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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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ripki ipvi rpe routing country security

Qasim Lone — 3 Apr 2025
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Antonella De Bellis • 26 Mar 2025 • 5 min read

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Alun Davies

31 Mar 2025

2 min read



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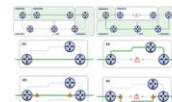
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A Deep Dive Into the Baltic Sea Cable Cuts

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.



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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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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



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About the author

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Based in [Amsterdam, NL](#)

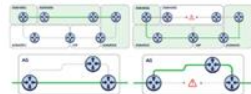
I'm a data scientist at the RIPE NCC. I'm a chemist by training, but have been working since 1998 on Internet related things, as a sysadmin, security consultant, web developer and researcher. I am interested in technology changes (like IPv6 deployment), Internet measurement, data analysis, data visualisation,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



Emile Aben • 19 Dec 2024 • 25 min read

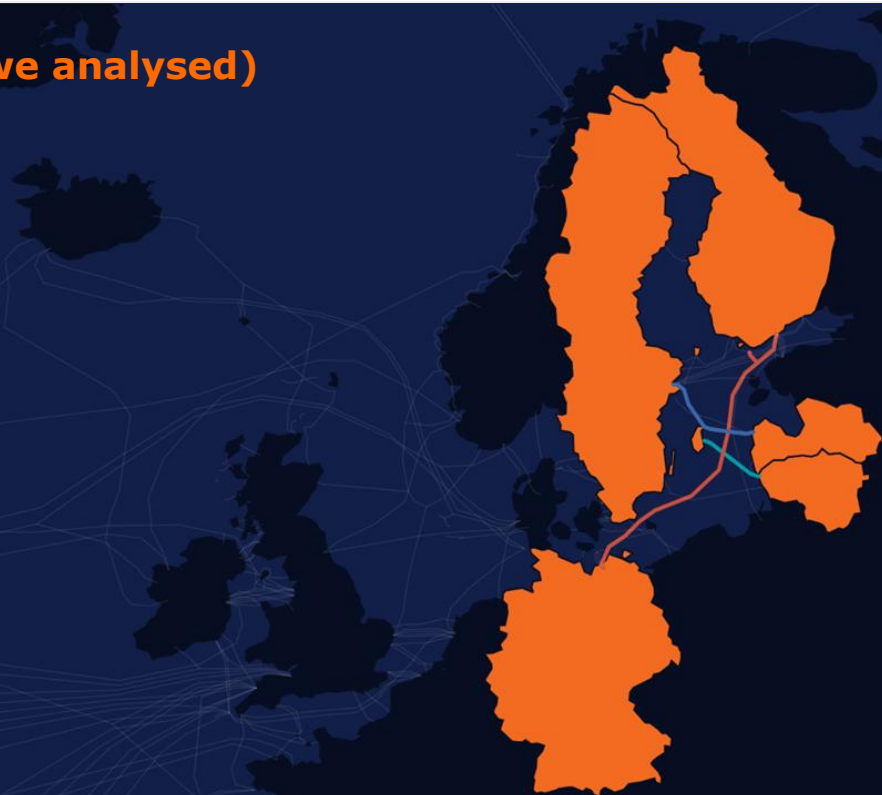
With last month's cuts in two major Baltic Sea Internet cables now successfully repaired, and another cut having occurred in the meantime, we analyse these events and delve deeper into the question of how

Baltic Sea cable damage



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

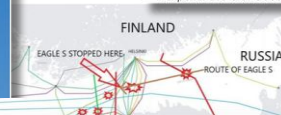
Christmas Day Cable Cuts in the Baltic Sea

Written by [Alexander Lott](#)

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involving a foreign c
or over a hundred kilon

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ber 2024, and the Ea
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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



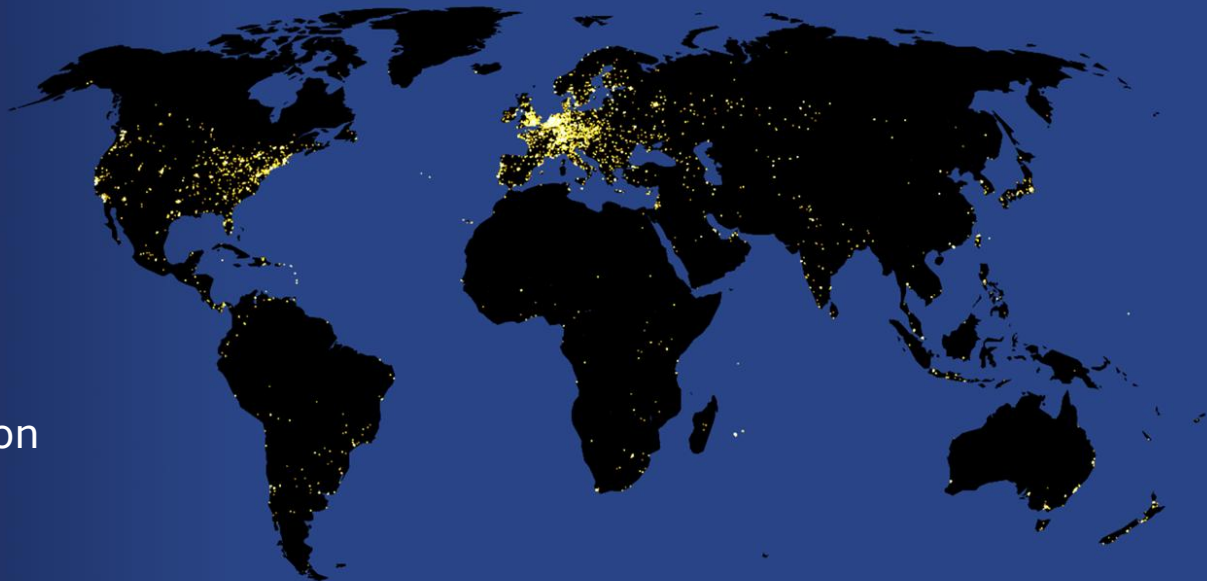
RIPE Atlas

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

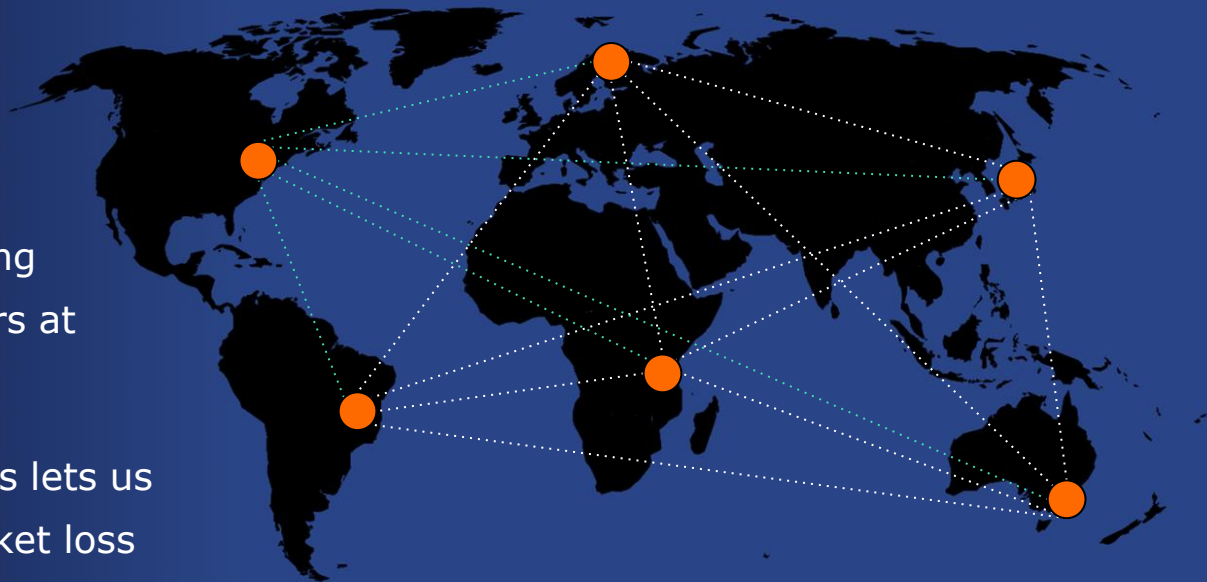


Anchor mesh

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

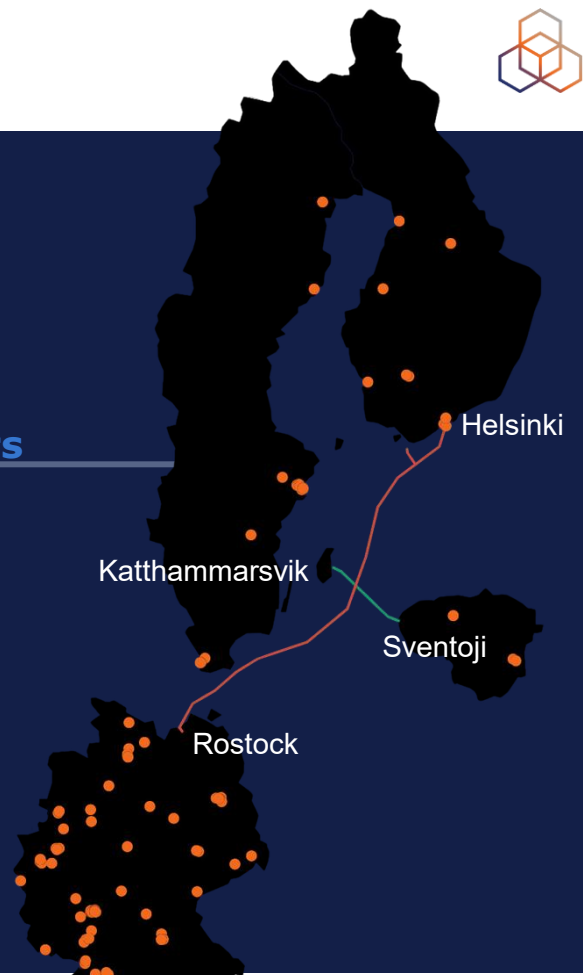
Country	# anchors
---------	-----------

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

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

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

Lithuania:	5
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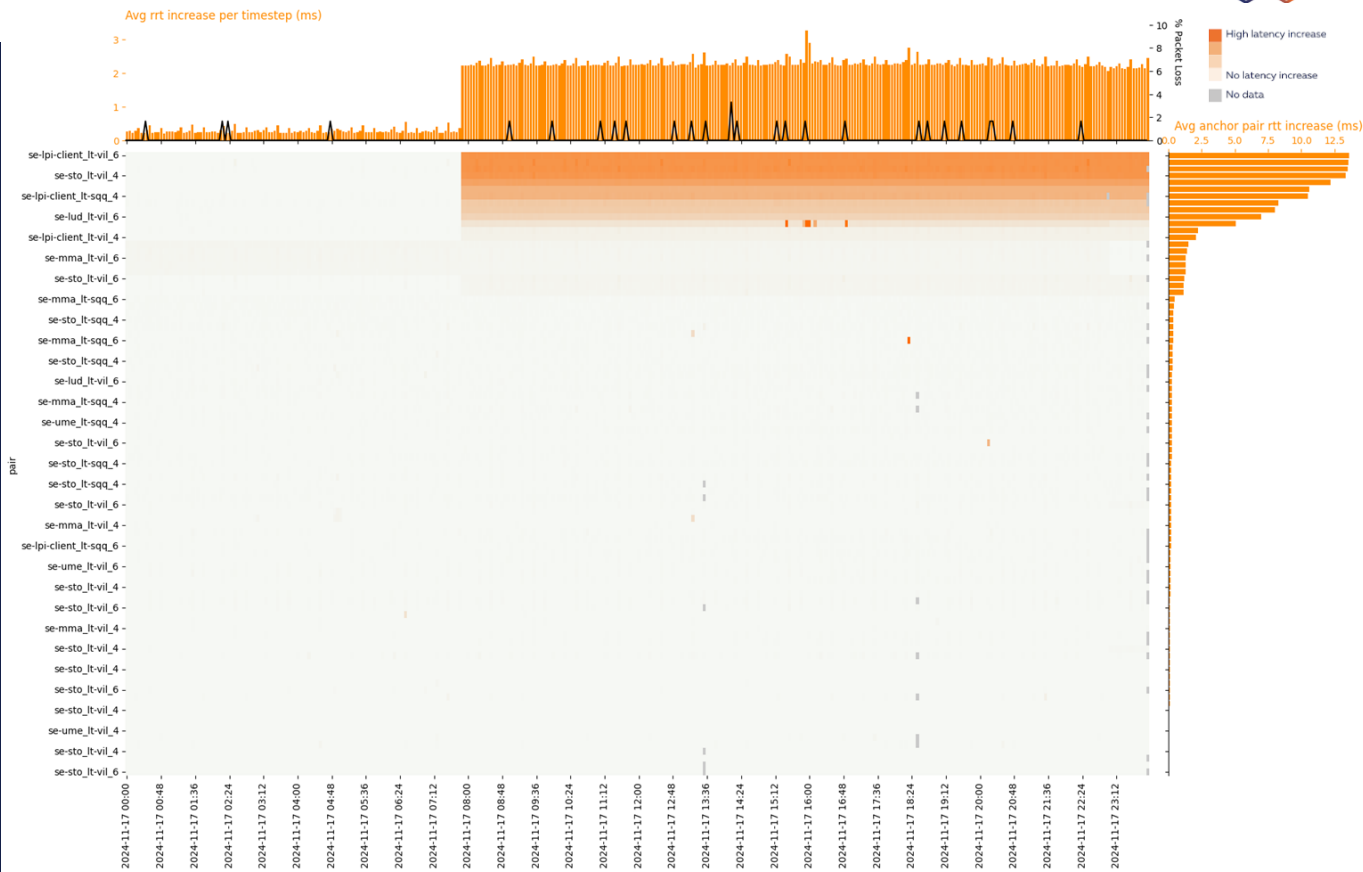
BCS East West

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*



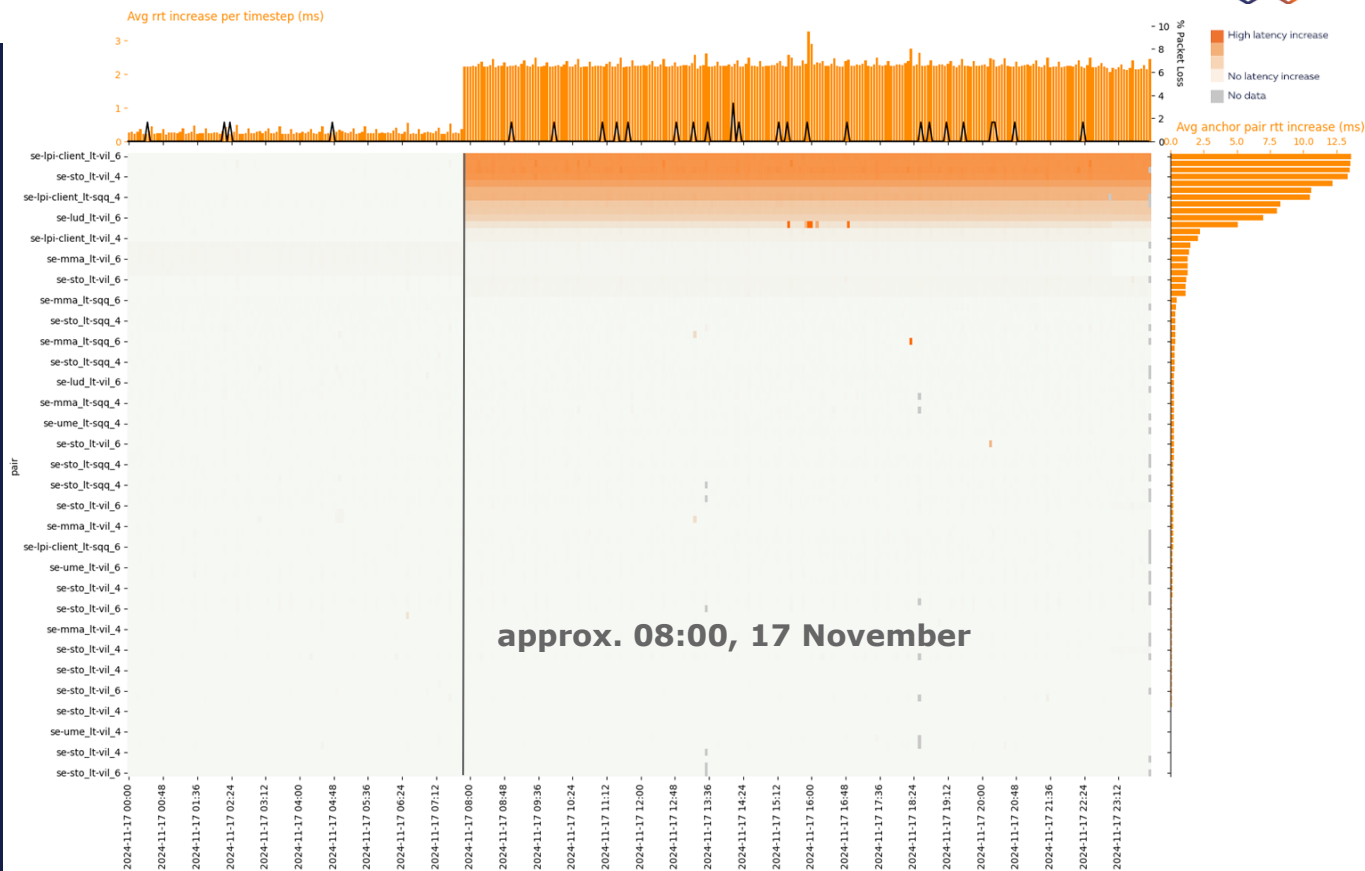
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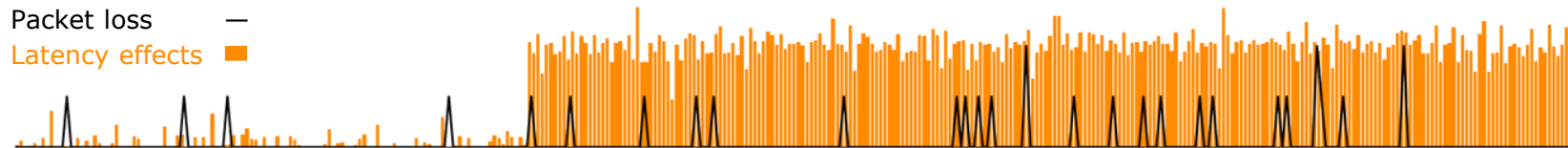
*We subtract the minimum
latency for a path during our
observation period to make
the latency jumps comparable*





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

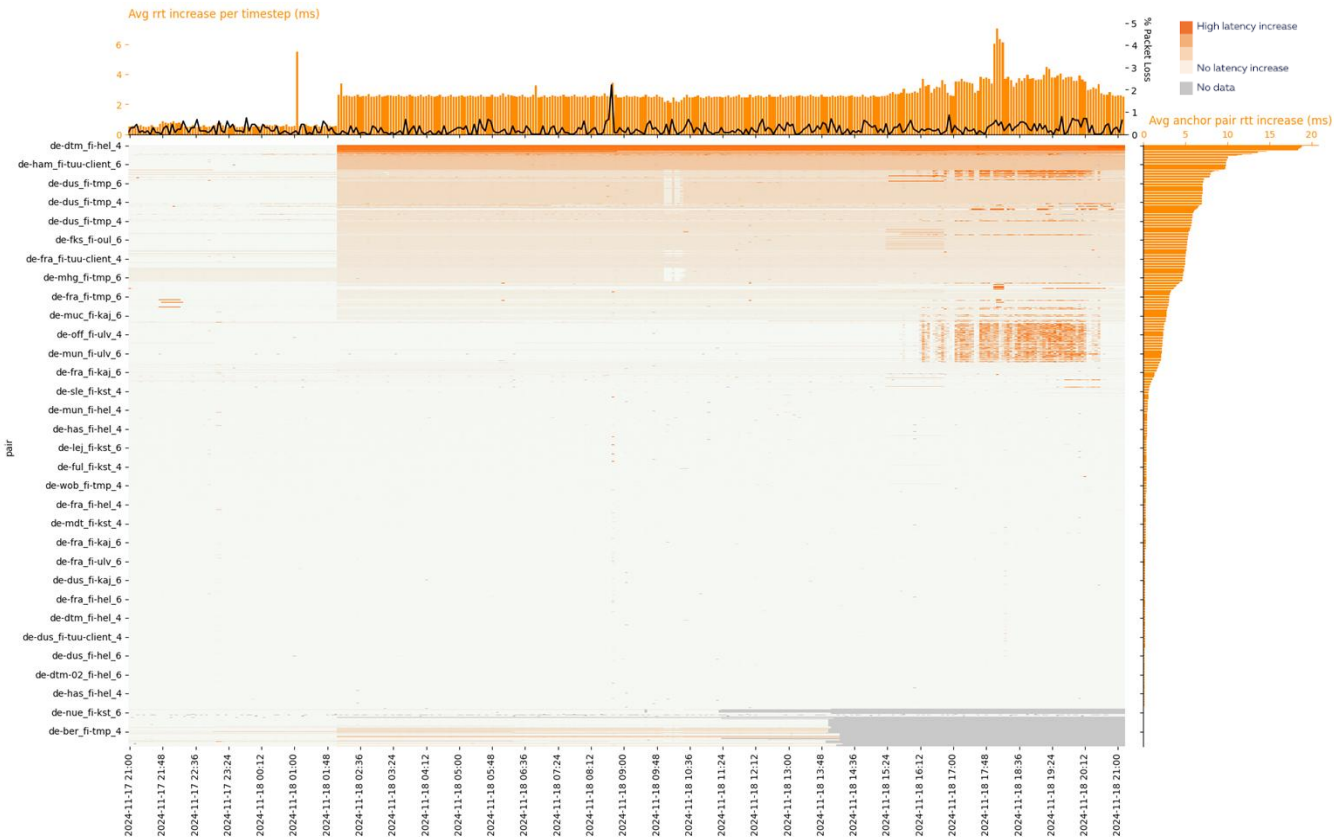


Latency shift

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



C-LION1

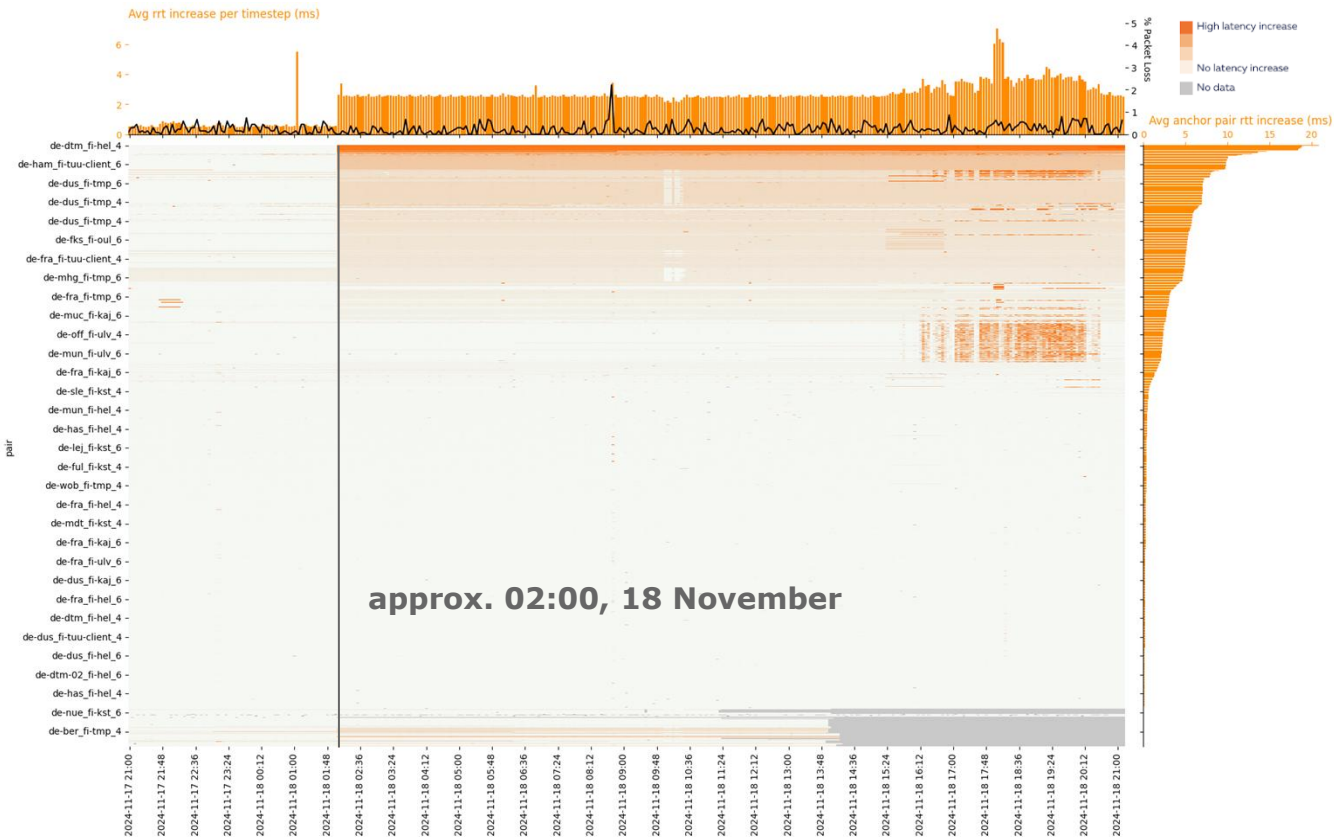


Latency shift

Latency increase of
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Packet loss

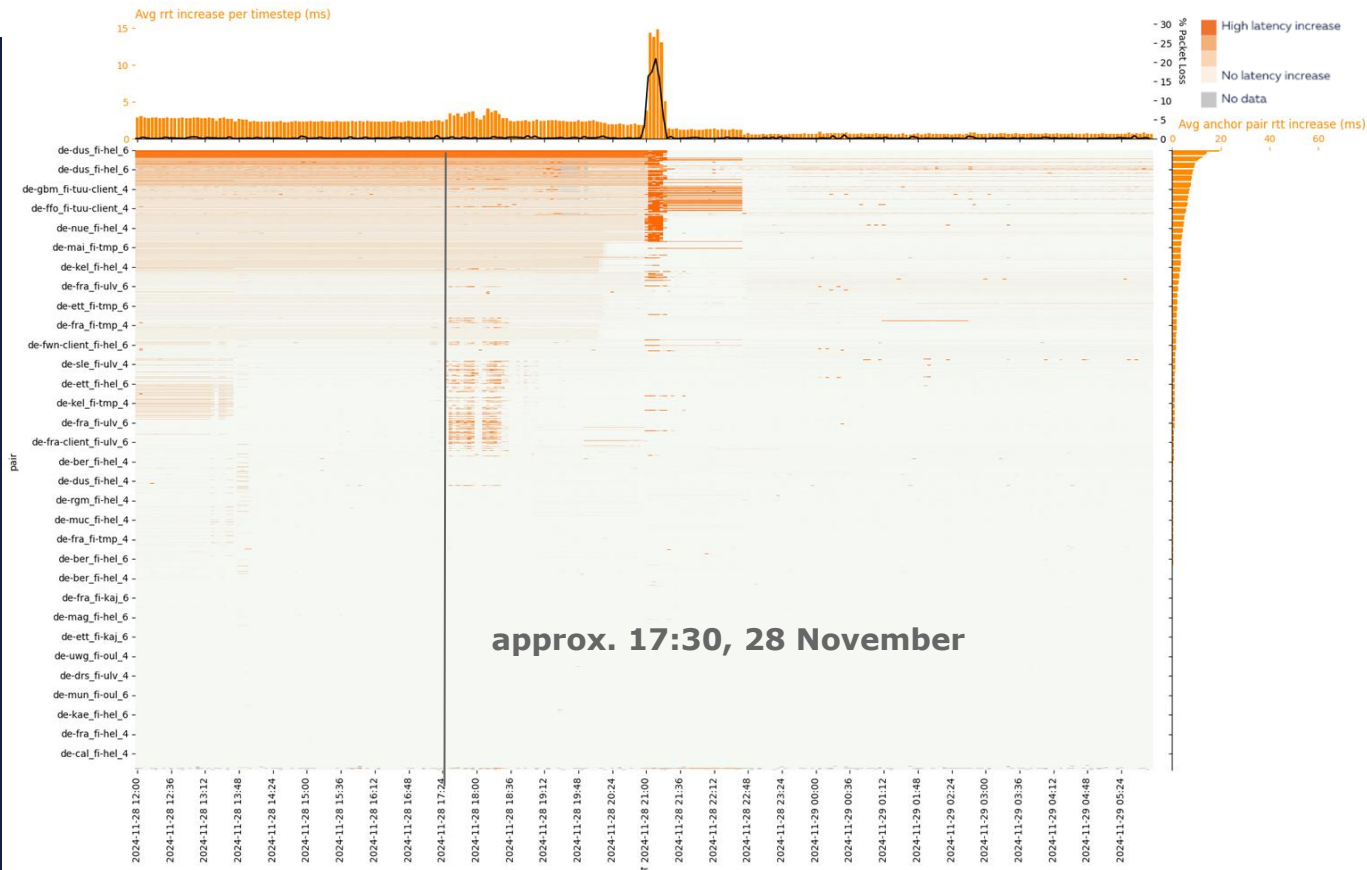
Again, no significant
increase in packet loss
at time of outage



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...

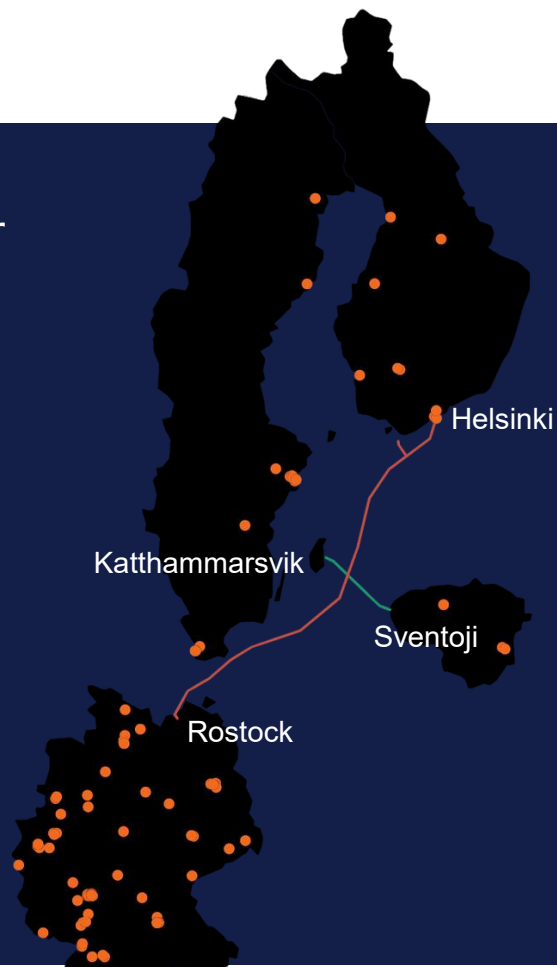


Summing up



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



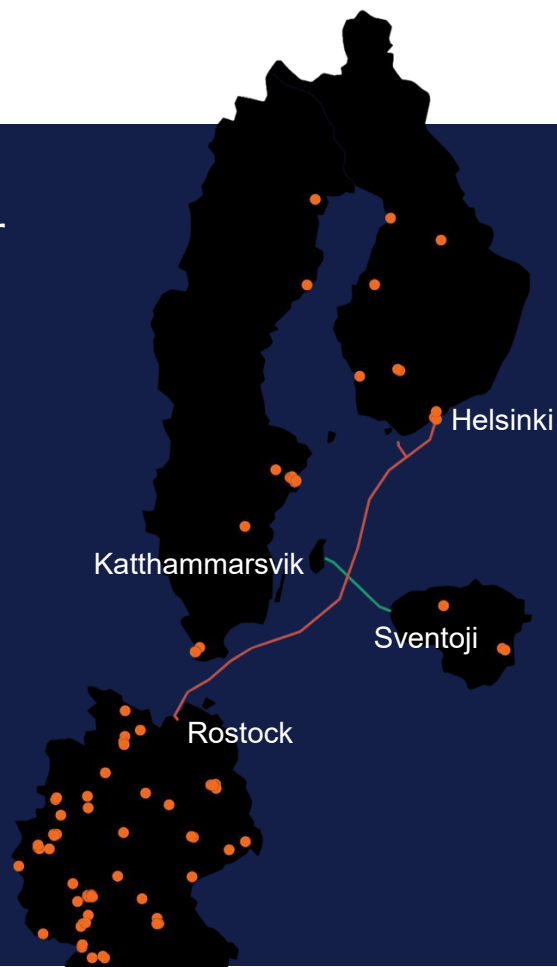
Summing up



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!



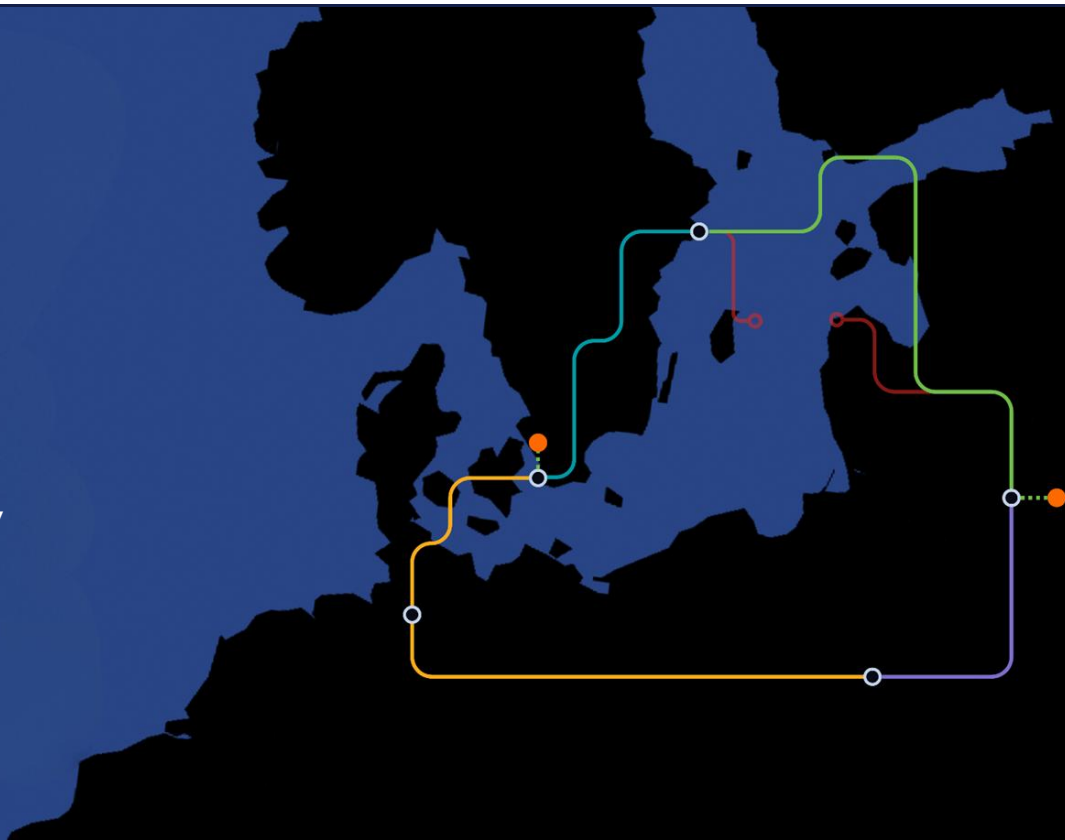
Deeper dive



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

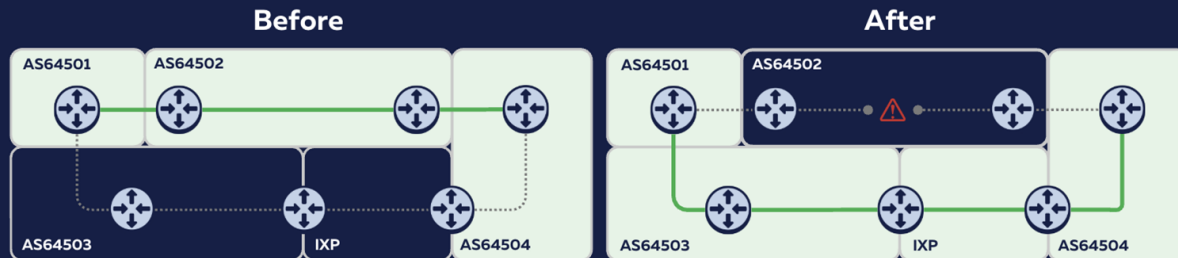


Levels of resilience



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!)



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

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)

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?



Country code	Nr of anchor	Nr of cities w a...	Nr of ASNs w a...	landings
DE	100	47	91	8
NL	48	21	46	8
FR	41	24	39	28
GB	31	17	29	119
CH	30	14	27	0
AT	22	8	21	0
IT	20	14	19	54
CZ	16	4	14	0
FI	14	9	14	11
SE	14	7	12	27
PL	13	10	13	1
ES	9	5	9	49
LU	9	4	8	0
BE	6	5	4	2
LT	4	2	4	2
NO	4	2	4	47
EE	3	1	3	3
IE	2	2	2	13
SK	1	1	1	0
LV	1	1	1	2



Questions & Comments



astracha@ripe.net



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THANK YOU!