



OPTICAL FIBER CABLE REDUNDANCY IN GEOPOLITICAL CHALLENGING TIMES

September 10th, 2024 – NDN Bergen



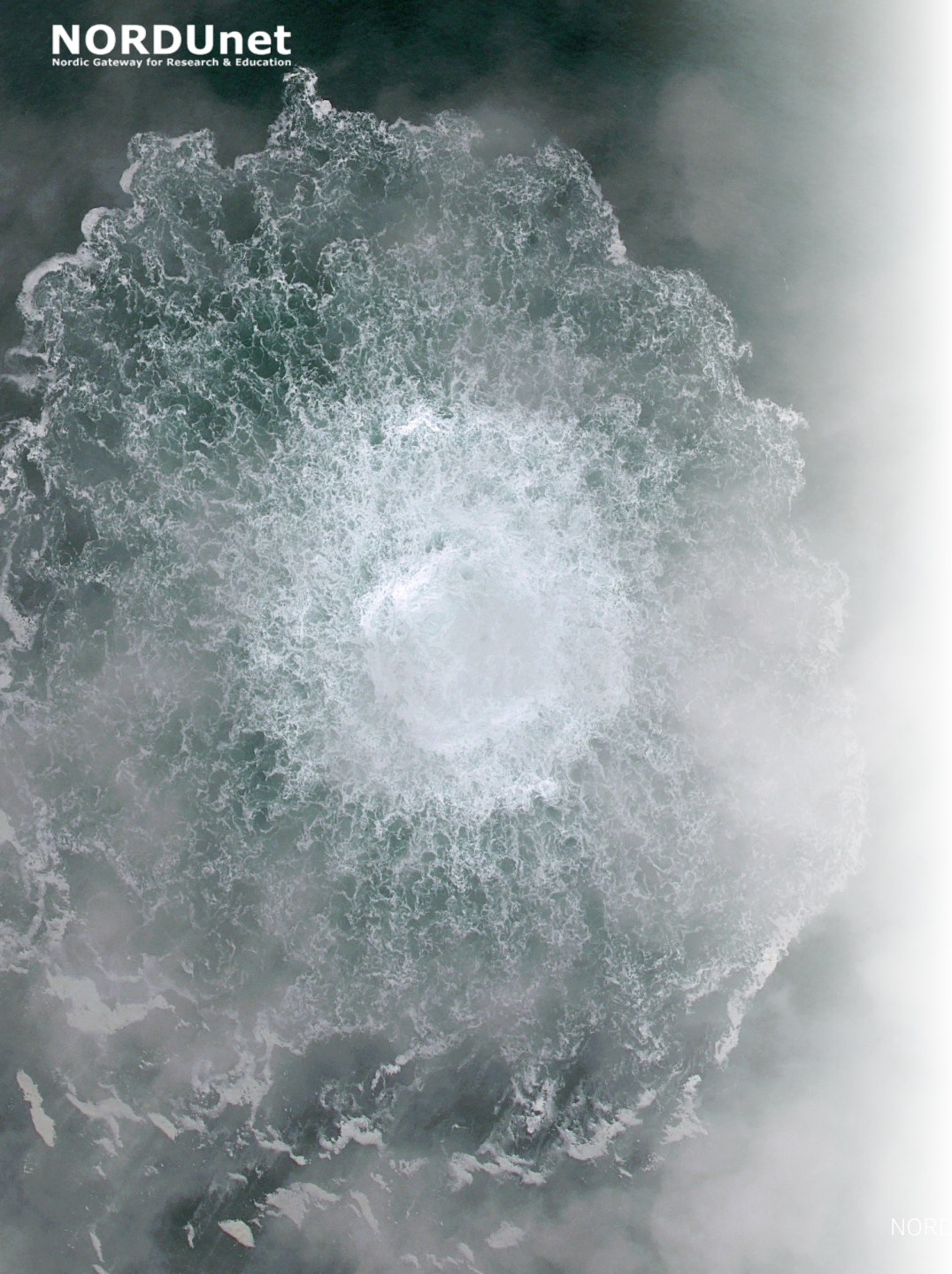


WHAT HAVE WE SEEN?

- 'Human activity' behind Svalbard cable disruption
- Subsea cable and pipeline in Baltic Sea damaged in possible act of sabotage
- A Mystery of Deep-Sea Sabotage Unfolds in Norway



WHAT HAVE WE DONE?





NORDUNET CONFERENCE 2018

ABOUT THE NORDUNET NEXT GENERATION OPTICAL NETWORK









NEXTGEN NETWORK OBJECTIVES

- Accommodate ladder architecture
- Adding real geographic redundancy out of Norway
- Adding redundancy N+2(3)
- *Have topology protect against major city or regional infrastructure outages*

Redundancy to support "100% availability" starts with the number 3



$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$\int (2x + 4) dx = 3x^3 + x^2 + 4x + C \Big|_0^3 = 102$$

$$e^{x+iy} = e^x (\cos y + i \sin y)$$

NEXTGEN NETWORK OBJECTIVES

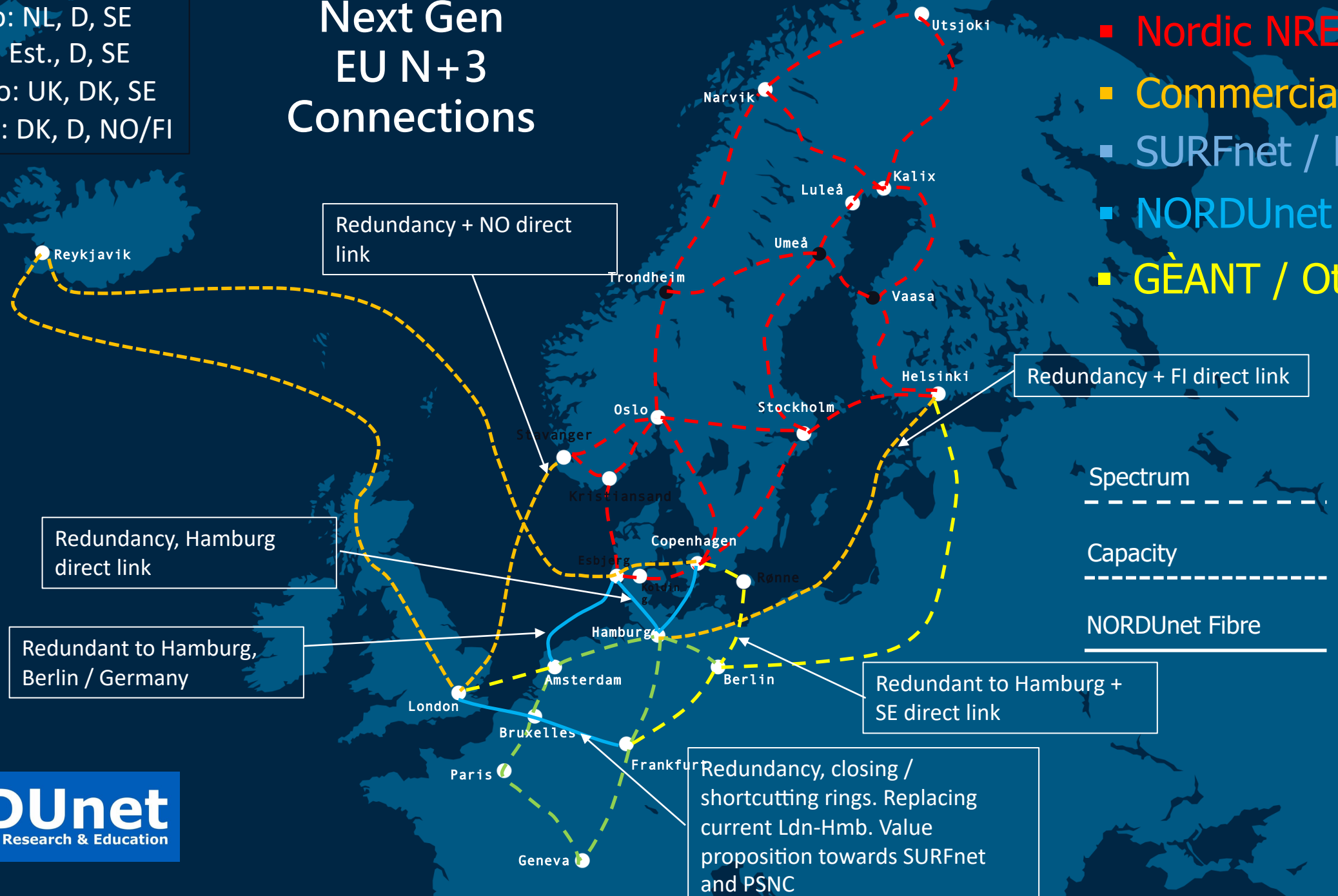
- Have one link from each NREN to Europe not touching any other Nordic NREN
- Using NREN spectrum where technically possible

Redundancy to support "100% availability" starts with the number 3

DK connects to: NL, D, SE
 FI connects to: Est., D, SE
 NO connects to: UK, DK, SE
 SE connects to: DK, D, NO/FI

Next Gen EU N+3 Connections

- Nordic NREN's
- Commercial
- SURFnet / PSNC
- NORDUnet
- GÉANT / Other



Redundancy + NO direct link

Redundancy + FI direct link

Redundancy, Hamburg direct link

Redundant to Hamburg, Berlin / Germany

Redundant to Hamburg + SE direct link

Redundancy, closing / shortcutting rings. Replacing current Ldn-Hmb. Value proposition towards SURFnet and PSNC

Spectrum

 Capacity

 NORDUnet Fibre





▪ **Nordic NREN's**

▪ **Commercial**

▪ **SURFnet / PSNC**

▪ **NORDUnet**

▪ **GÉANT / Other**

Spectrum

Capacity

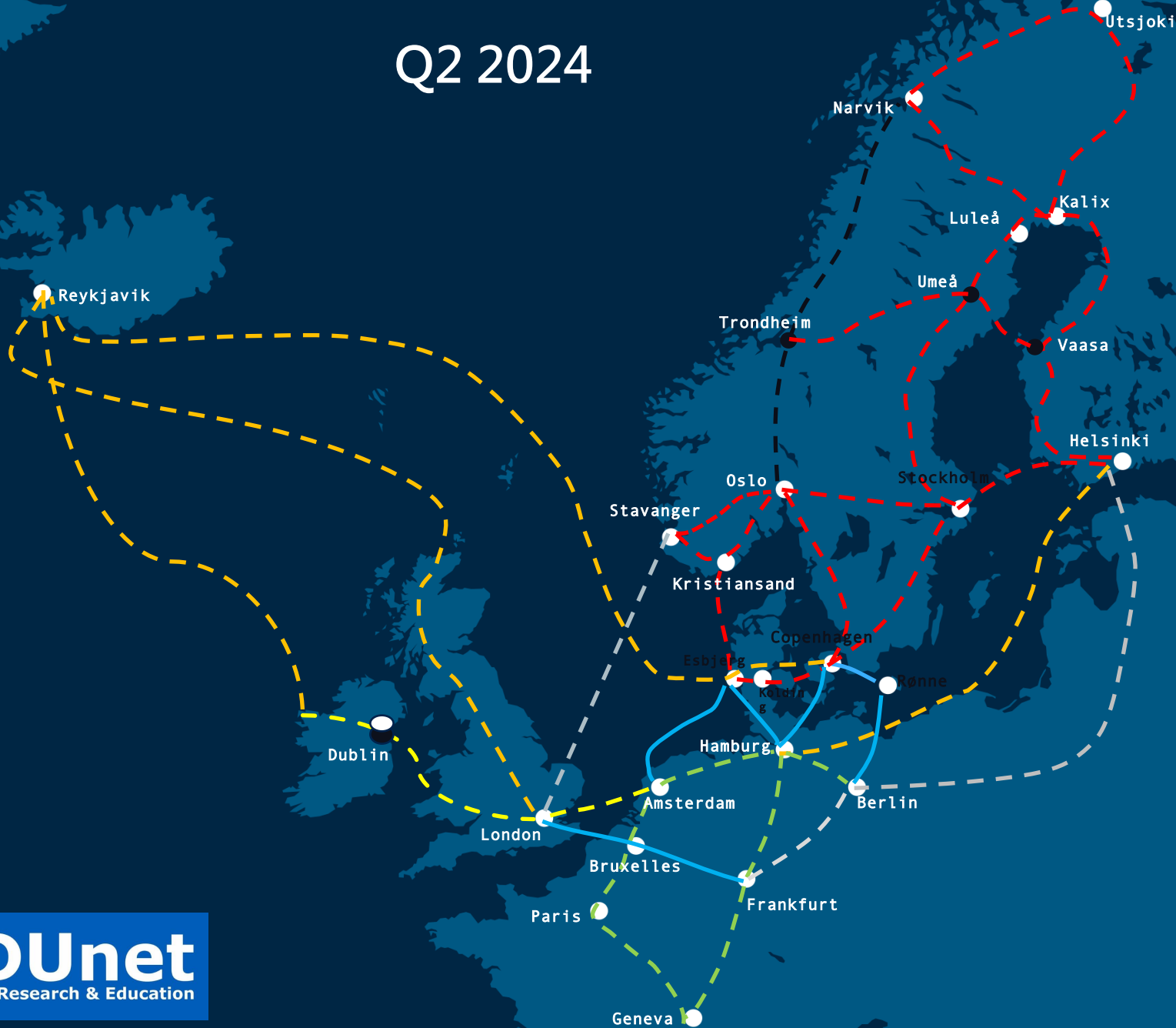
NORDUnet Fibre

NORDUnet
Nordic Gateway for Research & Education

"Q3-2021"

Q2 2024

- Nordic NREN's
- Commercial
- SURFnet / PSNC
- NORDUnet
- GÉANT / Other



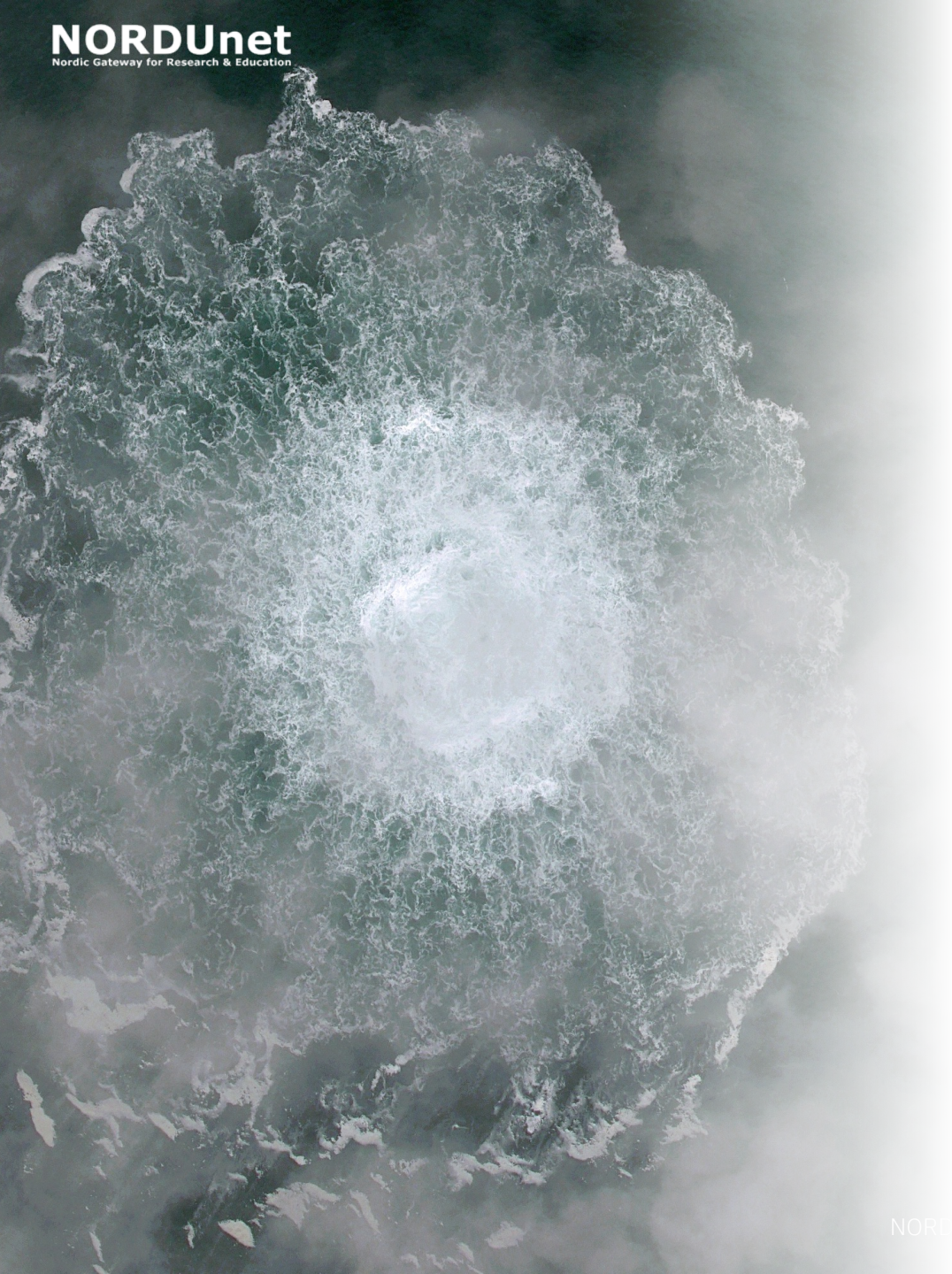
Spectrum

Capacity

NORDUnet Fibre



WHAT CAN WE DO?





$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\int_0^3 (2x + 4) dx = 3x^2 + x^2 + 4x + C \Big|_0^3 = 102$$

$$e^{x+iy} = e^x(\cos y + i \sin y)$$



NDN 2024



Partner locations



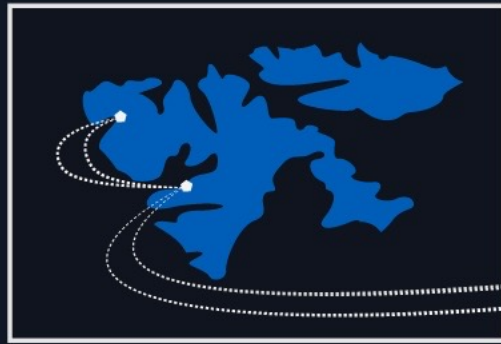
Capacity / spectrum



NDN Fibre footprint



NORDUnet NORDIC NETWORK



 Sikt


SUNET

FUNET

 DeiC

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THANK YOU!

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