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Nordic Gateway for Research & Education

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EISCAT-3D Instrument Networking

4th SIG-NGN, 16 January 2020

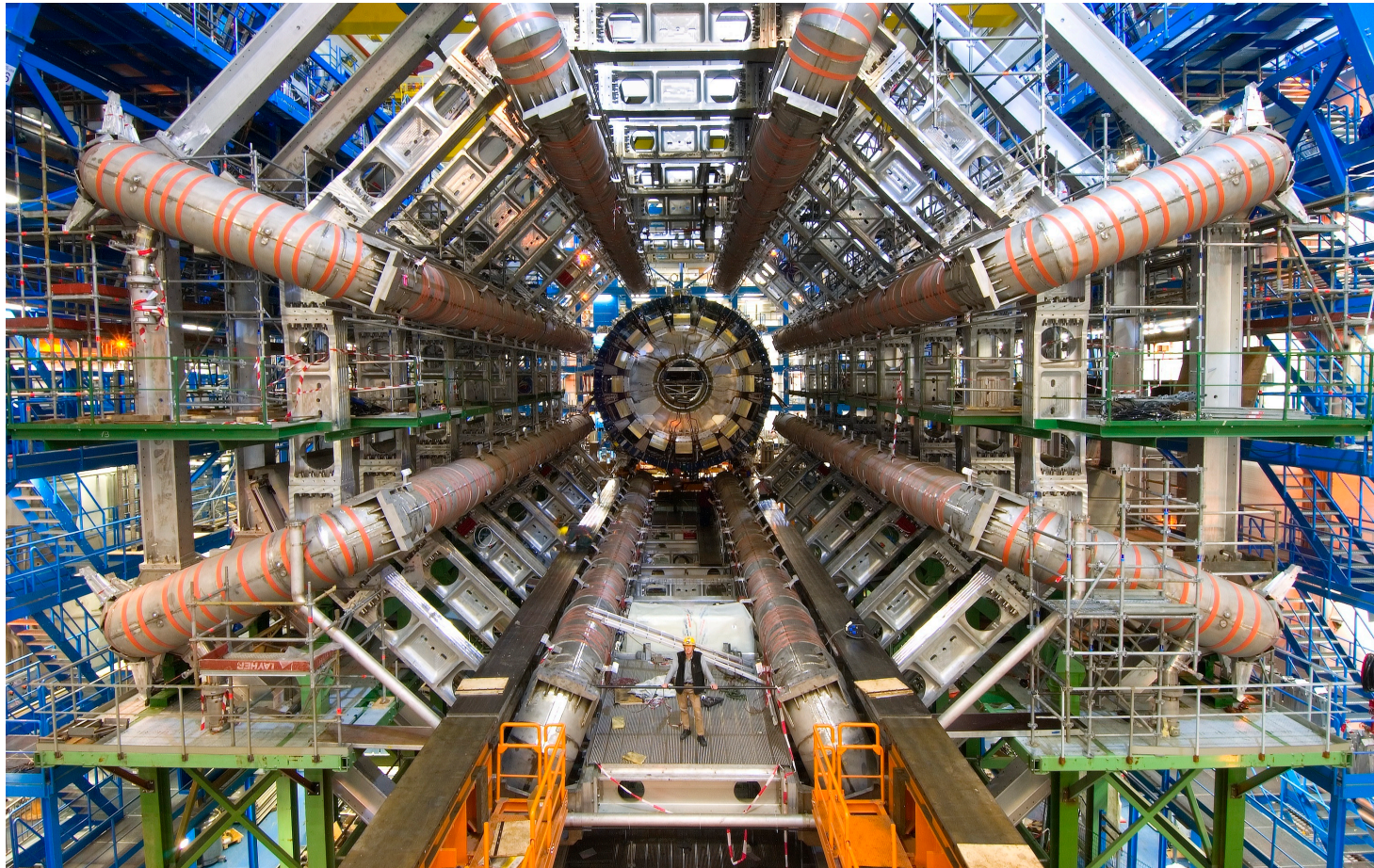
Lars Fischer <lars@nordu.net>

NRENs

... remember

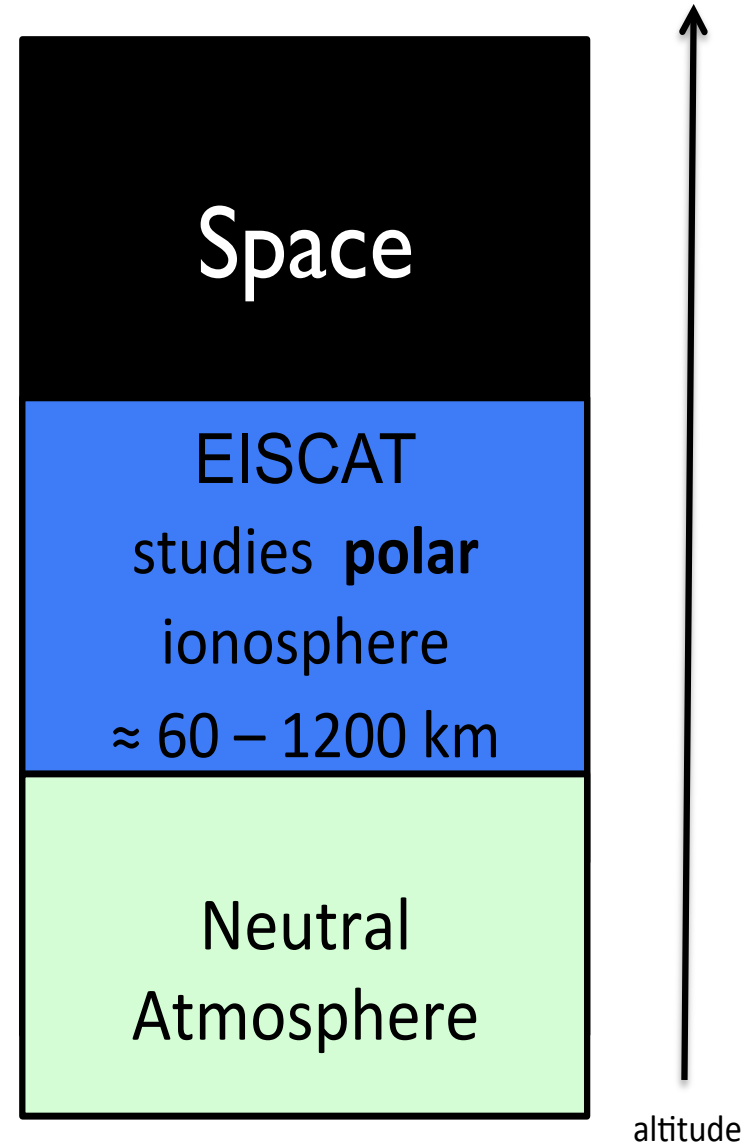
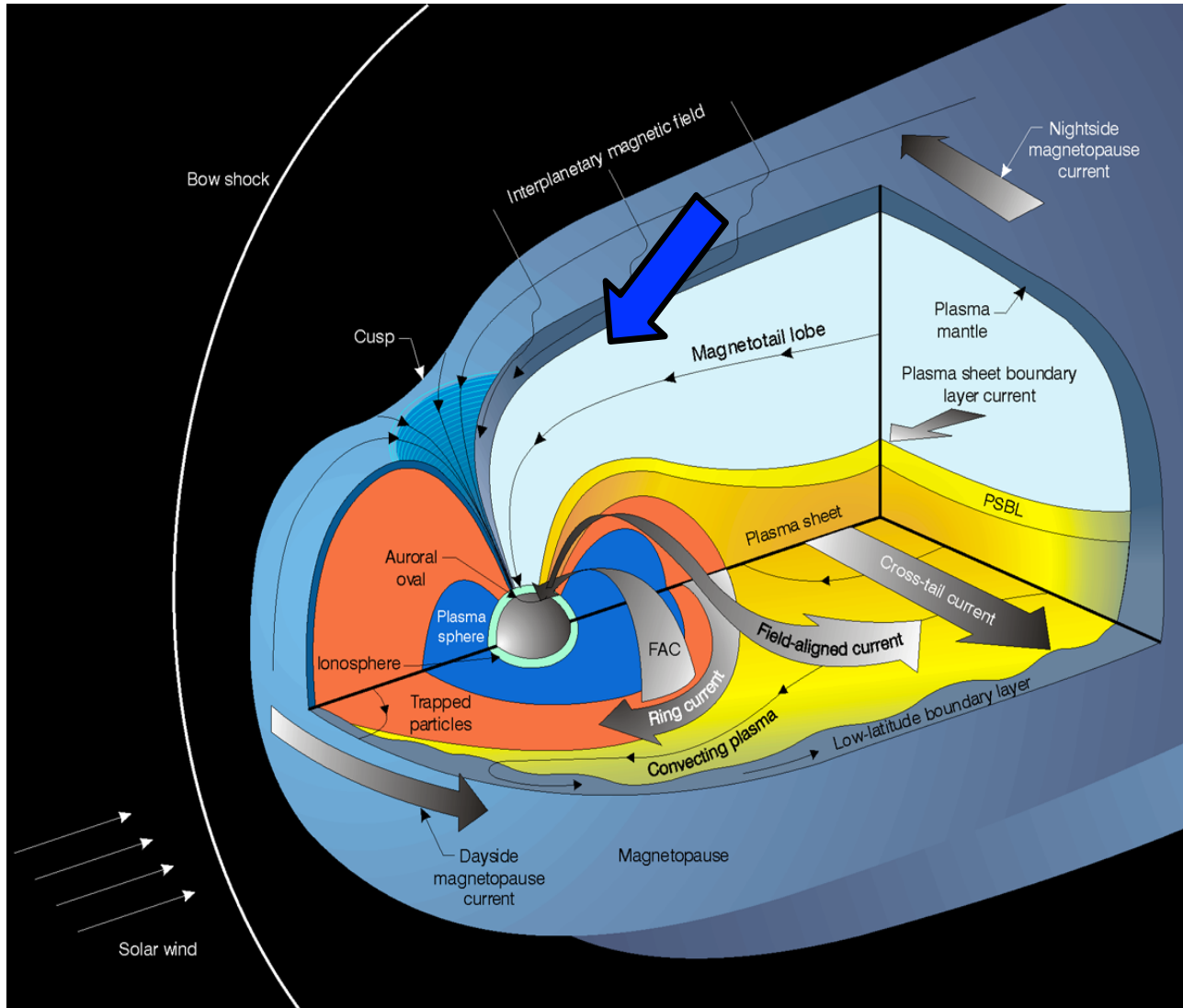
Research and education will be
completely unconstrained
by the physical location of instruments,
people, computational resources, or data.

Big Science

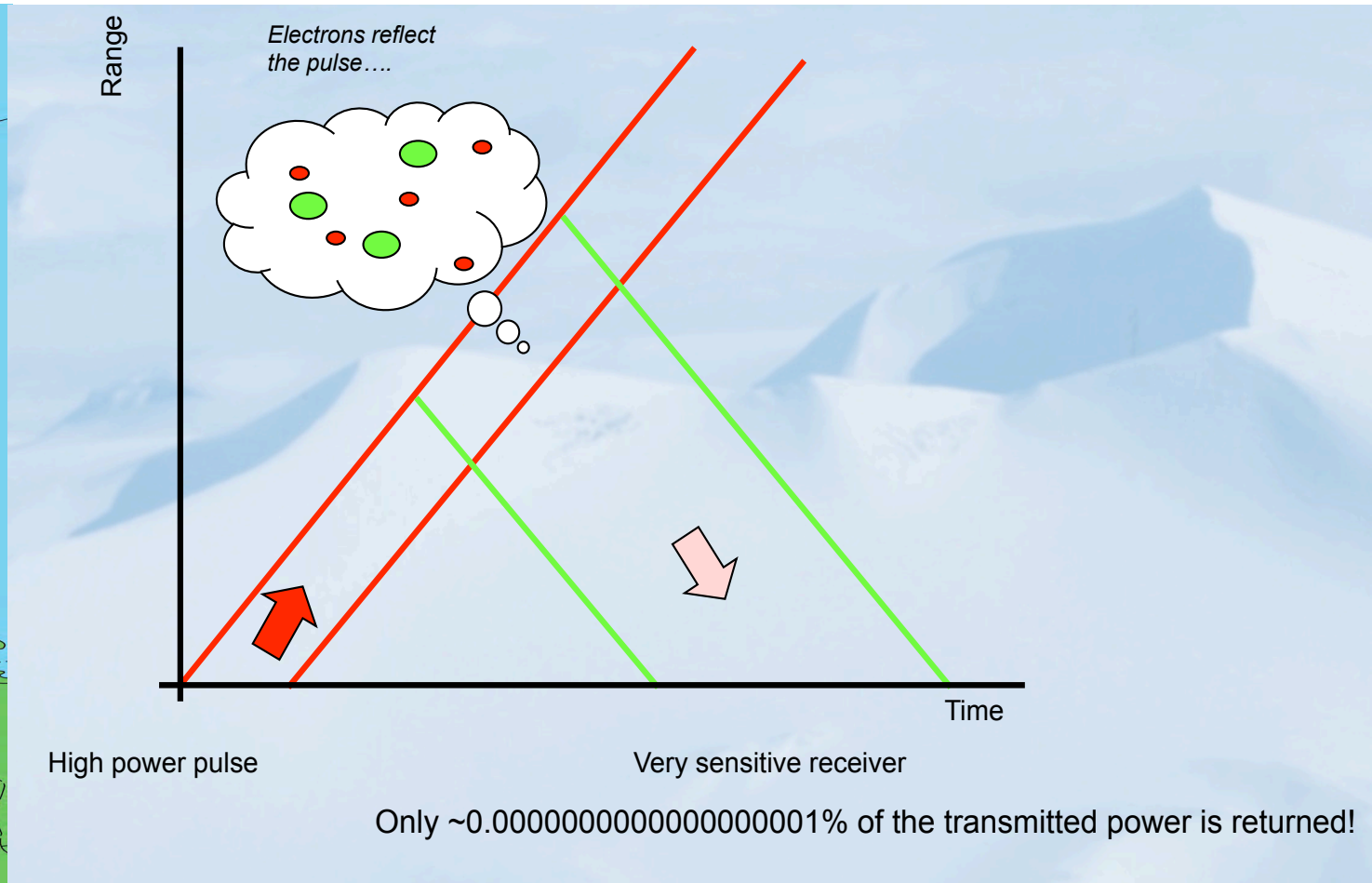
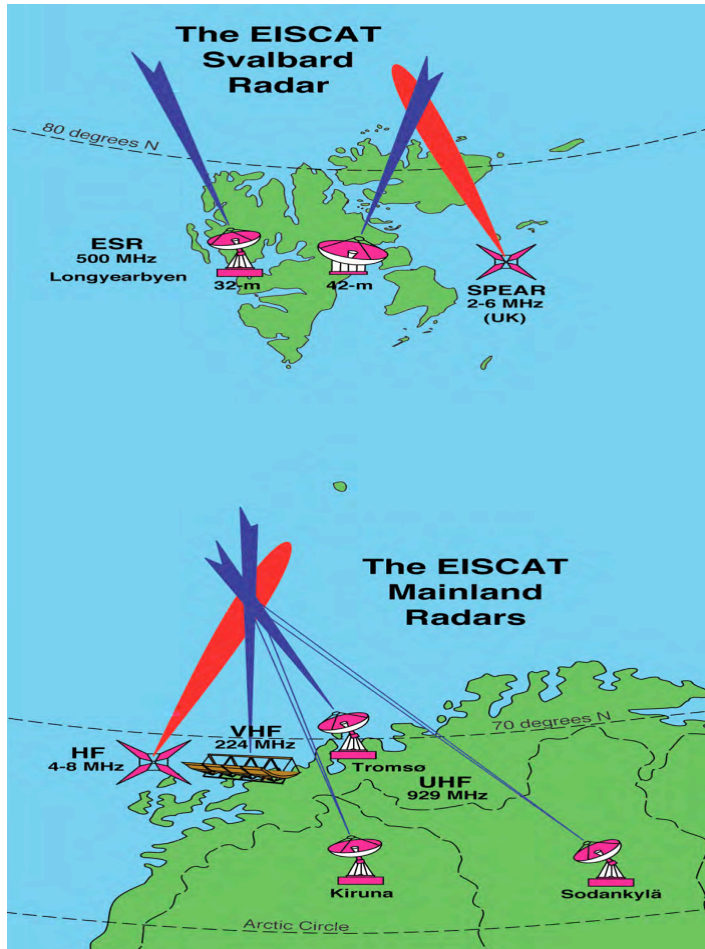


EISCAT

How is the Earth atmosphere coupled to space?



Incoherent Scatter Radar





Tromsø, Norway
1981, 1985



Sodankylä, Finland

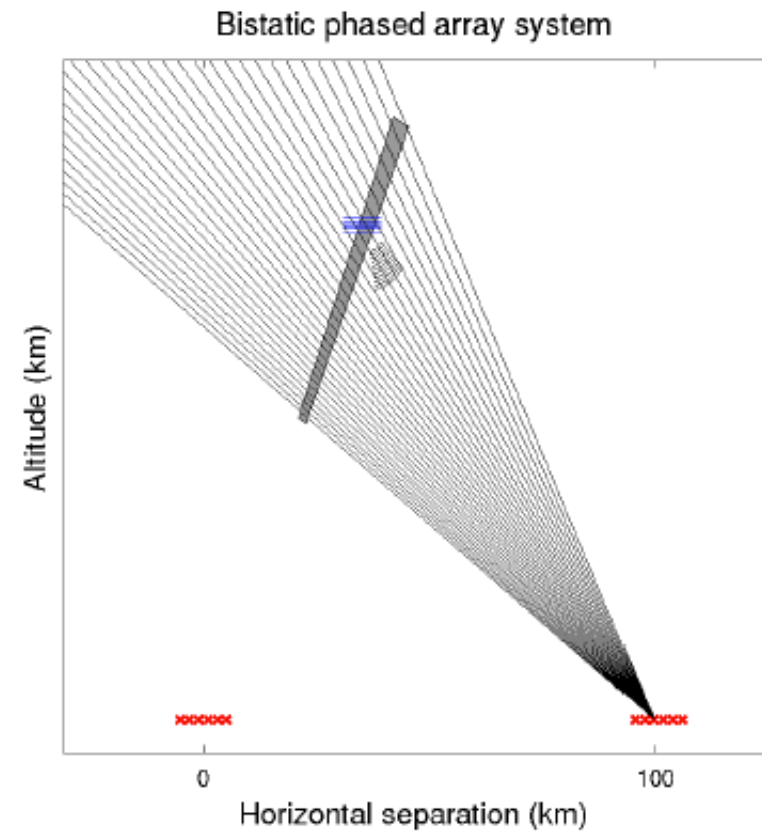
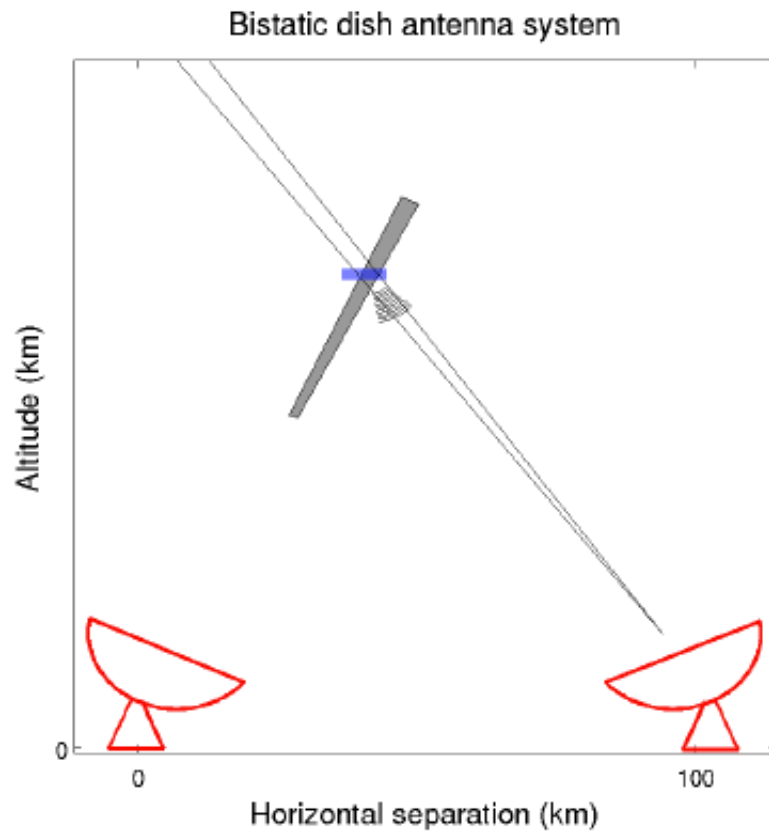


Kiruna, Sweden



Svalbard
1996

EISCAT-3D

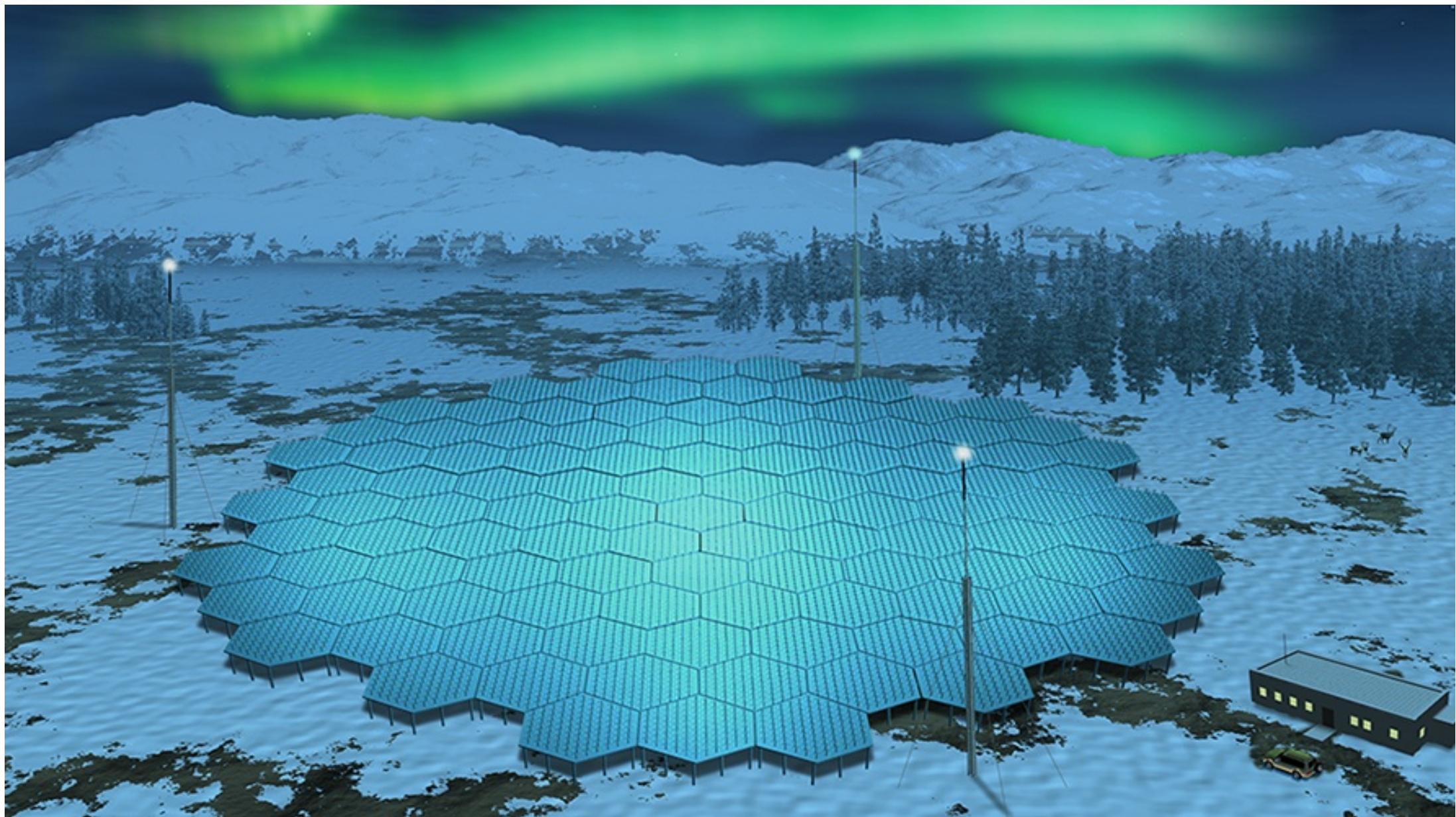


Applications

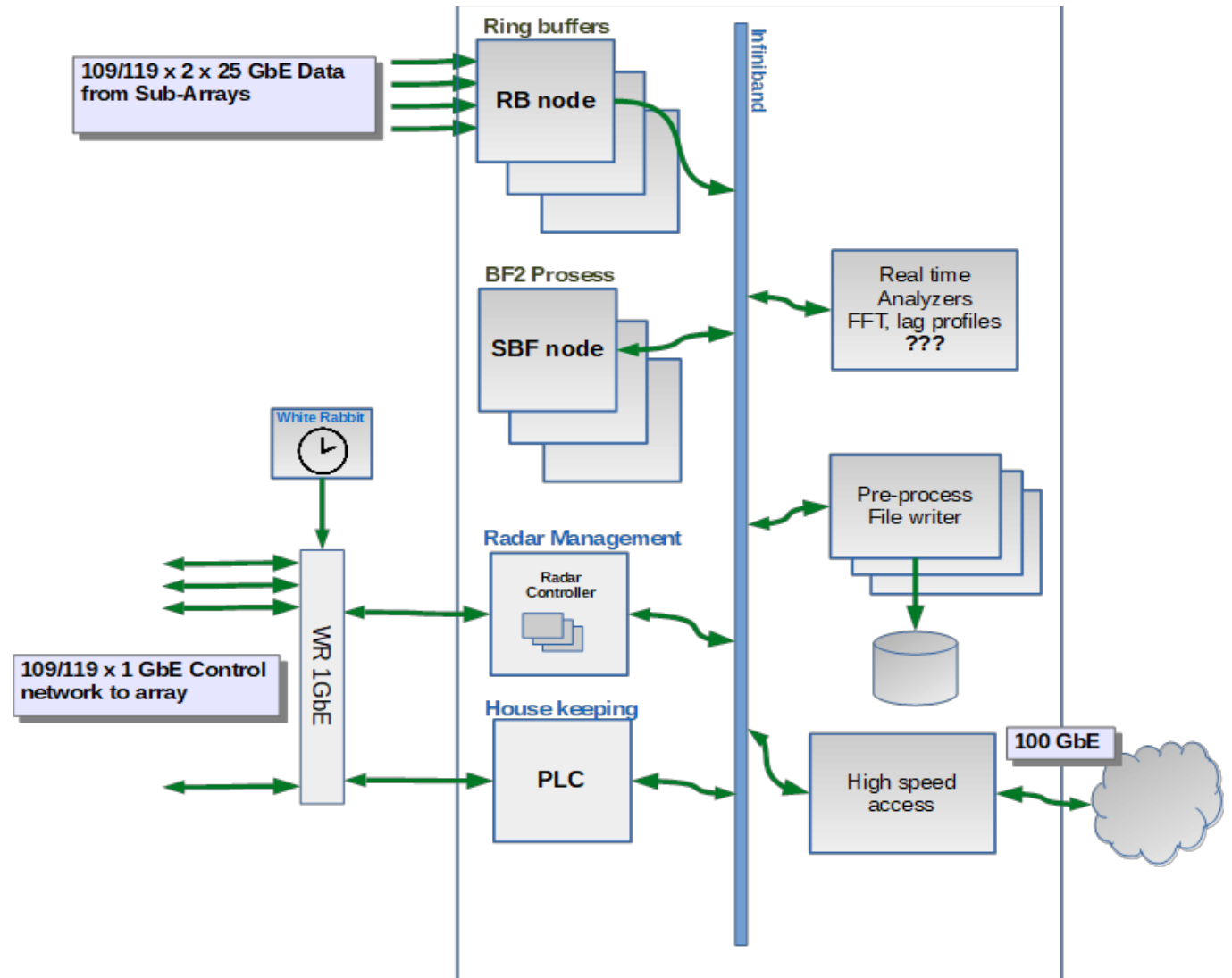
- Ionosphere studies
 - Space weather studies, forecasting
 - Space debris tracking
 - Auroral observation
 - Meteor studies
 - Planetary imaging
-
- Many applications in collaboration with other instruments, satellites, etc.

Antenna array prototype

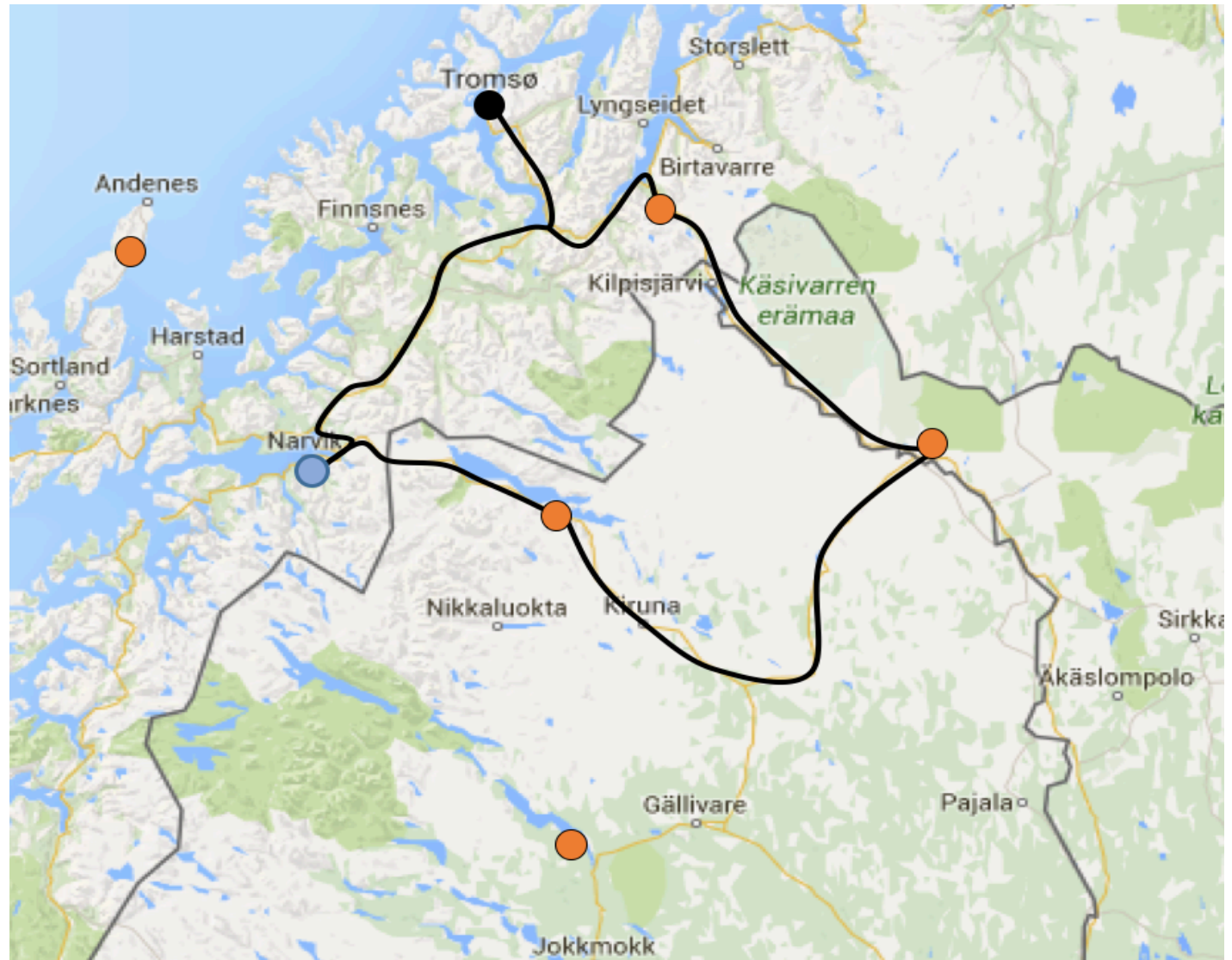




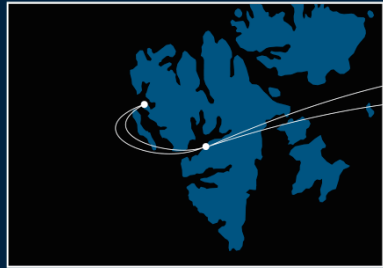
Architecture



Geography



Networking

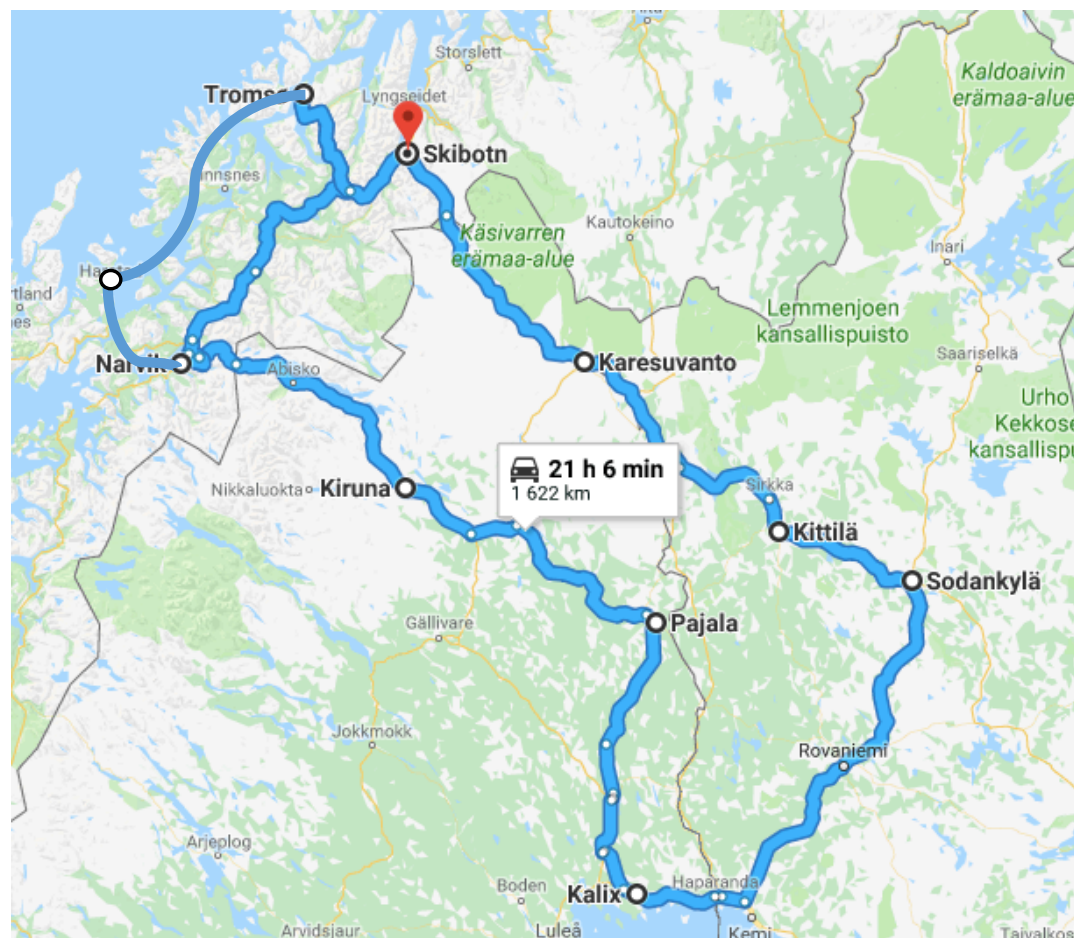


The NREN Networks

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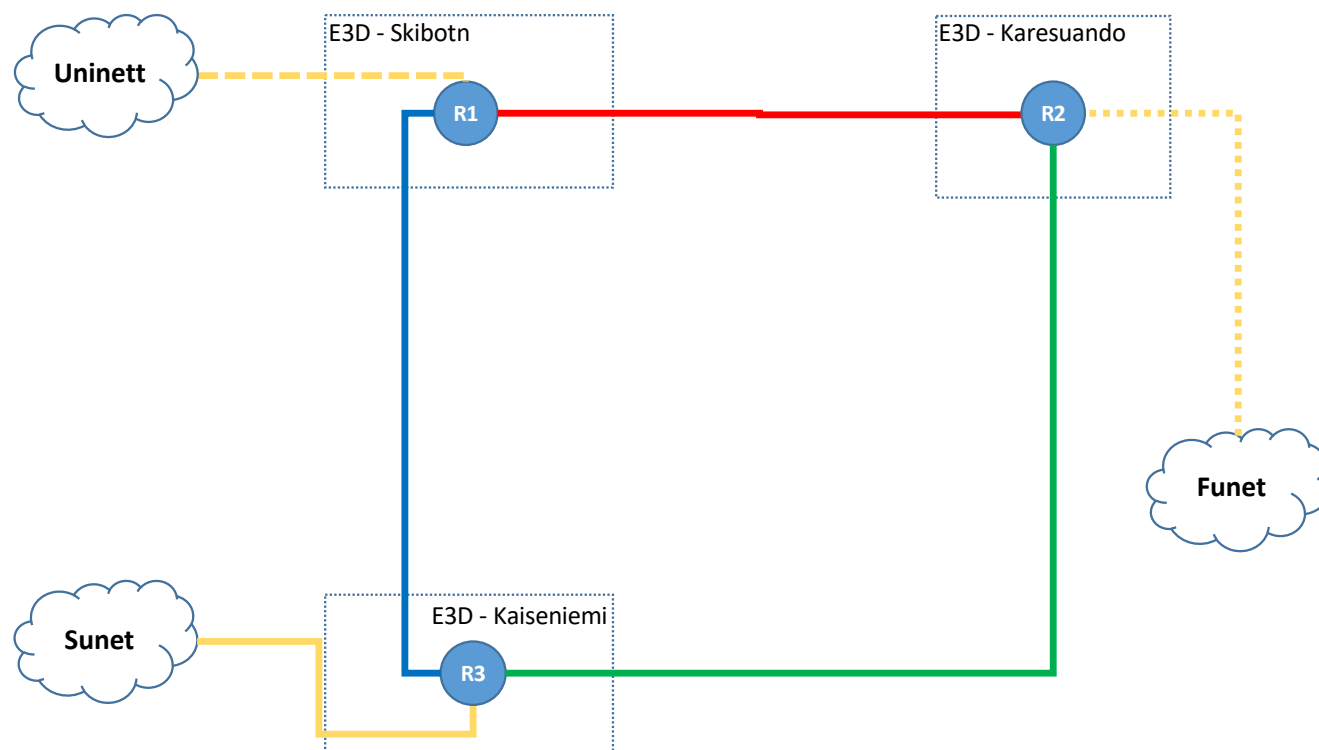
Network Topology: a Ring

- Existing fibre Tromsø-Narvik-Kiruna-Kalix-Sodankylä
- New Fibre Tromsø-Skibotn-Kilpisjärvi-Karresuvanto-Sodankylä
- Site optical and IP equipment
- Allow future connectivity to HPC facilities in SE, NO, FI



Traditional: Routed IP Network

- Inter-site connectivity: an EISCAT-3D "LAN" connecting the local networks of the sites
- NREN uplink: Ring connects to each of the national networks for upstream traffic
- Total, aggregate ring capacity: 100G



Alternatives

(Data Acquisition, WAN, and DC network)

NOTE: Work in Progress

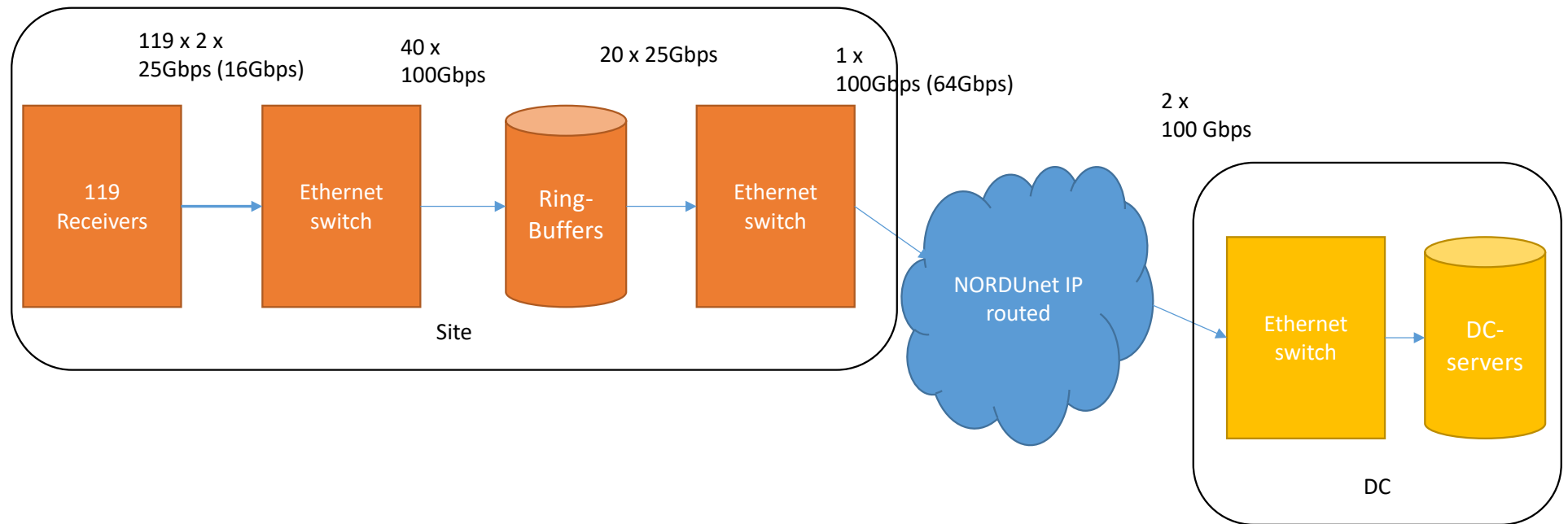
Task: Move data to Data Centre

Alternatives

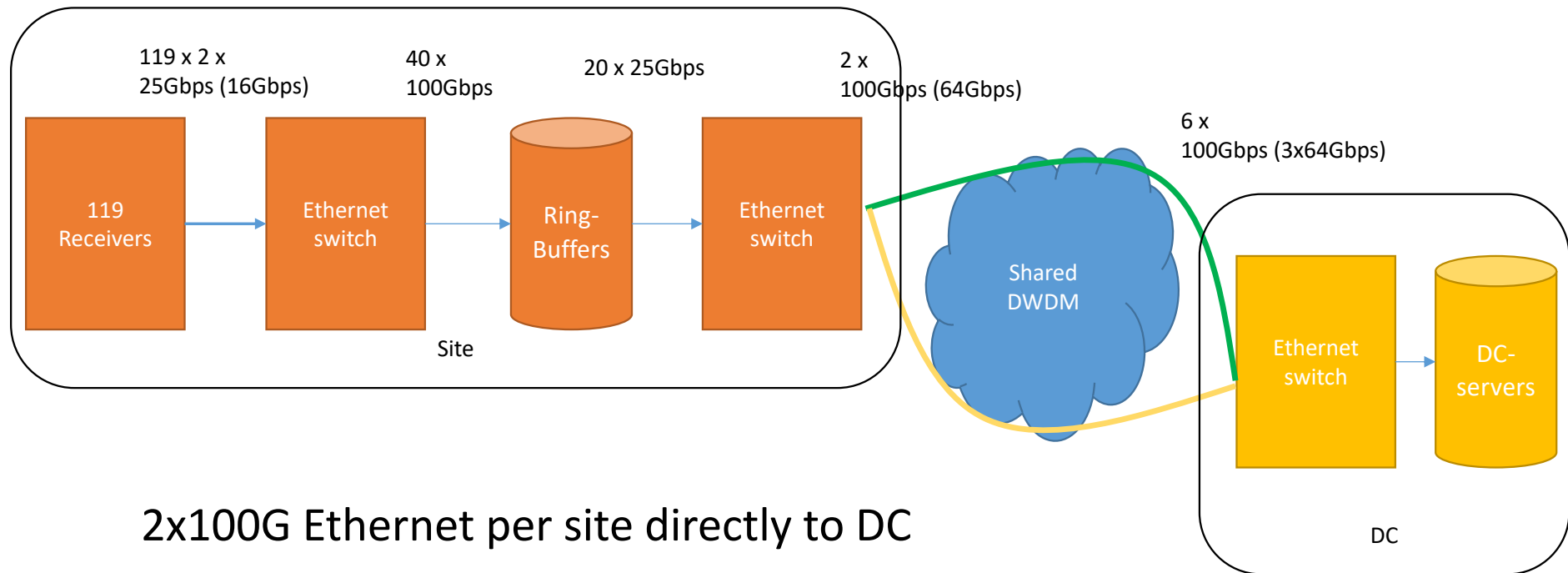
1. Connect the Ring Buffer nodes secondary side to DC
2. Aggregate Receivers data ethernet ports and extend to DC
3. Extend Receivers ethernet ports to DC

(in order of *more* flexibility, capacity, & cost, *less* site equipment)

Traditional IP Design

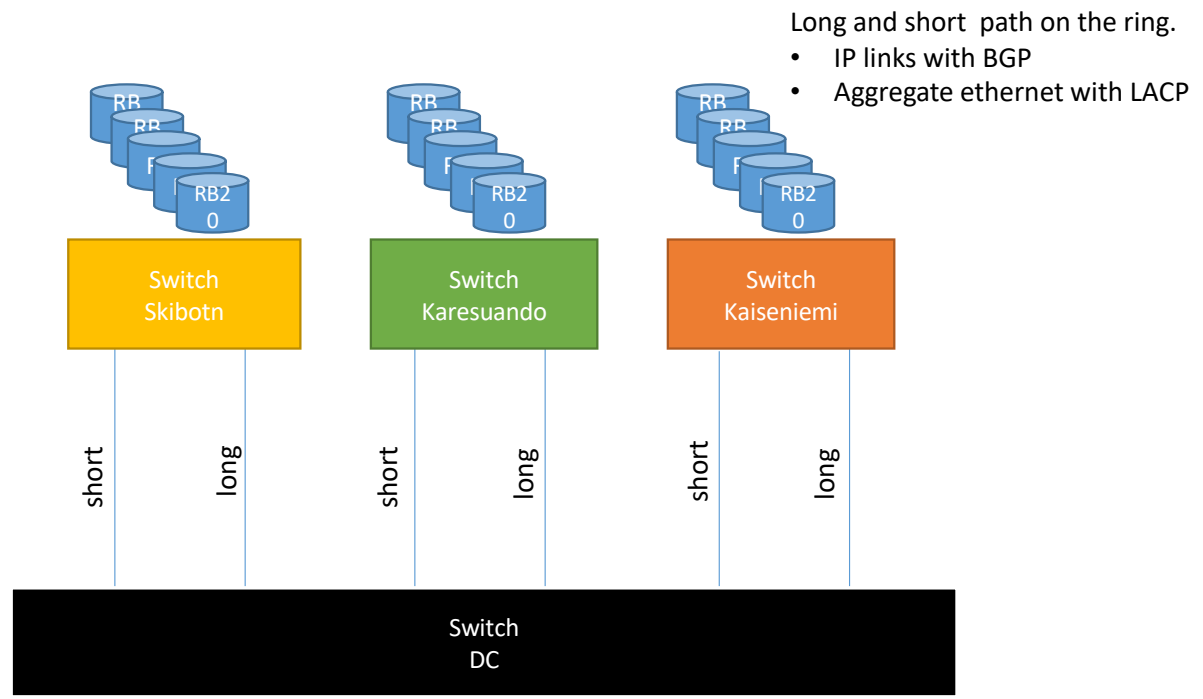


2x100G Point-to-Point Ethernet

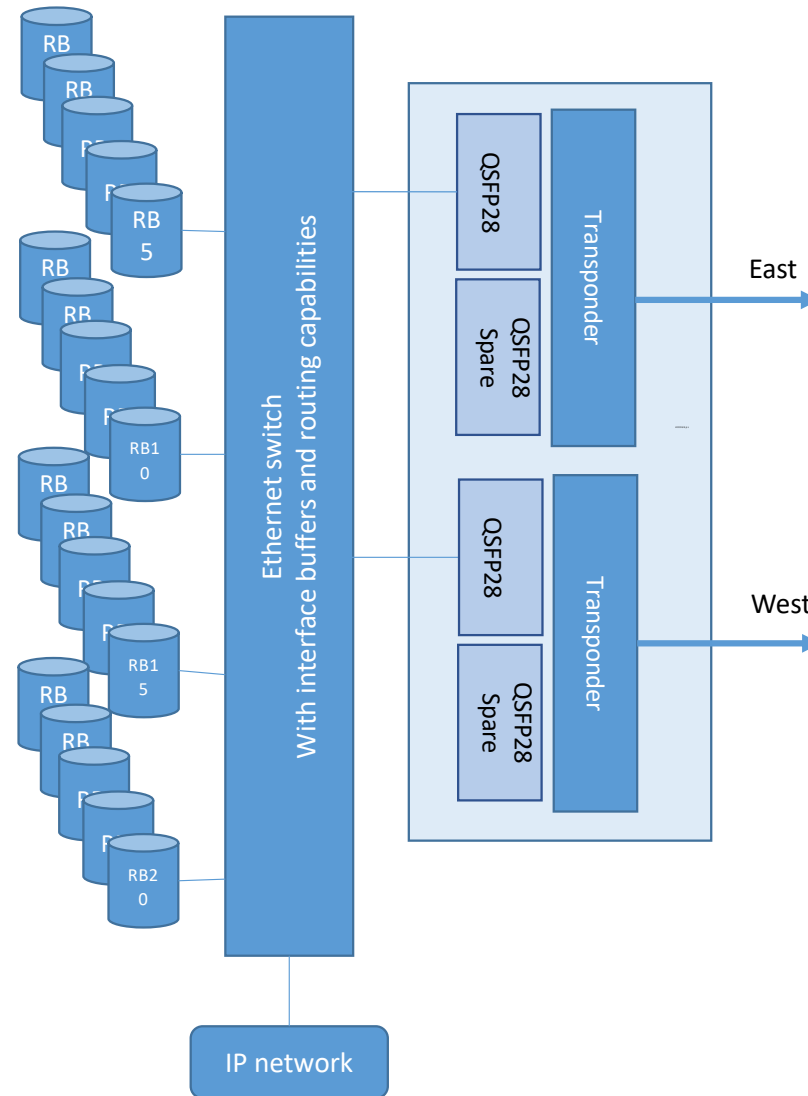


2x100G Ethernet per site directly to DC

Logical view Site 2x100G to DC

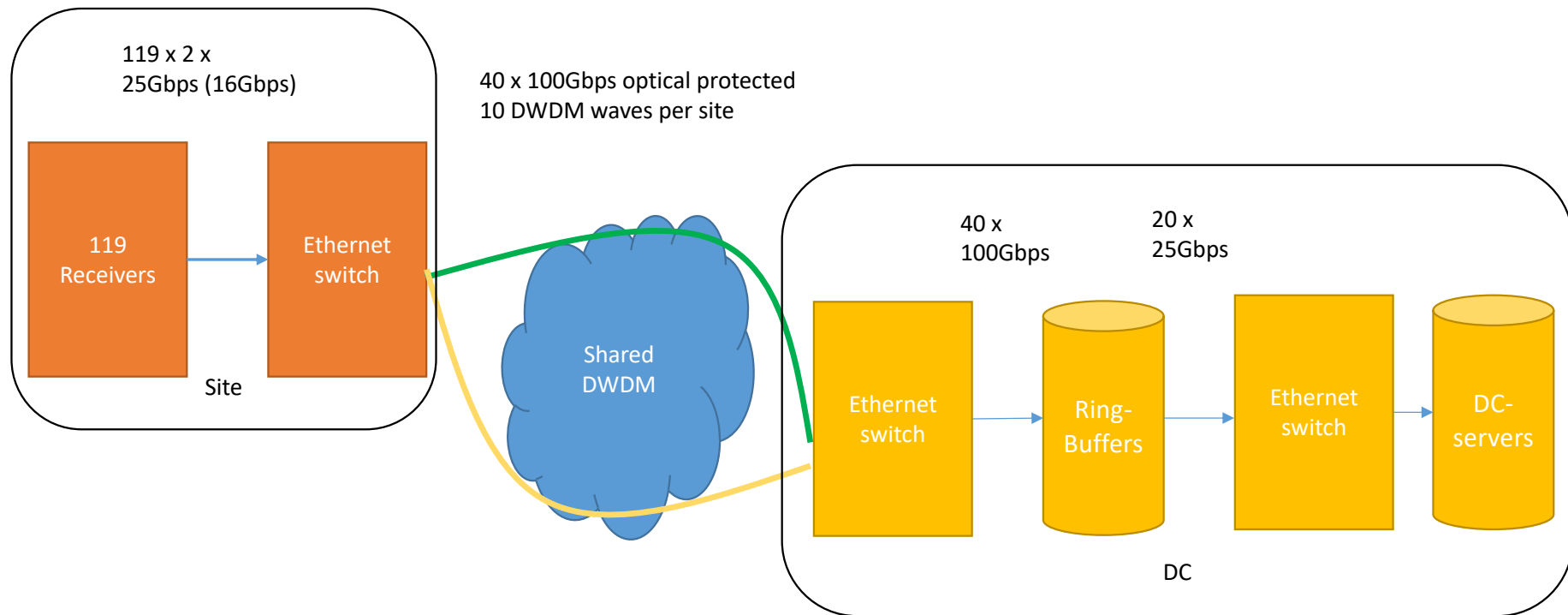


2 x 100G from Site directly to DC



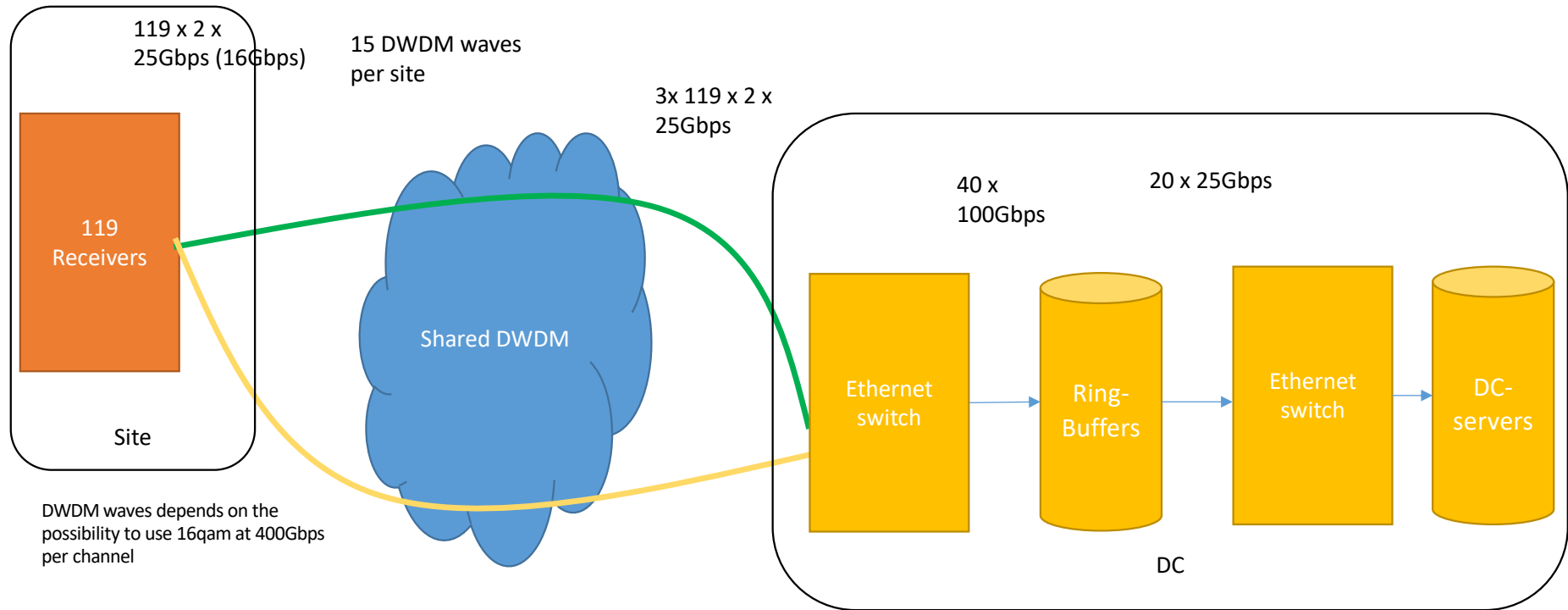
Site 1-3

Ring-buffers at D.C. (1)



Ring Buffers at DC. 40x100G Ethernet per site directly to DC
Optical network protection

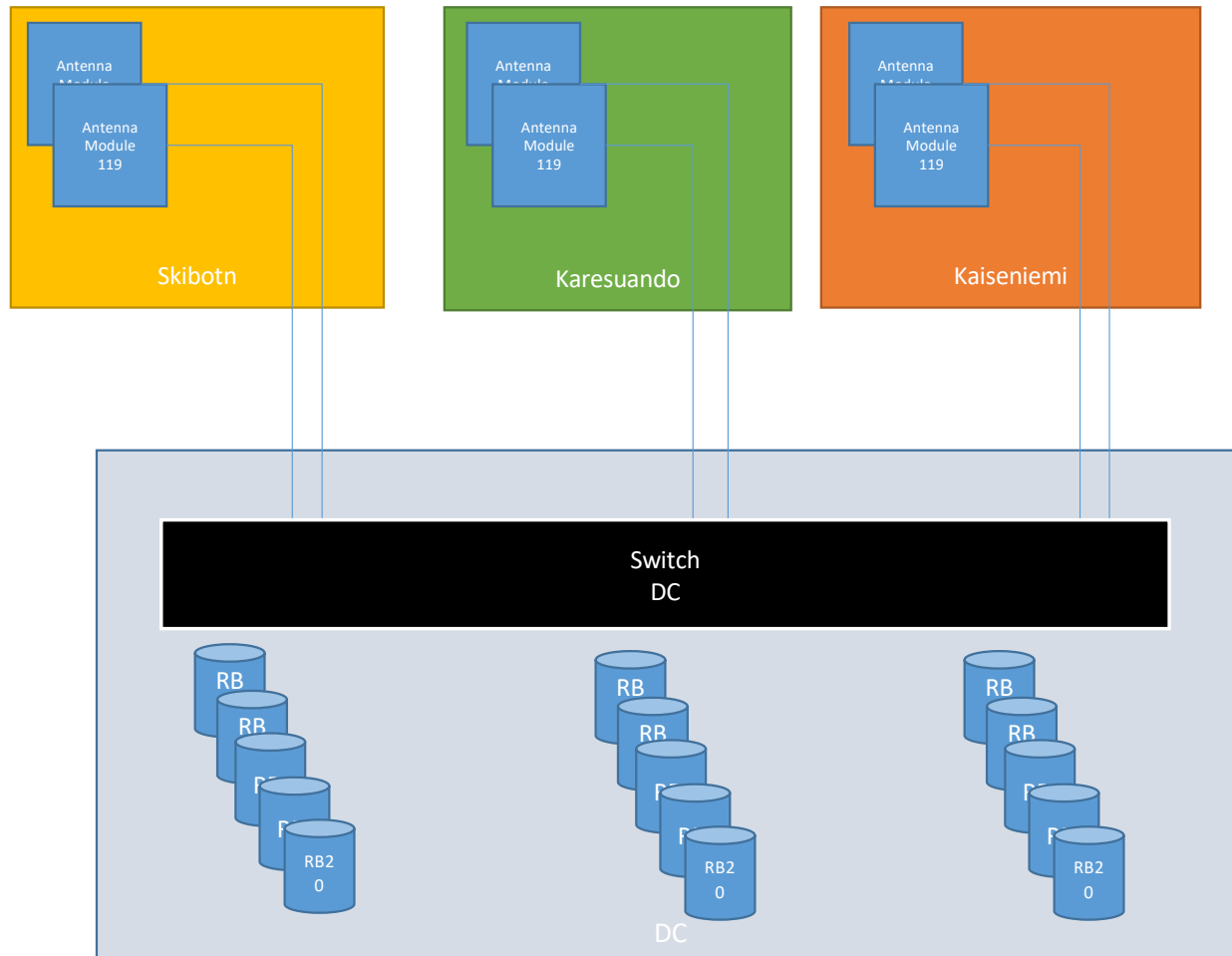
Ring-buffers at D.C. (2)

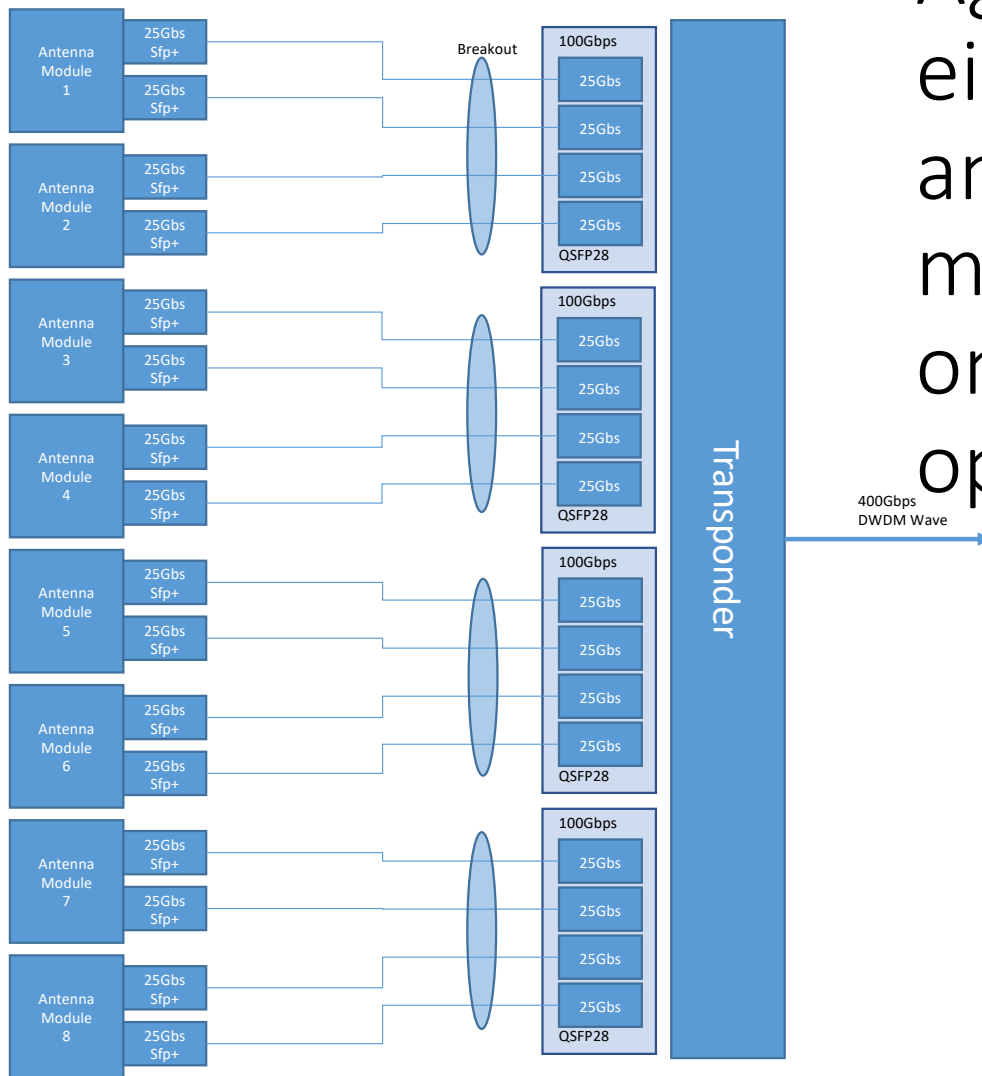


Ring Buffers at DC. 60x100G Ethernet per site directly to DC
Optical network protection

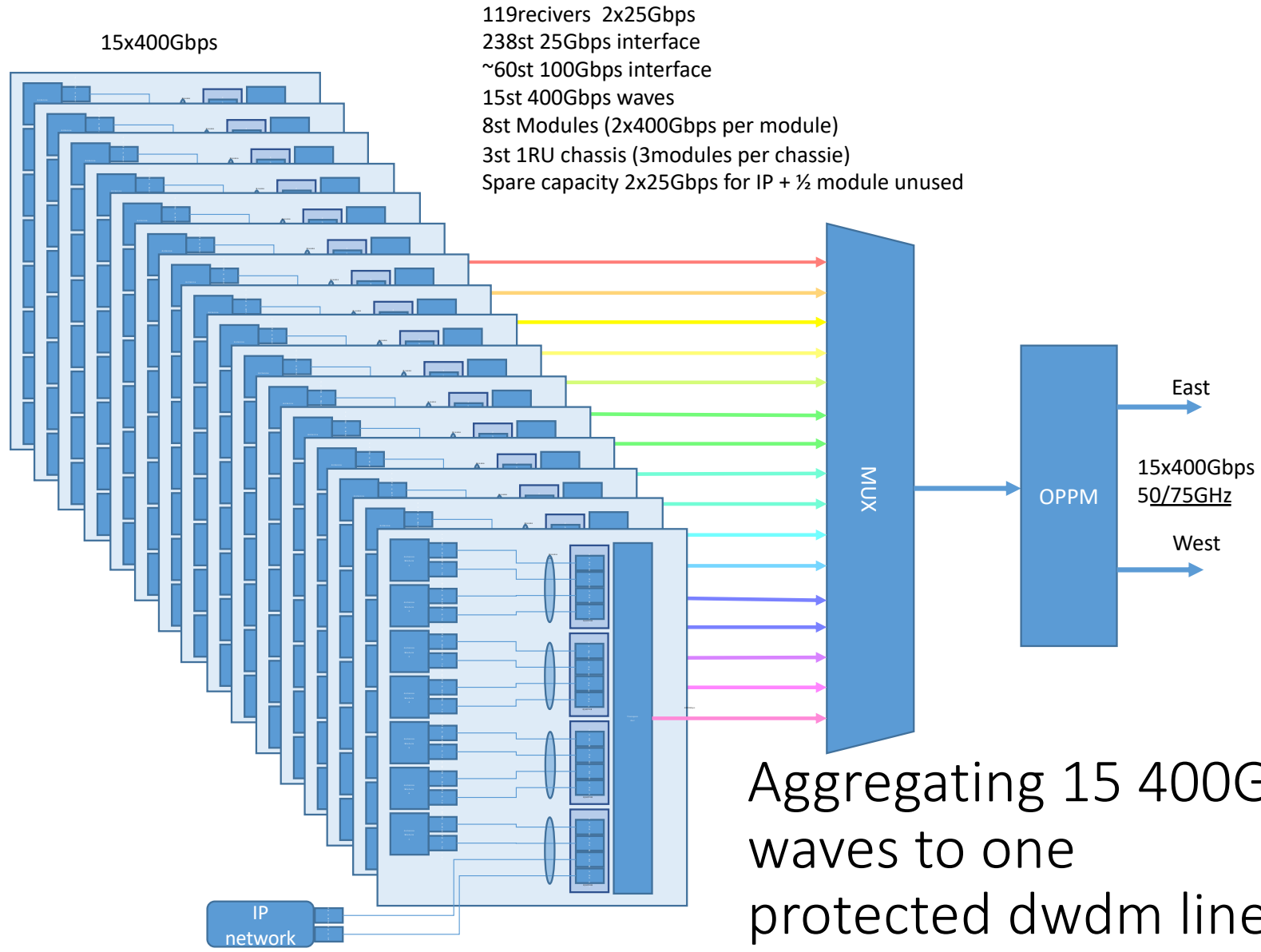
Antennas at site, switch and Ringbuffer at DC

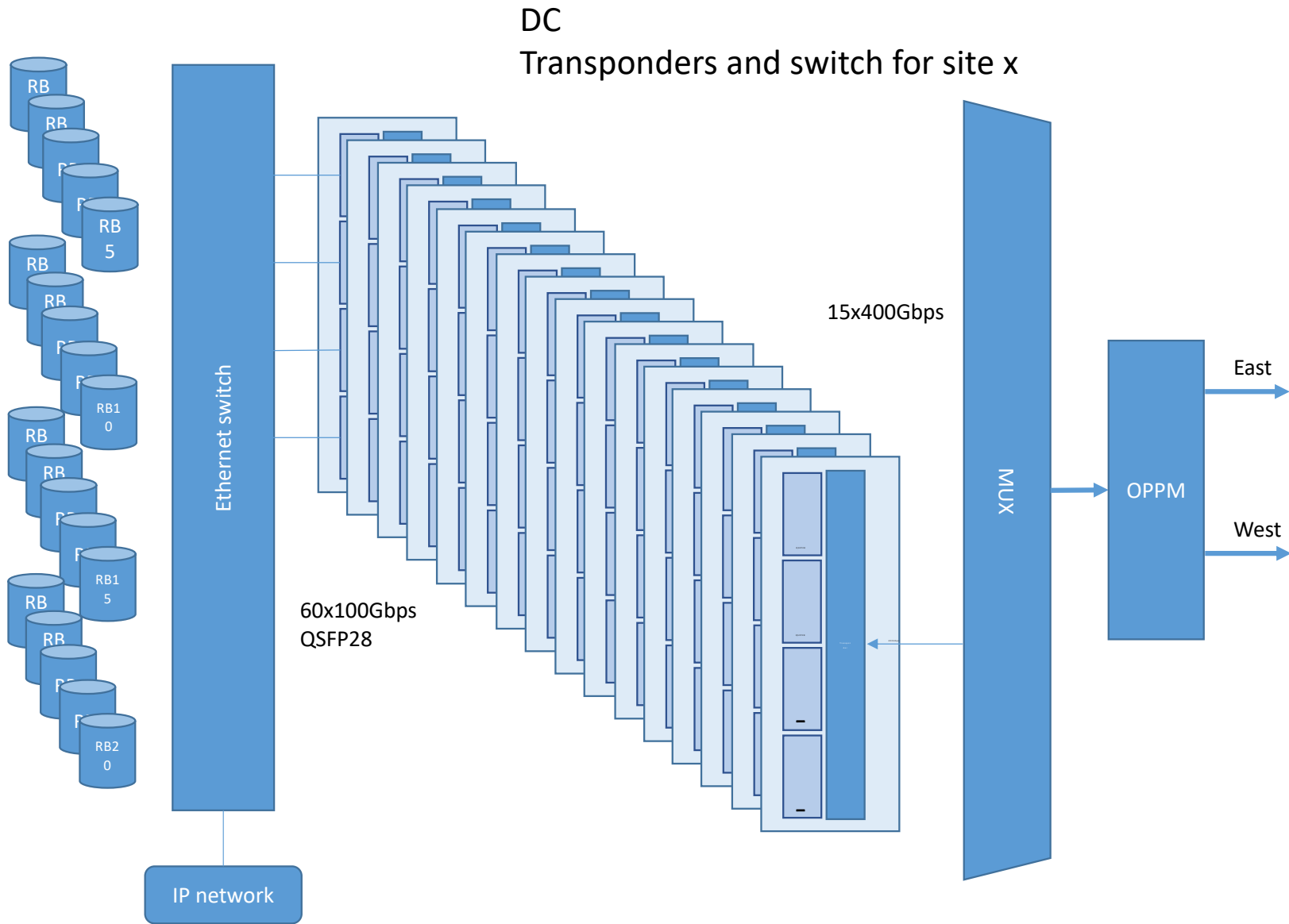
Logical view

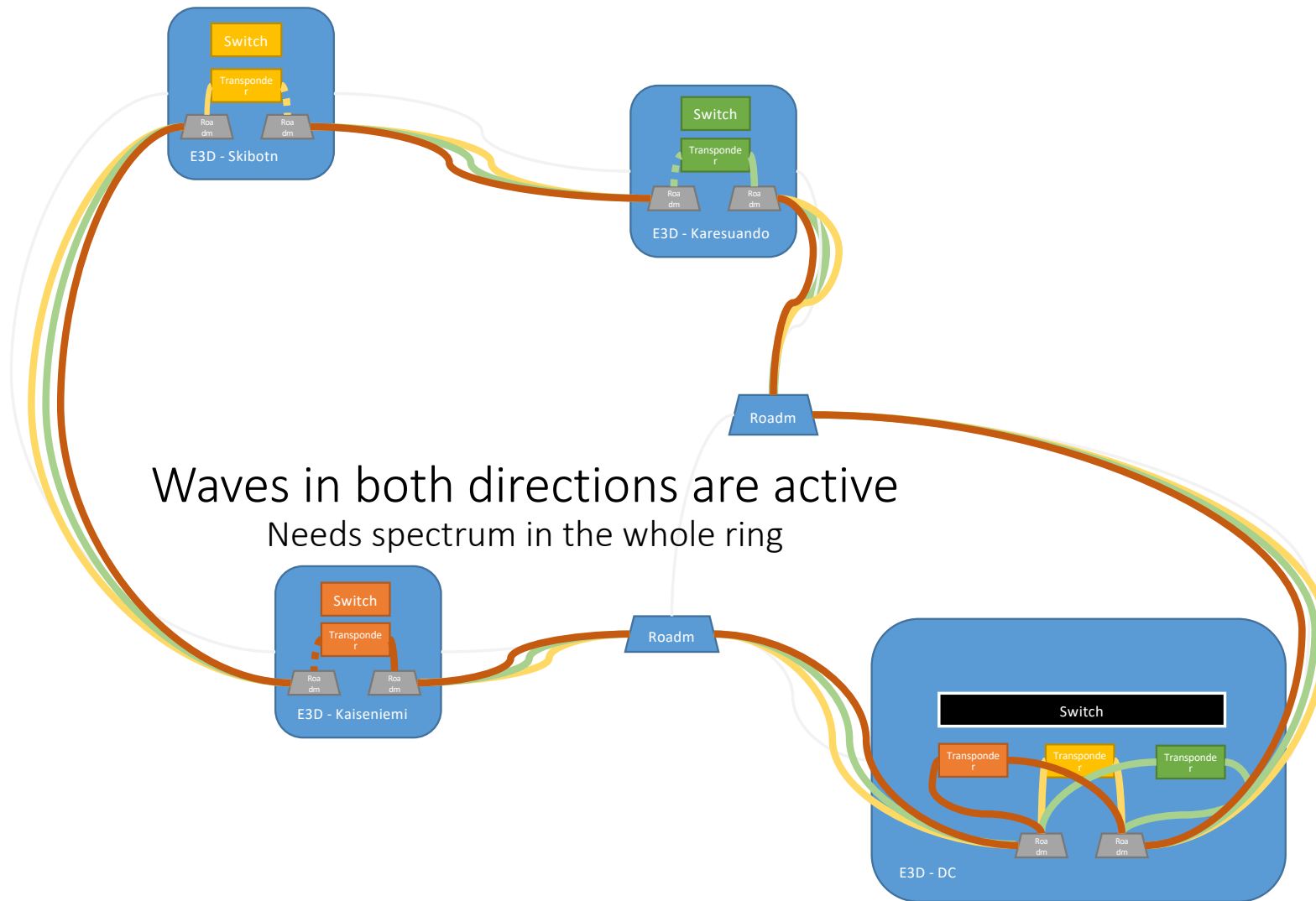




Aggregating
eight
antenna
modules to
one 400G
optical wave







Can be FI, SE, NO – but must be close to ring

Rethinking Instrument Networking



- New options w/ DCI optical equipment
 - Tunable & High capacity
 - Small form factor
 - Lower cost
- Modern Data Centres
 - Hosting, Facility Management
 - Containerized Computing Services
 - Large-scale Science Storage Facilities
- Integration of Instrument, NREN, and Data Centre networks

Thank You
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