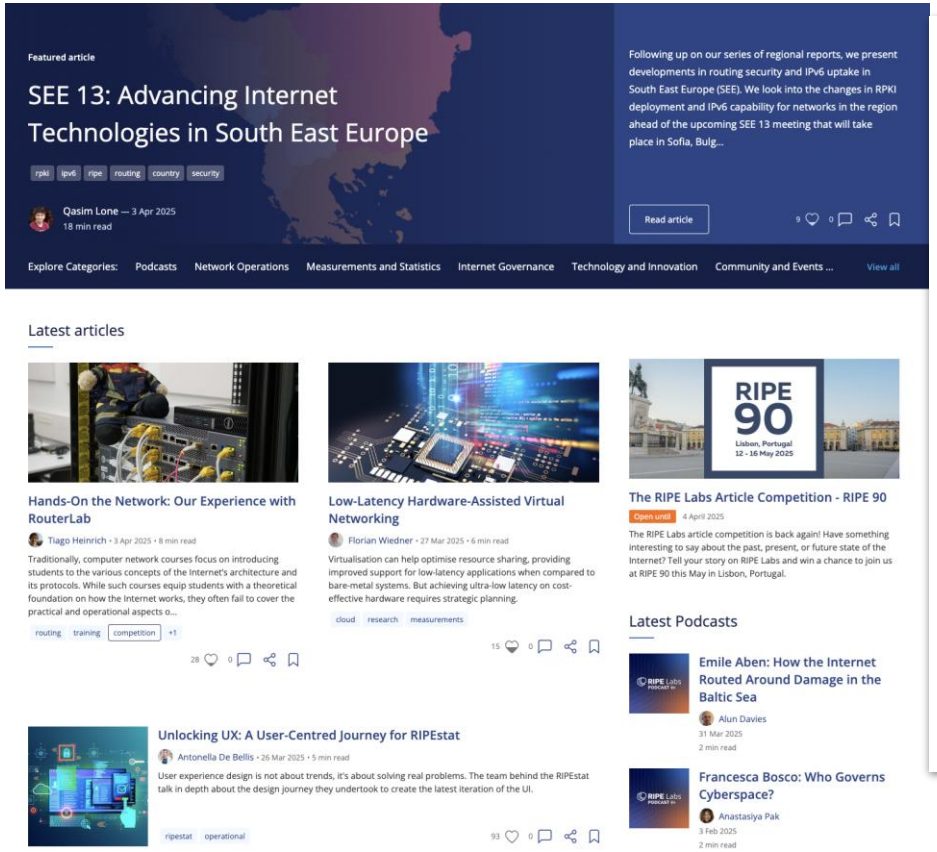
RIPE NCC
RIPE NETWORK COORDINATION CENTER

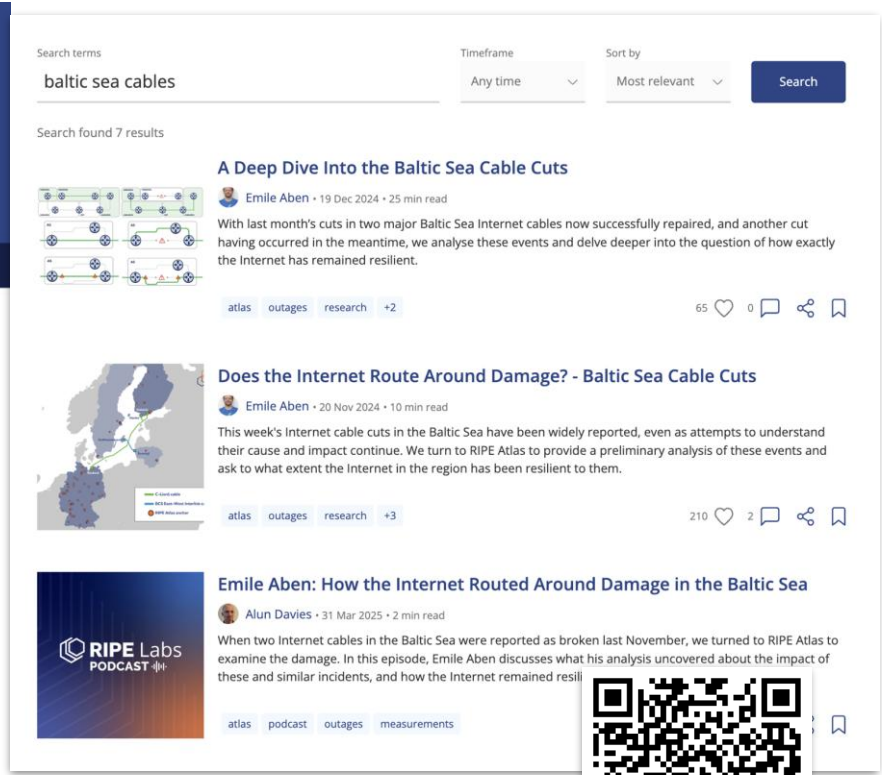
# How the Internet routed around Cable Damage in the Baltic Sea

Internet event analysis with **RIPE Atlas**

**Alastair Strachan | NETUK, London UK |** 7 July 2025

# RIPE Labs

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## Emile Aben

105 Articles

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### 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.

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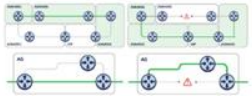


**A Deep Dive Into the Baltic Sea Cable Cuts**

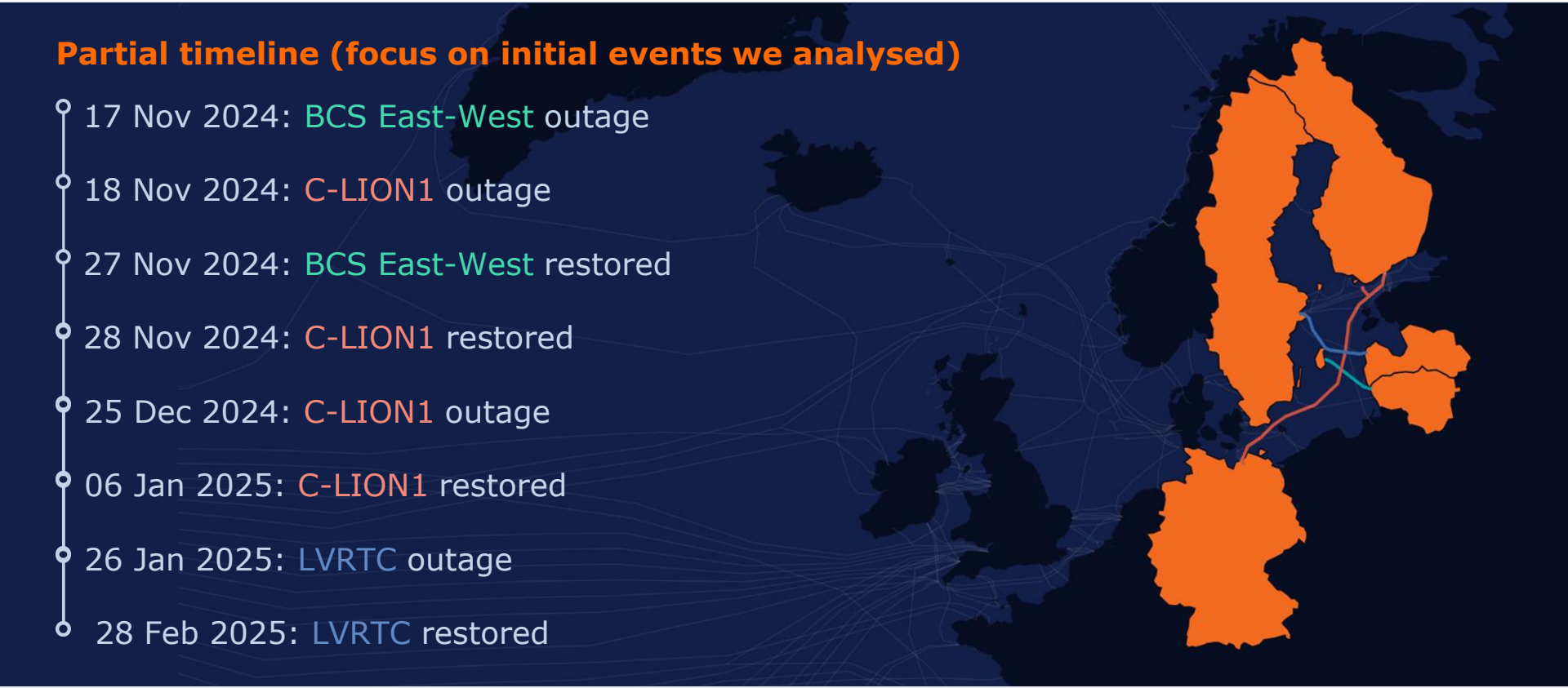
Emile Aben • 19 Dec 2024 • 25 min read

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

Mary Lennighan
November 20, 2024

3 Min Read

**Sweden opens inquiry into damaged undersea cable as Nato deploys ships**

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

**Damaged cables appear to be accident, Finland says**

3 December 2024

Share Save

George Wright
BBC News

December 31, 2024

**Christmas Day Cable Cuts in the Baltic Sea**

*Written by Alexander Lott*

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**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.

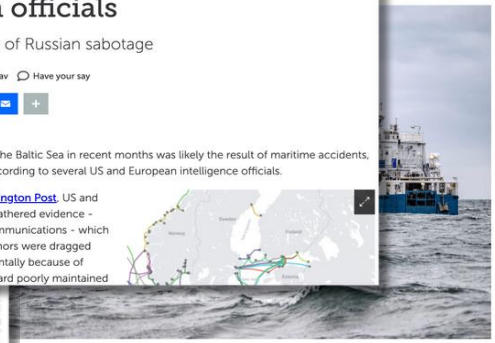
As reported by The Washington Post, US and European officials have gathered evidence - including intercepted communications - which have concluded that anchors were dragged across the seabed accidentally because of inexperienced crews aboard poorly maintained



**Sweden Investigates New Cable Break Under Baltic Sea**

e authorities are looking into possible damage to an undersea
east of Gotland island. NATO has stepped up its surveillance
he region.

ll article



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

# Baltic Sea cable damage

# Measuring damage with RIPE Atlas

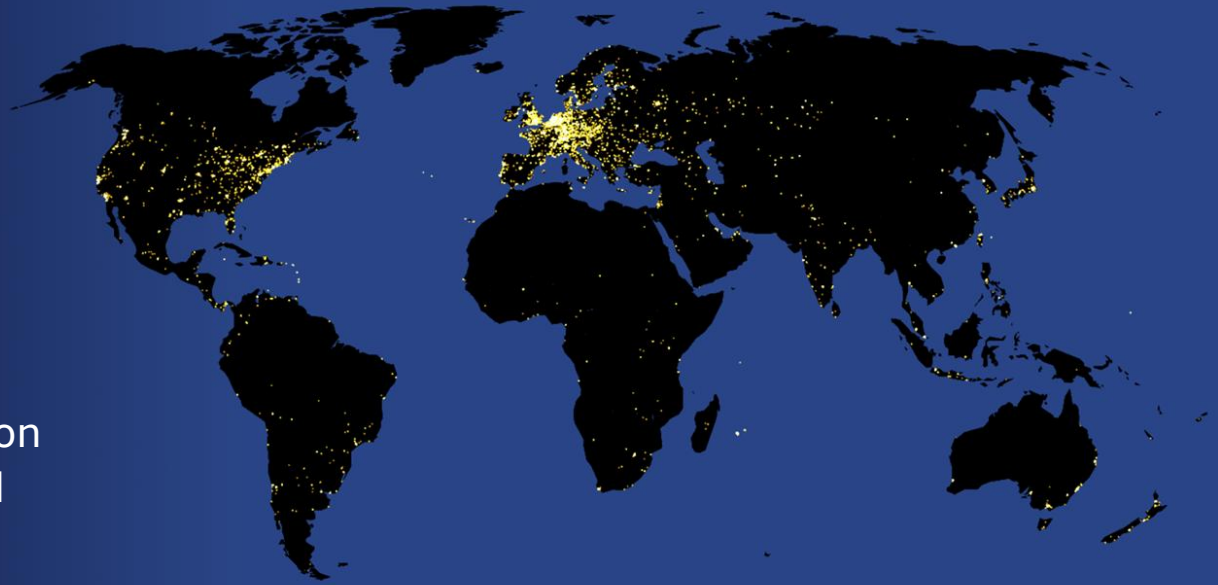
## RIPE Atlas

**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)



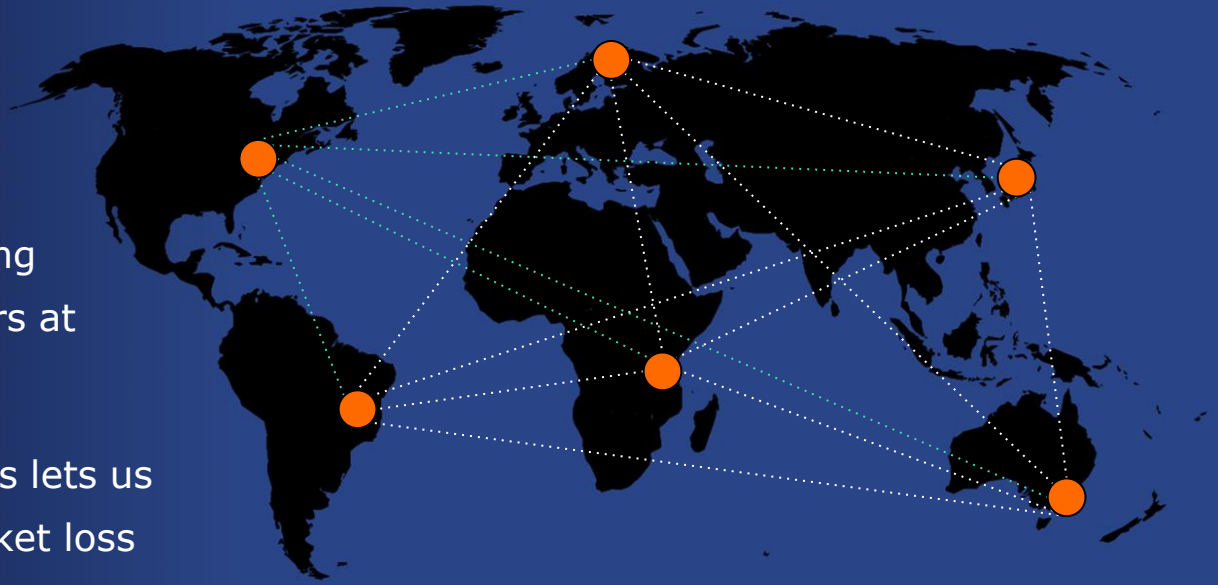
# Measuring damage with RIPE Atlas

## 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

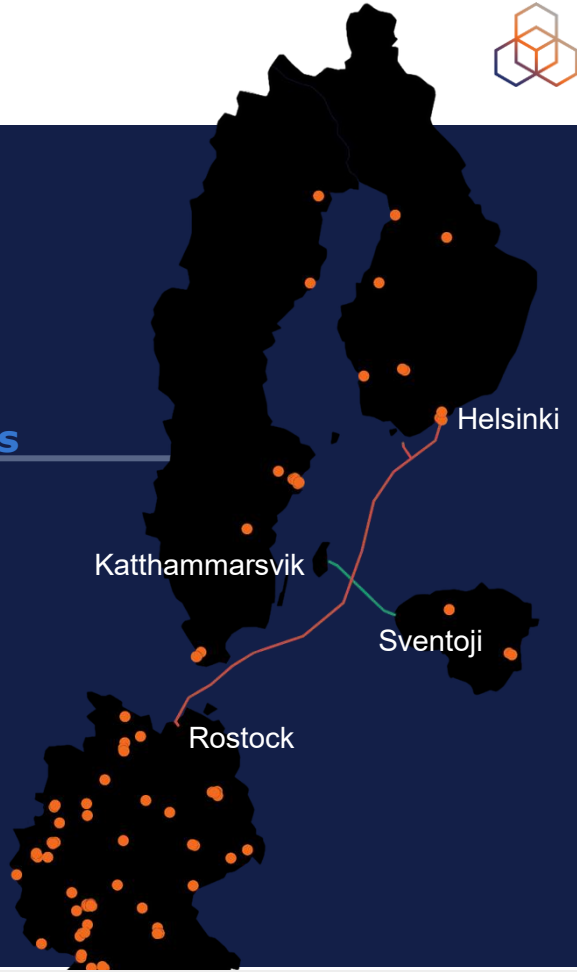
## 17-18 November

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 |



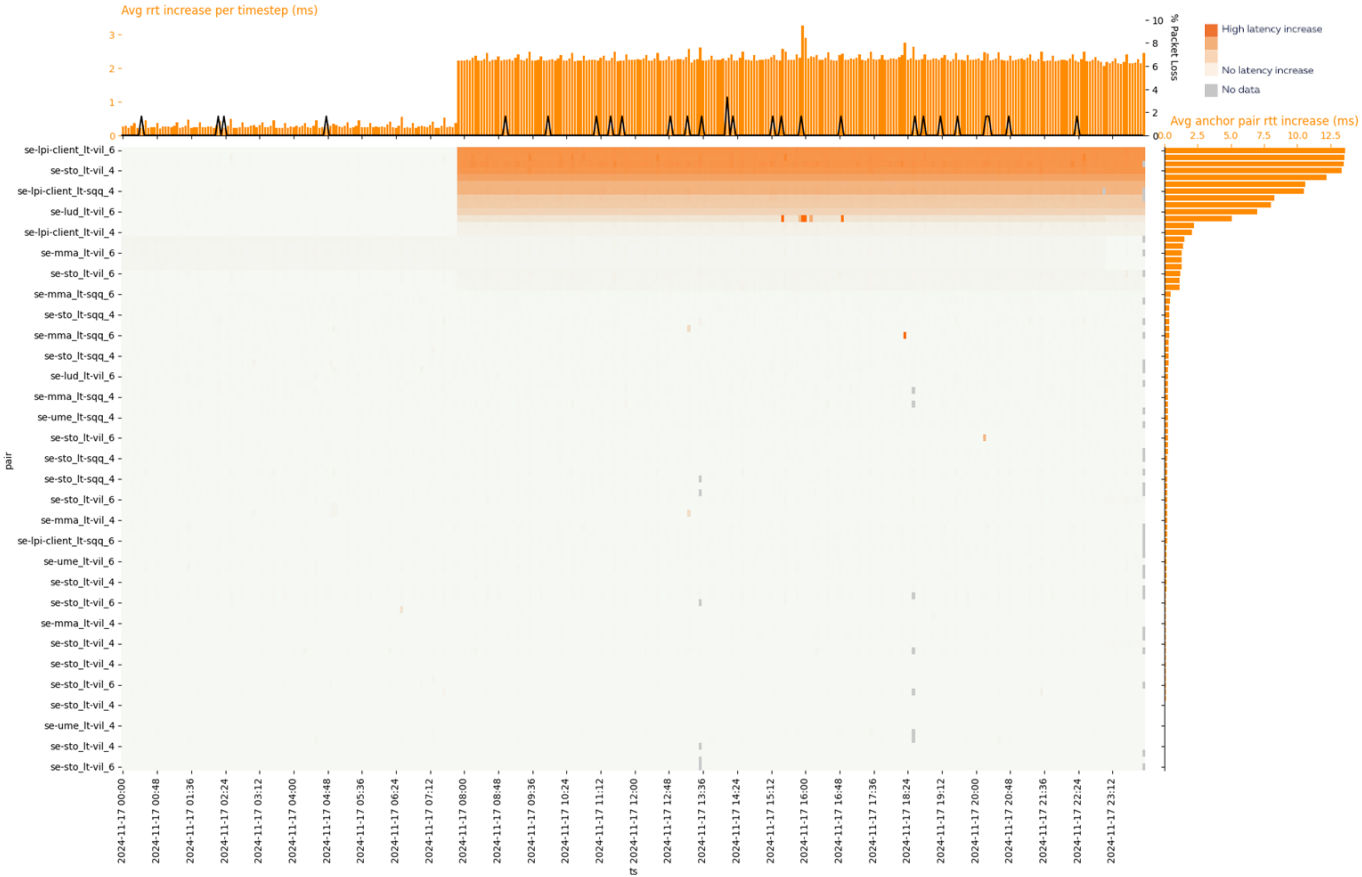
# BCS East West

## Latency shift

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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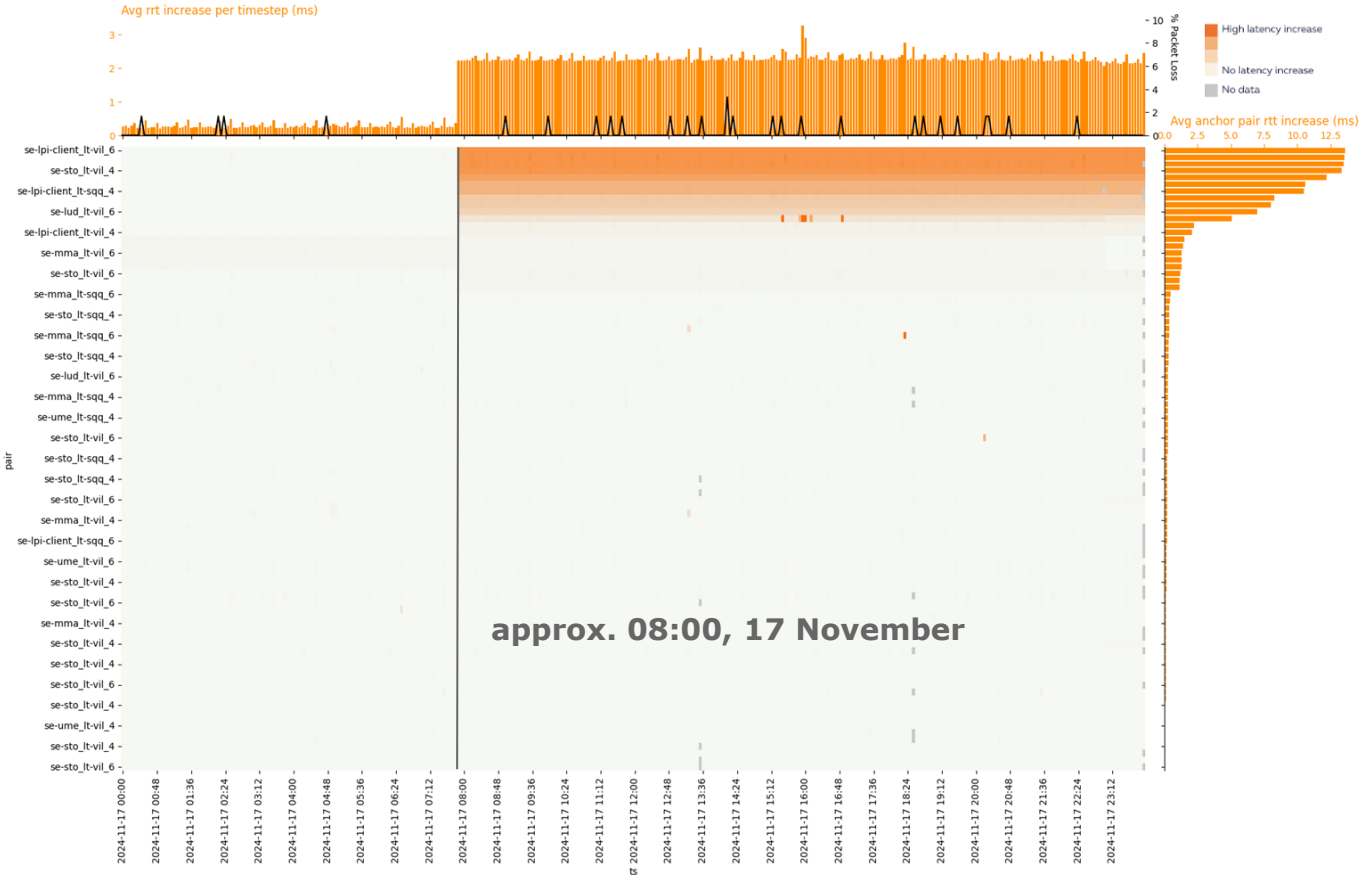
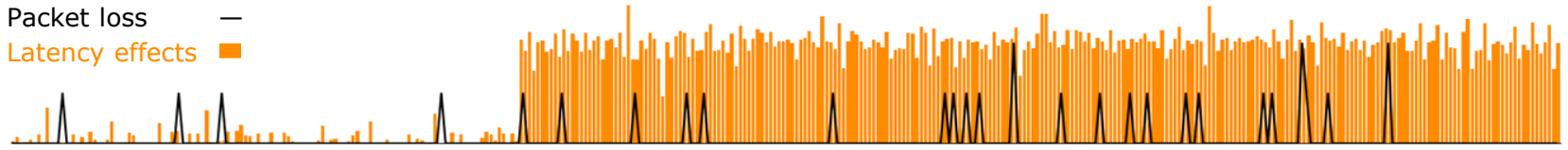


# BCS East West

## 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)

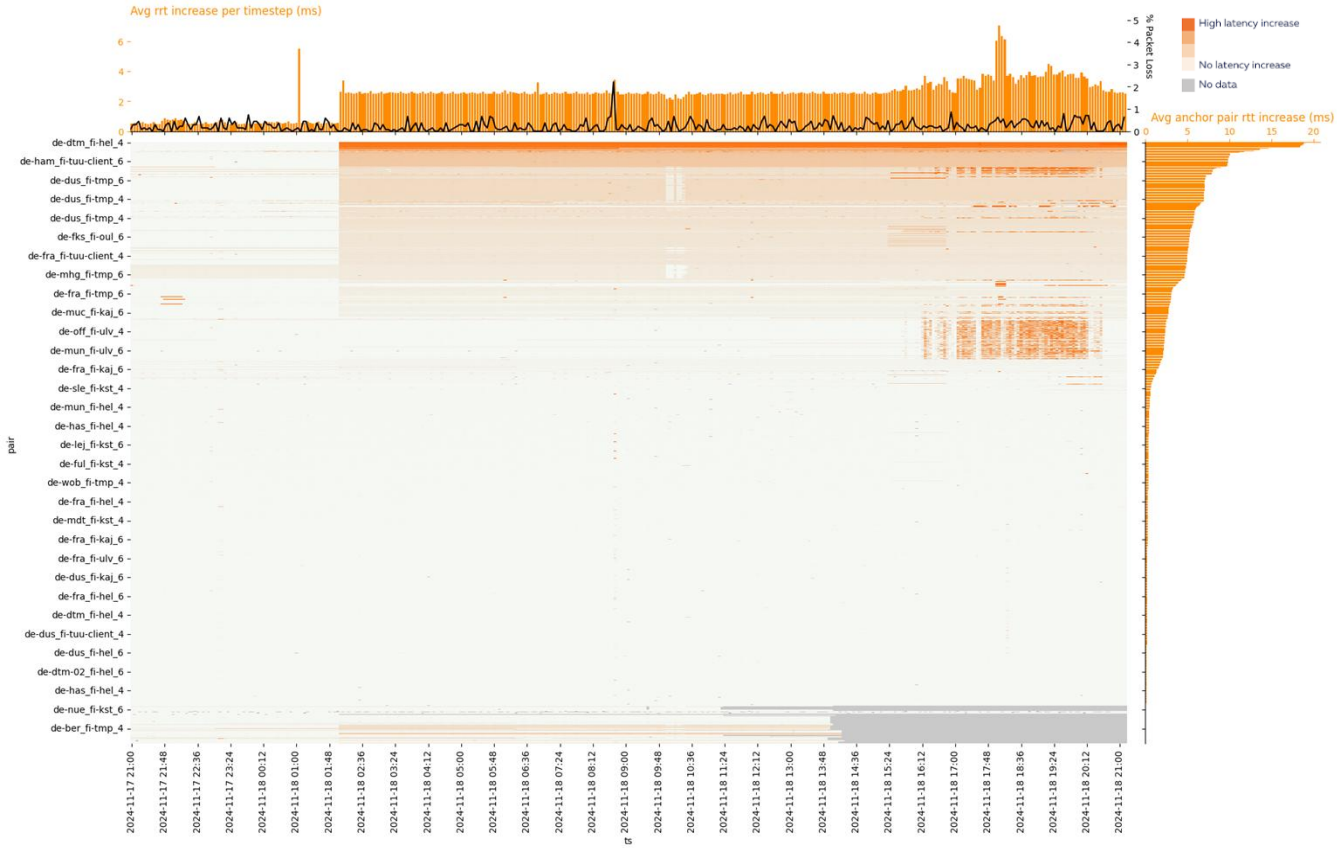
# C-LION1

## 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



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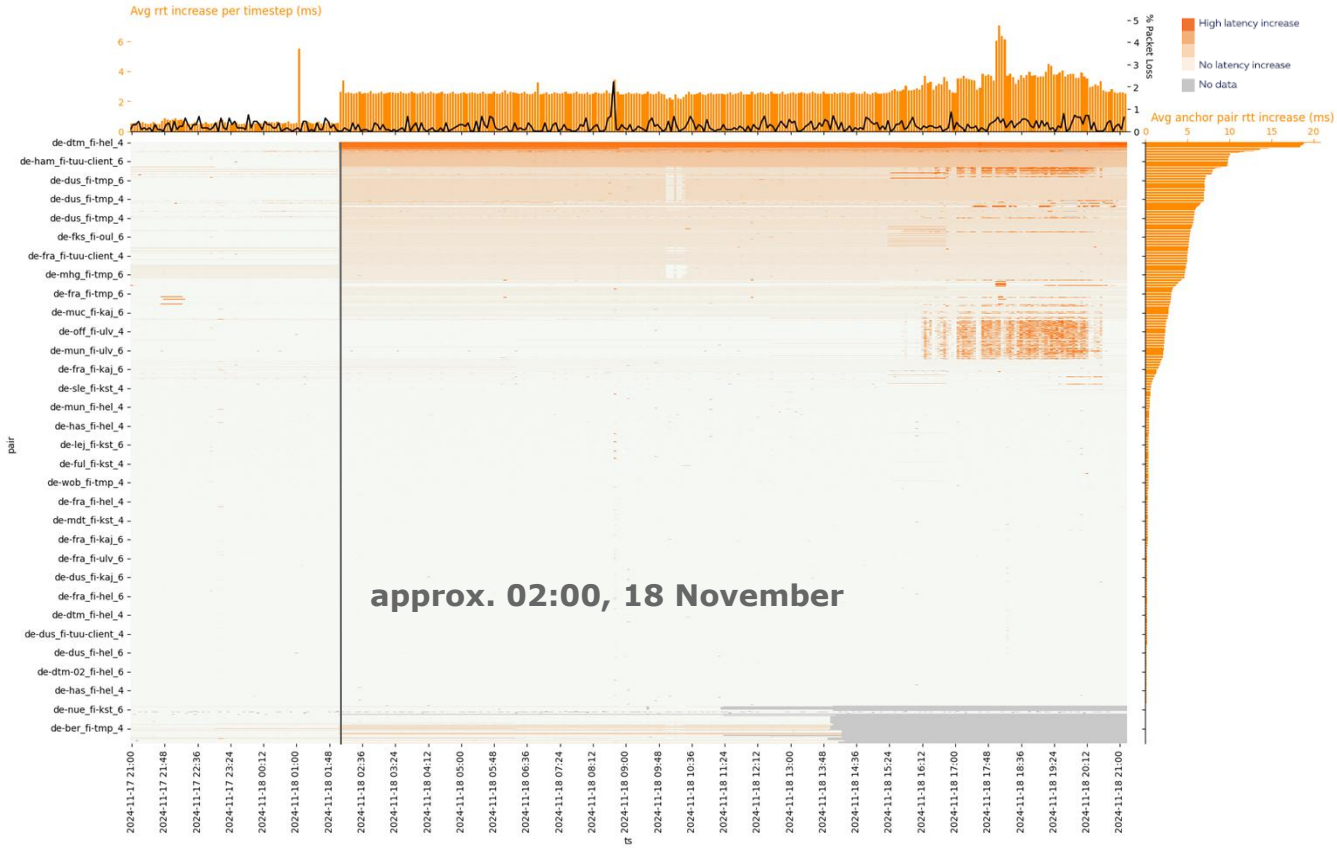
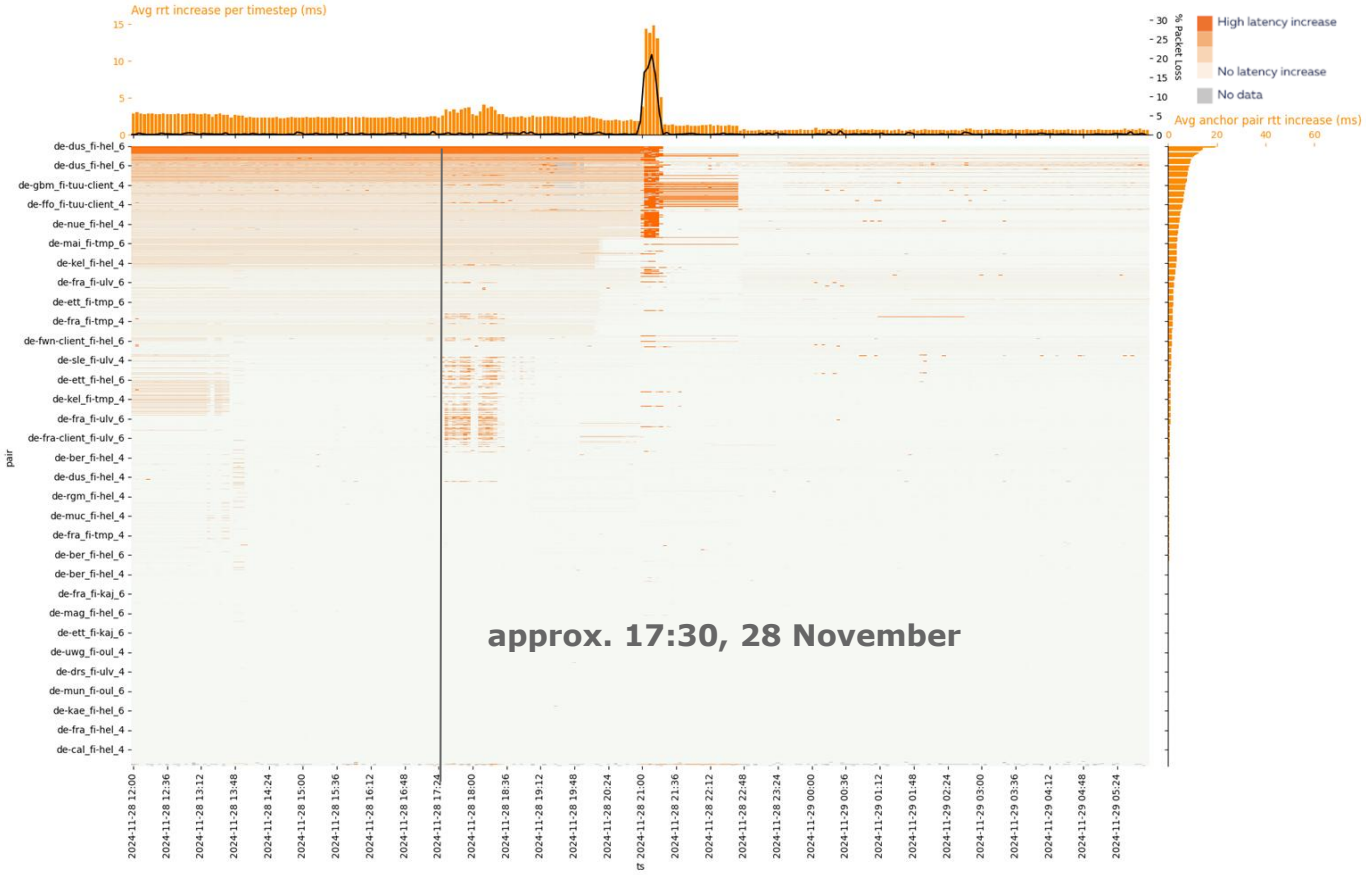


# C-LION1 repair

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

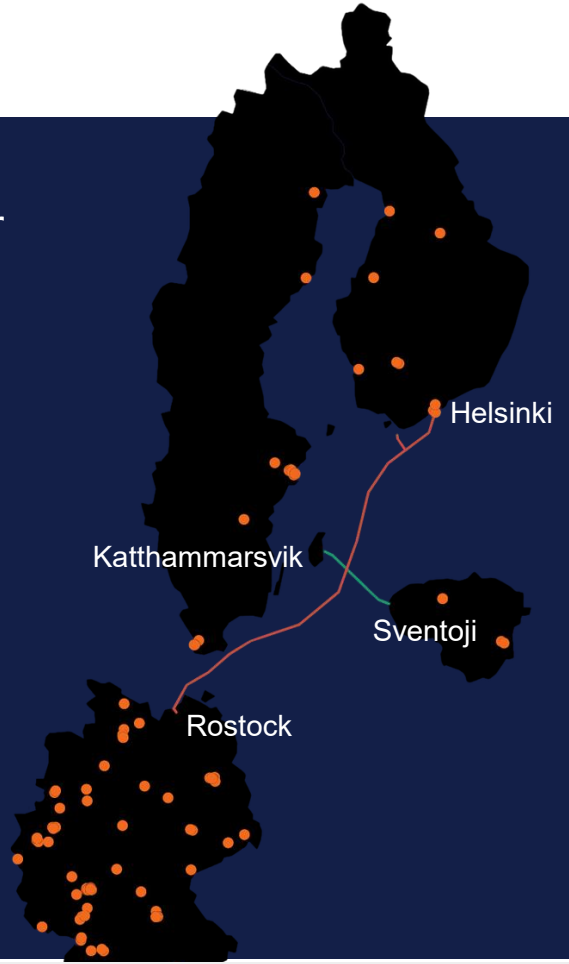
*Unclear what exactly causes these latency effects and the temporary increase in packet loss…*



# 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



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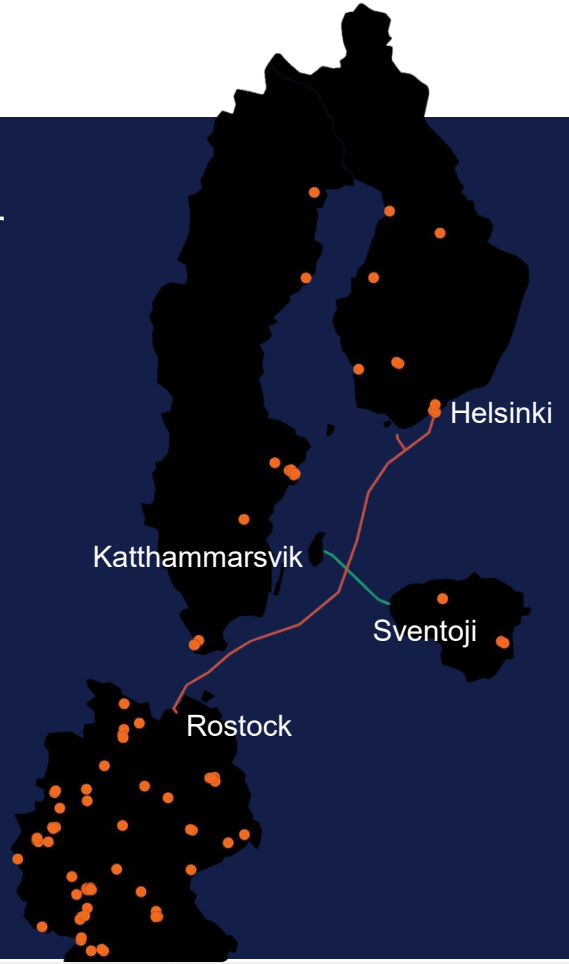
**The Internet routed around damage!**

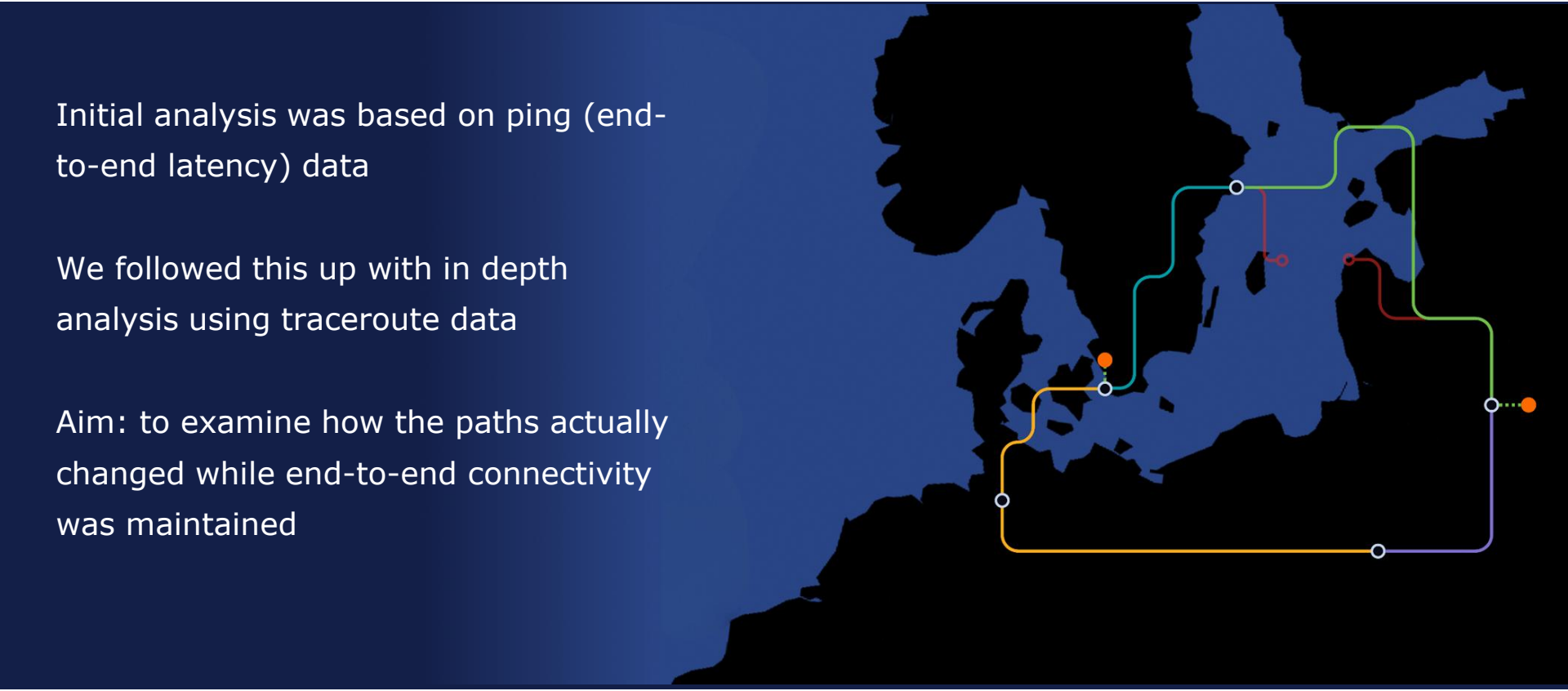


# Deeper dive

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:**

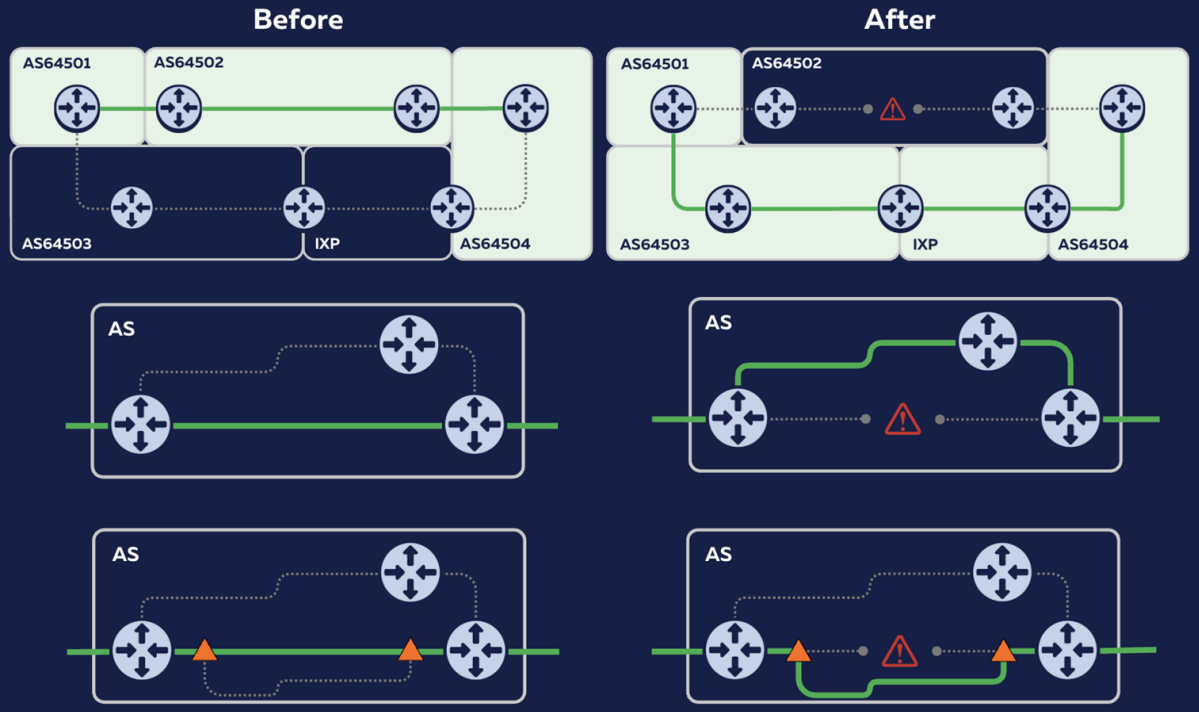
Traffic rerouted through alternative ASes/IXPs (eBGP routing protocol)

**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)

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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

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# THANK YOU!