

Interconnection in the Nordics

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The Nordics



Scandinavia explained:

<https://youtu.be/TsXMe8H6iyc>

Agenda

- The Connectivity
 - How to connect.
- The Markets
 - Who to connect with.
- The Datacentres and IXPs
 - Where to connect.

The Countries

- Denmark
- Sweden
- Norway
- Finland
- Iceland

Self-governing regions:

- Greenland (Denmark)
- Faroe Islands (Denmark)
- Åland (Finland)

Country Overview

And top broadband-operators / incumbents

Denmark	Sweden	Norway	Finland	Iceland	Greenland	Faroe Islands	Åland
							
Copenhagen	Stockholm	Oslo	Helsinki	Reykjavik	Nuuk	Torshavn	Mariehamn
5,7M	9,9M	5,2M	5,5M	300K	56K	50K	26K
.dk	.se	.no	.fi	.is	.gl	.fo	.ax
Lego	IKEA	Fjords	Lakes	Geysers	Polar bears	Tunnels	Kurtis!
TDC	Telia	Telenor	Sonera/ Elisa	Siminn	Tele- Greenland	Faroese Telecom	

Highlights

Or "Where to PoP?"

- **Stockholm**

- Interconnection hub of the Nordics
- Lots of russian carriers peering here



- **Copenhagen**

- Gateway to the Nordics
- 40% of swedes live closer to Copenhagen than to Stockholm



- **Helsinki**

- Gateway to the east (Russia, China and the baltics)



- **Reykjavik**

- Free power and cooling
- Expensive connectivity



The Connectivity in Scandinavia+Finland

Main routes:

- Copenhagen-Stockholm-Oslo-triangle
- Copenhagen-Hamburg
- Stockholm-Helsinki-Tallinn-Stockholm

Caveats:

- Copenhagen choke-point. (5km)

Alternatives:

- Stockholm-Gothenburg-Hamburg
- Oslo-Kristiansand-Hamburg
- Helsinki-Moscow
- Helsinki-Talinn-Warsaw

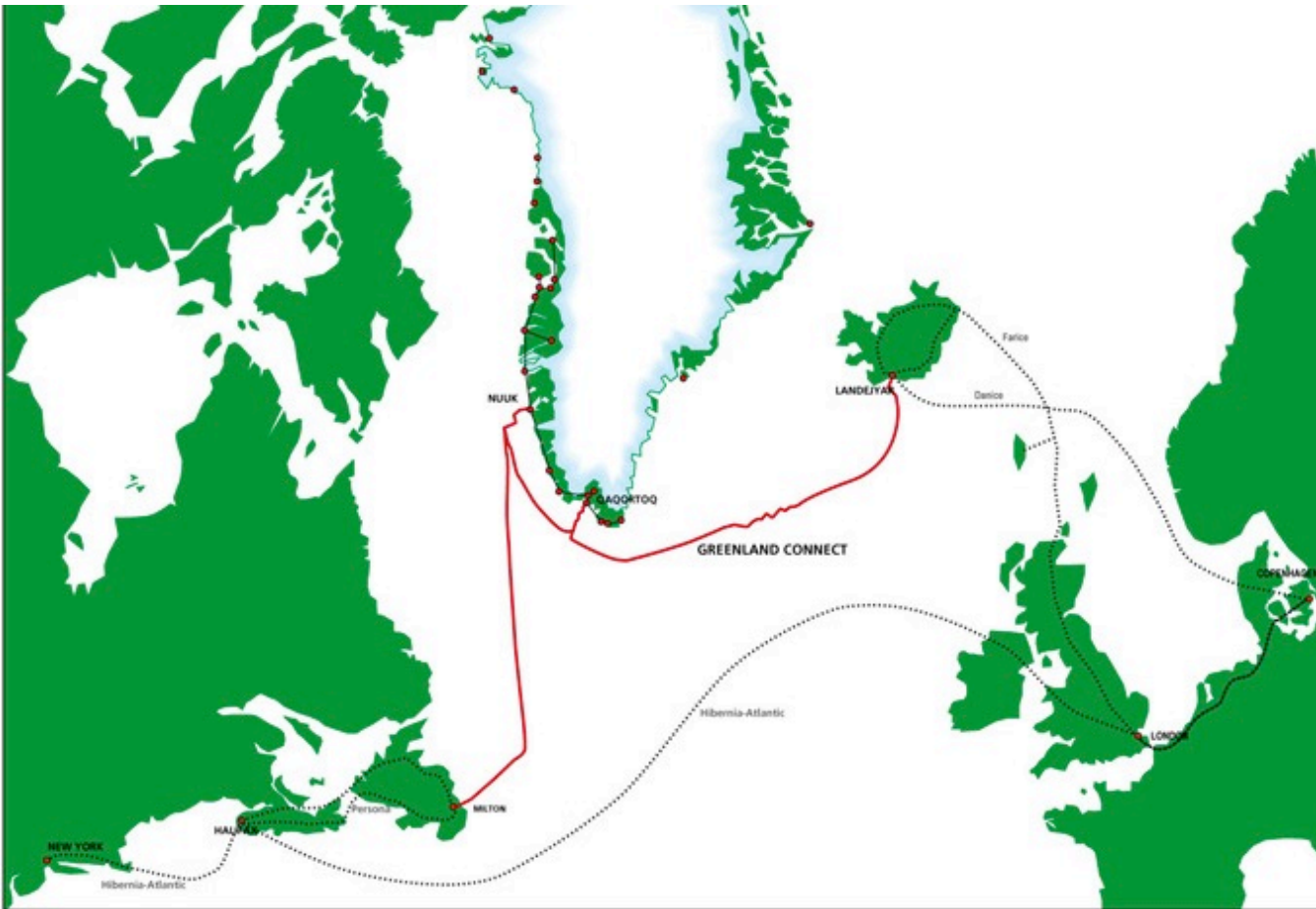
New developments (sea-cables):

- C-LION; Helsinki-Rostock
- Denmark – United Kingdom

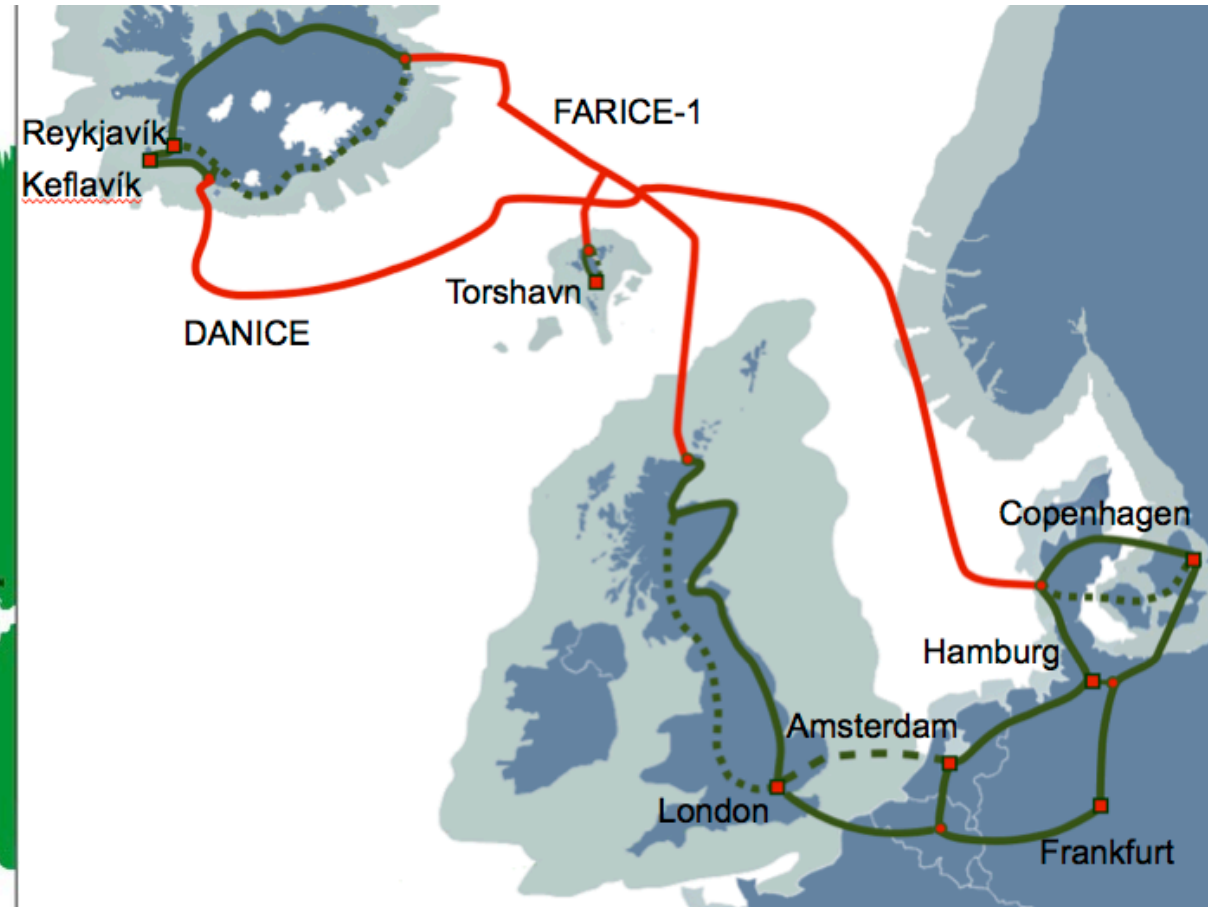


The connectivity - Atlantics

- **Greenland connect**



- **FARICE**



The Markets

Residential broadband subscriptions (incl. mobile broadband)

Denmark 	Sweden 	Norway 	Finland 
Copenhagen	Stockholm	Oslo	Helsinki
5,7M	9,9M	5,2M	5,5M
.dk	.se	.no	.fi
Lego	IKEA	Fjords	Lakes
TDC (AS3292) 	Telia (AS3301) (part of AS1299) 	Telenor (AS2119) 	Elisa (AS6667)
Stofa (AS39642)	Telenor (AS2119) 	GET (TDC) (AS41164) (part of AS3292) 	Sonera (AS1758) (part of AS1299) 
Telenor (AS9158) (part of AS2119) 	Tele2 (AS1257)	NextGenTel (AS15659)	DNA (AS16086)
Telia (AS3308) (part of AS1299) 	3 (AS44034)	Altibox (AS29695)	Finnet (AS47605)
	ComHem (AS39651) 		

The Markets

Notable aggregators - local wholesale IP transit-providers

Denmark 	Sweden 	Norway 	Finland 
Copenhagen	Stockholm	Oslo	Helsinki
5,7M	9,9M	5,2M	5,5M
.dk	.se	.no	.fi
Lego	IKEA	Fjords	Lakes
TDC (AS3292) 	Telia (AS3301) (part of AS1299) 	Telenor (AS2119) 	Elisa (AS6667)
Nianet (AS31027)	IP-only (AS12552)	TDC (AS3292) 	Sonera (AS1758) (part of AS1299) 
GlobalConnect (AS9158)	Bahnhof (AS8473)	Broadnet (AS15659)	DNA (AS16086)
Telia (AS3308) (part of AS1299) 	TDC (AS3292) 		Finnet (AS47605)
	Bredband2 (AS29518)		

IXPs and datacentres

Copenhagen



IXPs:

- COMIX (COpenhagen/Malmö Internet eXchange)
 - Operated by Netnod
 - InterXion CPH, GlobalConnect, Telia Telehouse, Malmö/B, Malmö Vestergatan
 - ~40 networks, ~55G, increasing
 - Fun fact: 40% of swedes live closer to Copenhagen than to Stockholm
- DIX (Danish Internet eXchange point)
 - Operated by the Technical University
 - Locations: Lyngby, InterXion CPH, Skanderborg
 - 44 networks, ~70G, declining/stable

Datacentres:

- InterXion CPH
 - Known operational level and quality
 - Not on the direct fiber-path for international connectivity
- GlobalConnect – Hørskæppen
 - Aggregation-point for (almost) all small local networks.
 - On direct international fiber-paths.
 - No remote-hands-service.
- Telia Telehouse – Sydvestvej
 - The legacy telco-site
 - Where most international fiber lands.
 - Almost(?) completely full

Local Datacentres and IXPs



Stockholm

IXPs:

- Netnod Stockholm
 - Two LANs – mandatory to connect to both
 - *"Why sell one port, when you can sell two at double the price"*
 - About 1100 Gbps across both LANs
 - Participants from Russia, Finland and the Baltics
- STHIX
 - Independent IXP in Stockholm
- Netnod COMIX
 - Copenhagen/Malmö metro-region
 - Participants from Denmark and Sweden
 - Fun fact: *"40% of Swedes live closer to Copenhagen, than to Stockholm"*
- Netnod Gothenburg, Sundsvall, Luleå
 - Local participants

Datacentres:

- InterXion Stockholm, Kista
- TeleCity Stockholm 1, Bromma
 - Both sites are equally popular
 - ~10 km apart
 - Local Netnod presence (WDM) in both
- TeleCity Stockholm 2, Sköndal
 - Far south of Stockholm – no cross-campus cross-connects, 20+ km
- Digiplex, Upplands Väsby
 - Up and coming.

Local Datacentres and IXPs



Oslo

IXPs:

- The University of Oslo runs six IXPs:
 - NIX1, Oslo
 - 60 Gbps
 - NIX2, Oslo
 - 10 Gbps
 - Also in Bergen, Trondheim, Stavanger and Tromsø – mainly relevant for local carriers trying to reduce latencies in a vast country
- Bulk is threatening to start a new IXP in HMG9

Datacentres:

- Digiplex, Ulvenveien (aka. "Ulven", The Wolf)
 - Well connected with lots of local providers.
- Bulk Infrastructure, Hans Møller Gassmansvei 9 (aka. HMG9)
 - Well connected with lots of local providers.
 - New owner with fantastic/fanatic visions causing uncertainties about future pricing.
 - Some local providers looking to vacate.
- Vault, Økernveien

Local Datacentres and IXPs

Helsinki



IXPs:

- FICIX2, Helsinki
 - 26Gbps
- FICIX1, Espoo (suburbs of Helsinki)
 - 10Gbps

Regional exchanges:

- FICIX3, Oulu
- TREX, Tampere

Datacentres:

- Telecity, Helsinki,
- Digita, Pasila
- Nebula, Kiviaidankatu
- Technopolis Innopoli (FICIX1)
 - legacy