



RIPE NCC
RIPE NETWORK COORDINATION CENTER

How we see submarine cable outages with **RIPE Atlas**

Emile Aben | RIPE NCC Days Baltics | 3 June 2026



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

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...

Read article



Explore Categories: Podcasts Network Operations Measurements and Statistics Internet Governance Technology and Innovation Community and Events ... View all

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



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



The RIPE Labs Article Competition - RIPE 90

Open until 4 April 2025

The RIPE Labs article competition is back again! Have something interesting to say about the past, present, or future state of the Internet? Tell your story on RIPE Labs and win a chance to join us at RIPE 90 this May in Lisbon, Portugal.

Latest Podcasts



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

Alun Davies
31 Mar 2025
2 min read



Francesca Bosco: Who Governs Cyberspace?

Anastasiya Pak
3 Feb 2025
2 min read



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



Search terms

baltic sea cables

Timeframe

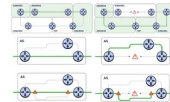
Any time

Sort by

Most relevant

Search

Search found 7 results



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



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



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:



About the author

Manage Profile

Based in [Amsterdam, NL](#)

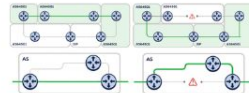
I'm a data scientist at the RIPE NCC. I'm a chemist by training, but have been working since 1998 on Internet related things, as a sysadmin, security consultant, web developer and researcher. I am interested in technology changes (like IPv6 deployment), Internet measurement, data analysis, data visualisation, 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.

Links & Social



Articles 105 Contributions 64 Comments 18

Newest



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

Baltic Sea cable damage 2024-2025



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 Lennighan
November 20, 2024

3 Min Read



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

Damaged cables appear to be accident, Finland says

3 December 2024
George Wright
BBC News

Share Save

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



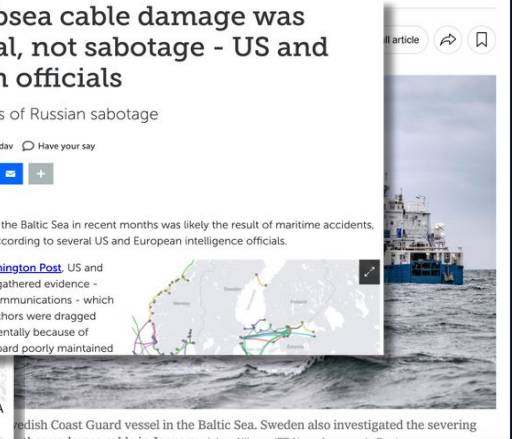
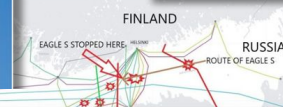
submarine telecommunication cables in Lithuania, Russia, and... In addition, an undersea cable was cut by a ship anchor. The incident involving a foreigner killed over a hundred kilowatts

incident occurred in October 2024, and the Eagle S is indicated on the map by the infrastructure located in the NewNew f... electricity cable and its decisive intervention

ical offshore infrastructure and the Eagle S incident

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

Measuring damage with RIPE Atlas



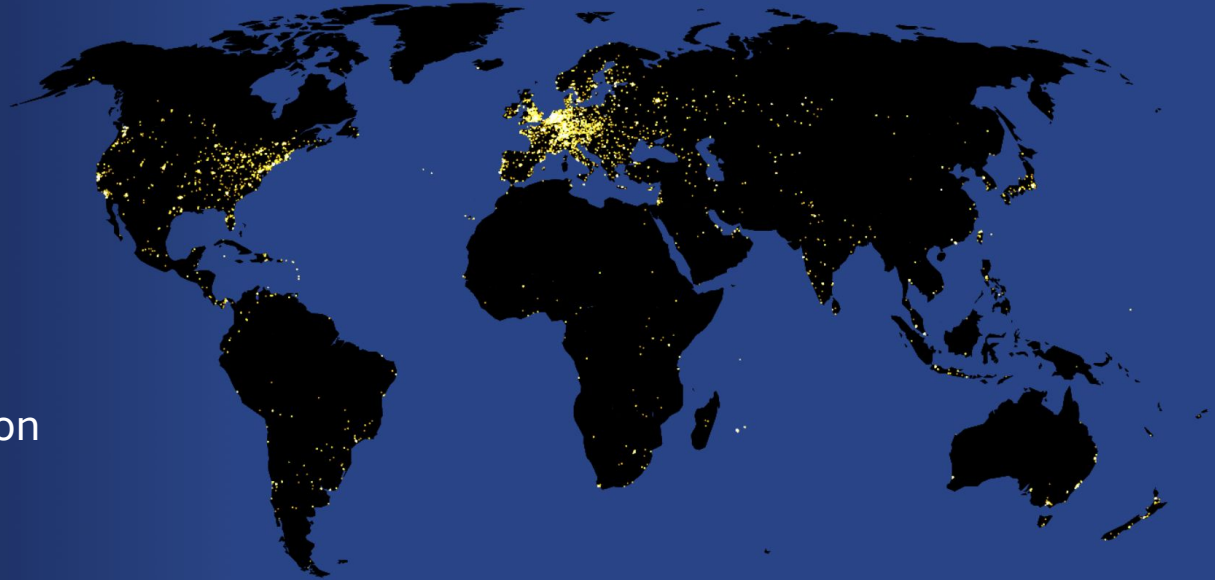
RIPE Atlas

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

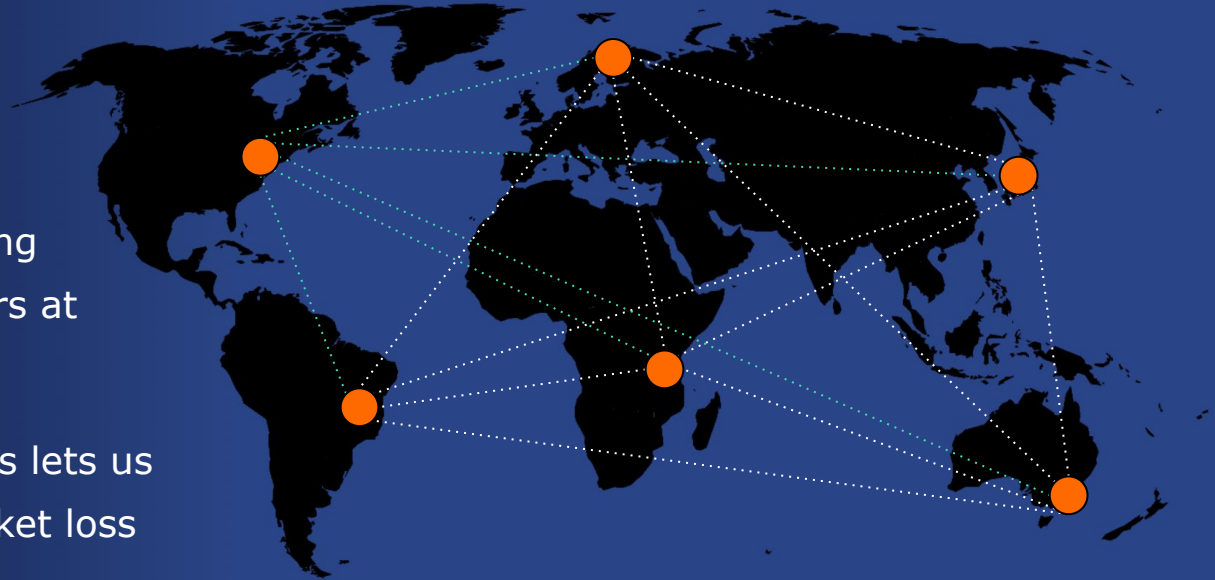


Anchor mesh

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

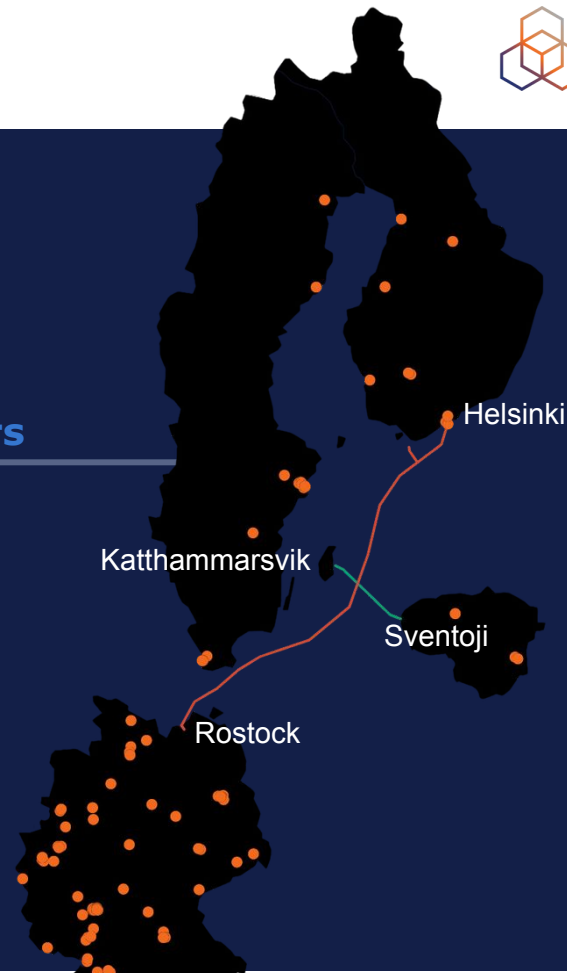
Country	# anchors
---------	-----------

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

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

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

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



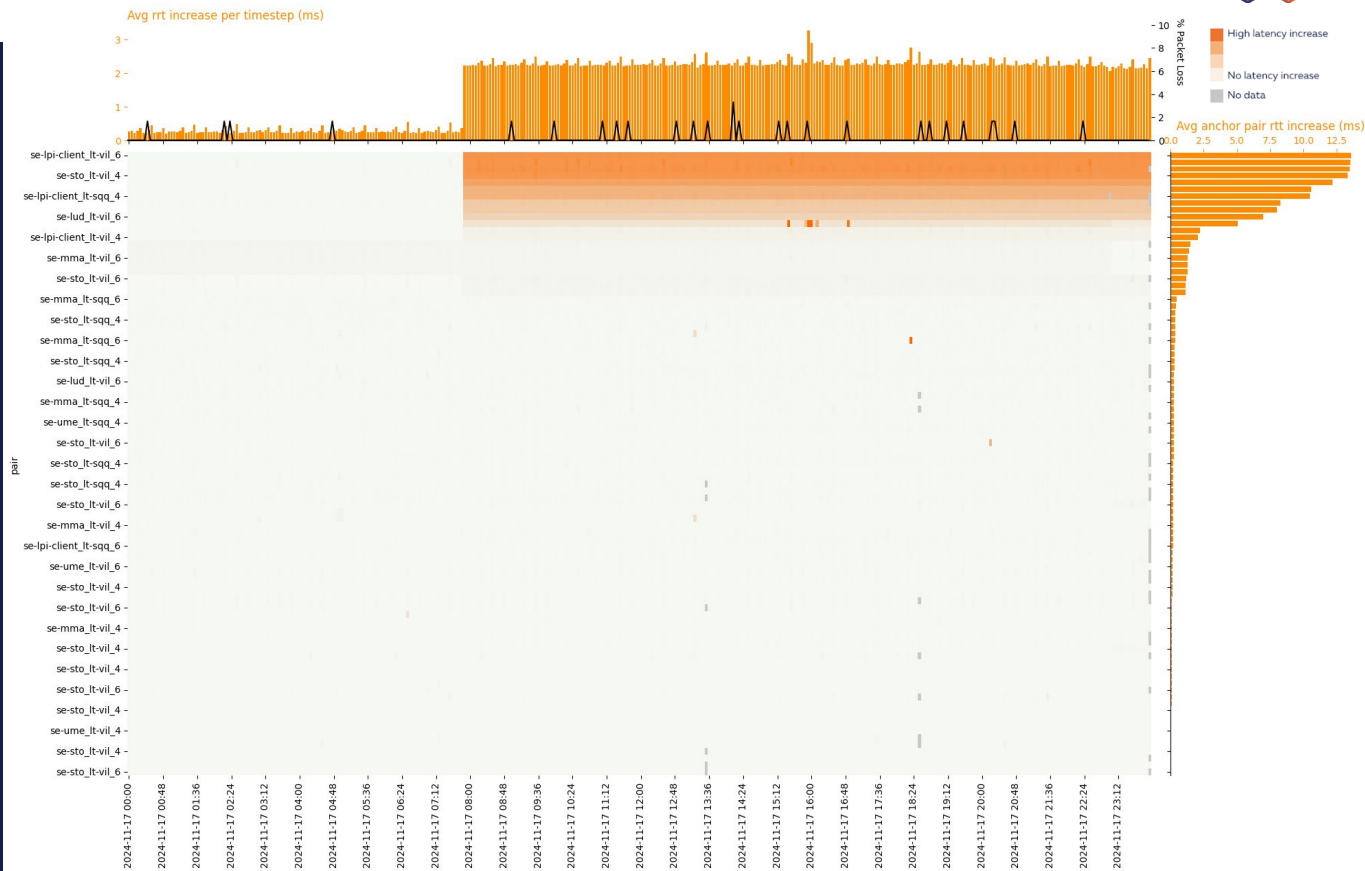
BCS East West

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*



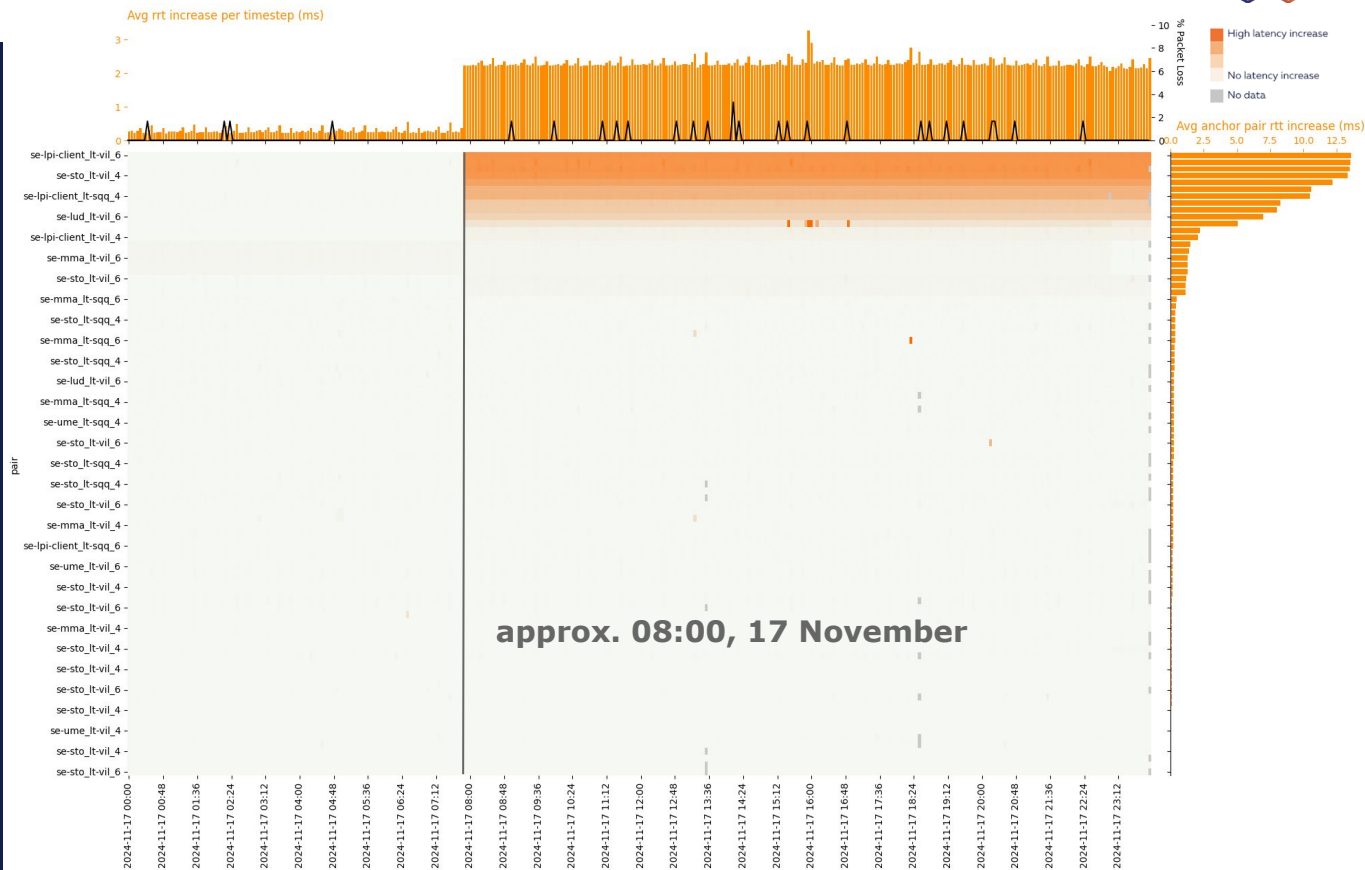
BCS East West

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*



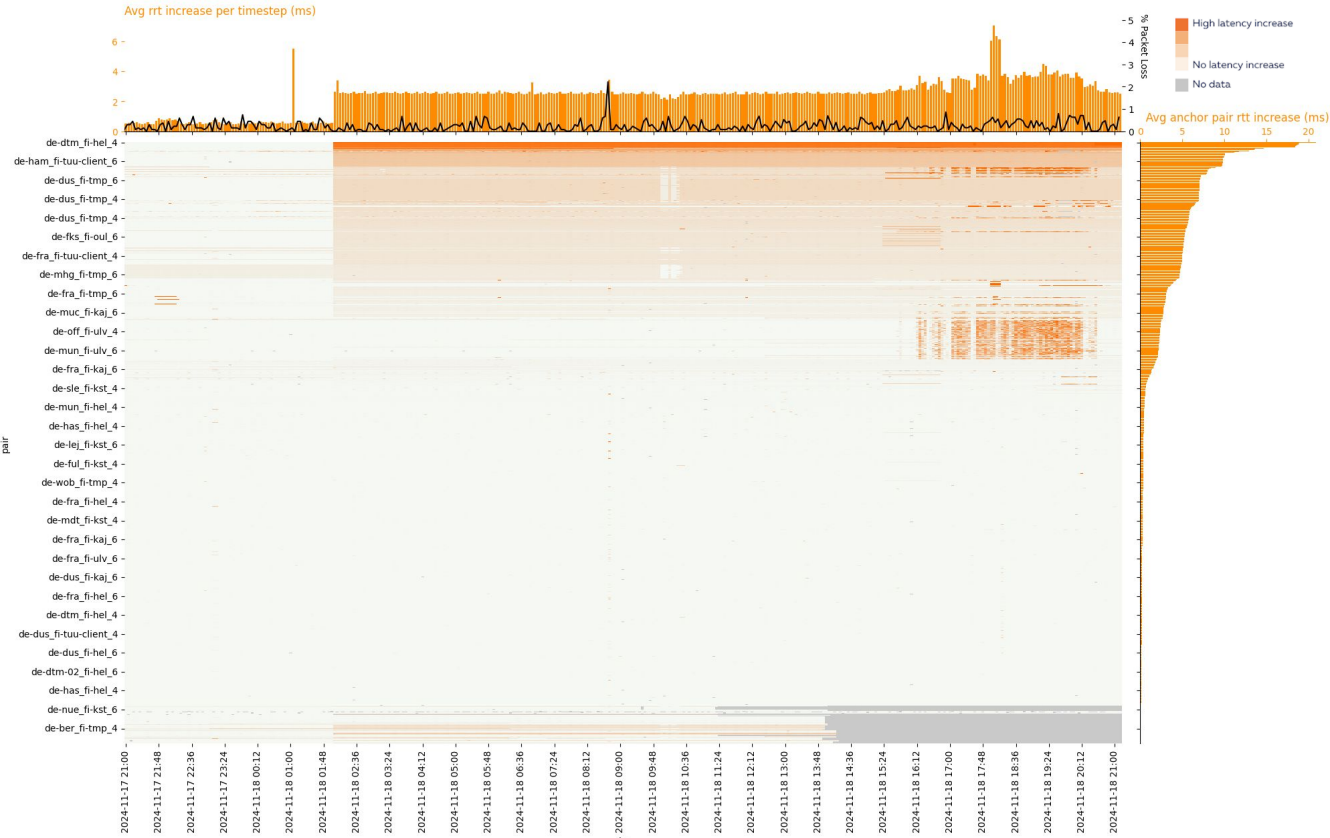


Latency shift

View of paths between anchors in 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**



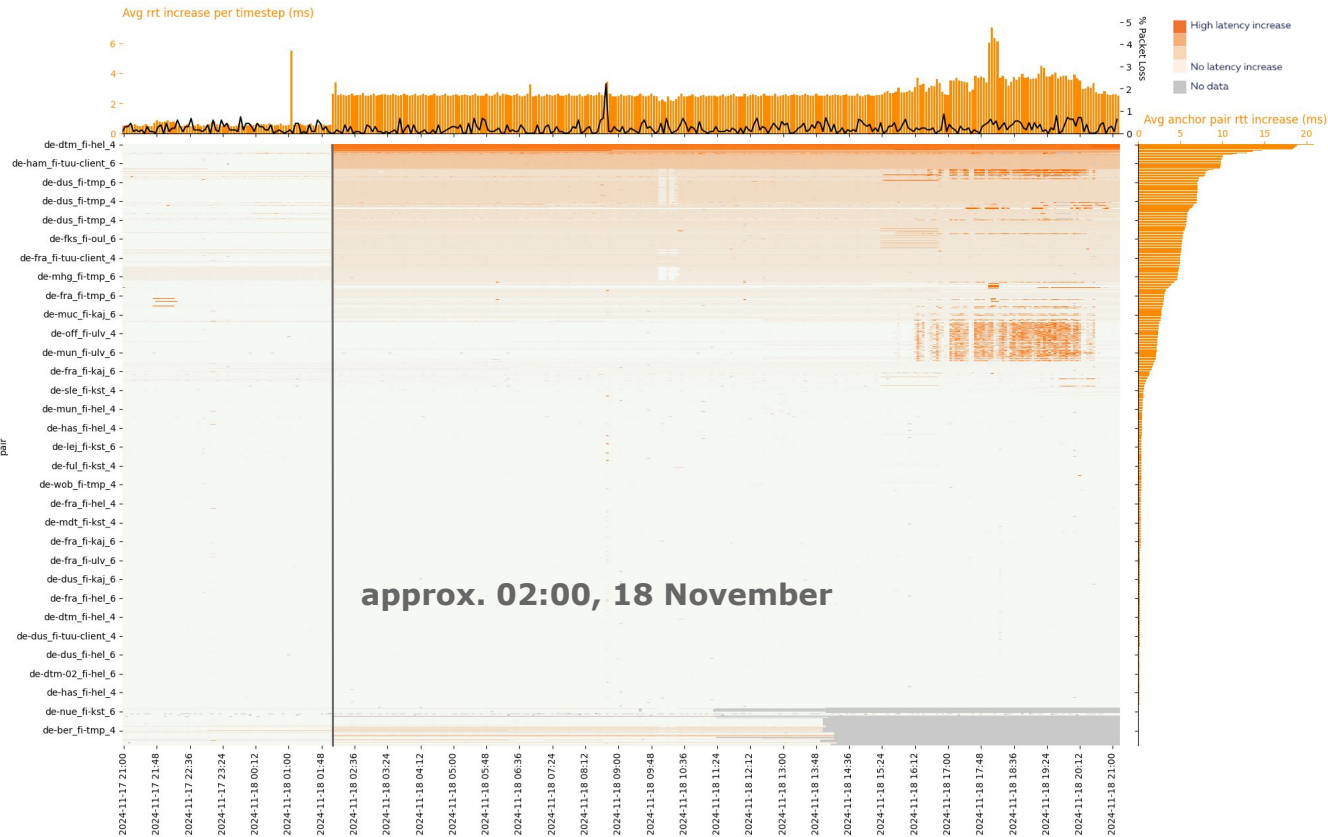


Latency shift

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

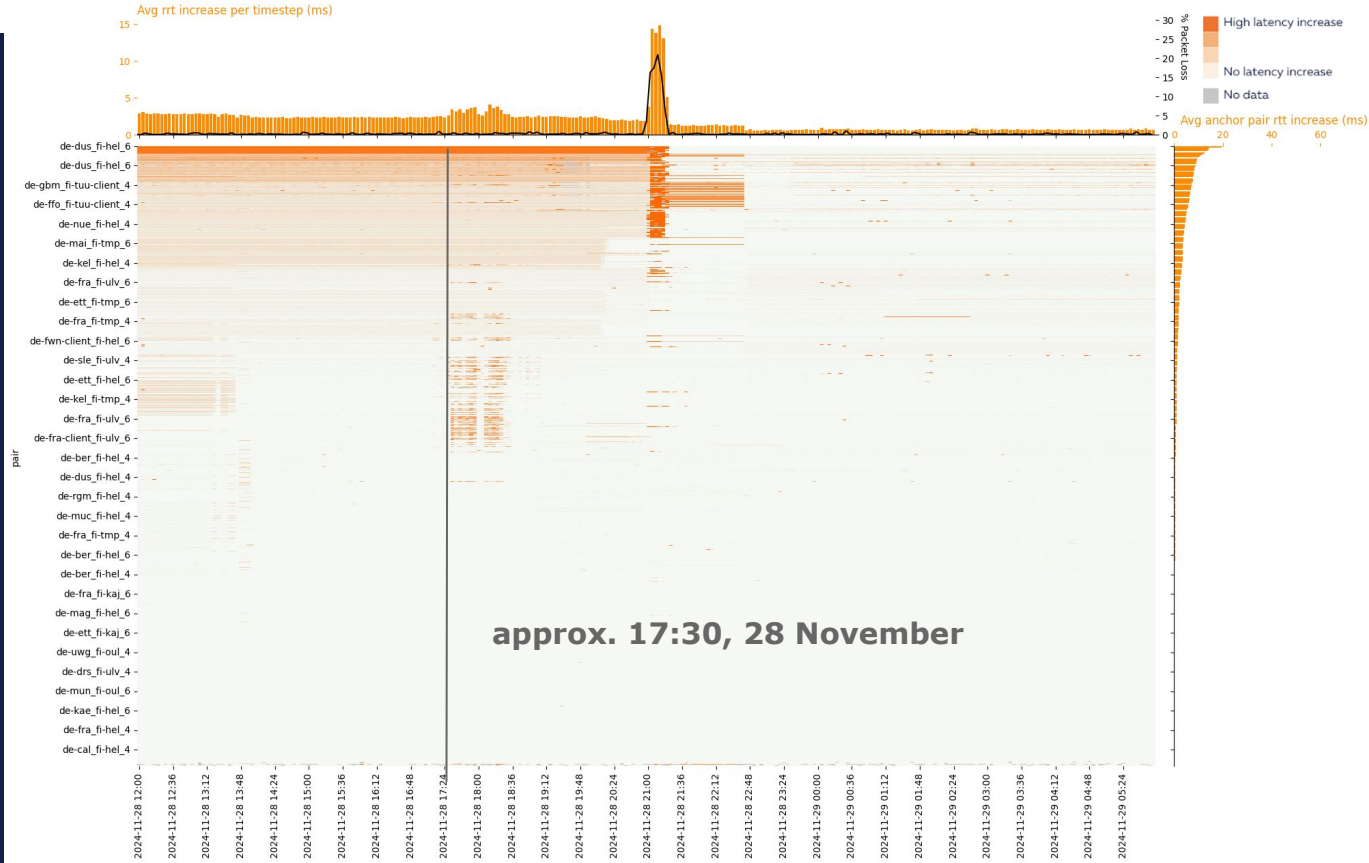
Again: **no significant increase in packet loss**



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...

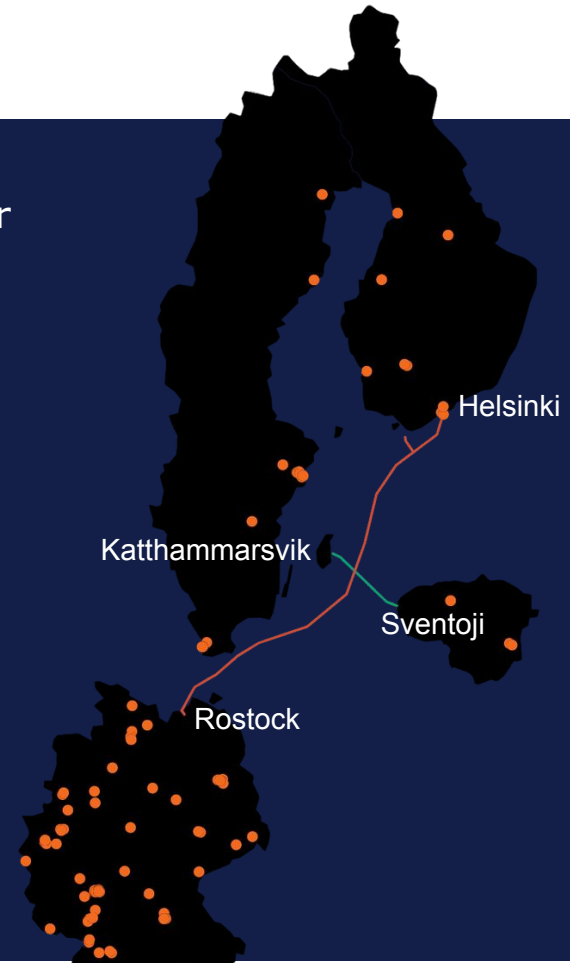


Summing up



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



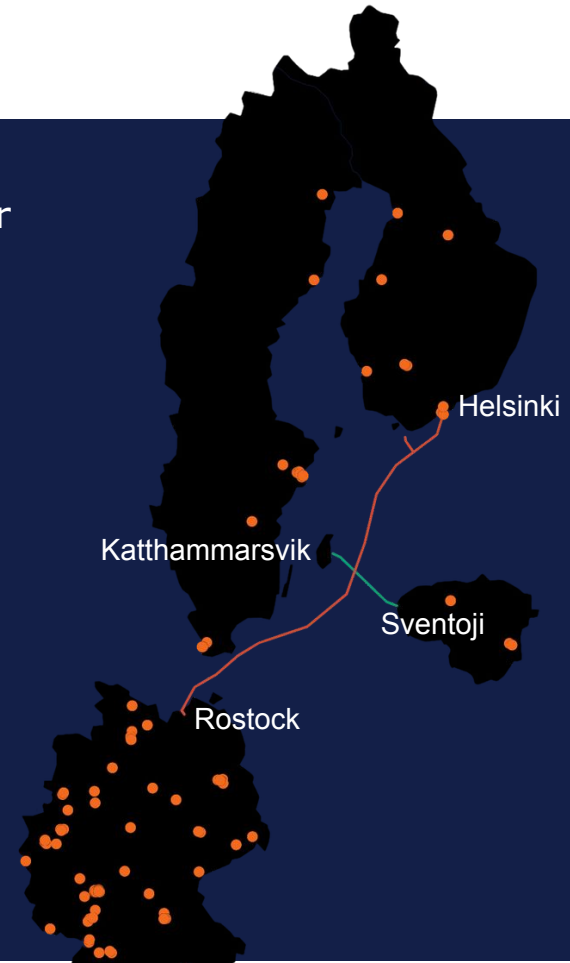
Summing up



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!



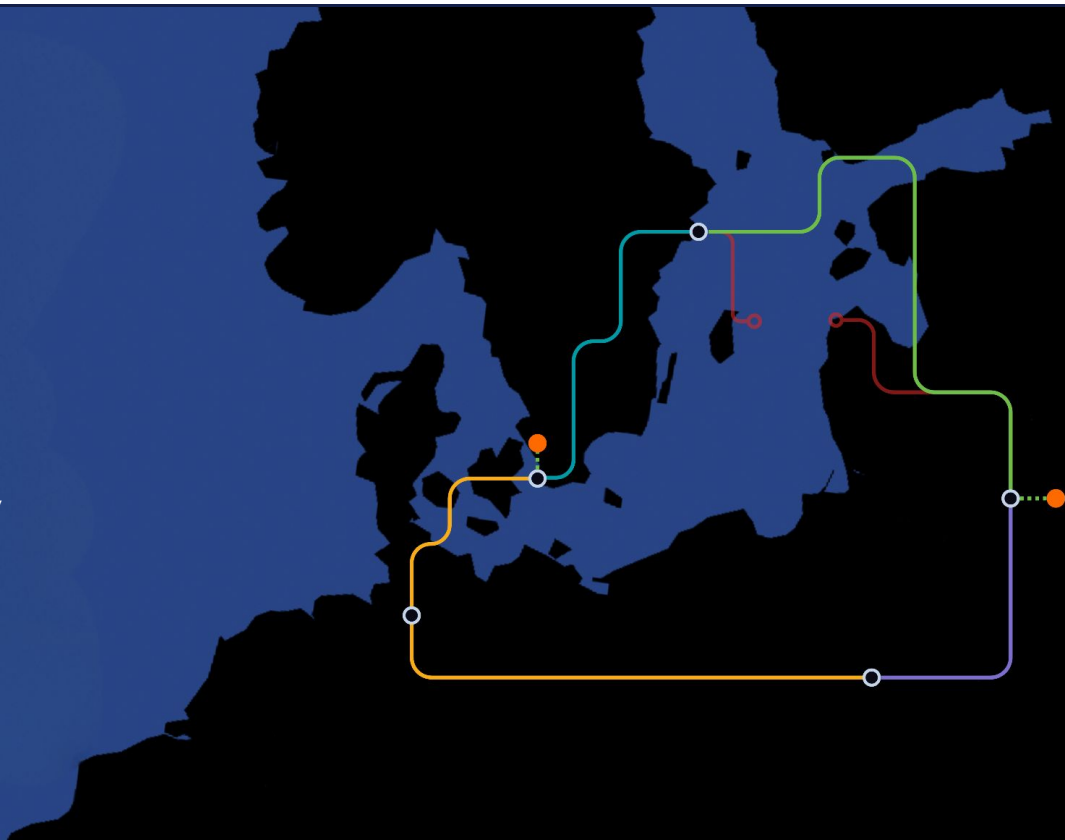
Deeper dive



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

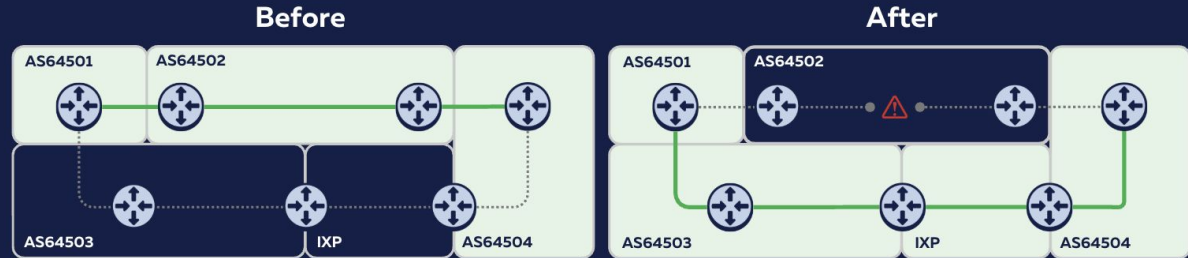


Levels of resilience



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!)



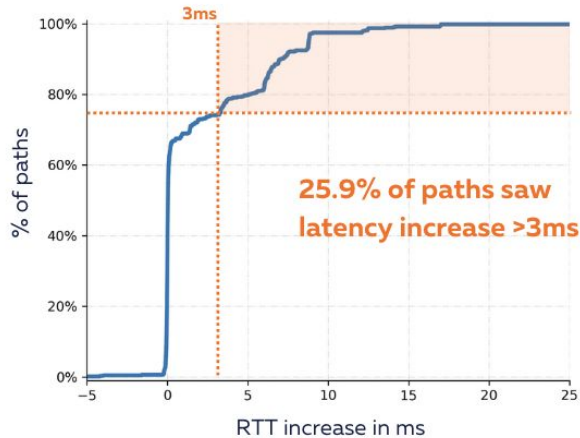
Levels of resilience



Of the 2,141 paths between anchors in Germany and Finland used for this analysis:

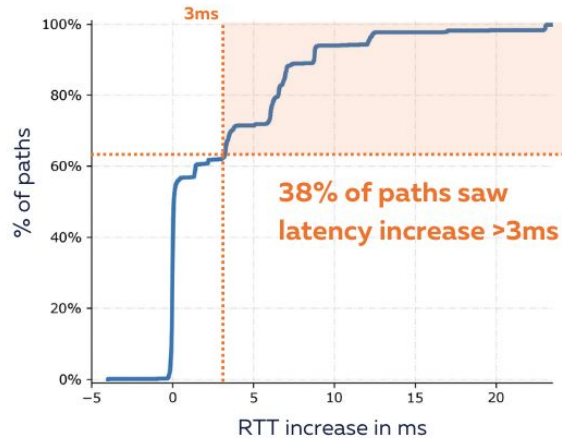
Inter-domain rerouting

RTT profile for **637** paths where inter-domain routing changed.



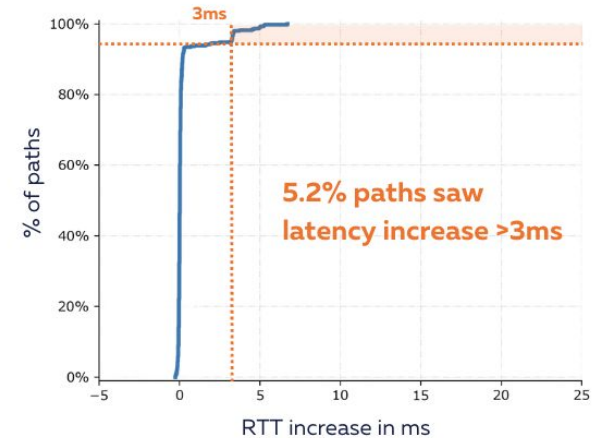
Intra-domain rerouting

RTT profile for **1,044** paths with IP-level changes, but no inter-domain changes.



Circuit-level rerouting

RTT profile for **460** paths with no inter-domain or intra-domain changes.



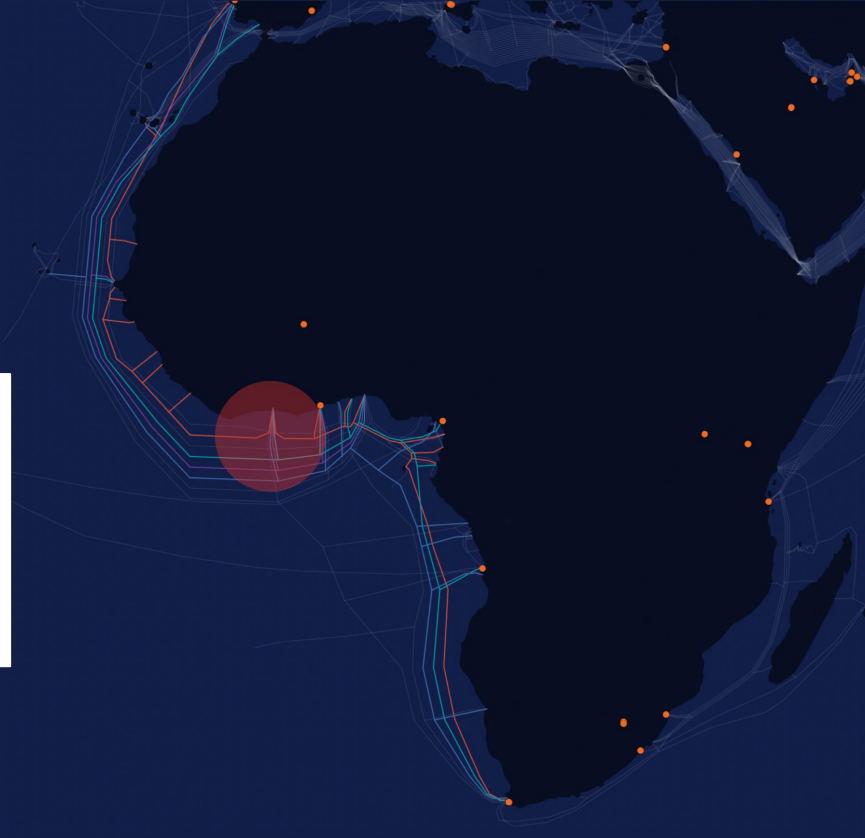
Resilience is not guaranteed: Côte d'Ivoire, 2024



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**



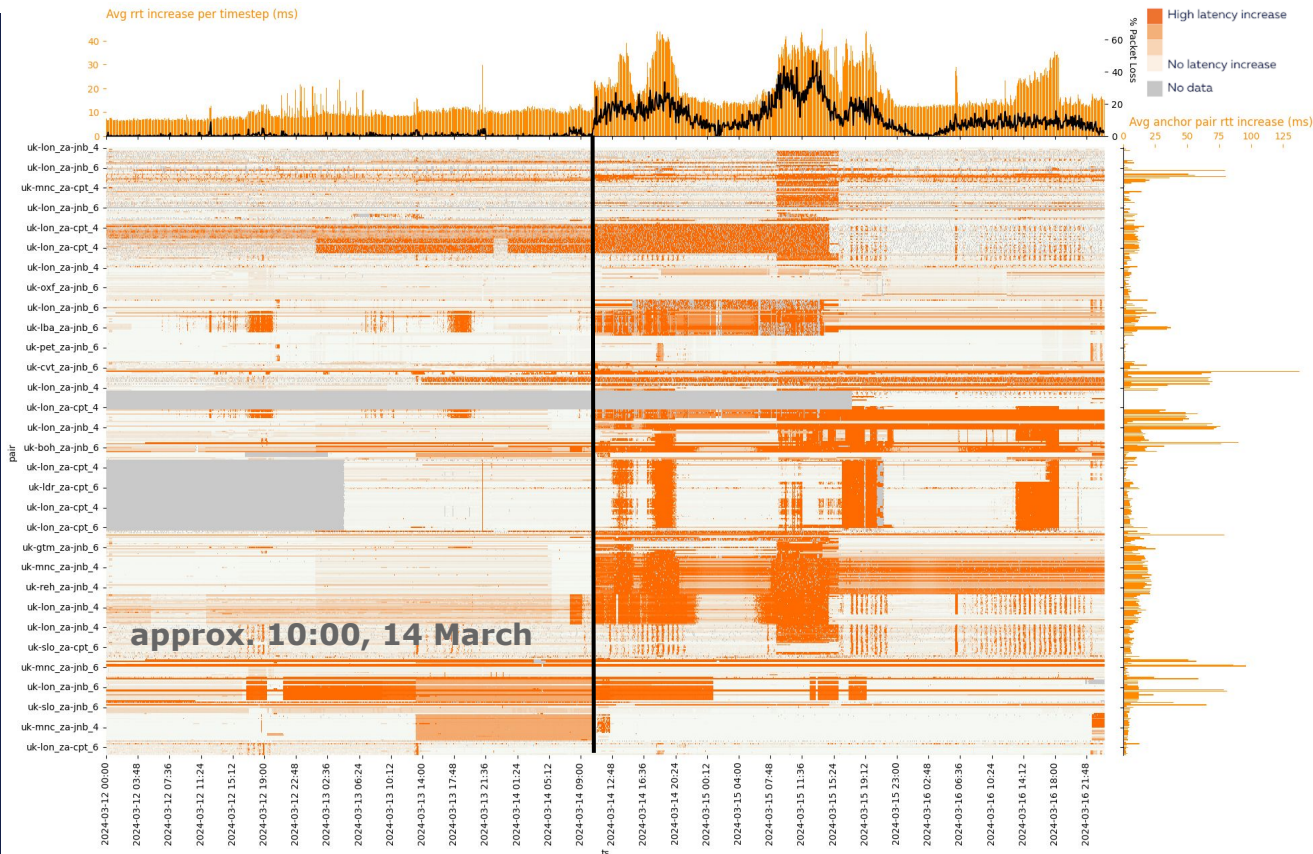
Resilience is not guaranteed: Côte d'Ivoire, 2024



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



Baltic Sea cable damage 2025-2026



Timeline

- 28 Dec 2025: **SE-EE CITIC outage**
- 30 Dec 2025: **SE-EE Arelion outage**
- 31 Dec 2025: **FI-EE Arelion outage**
- 31 Dec 2025: **FI-EE Elisa outage**
- 02 Jan 2026: **LT-LV Arelion outage**

- Info much sparser
- Less publicity



Congestion effects



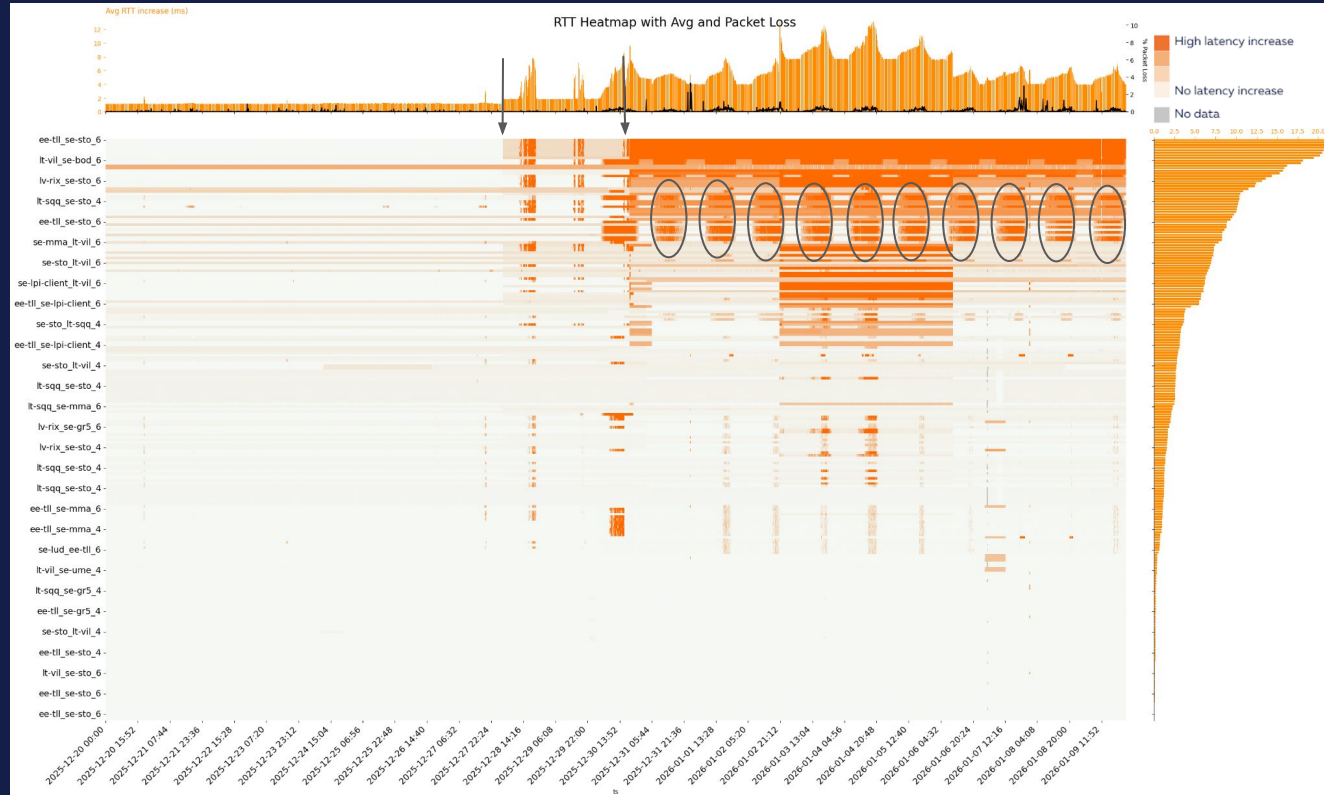
Effects are less clear!

View of paths between anchors in Sweden and Baltic states

Similar view from Finland

Some minor latency increases

Emerging daily congestion





Resiliency of the Internet around the Baltic Sea:

- Winter 2024-2025: The Internet routed around damage
- Winter 2025-2026: Different combination of cables, different footprint
 - Stretching our measurement capability
 - Congestion patterns appearing



Conclusions



But why the difference?

- Different sets of cables = different type of effect
- Hidden centralisation?
- Lack of data from the right places?
- Congestion patterns due to:
 - Internet across the Baltics reaching capacity?
 - Christmas holiday effect?
 - DDoS or other large shifts in traffic?
- What are the stories from the ground?

Going forward



- Work towards a better measurement footprint
- Better characterisation of congestion: lightweight detection
- Understanding local Internet better
 - Collect the local network operational stories around outages
 - Mechanisms for knowledge sharing

Because 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?

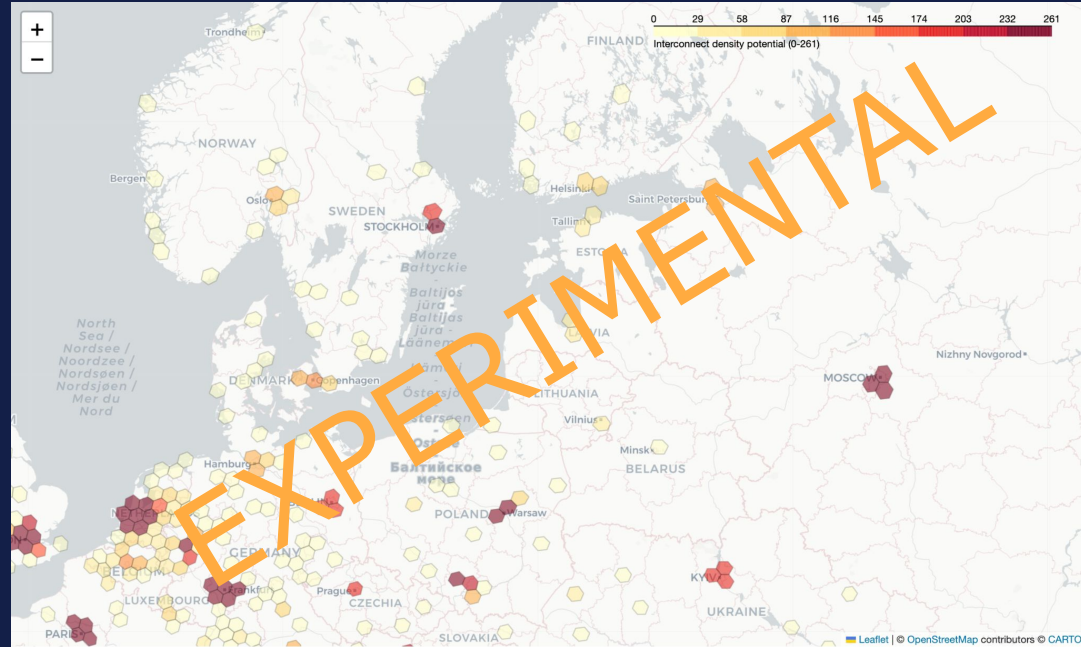


Country code	Nr of anchor	Nr of cities ...	Nr of ASNs ...	landings
EE	4	1	4	3
LT	4	2	4	2
LV	1	1	1	2
SE	17	7	15	27
FI	15	9	15	11
NO	6	4	6	47
DK	6	6	6	33
DE	114	49	102	8
RU	18	10	17	28
NL	62	24	60	8
GB	38	20	35	119
BY	1	1	1	0
BE	7	6	5	2
IS	1	1	1	3

Where to monitor?



- Important points in Internet topology
- Our approach per country:
 - Minimum of 5 anchors
 - At least 3 cities
 - At least 3 networks
- Is "country" the right granularity?





Resilience is not guaranteed

Together we can monitor, measure and understand

By deploying RIPE Atlas in the right places

By mixing what RIPE Atlas sees and local expertise



Questions & Comments



eaben@ripe.net



RIPE NCC
RIPE NETWORK COORDINATION CENTER

THANK YOU!