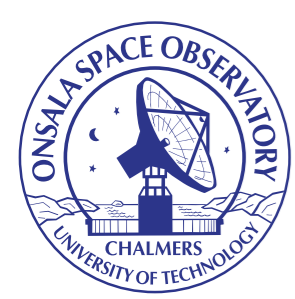


Connectivity at Onsala Space Observatory

Roger Hammargren

roger.hammargren@chalmers.se

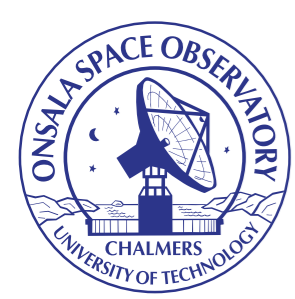


Now and the future of the SUNET Network (Swedish University NETwork)

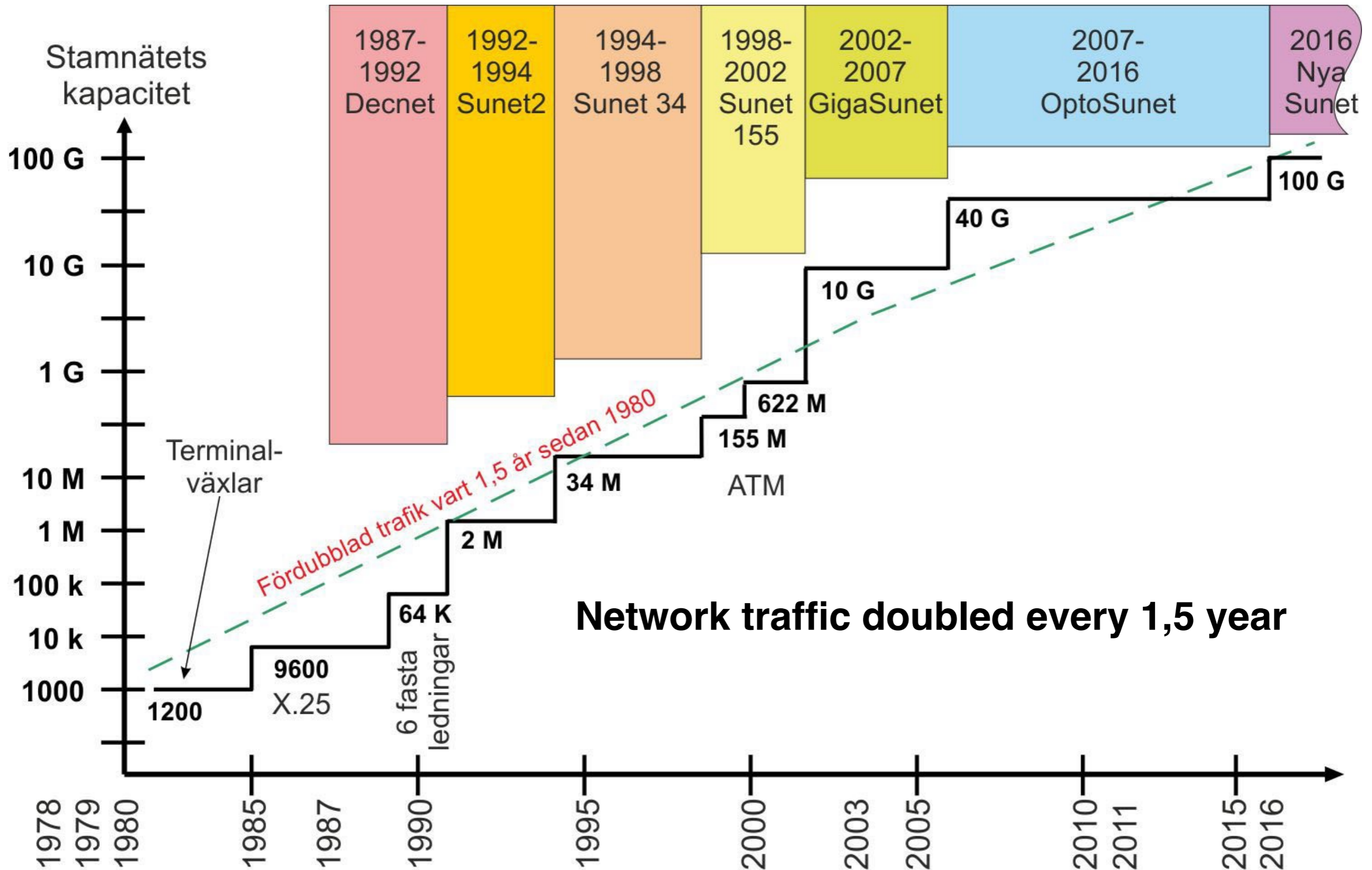
Future connectivity to Onsala

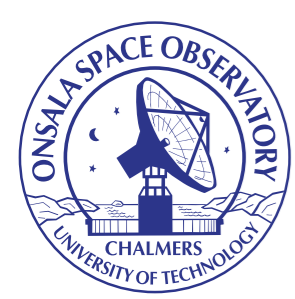
Equipment at Onsala

Local connectivity



Background



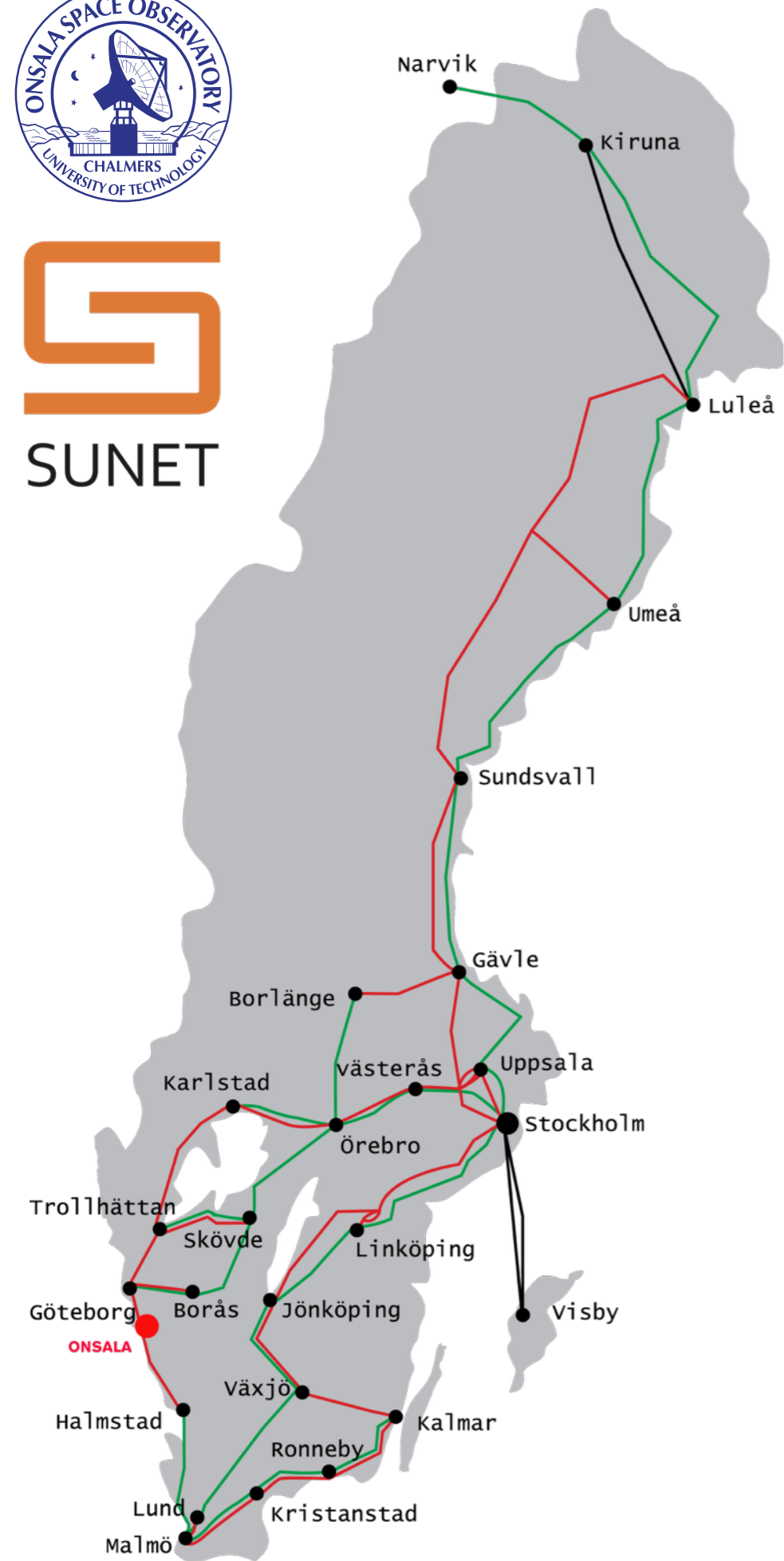


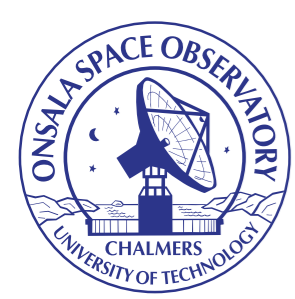
SWEDEN

and the backbone of Swedish University NETwork Today

OptoSUNET at 40G

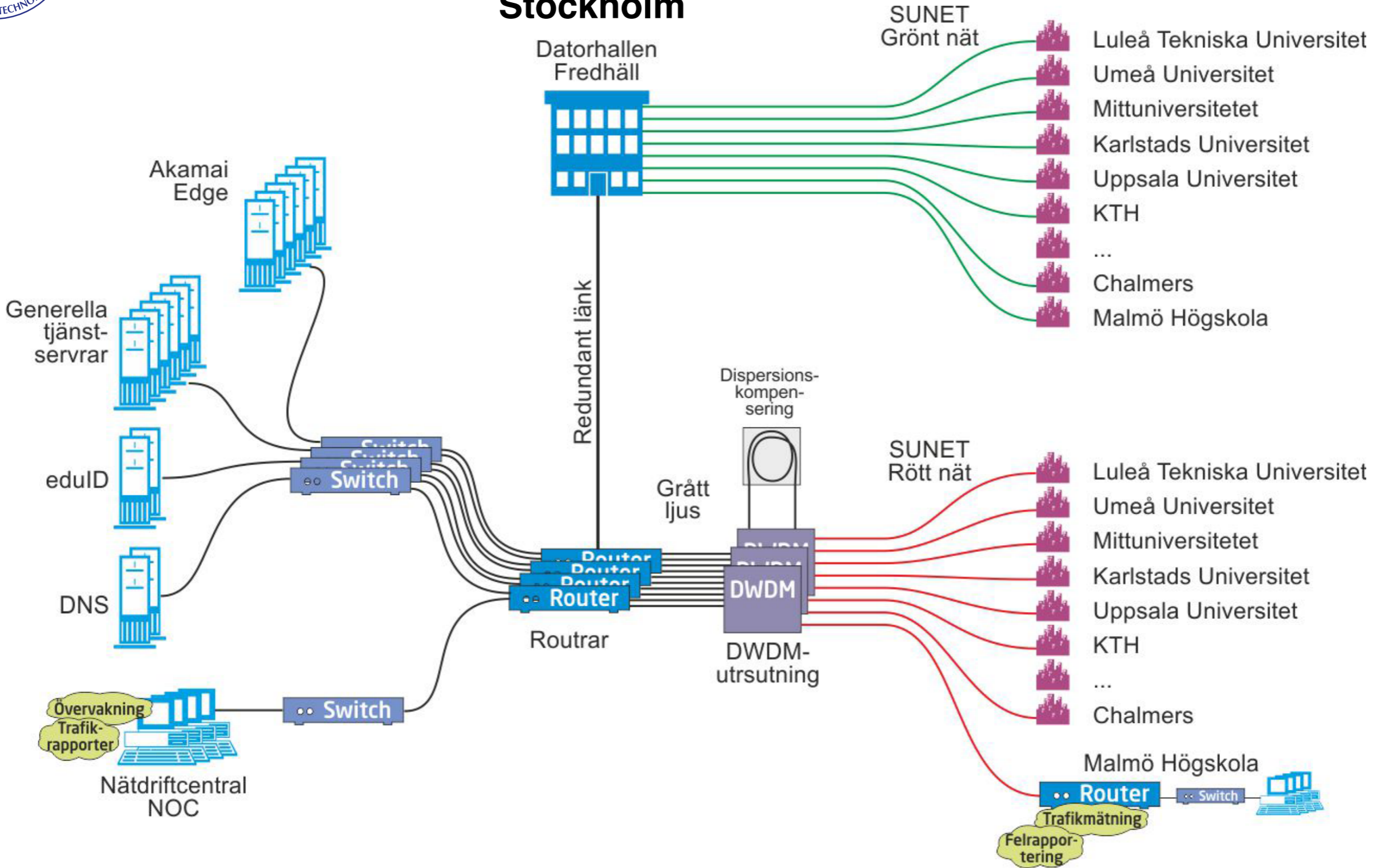
**Redundancy between most of the areas
(red and green network)**

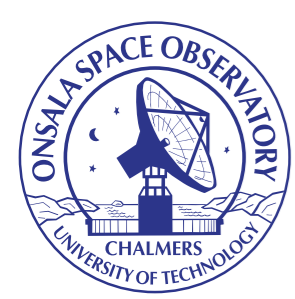




Drop off

Stockholm





Future

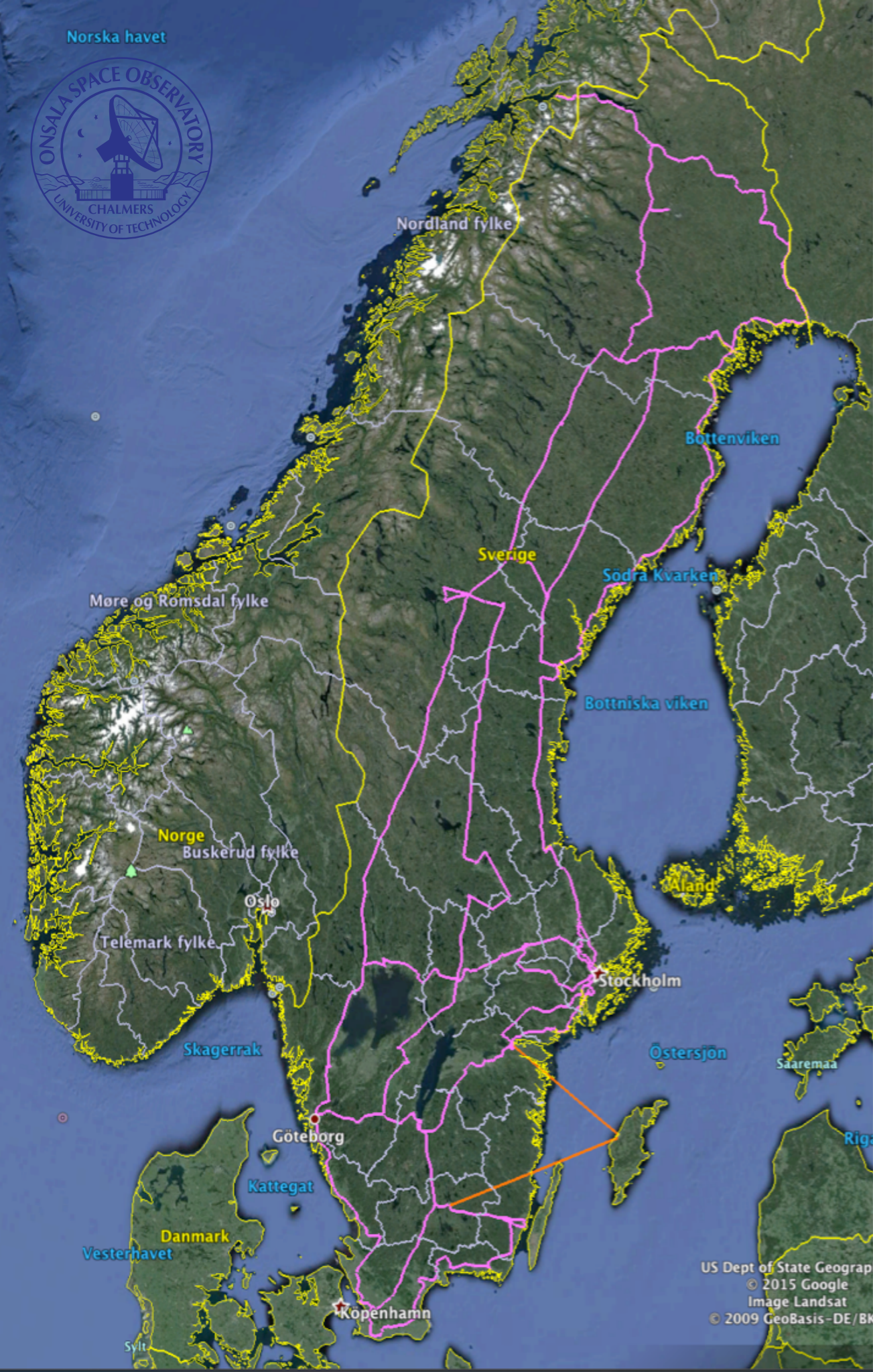
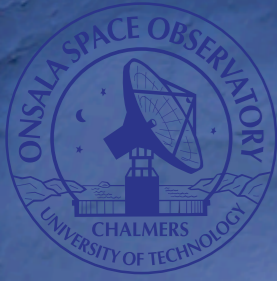
of



SUNET

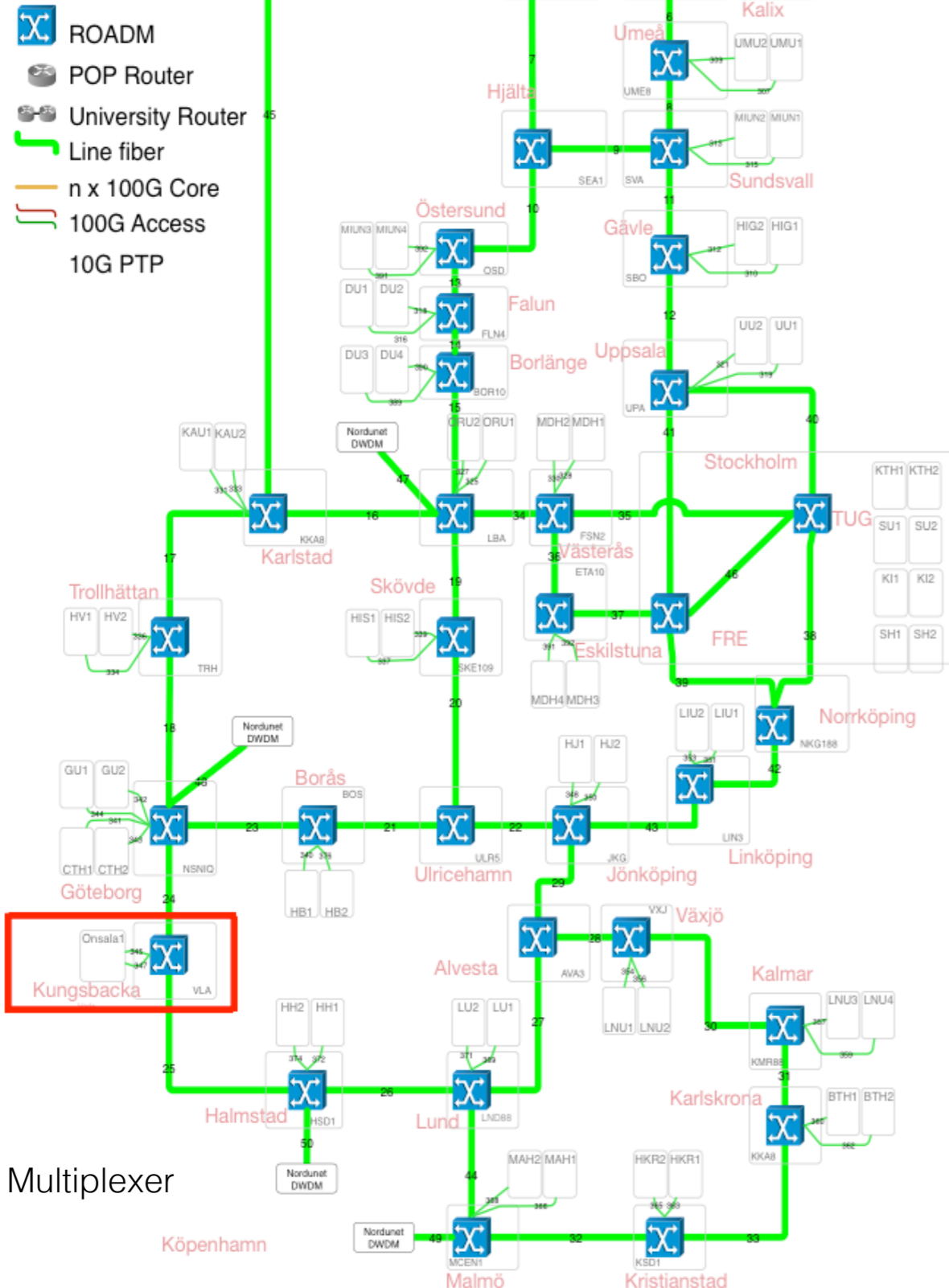
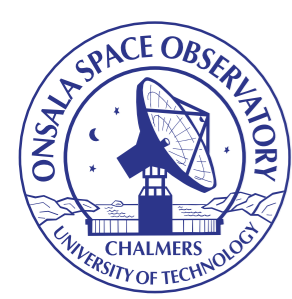
Why now? 10 years has passed since last procurement

Why Onsala? It's now or in 10 years (otherwise it will be at a much higher cost).



New topology

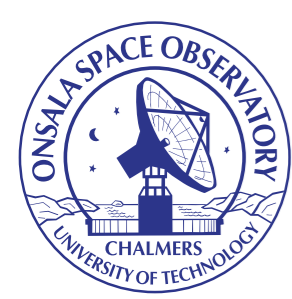
- 3 fiber paths to all regions
 - Redundancy on layer 3
 - Possibly also layer 1
- Fully Redundant Network
 - Separation between fiber paths [$>10\text{m}$]
- Desire for High Capacity Growth
- Support for Special Applications
 - Transfer of frequency of light
- Support both;
 - Router Connectivity
 - Dedicated High BW Pt-Pt Connectivity
- Cost Sensitive 10GE and 100GE
 - But also 1TE Ready



Optical Multiplexer

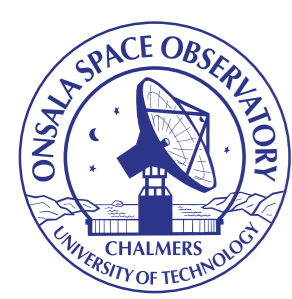
Optical

- ROADM site in each University city
- Four pure ROADM sites
 - No traffic drop there
- Interconnection with NORDUnet in several places
 - NORDUnet bypass Norway
 - ESS connectivity to Copenhagen
 - SUNET exit in Malmö/Copenhagen
- New node in Kungsbacka**
 - Connecting straight to Onsala



Optical equipment (what SUNET Buys)

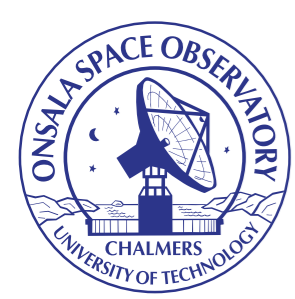
- Optical transmission equipment
 - 100 Gbit/s end to end in core.
 - Can later be upgraded, where needed, to 400 Gbit/s or 1 Terabit/s.
 - Communication nodes.
 - 36 core nodes (at telco sites etc.).
 - 29 university nodes.
 - 79 amplifier nodes ("in the middle of nowhere").
 - Installation.
 - Service, maintenance, spare parts.
 - Monitoring- and management system.
 - Service and maintenance until 2028



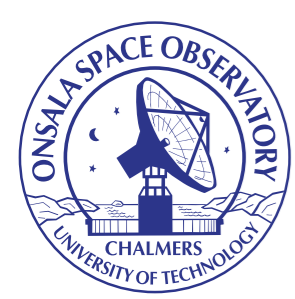
Handoff at the universities

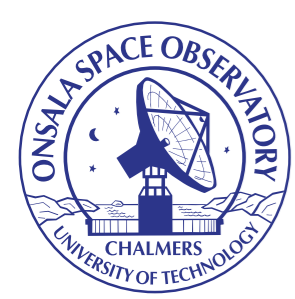
- 2 routers, 100GE-capable
 - Contains 10 x 10GE-ports day 1.
 - Each of them can support up to ~200 x 10GE.
 - Or a combination of 40/100G.
 - Can be upgraded even more (exchange of chassis).



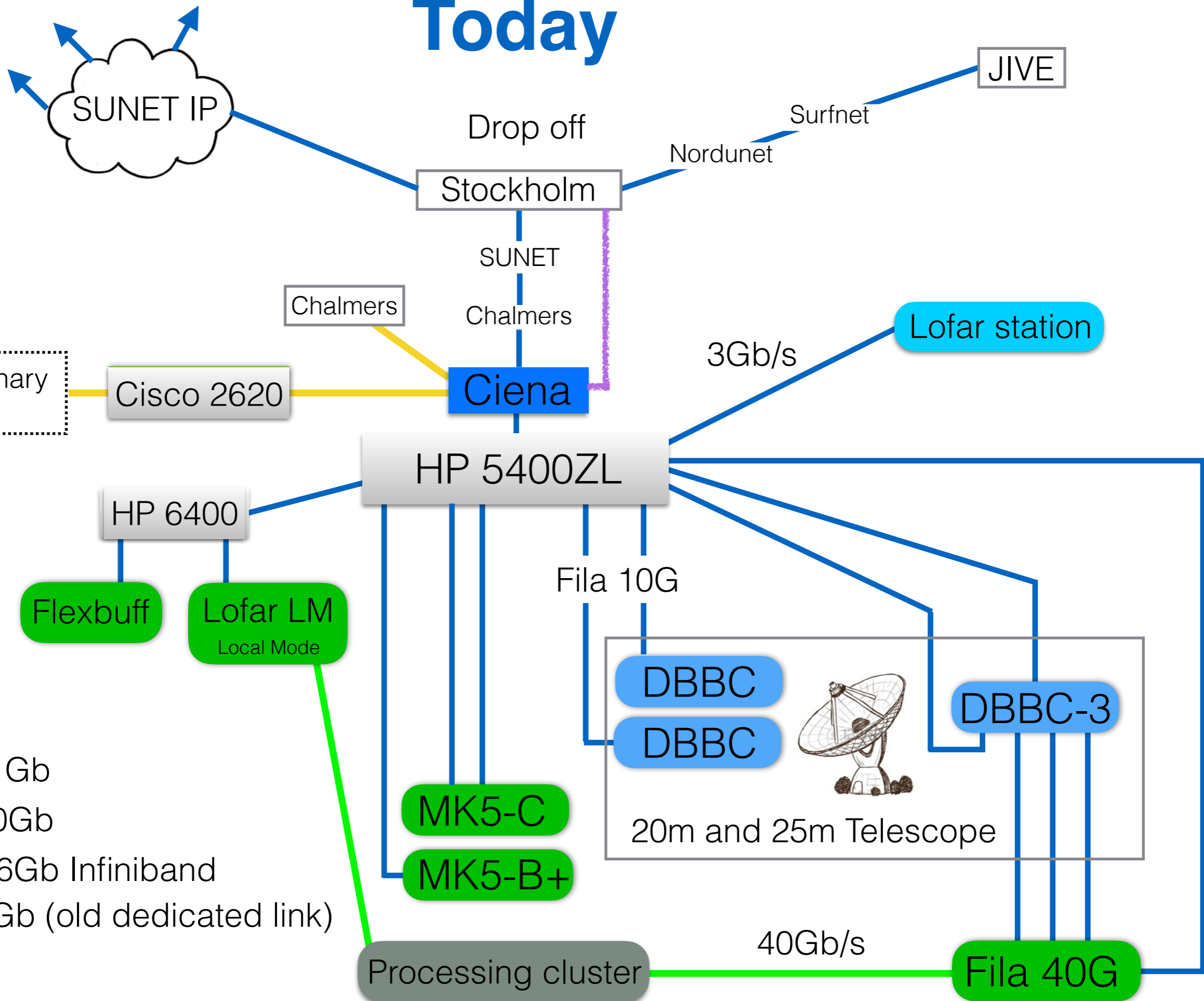


**What to do with all this
bandwidth?**



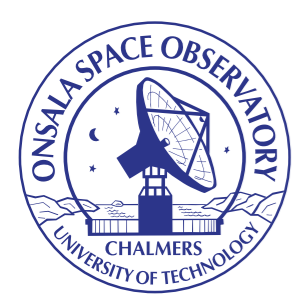


Today



Onsala Ordinary network

- 1Gb
- 10Gb
- 56Gb Infiniband
- 1Gb (old dedicated link)



Flexbuff

Flexbuff

Main Chassie: Supermicro 847A-R1400LPB

Motherboard: Asus P9X79 Deluxe

i7-3820 16GB RAM

2x Adaptec ASR-71605E (16 internal ports SAS2)

20 x 2TB Seagate Barracuda Green ST2000DL003

4 x 3TB Western Digital AV-GP WD30EURS

3 x 4TB HGST DeskStar 7K4000 HDS724040ALE640

64TB

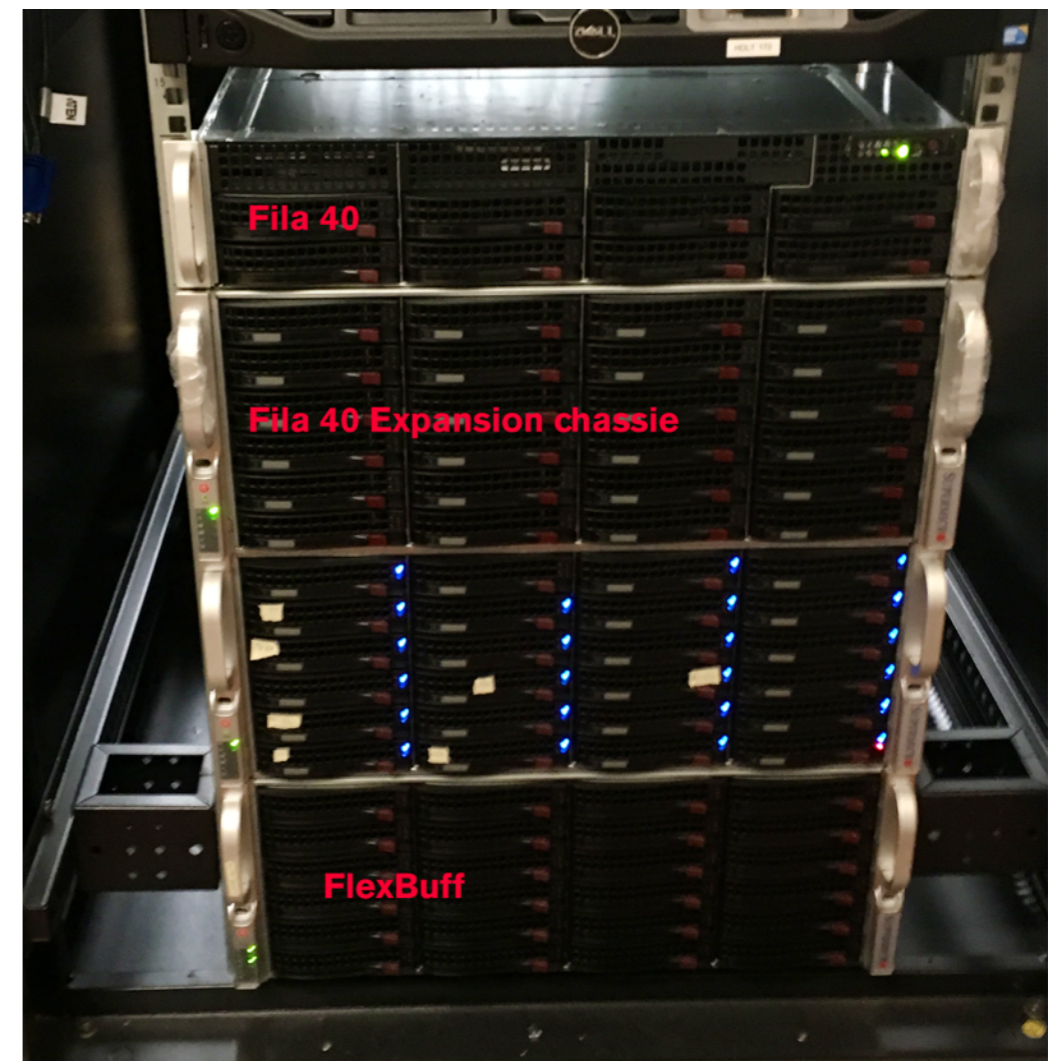


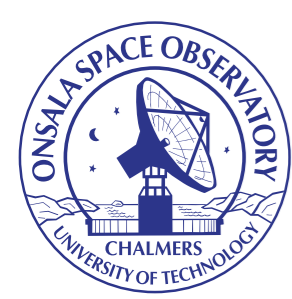
Recording 4-8 Gb/s

Transmitting 4-8 Gb/s

Transmitting While Recording 1-2 Gb/s

6 disks failures since 2013





Fila40/Flexbuff

FILA40G/Flexbuff

Main Chassie: Supermicro 825TQ-R740LPB

Motherboard: SM X9DRH-7TF

2 x E5-2670 64GB RAM

1 x 40GbE/56Gb Infiniband

2 x dual 10GbE SFP +

9 x 6TB HGST DeskStar NAS HDN726060AL

2x Adaptec ASA-7085H

Disks Chassie: Supermicro 847E16-R1K28JBOD

45 x 6TB HGST DeskStar NAS HDN726060AL

324TB



Recording 16-32 Gb/s

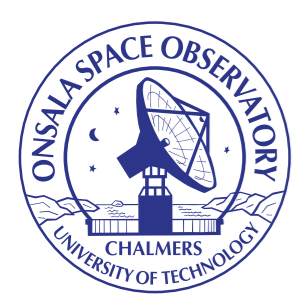
Transmitting 32 Gb/s

Transmitting While Recording 8 Gb/s

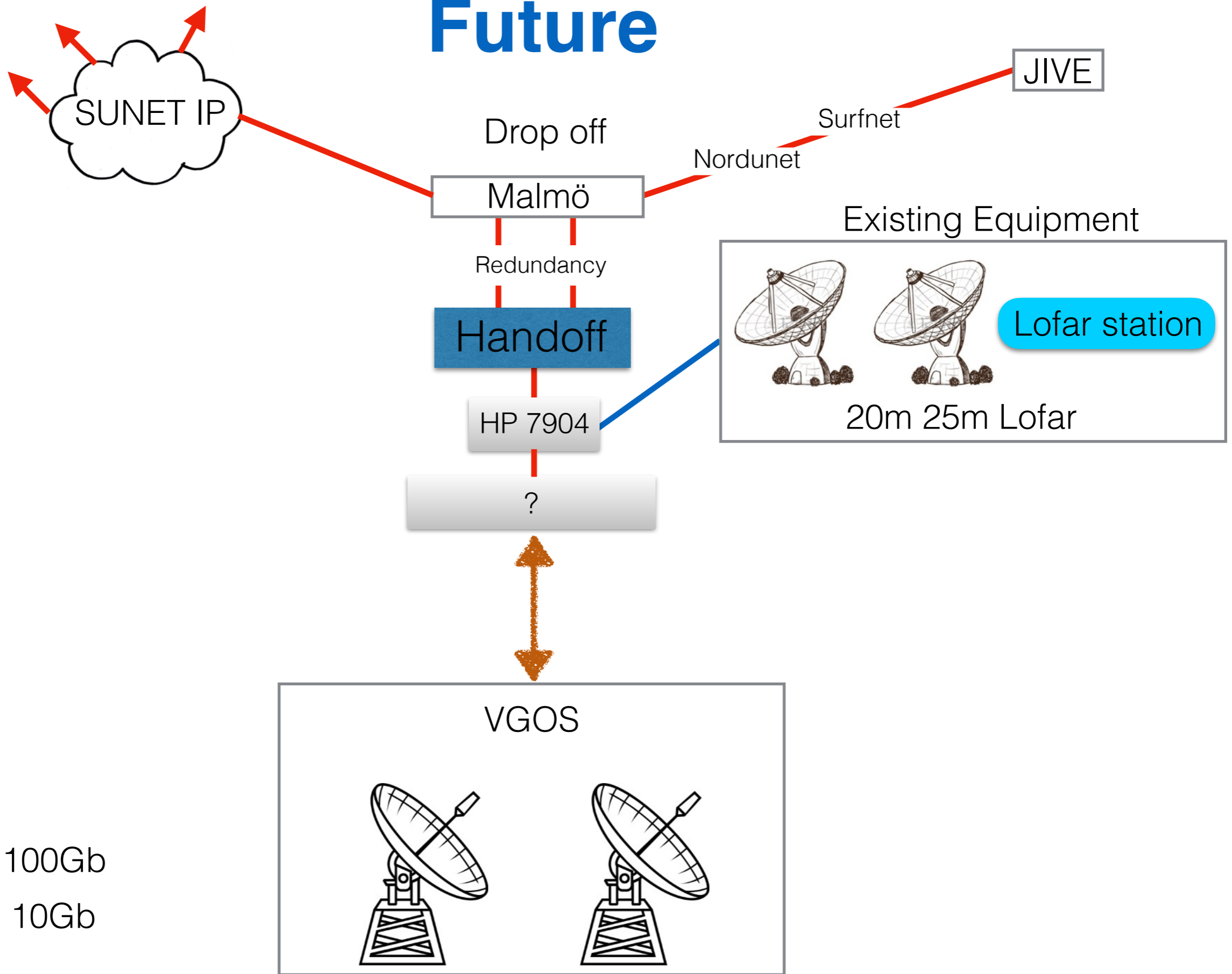
Main Chassie



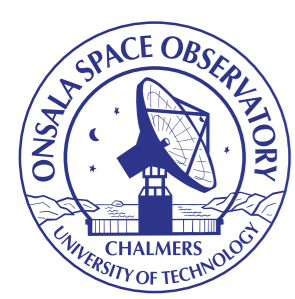
Disk Chassie



Future



100Gb
10Gb



VGOS

10Gb solution

HP 7904

Netgear ProSAFE

Fila40/
Flexbuff

MK 6

DBBC-3

DBBC-3



100Gb solution

HP 7904

Mellanox SN 2410

Fila40/
Flexbuff

Fila40/
Flexbuff

8x10Gb

8x10Gb

DBBC-3

DBBC-3



10/40Gb solution

HP 7904

HP 5900AF 40G

Fila40/
Flexbuff

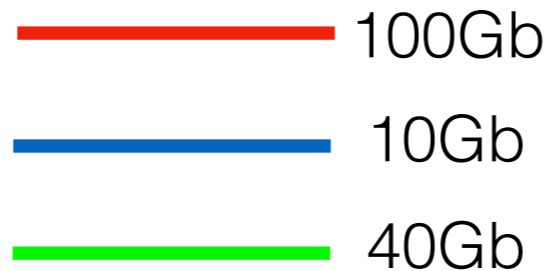
Fila40/
Flexbuff

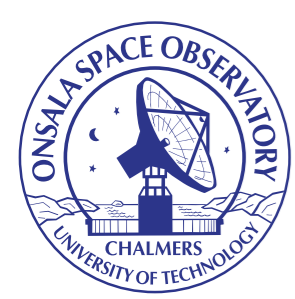
8x10Gb

8x10Gb

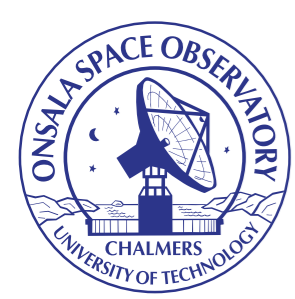
DBBC-3

DBBC-3





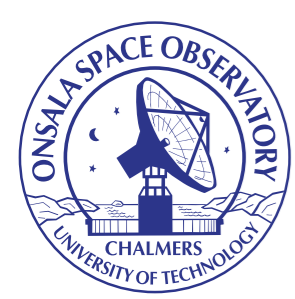
Lot's of data @ fast speed



Lot's of data @ fast speed

How to correlate





High speed networks? Naaaaaa, lets use drones.



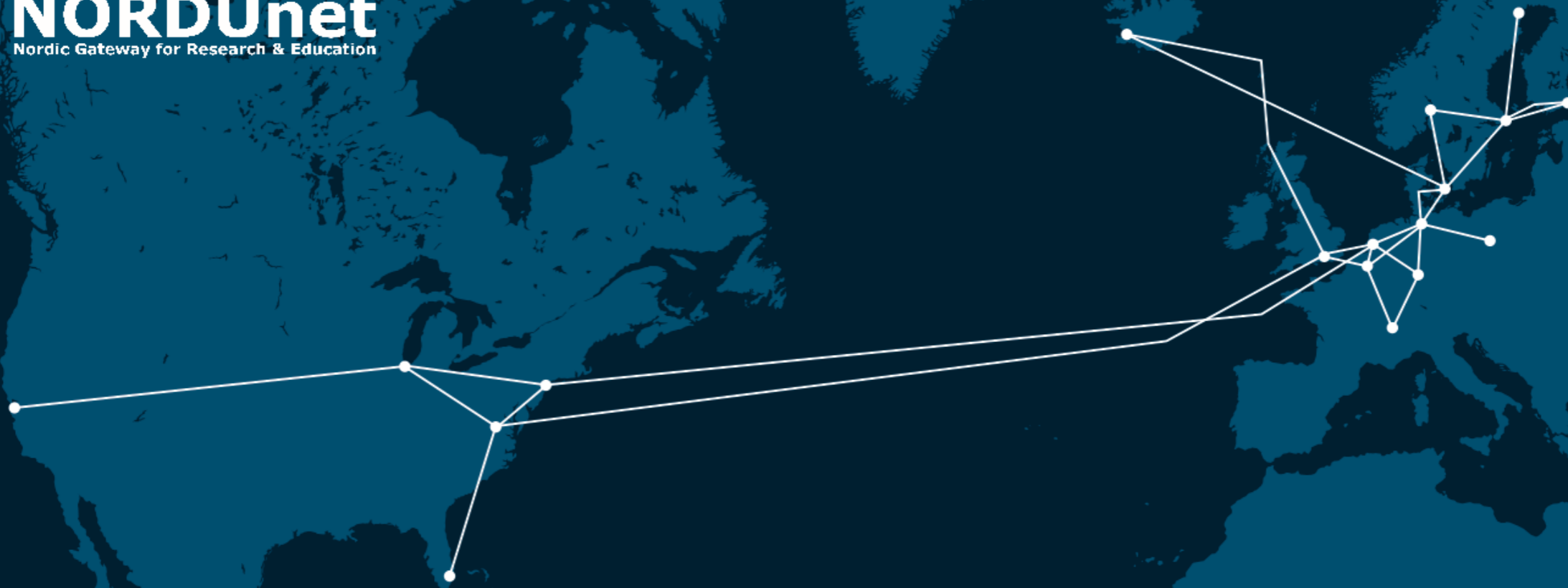


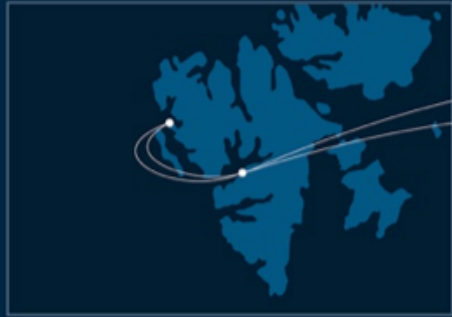
Questions

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roger.hammargren@chalmers.se

NORDUnet

Nordic Gateway for Research & Education





NORDUnet
Nordic Infrastructure for Research & Education