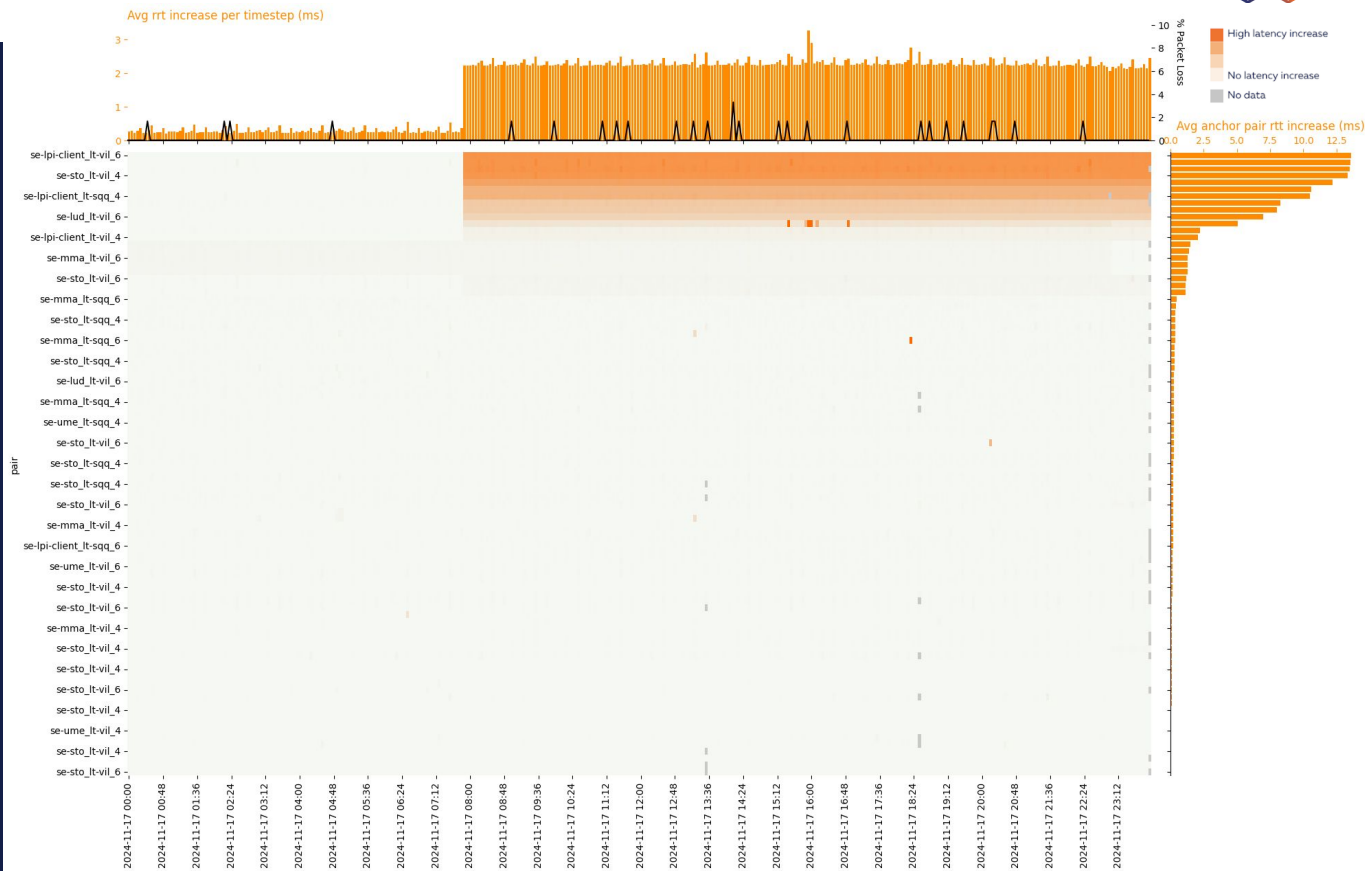


Latency shift

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*



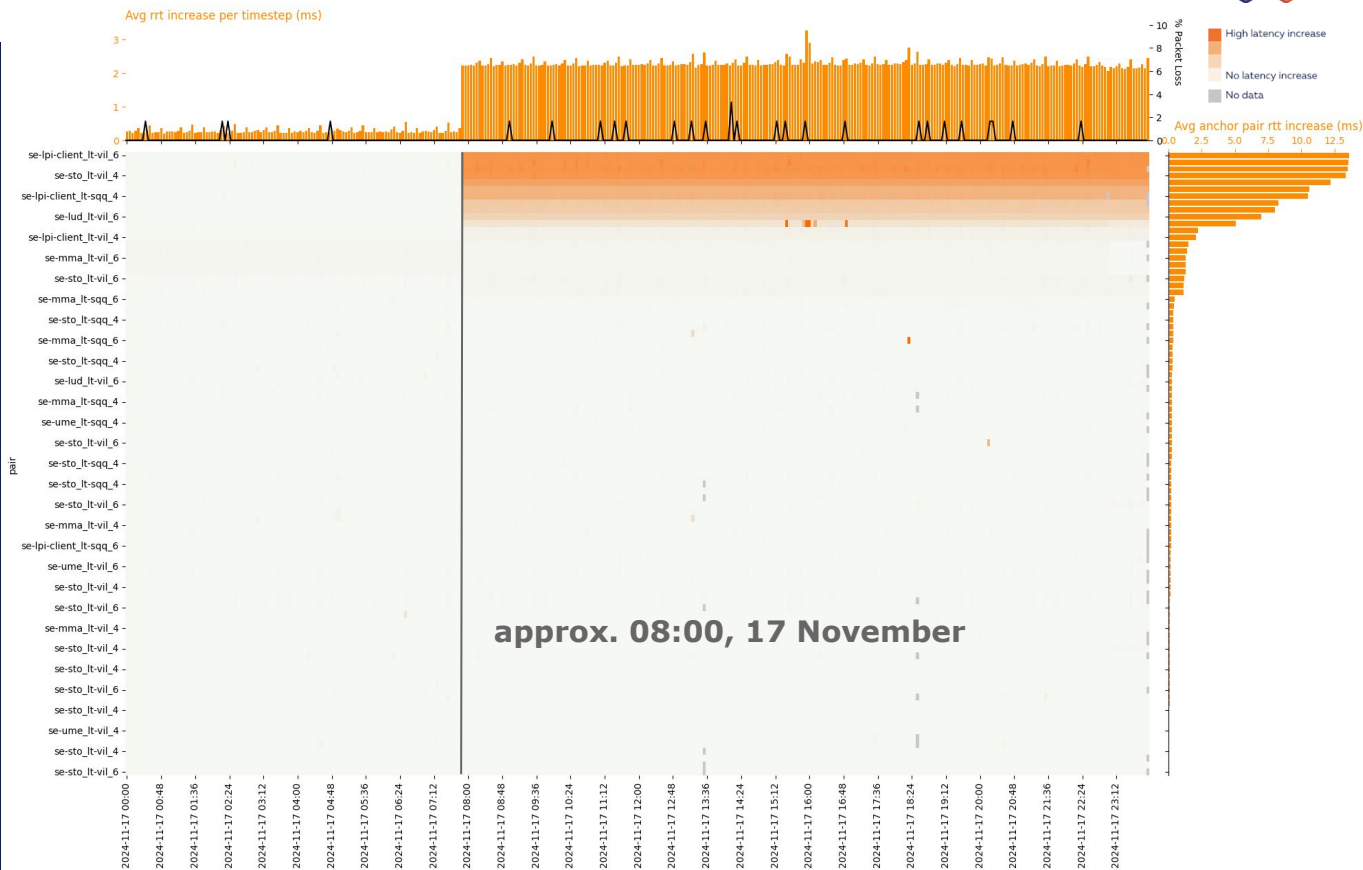


Latency shift

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

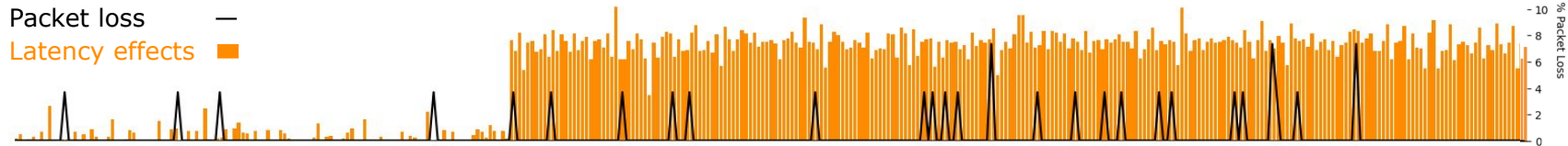
Latency increase of approx 10-20 ms shortly before 08:00 UTC on 17 November

**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)



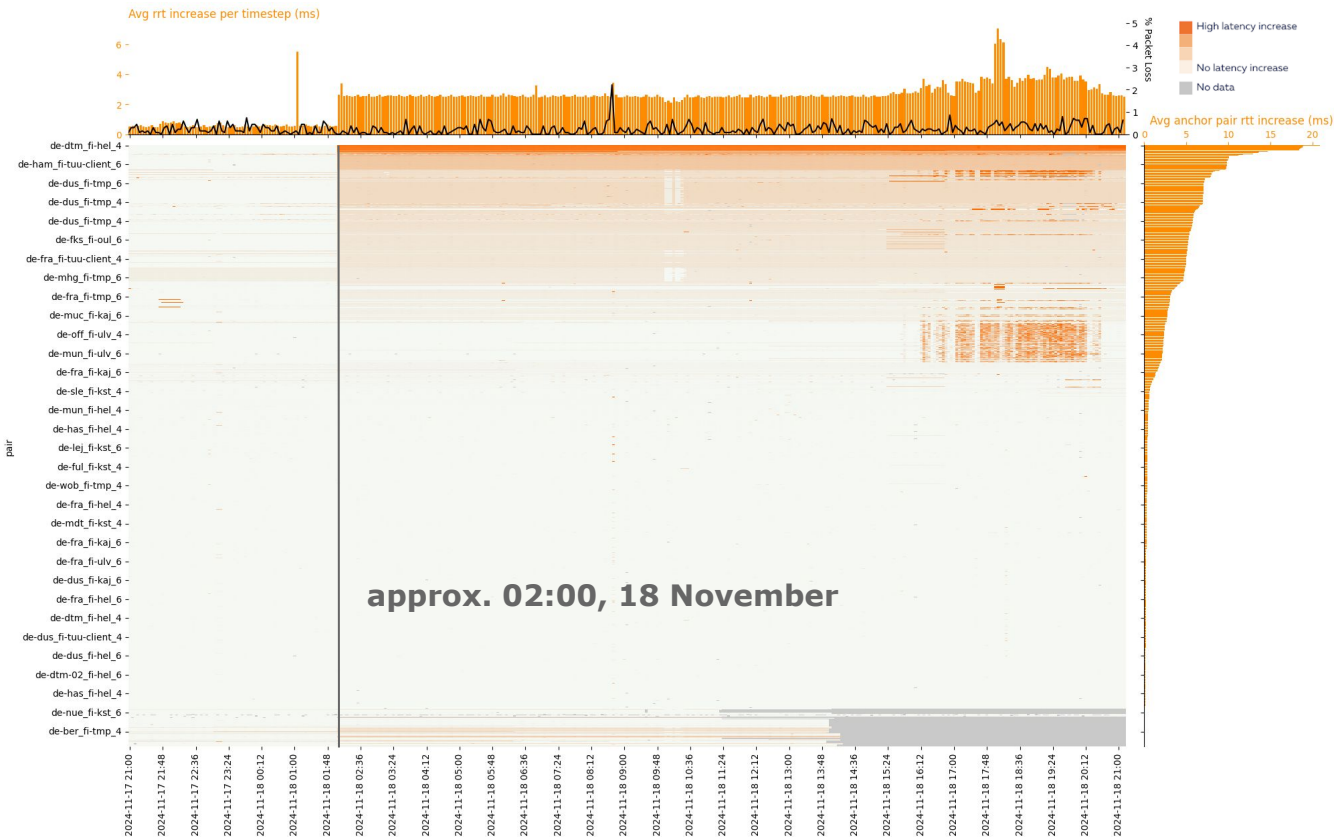
No significant increase in packet loss at time of the cable outage (shortly before 08:00 UTC)

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

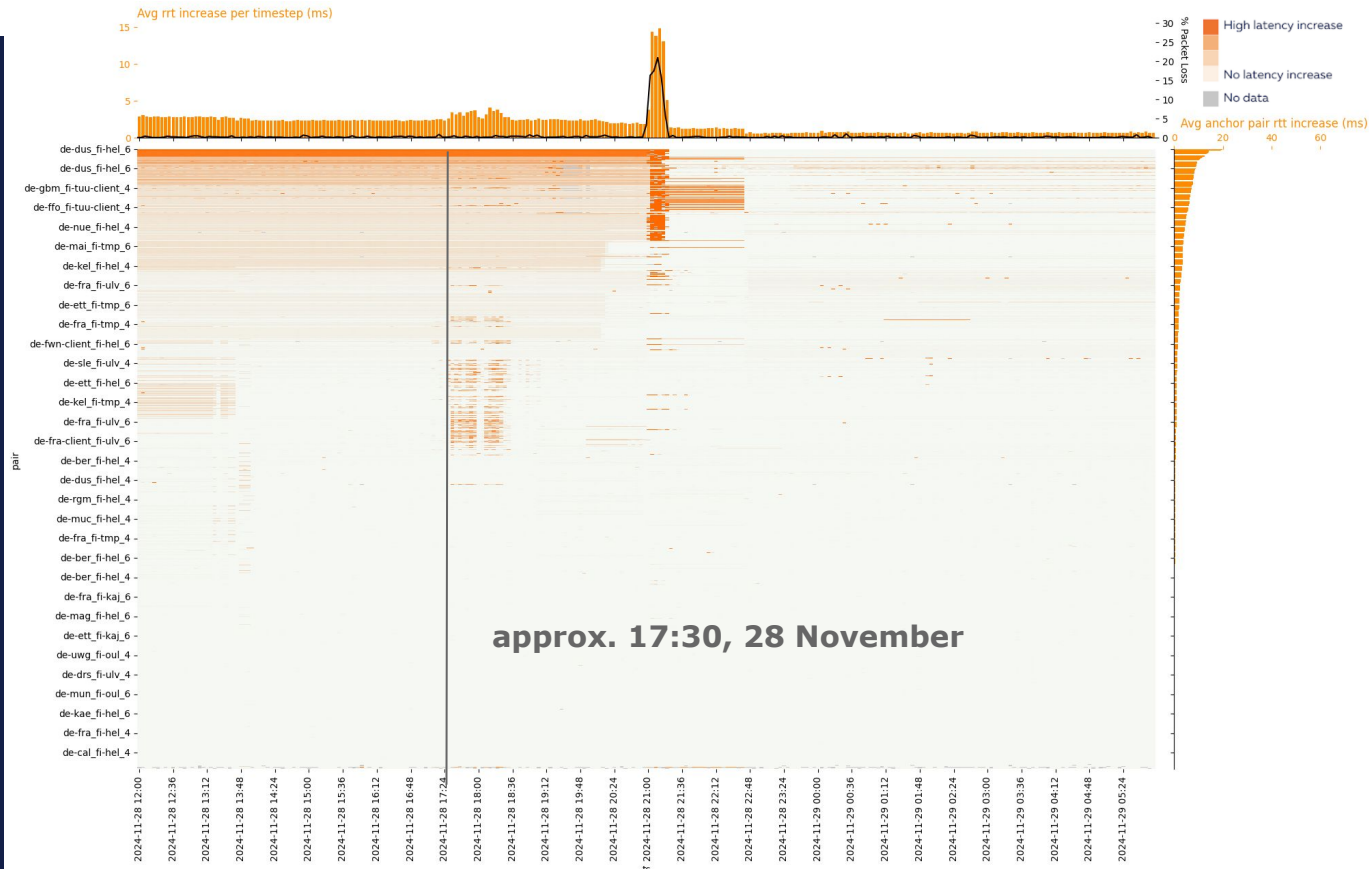
Again: **no significant increase in packet loss**



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



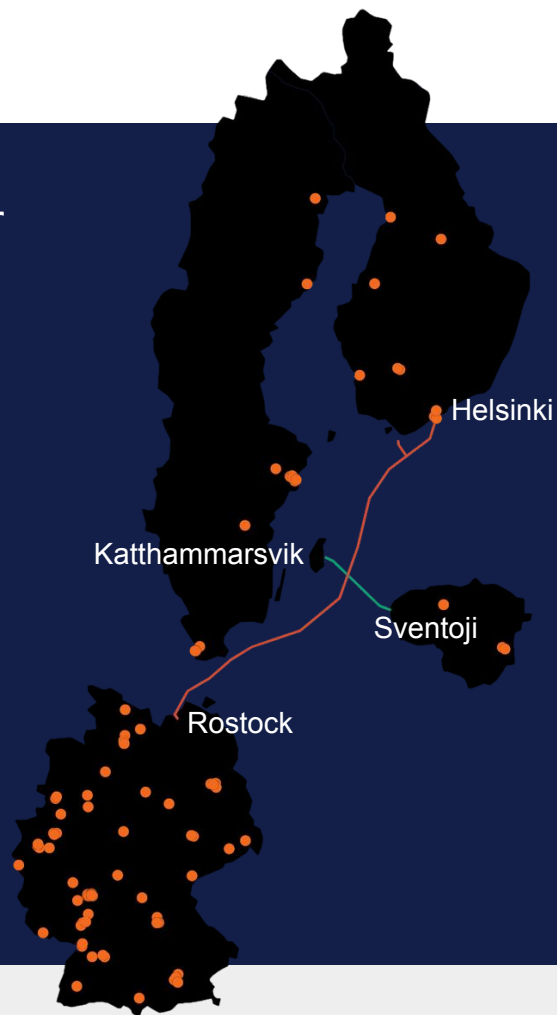
Summing up



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!



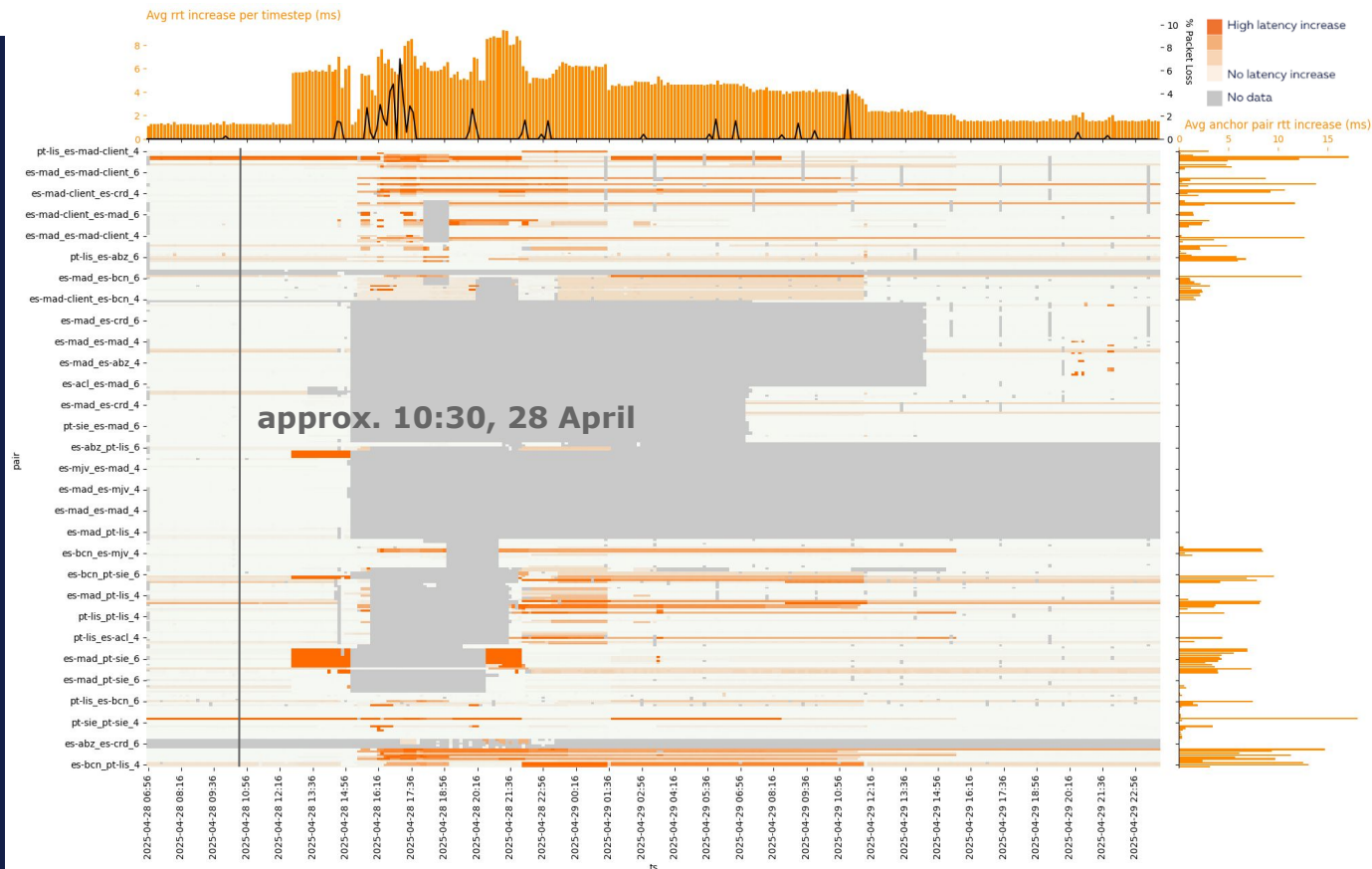
Beyond the Baltic: ES-PT Power Outage April 2025



Anchor mesh
measurements -
potential for getting
insights into outages

Power outage events
much harder to
measure compared to
cable outage events

Due to the
infrastructure being
brought offline by the
event itself



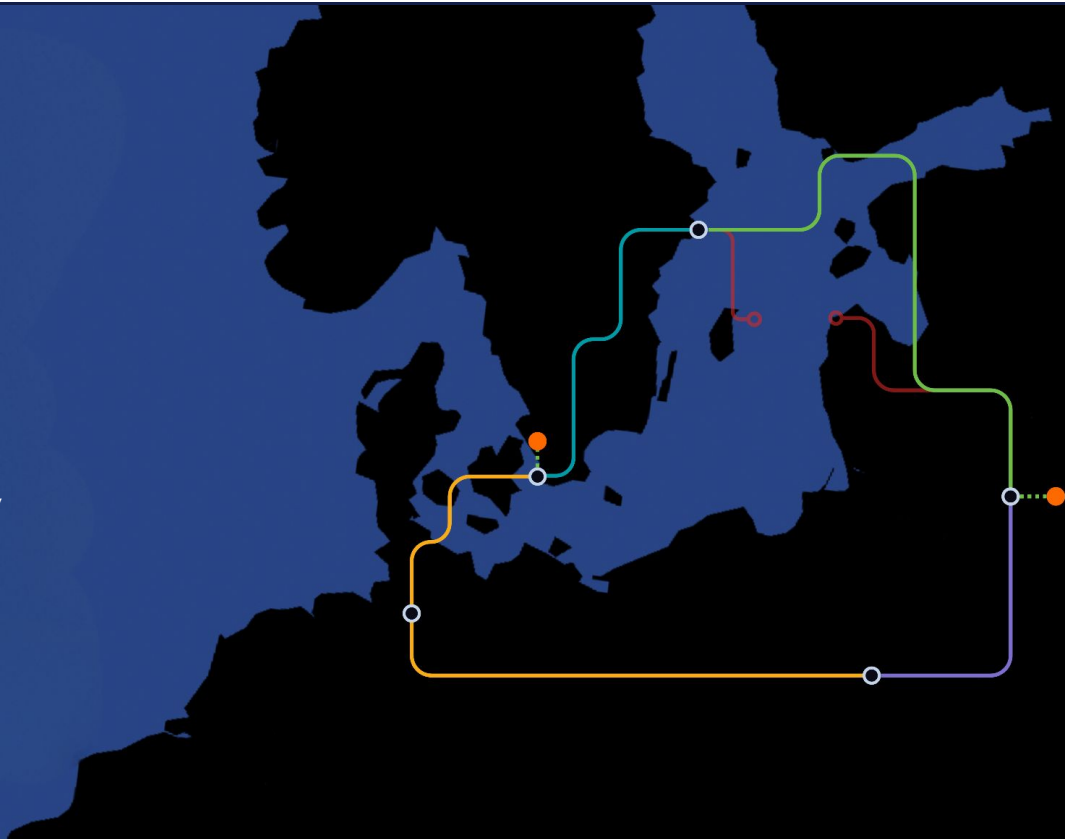
Deeper dive



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

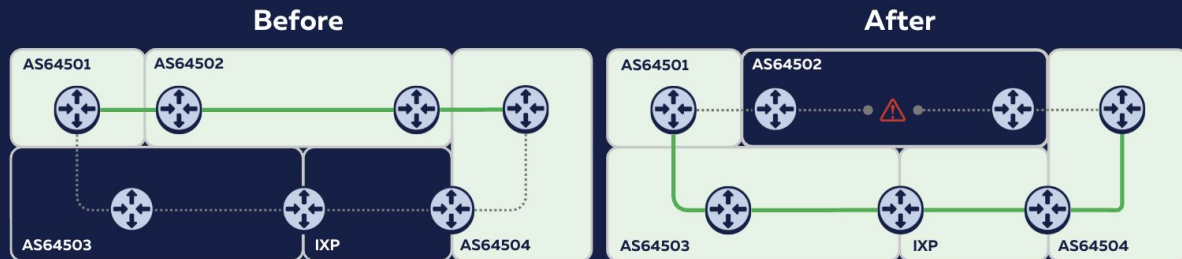


Levels of resilience



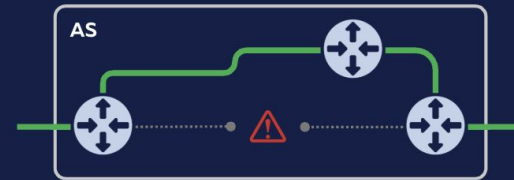
Inter-domain rerouting:

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

Read more on RIPE Labs



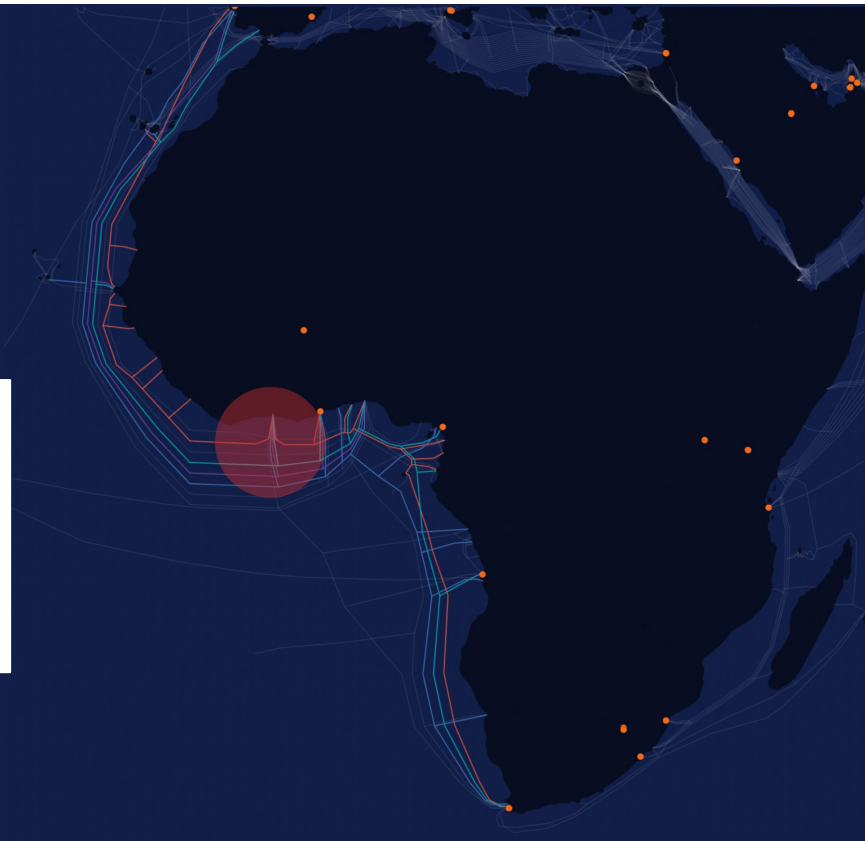
Resilience is not guaranteed: Côte d'Ivoire, 2024



Cable damage in Africa

14 March 2024: Submarine landslide off coast of Cote d'Ivoire resulted in damage across multiple cables:

- **ACE: Africa Coast to Europe**
- **MainOne**
- **SAT-3: Submarine Atlantic 3/West Africa Submarine Cable**
- **WACS: West Africa Cable System**



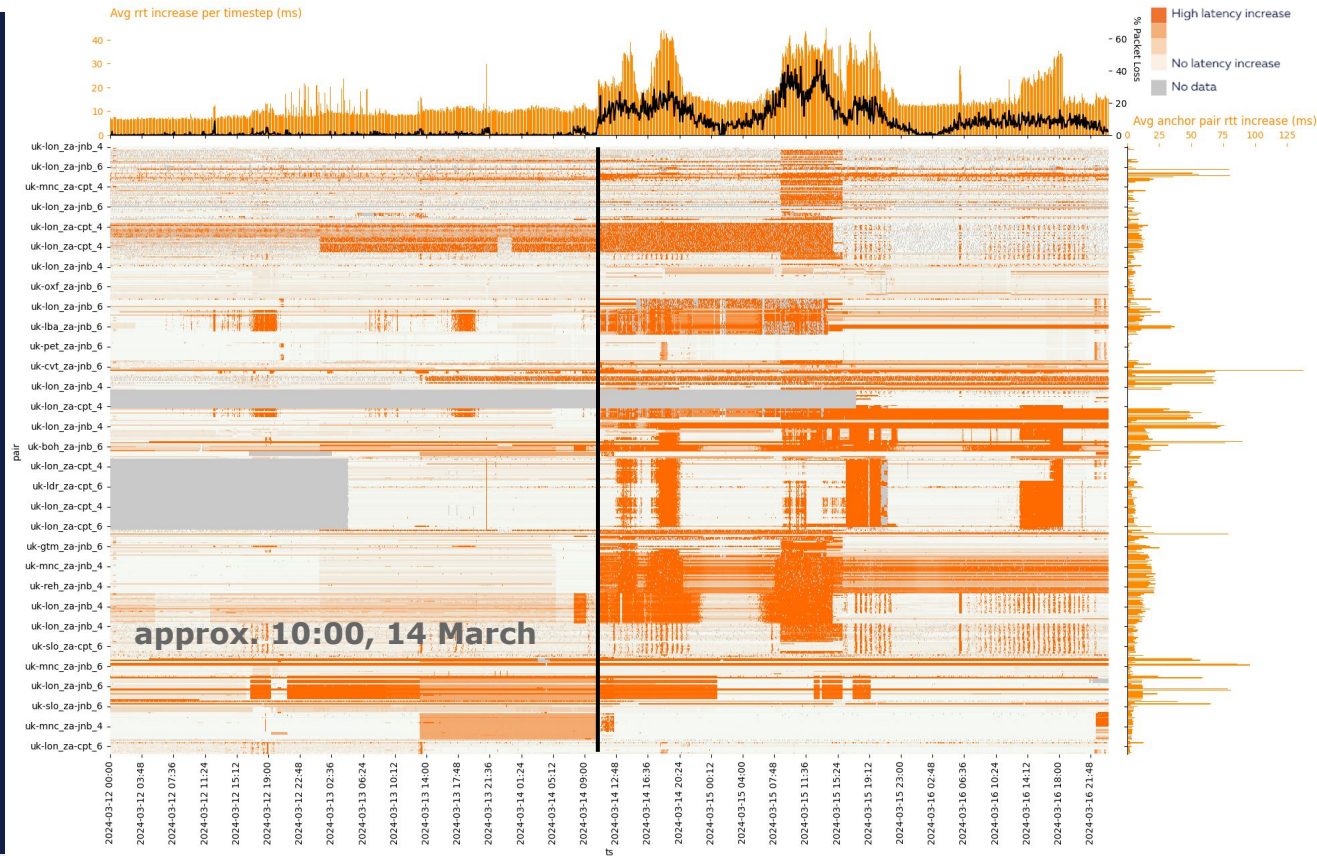
Resilience is not guaranteed: Côte d'Ivoire, 2024



Latency shift with packet loss

View of paths between
anchors in UK and
South Africa.

Latency increases of
approx 20-30 ms
accompanied by
concurrent increase in
packet loss



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)**



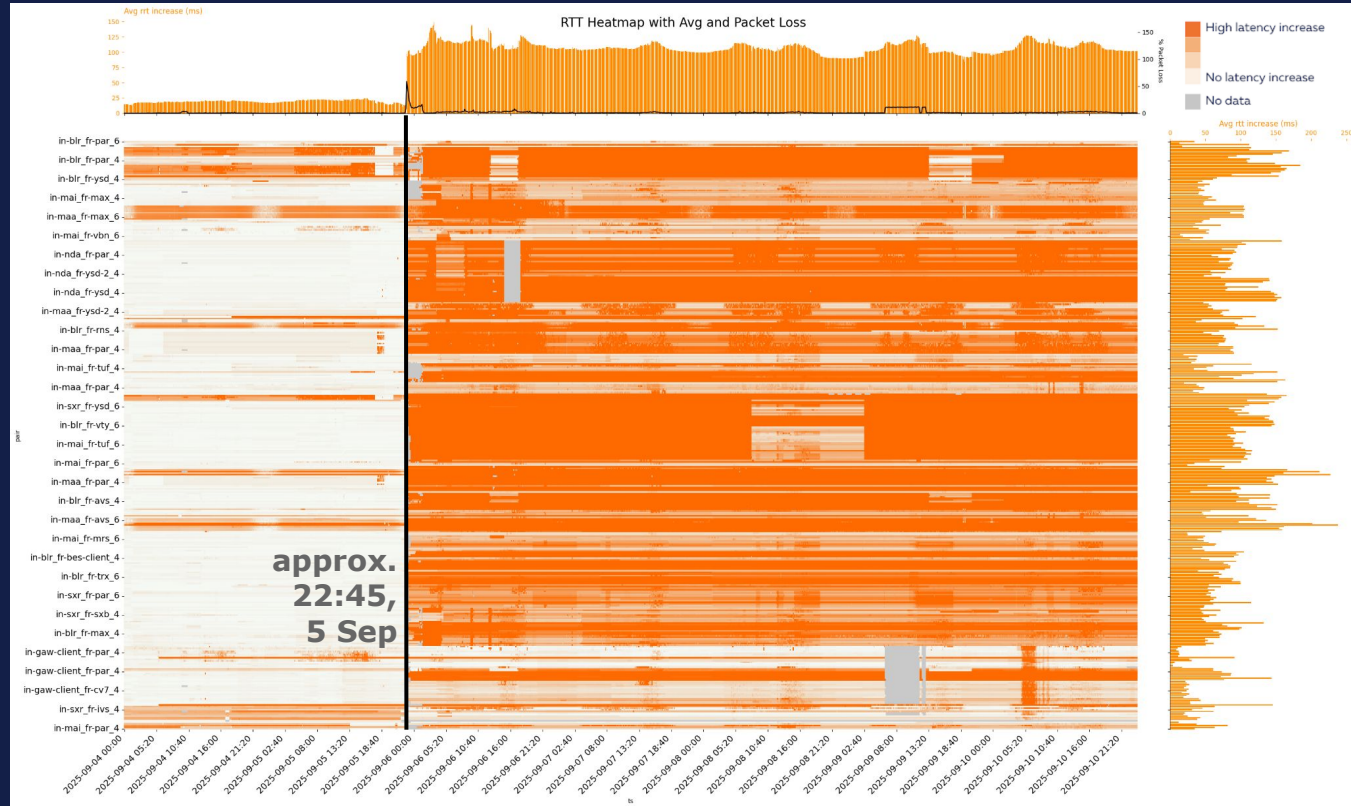
Resilience is not guaranteed: Red Sea, 2025



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

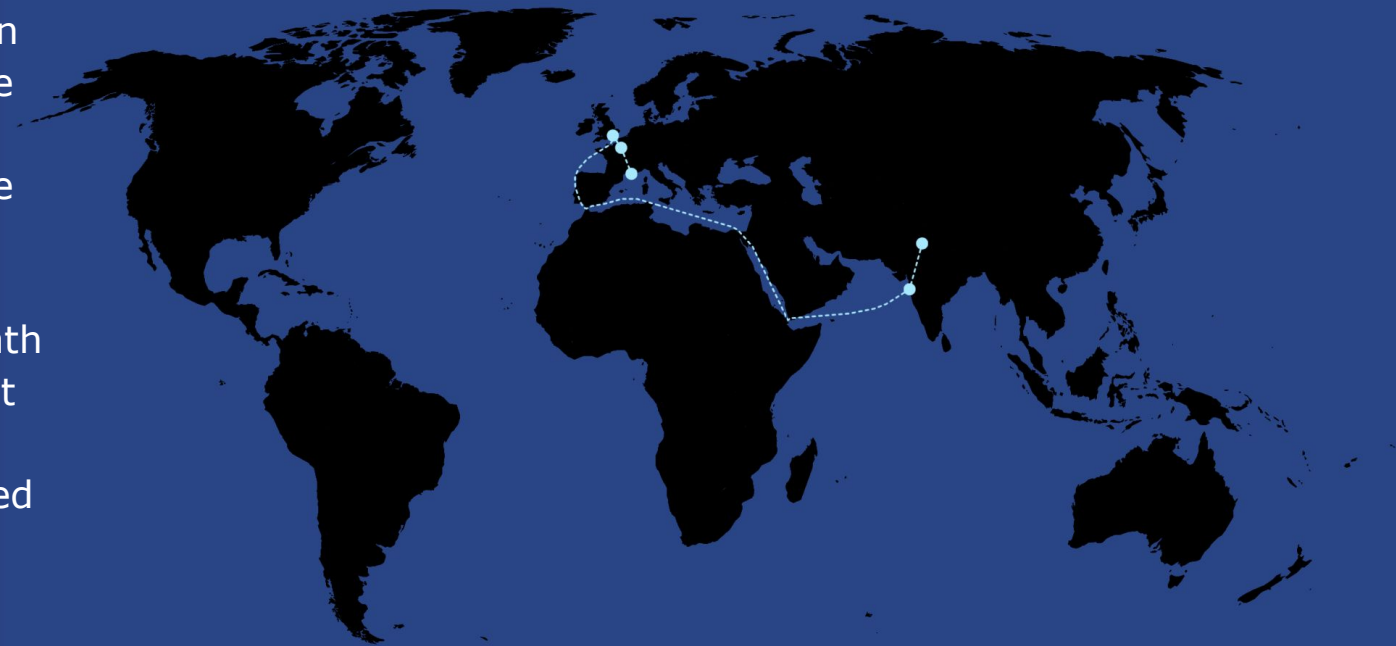


Levels of resilience



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





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)



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- Internet resilience depends on multiple levels of redundancy
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But resilience is not guaranteed

We have to keep monitoring, measuring, understanding

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:

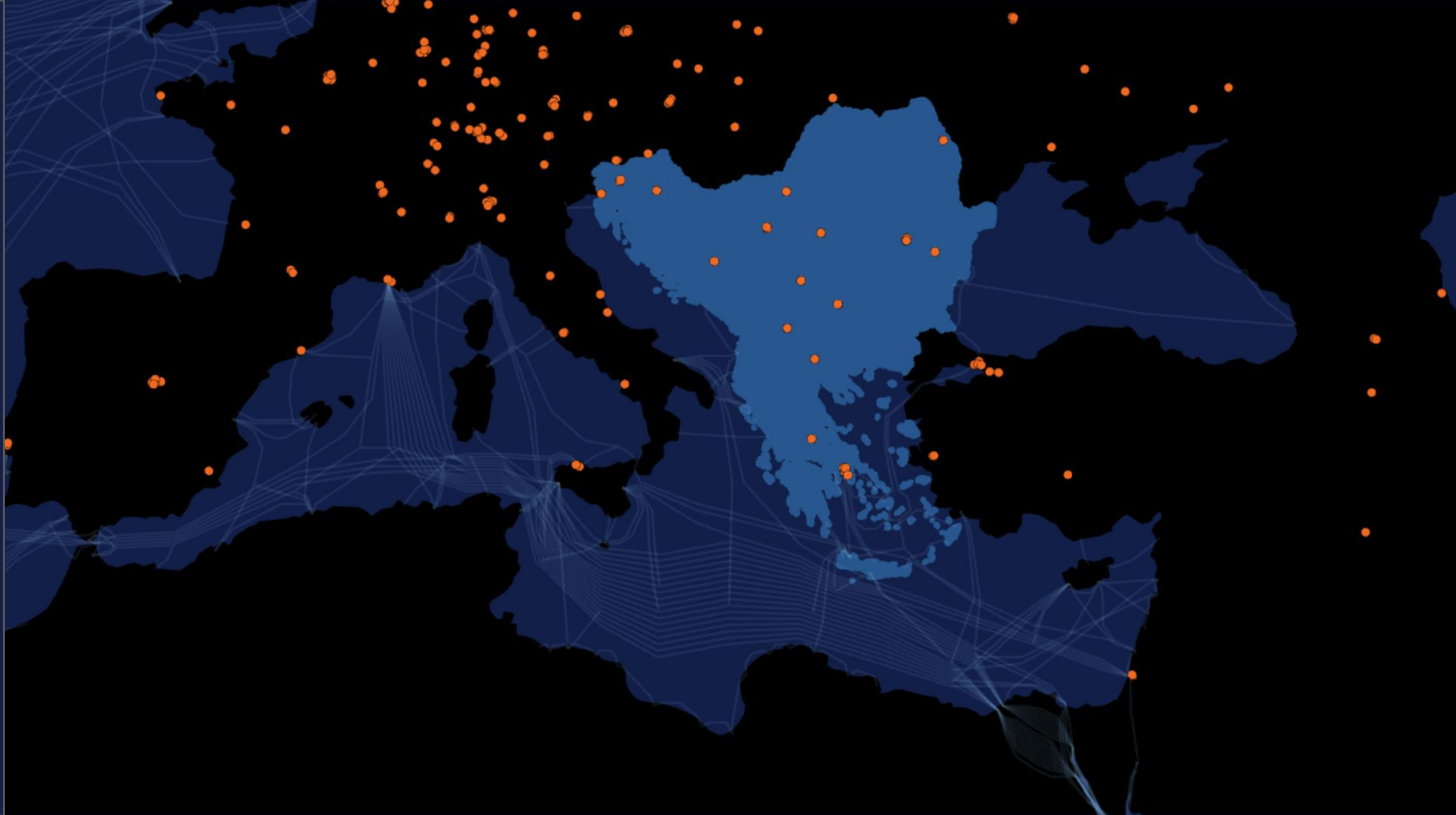


RIPE Atlas coverage - how far can we see?



SEE anchors

BG: 9
RO: 7
RS: 3
HR: 1
GR: 5
AL: 1
BA: 1
SI: 3
MK: 1
ME: 0





Questions & Comments



astergiopoulos@ripe.net

THANK YOU!