

How the Internet routed around Cable Damage in the Baltic Sea

Internet event analysis with **RIPE** Atlas

Lia Hestina | MYNOG 12, Kuala Lumpur Malaysia | 11 June 2025

Baltic Sea cable damage as seen on RIPE Labs



A Deep Dive Into the Baltic Sea Cable Cuts



Semile 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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C RIPE Labs PODCAST de

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 outages podcast measurements

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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.

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About the author



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Articles

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

Semile Aben + 19 Dec 2024 + 25 min read



Baltic Sea cable damage



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Sweden Investigates New

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 Balt and European governments are starting to suggest that Russia is behin

Mary Lennighan inventior 20, 2024

C 3 Min Read



Sweden opens inquiry into damaged

undersea cable as Nato deploys ships

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Baltic Sea cable damage





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
- ⁶ 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

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	# anch	ors
Germany:	100	
weden:	15	Katthammarsvik
inland:	12	Sventoji
ithuania:	5	
		Rostock
		11 · · · ·

BCS East West (SE-LT)

Latency shift

12 hour 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

12 hour 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)

C-LION1 (DE-FI)

Latency shift

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

Packet loss

Again, no significant increase in packet loss at time of outage



\bigotimes

C-LION1 repair

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

Unclear what exactly causes 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

The Internet routed around damage!



Beyond the Baltic Sea



Anchor mesh measurements have broad potential for getting insights into outages

Chile Power Outage

On 25 February, at around 18:00 UTC, a nationwide power outage affected Chile. The RIPE Atlas anchors (Internet measurement devices) in Chile give us a glimpse of how the Internet infrastructure coped with the power outage. Here's a breakdown of the effects we saw on the paths between the anchors.



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 circuitlevel connections between routers (same IP address!)





AS

After







Before



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

Intra-domain rerouting

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

100% 80% % of paths 60% 38% of paths saw latency increase >3ms 40% 20% 0% 10 -5 20 RTT increase in ms

Circuit-level rerouting

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



Resilience is not guaranteed



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



Packet loss

Latency shift with packet loss

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





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





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	Cables wit
	MY	2	1	2	20	vietnam-sin
	SG	24	1	24	8	ice-iv asia
	тн	2	2	2	7	cat-submar
	ID	12	8	10	139	padang-tua
	BN	0	0	0	2	asia-link-c
	PH	2	2	2	71	asia-conne
	VN	3	1	3	3	vietnam-sin
	КН	0	0	0	1	cambodia
	MM	0	0	0	2	umo asia-af
	LA	0	0	0	1	
	CN	4	2	4	25	cambodia
	BD	1	1	1	2	seamewe-6
A second the	IN	8	8	7	26	ice-iv seam
	NP	1	1	1	0	
	PK	0	0	0	1	seamewe-6
	TW	9	2	9	20	orca tpu tai
	нк	2	1	2	0	
	MV	1	1	1	16	seamewe-6
	KR	3	1	3	10	ulleung-mai
	JP	10	2	10	67	okinawa-mi

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- **Global Reach** Not just cloud servers, but *real users' networks*
- **Real-World Insight** See how your network looks from homes, schools, and ISPs
- **Custom Measurements** Run your own tests, your way, anytime
- **Open & Trusted** Community-driven, vendor-neutral, fully transparent
- **Cost-Effective** Free to use, fair credits model
- Network Level observation on Level 3 only, RIPE Atlas do not measure on Layer 2 level

RIPE Atlas is the only platform built on thousands of live probes around the world — giving you unmatched visibility from the ground up.

RIPE Atlas Interfaces





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RIPE Atlas Probes vs Anchors



Feature	RIPE Atlas Probe	RIPE Atlas Anchor			
Purpose	Lightweight, broad coverage	High-capacity, stable vantage point			
Hardware	Small device or software	Dedicated VM or hardware			
Measurements	Standard (ping, traceroute, DNS, NTP, SSL/TLS)	Standard + built-in anchoring measurements			
Stability	Various: residential/office networks/data centre	Hosted in data centers, highly stable			
Network Role	Acts as a probe only	Acts as both probe and measurement target (http)			
Visibility	Public Map (probe list)	Public map + used in anchoring infrastructure			
Credits Earned	Yes, 21600/24 hours	Yes, 10X more			
Hosting Requirements	Basic internet access, dynamic IP ok	Public static IPv4/IPv6, no firewall, stable VM			

Hosting a RIPE Atlas Anchor - Technical Overview

Network Requirements

- Public **IPv4 and IPv6** addresses (native, not tunneled)
- **Gateways** must be in the same subnet as the IPs (IPv6 link-local also allowed)
- Static IPs, unfiltered (no firewall blocking Atlas traffic)
- Up to **10 Mbit/s bandwidth** (actual usage is lower)

RIPE Atlas Anchors generate many built-in measurements (pings, traceroutes, DNS) that help in outage analysis

Application Process

Application Approved

Complete Anchor Details

Download ISO Image

Prepare Your VM

Install Software

Post-Install Steps

Internal Tests (RIPE NCC)

Anchor Goes Live!



Questions & Comments





THANK YOU!