

FUNET

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Nordic Gateway for Research & Education

SUNET

Networking for EISCAT-3D

EISCAT-3D stakeholder meeting

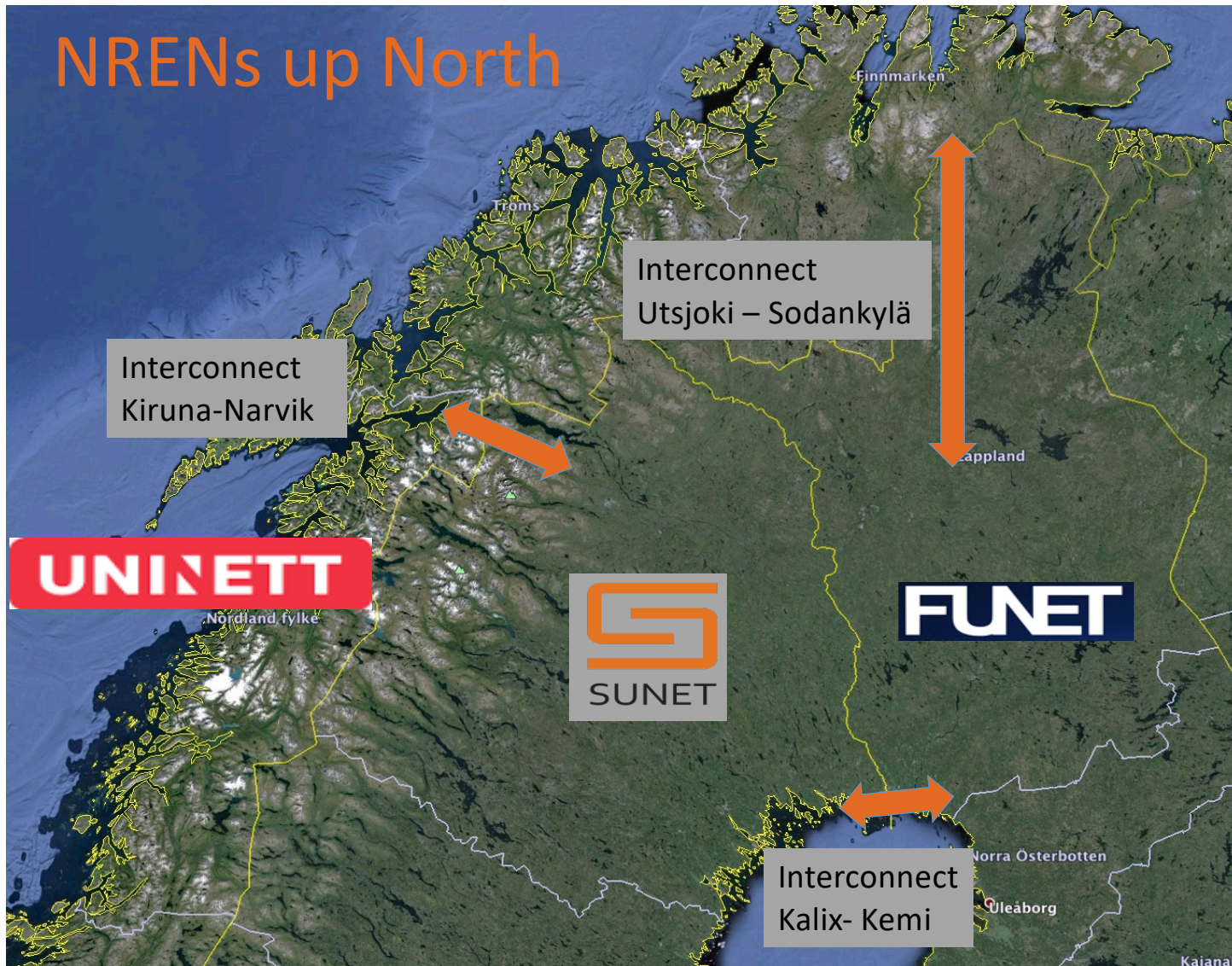
17 October 2019

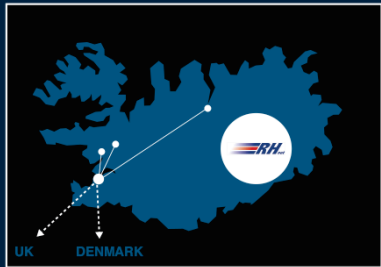
Lars Fischer <lars@nordu.net>

RECAP

(from March stakeholder meeting)

NRENs up North



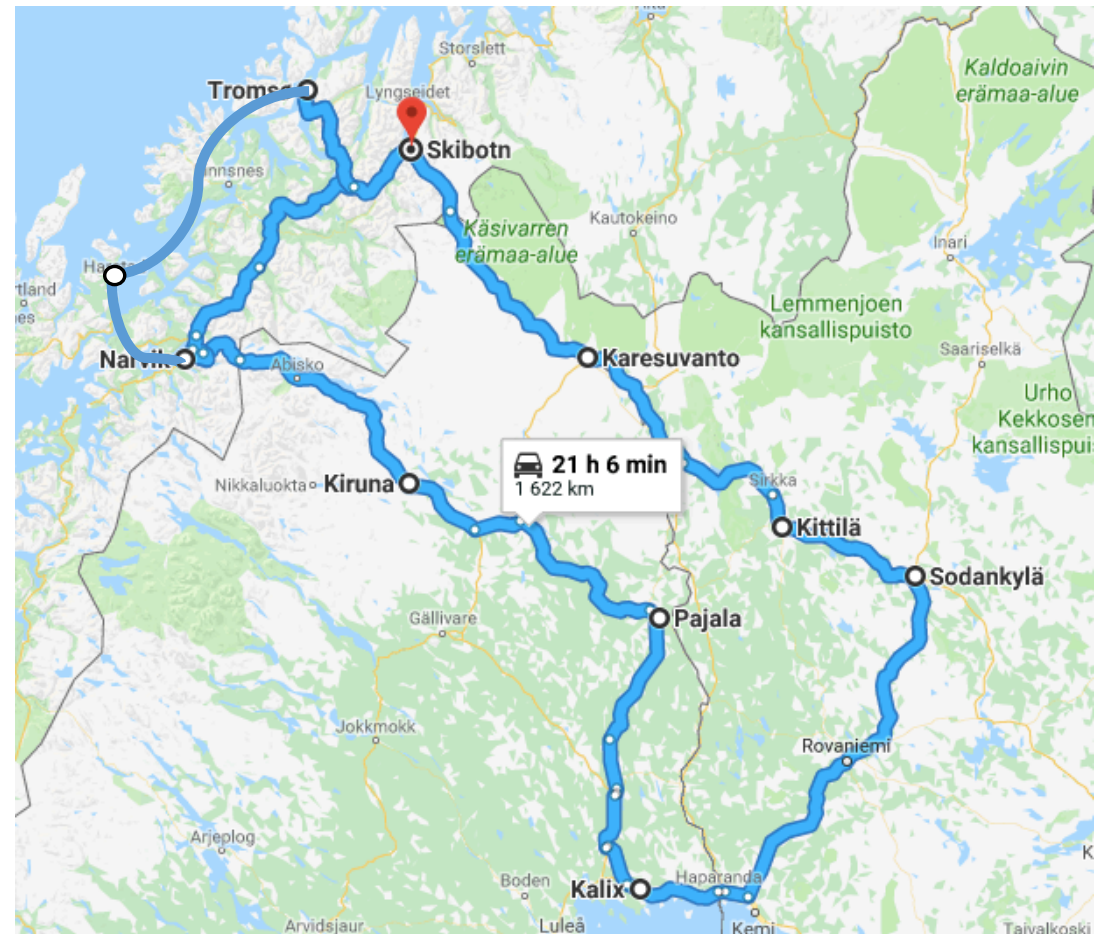


The NREN Networks

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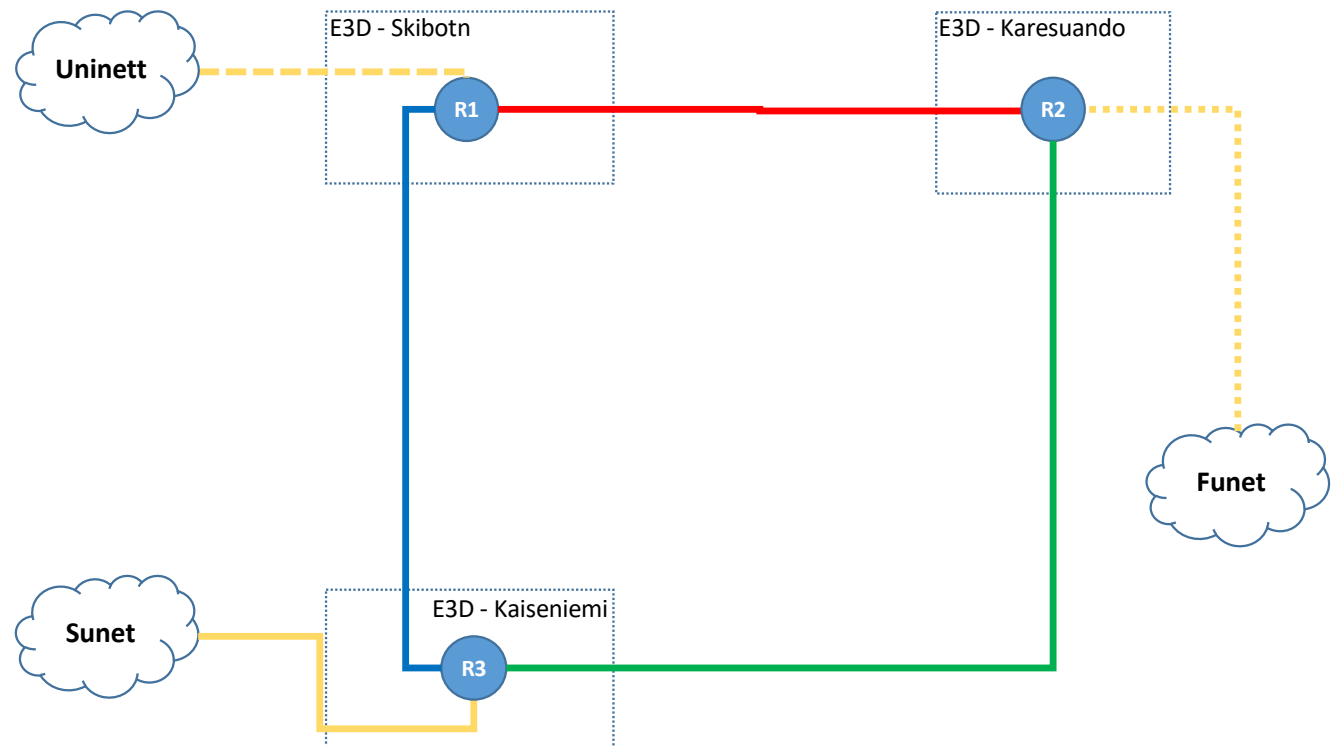
Network Topology: a Ring

- 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



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

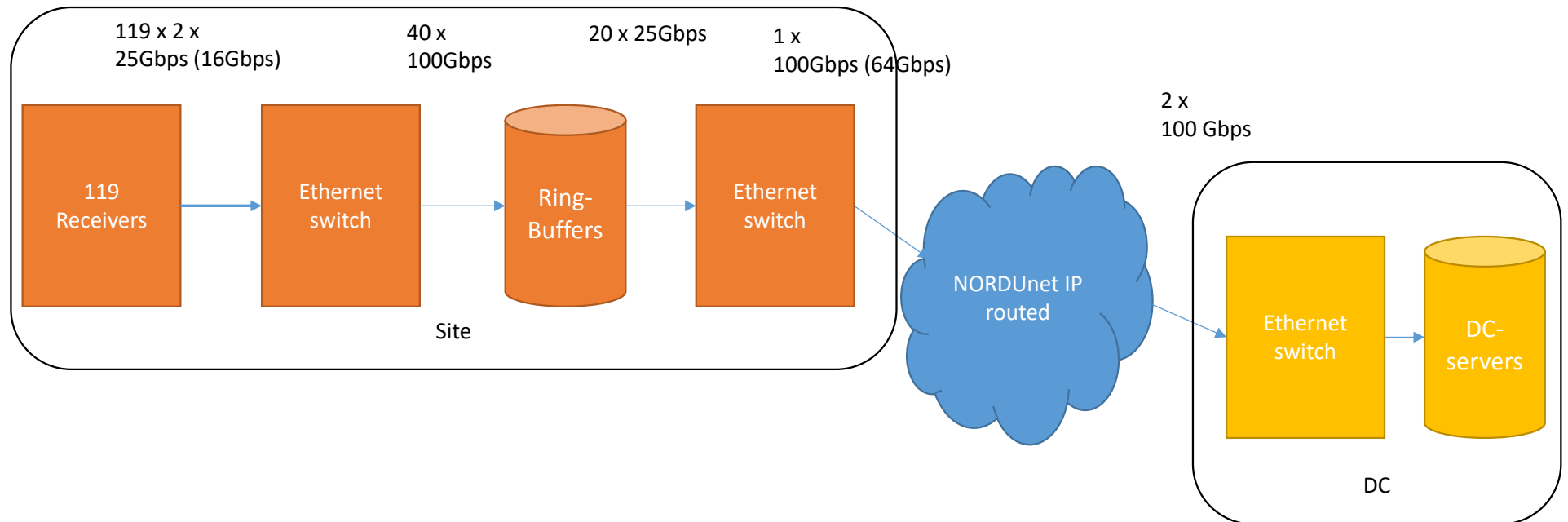
(New and Better Technology)

Moving data to Data Centre

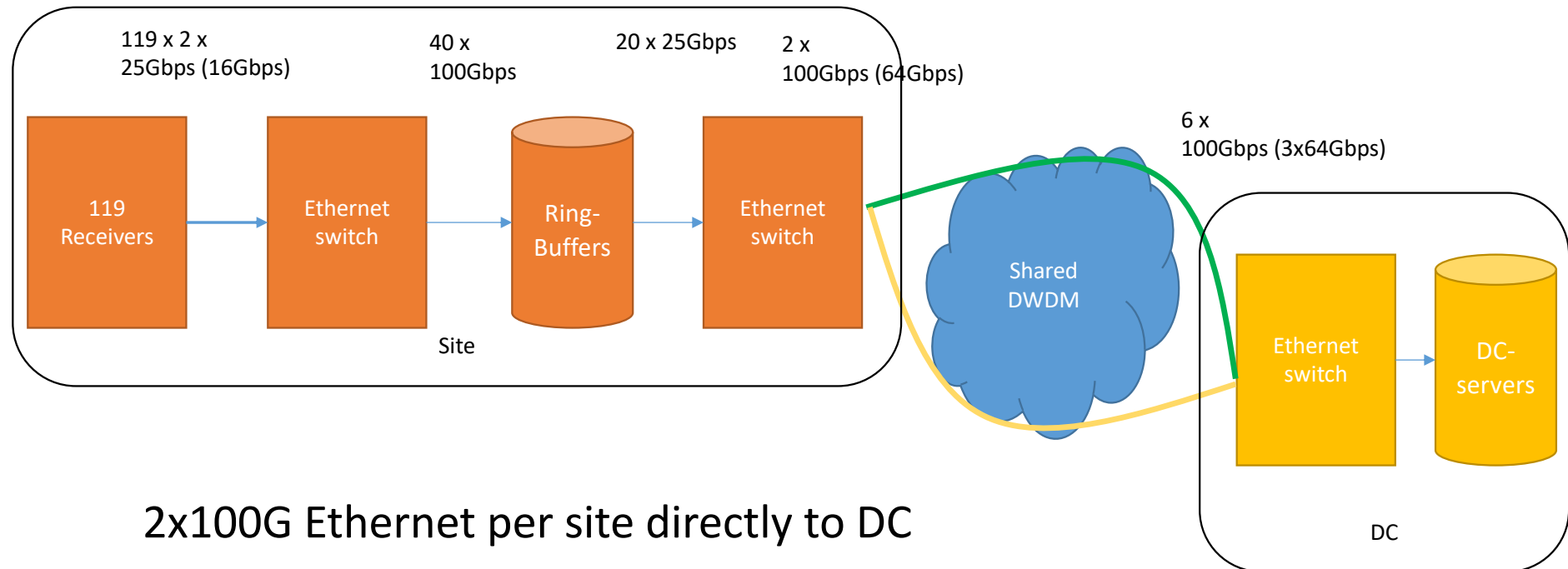
- Connect the Ring Buffer nodes secondary side to DC
- Aggregate Receivers data ethernet ports and extend to DC
- Extend Receivers ethernet ports to DC

- (order of *more* flexibility, capacity, and cost, *less* equipment at sites)

Original Design

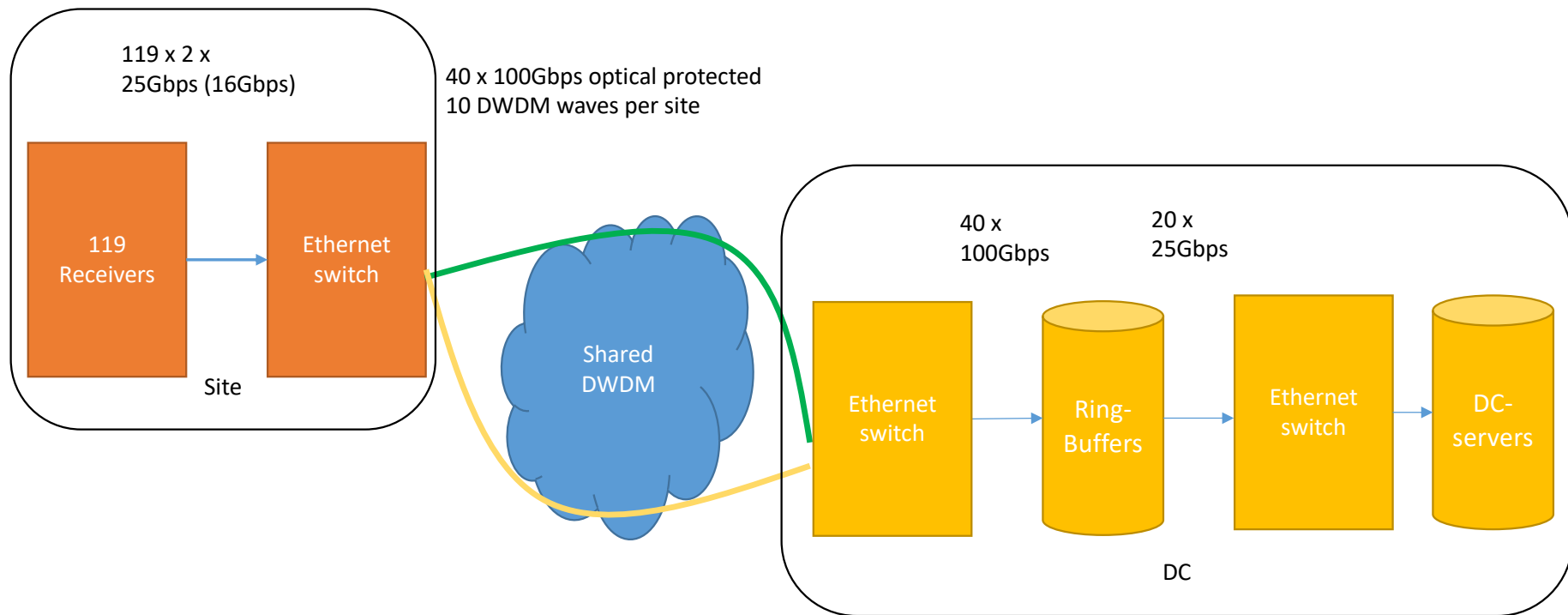


2x100G Point-to-Point Ethernet



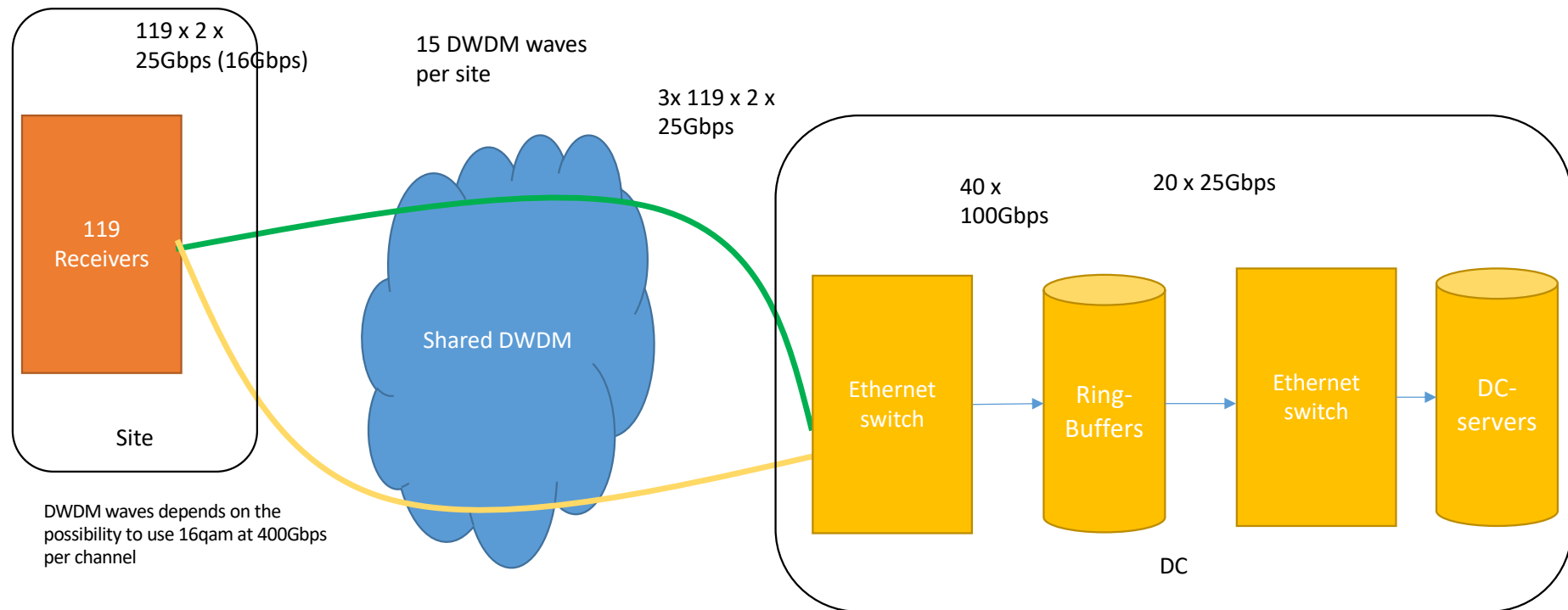
2x100G Ethernet per site directly to DC

Ring-buffers at D.C. (1)

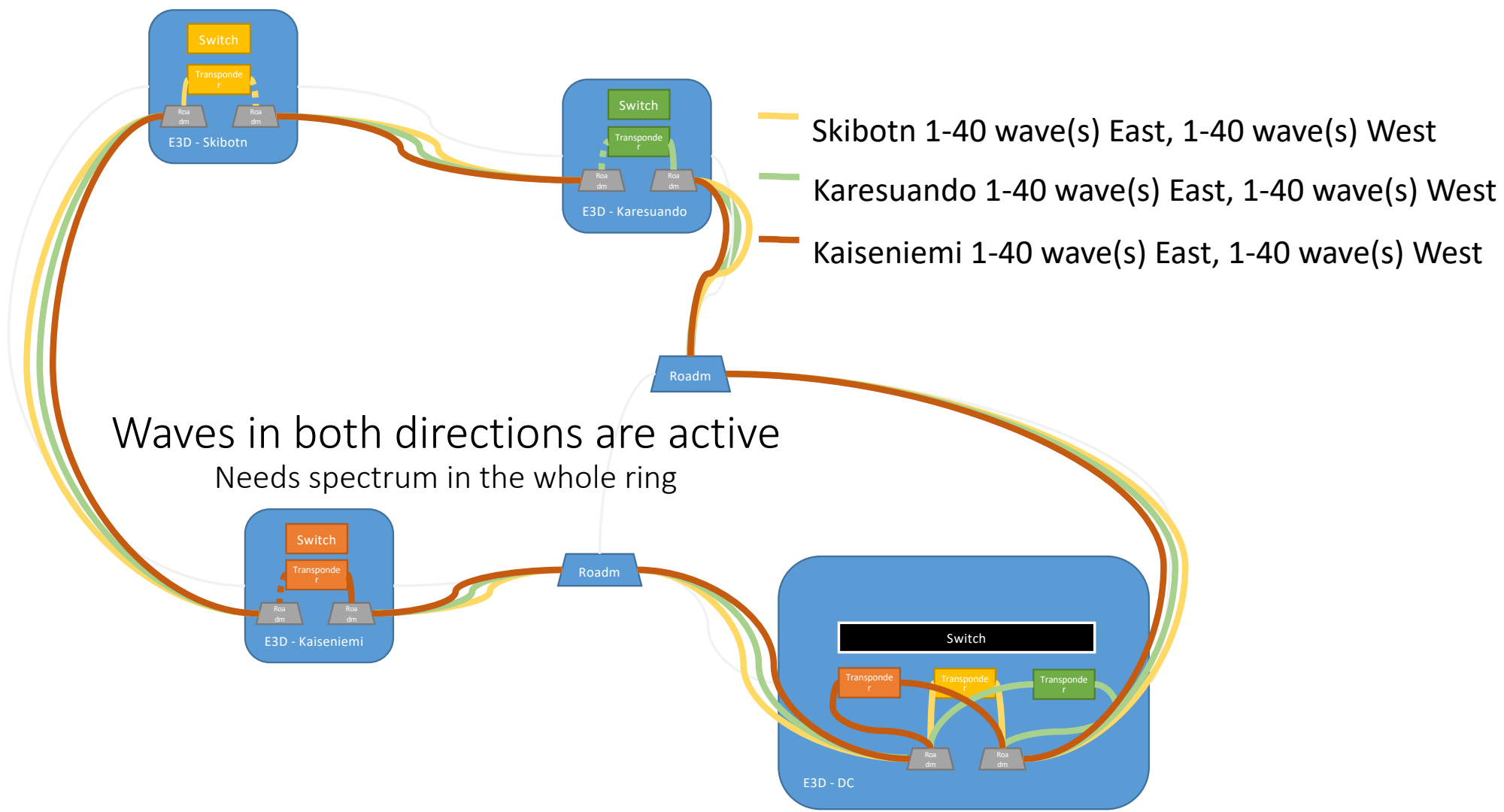


Ring Buffers at DC. 40x100G Ethernet per site directly to DC
Optical network protection

Ring-buffers at D.C. (2)



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



Waves in both directions are active
Needs spectrum in the whole ring

Location of DC for illustration only
Can be FI, SE, NO – but must be close to ring

Comparing the Alternatives

Alternative	Pro	Cons	Cost Delta
Original design with IP connectivity	IP full redundancy. Can be used for normal Internet	One interface handoff to the site. Only planed for 64Gbps of traffic to DC per site.	
2x100G Ethernet directly to DataCenter	Two interface handoff to DC. 2x100G of traffic to DC when all fibers are whole.	All internet traffic needs to go to the DC.	Slightly cheaper; no routers at sites
Ring Buffer at DC, 40x100G transport	All server can be placed at DC. Reduce size & power at sites.	All internet traffic needs to go to the DC.	+ ~1.400k€
Ring Buffer and aggregation switch at DC, 60x100G transport	All possible traffic from receivers can be transported to DC. All server can be placed at DC. Reduce size & power at sites.	All internet traffic needs to go to the DC.	+ ~2.100k€

Caveats

- Designs shown to indicate possibilities
 - Technology that has only recently become available
 - Changes in optical networking cost
 - Not fully engineered or tested
 - Not costed in details
- Impact on annual service cost not assessed
 - Optical (and point-to-point) equipment have longer lifetime
 - Fewer equipment replacement needed (with un-changed requirements)
 - 10-year system lifetime realistic
- Work remains on the details
 - ... if EISCAT find the idea interesting

Outstanding Issues

Questions & Concerns & Next Steps



- Should we go ahead with the new options
 - Which one?
- Data Centre
 - Where?
 - Include in network?
- Securing local fibre
 - Need to place SE and FI orders; Existing fibre offers have formally expired
 - Need to confirm sites
 - Can we confirm Kaiseniemi? Please?
- Network build
 - Fibre & optical network build
 - Integration with chosen computing setup

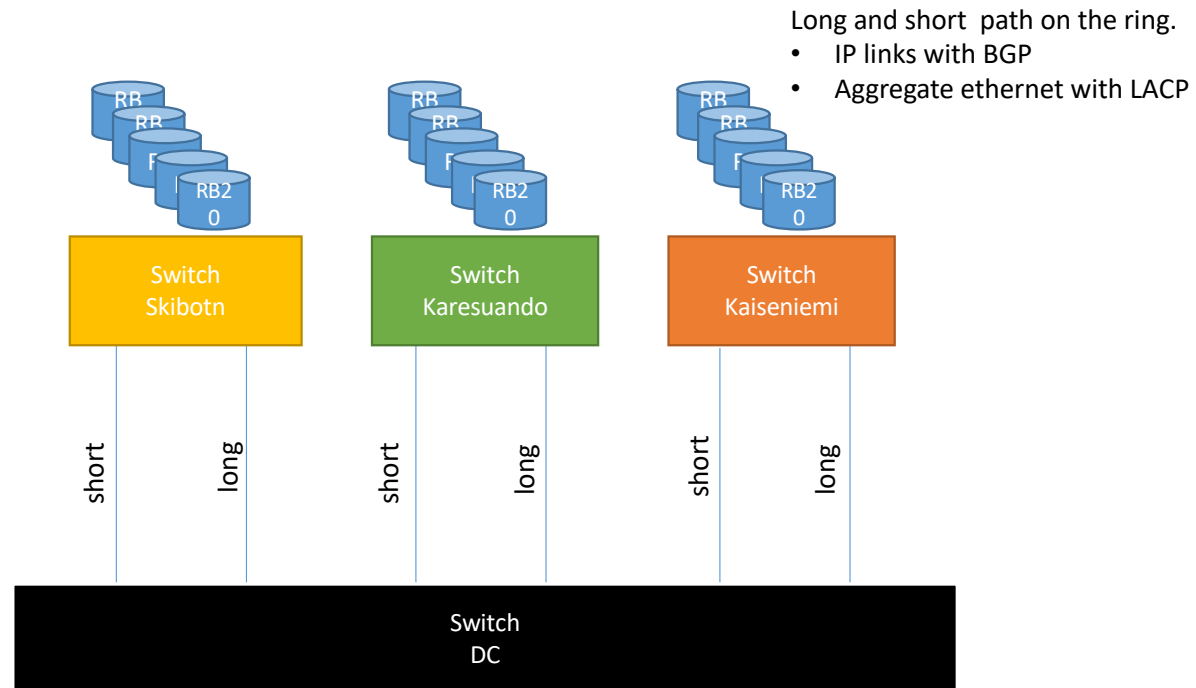
Thank You
<lars@nordu.net>

Backup Slides

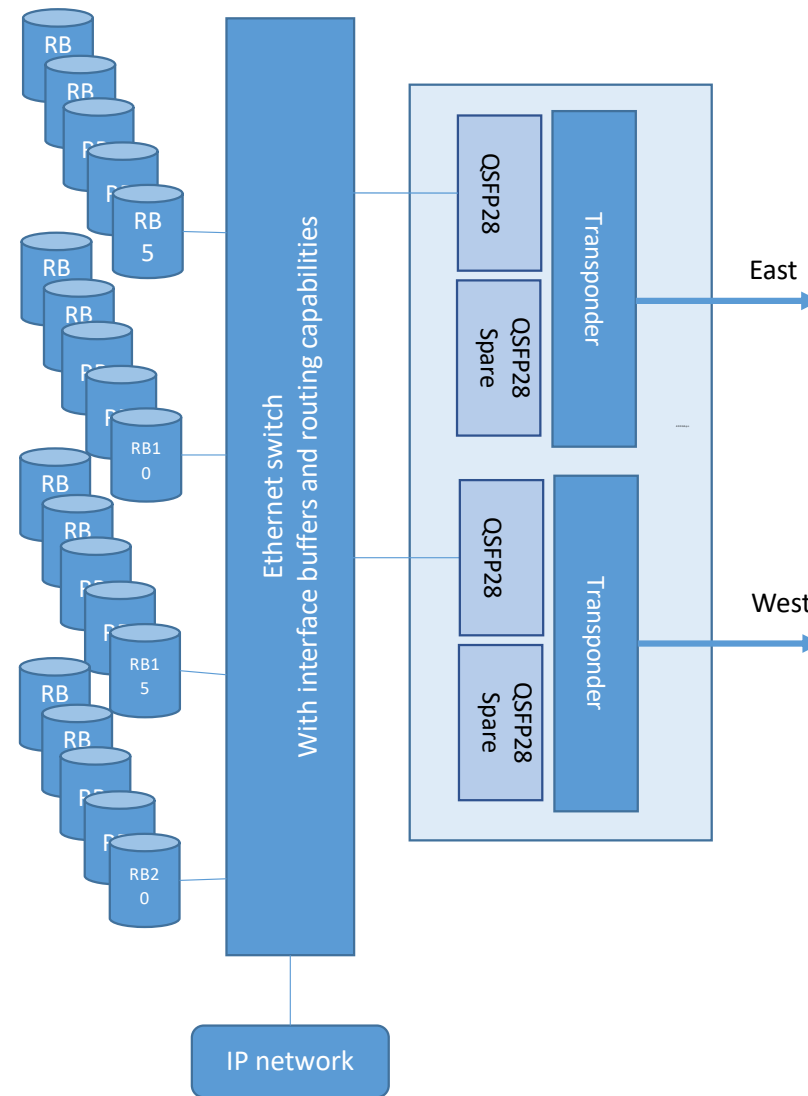
Aggregate and Extend Receivers ethernet ports to DC

- The receiver modules, 119 at each site, has 2x25Gbps SFP+ ethernet ports.
- The the ethernet ports are terminated in a switch and the ring buffer servers are connected to the same switch.
- The Ring Buffers secondary side are connected to another switch and the output from that switch is connected to the DC on 2x100G where each 100G goes on a different path on the DWDM ring.

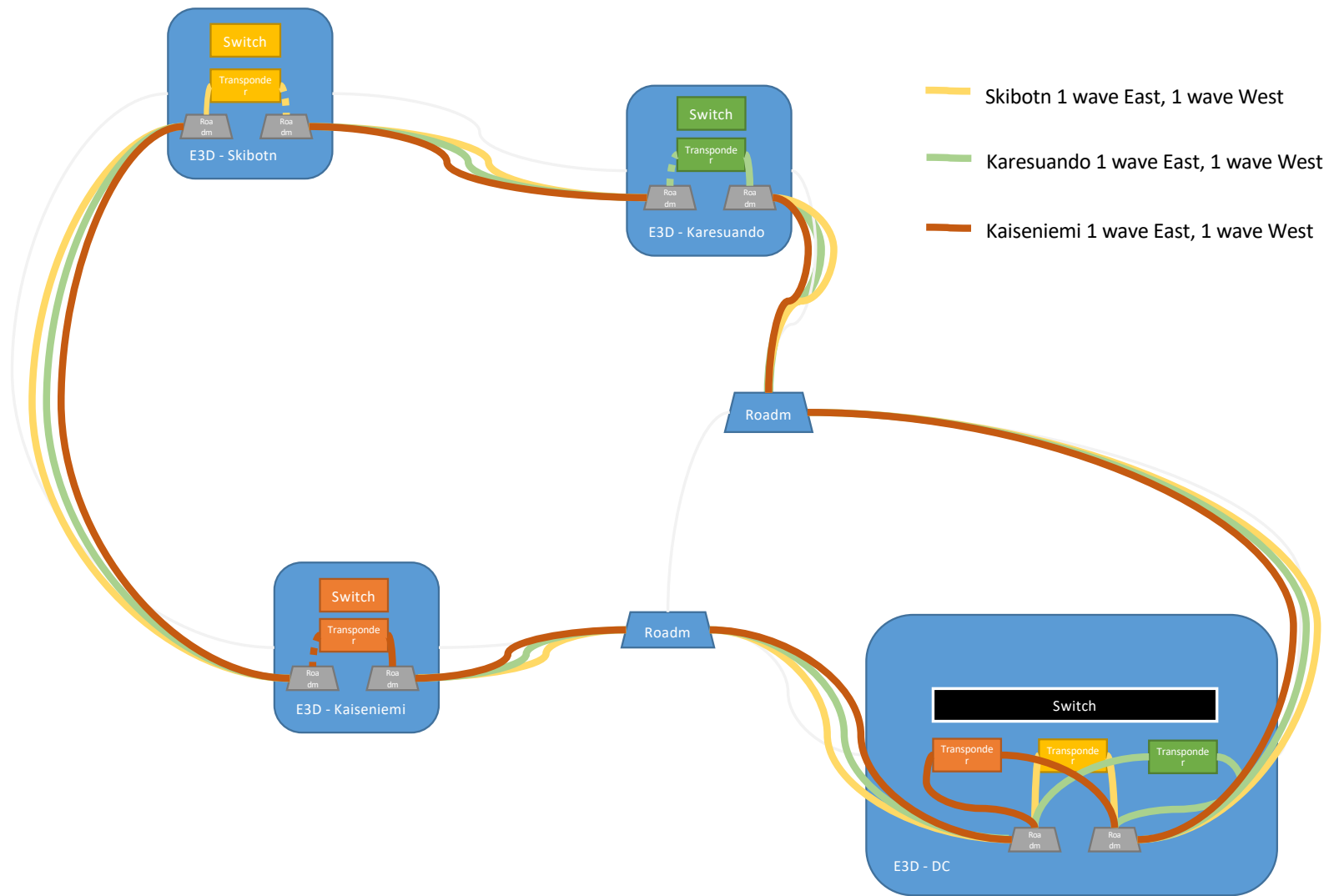
Logical view Site 2x100G to DC



2 x 100G from Site directly to DC



Site 1-3

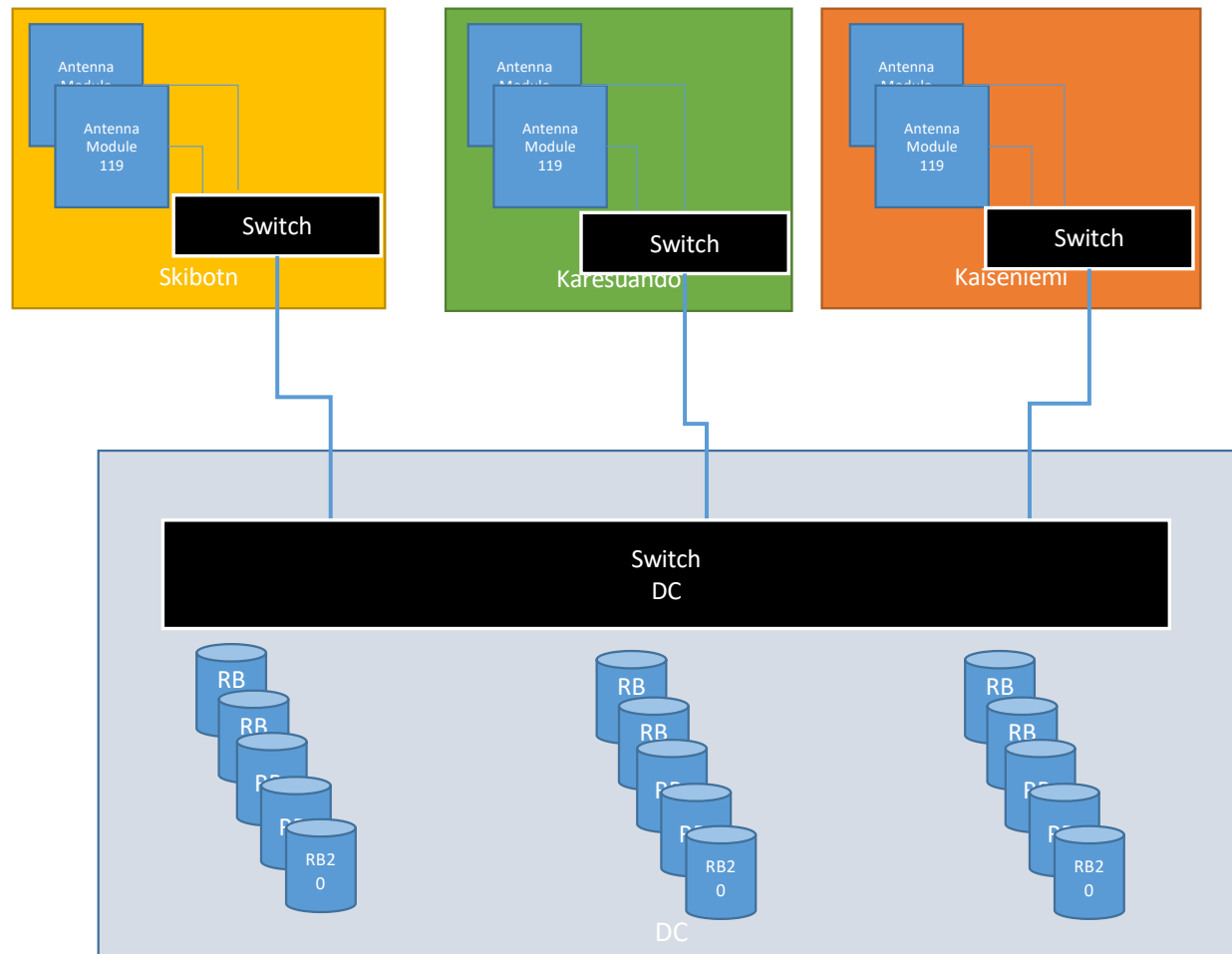


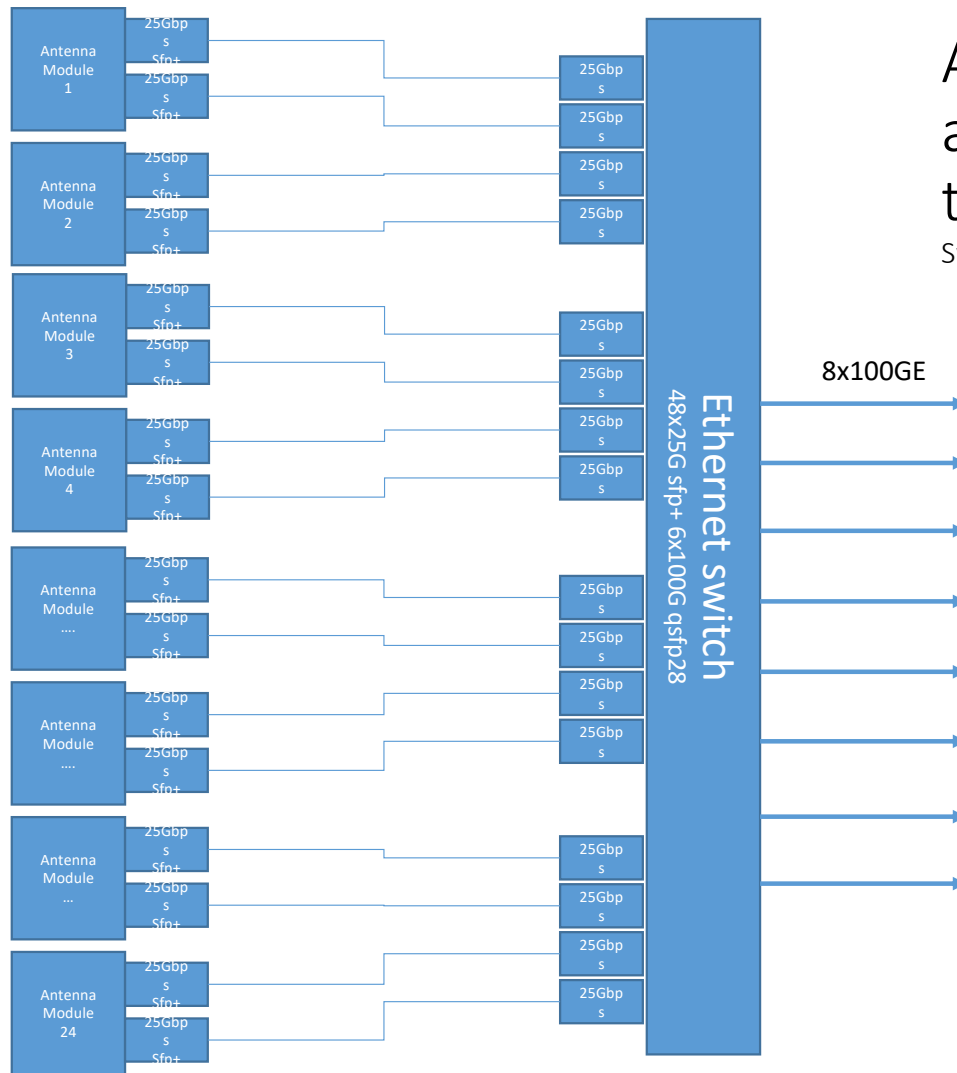
Aggregate and Extend Receivers ethernet ports to DC

- The receiver modules, 119 at each site, has 2x25Gbps SFP+ ethernet ports.
- The the ethernet ports are terminated in a switch and the ring buffer servers are connected to the same switch.
- The switch can stay at the site and aggregate the the traffic from the receivers as each receiver are not producing more than *2x16Gbps*. The ring buffer servers can then be moved to a DC and the optical network is used to forward the aggregated Ethernet from the receivers to the DC.

Antennas at site with aggregation switch, Ring buffer nodes with deaggregation switch at DC

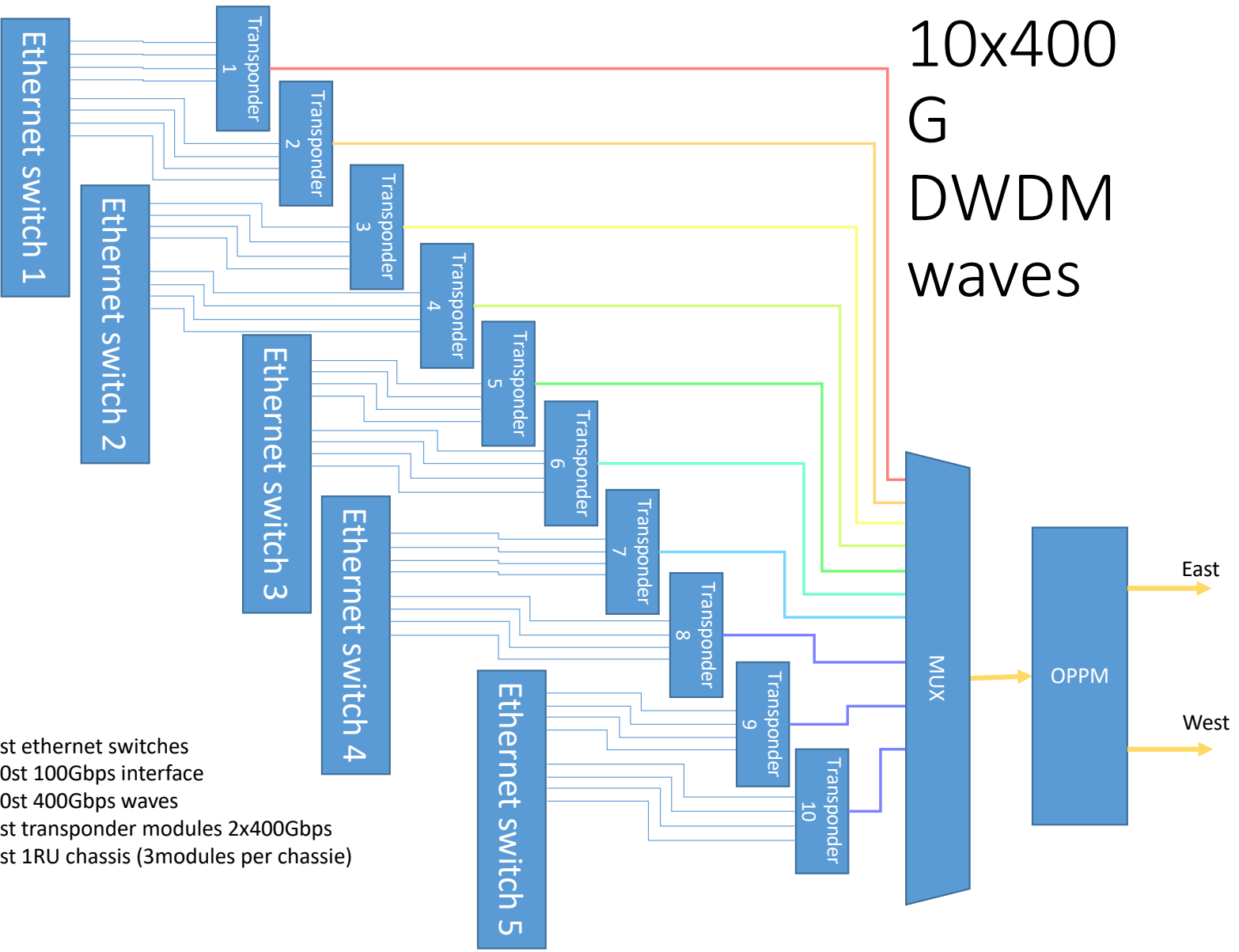
Logical view (reduces waves on the optical system)





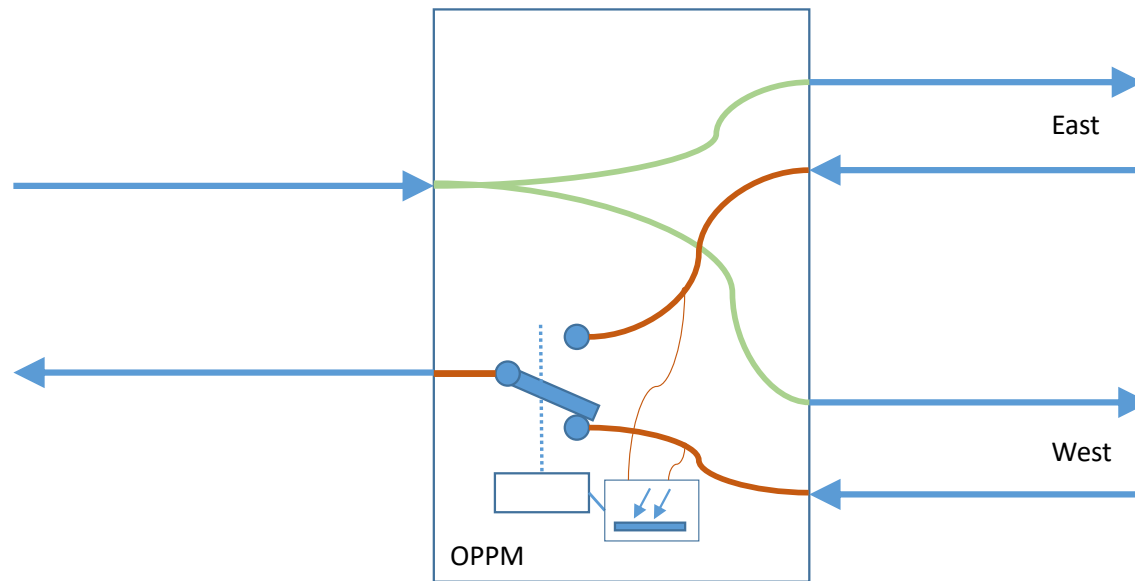
Aggregating 24 antenna modules to 8x100GE

Switch 48x25Gbps + 8x100Gbps

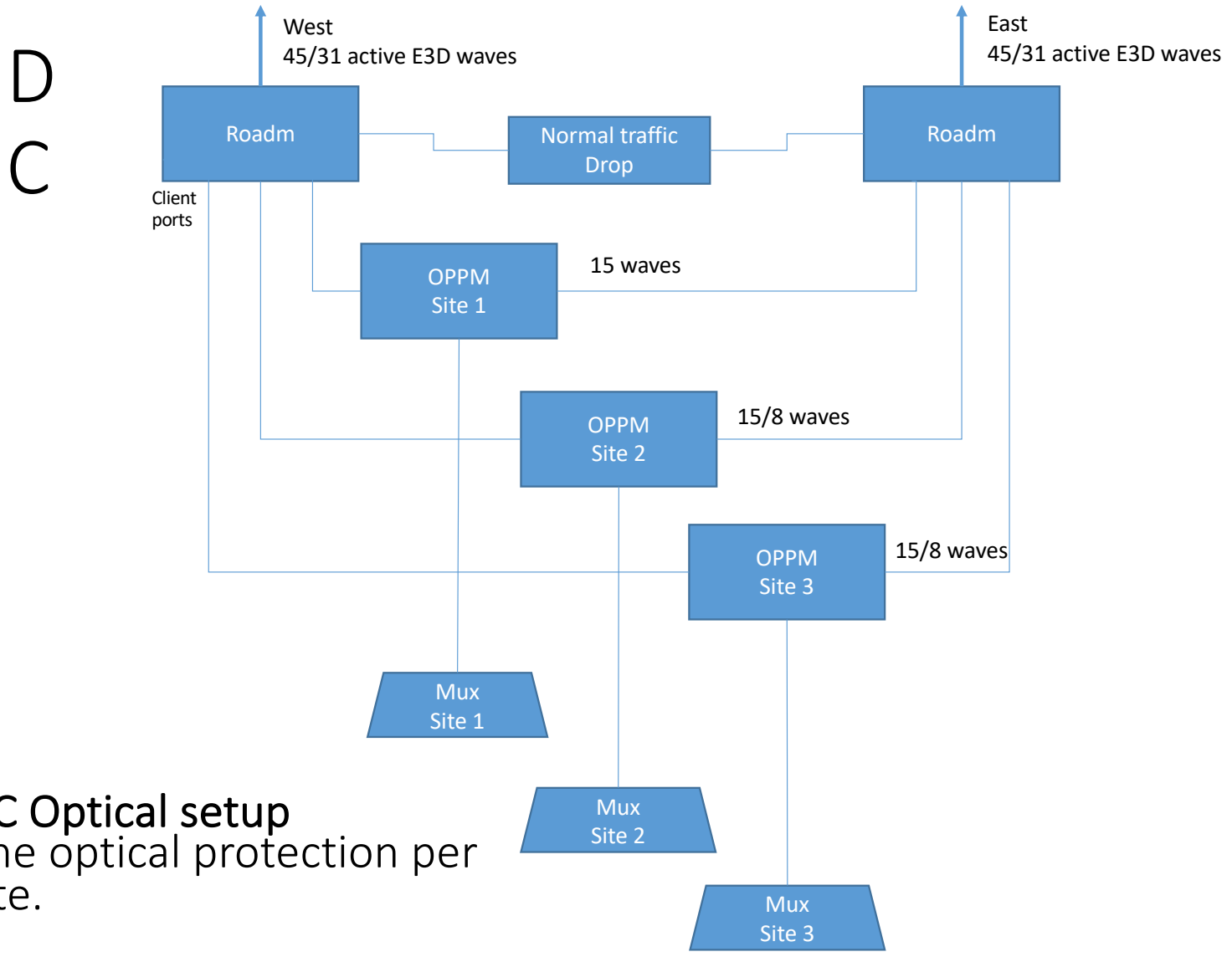


5st ethernet switches
 40st 100Gbps interface
 10st 400Gbps waves
 5st transponder modules 2x400Gbps
 2st 1RU chassis (3modules per chassie)

OPPM Optical Path Protection Switch Module

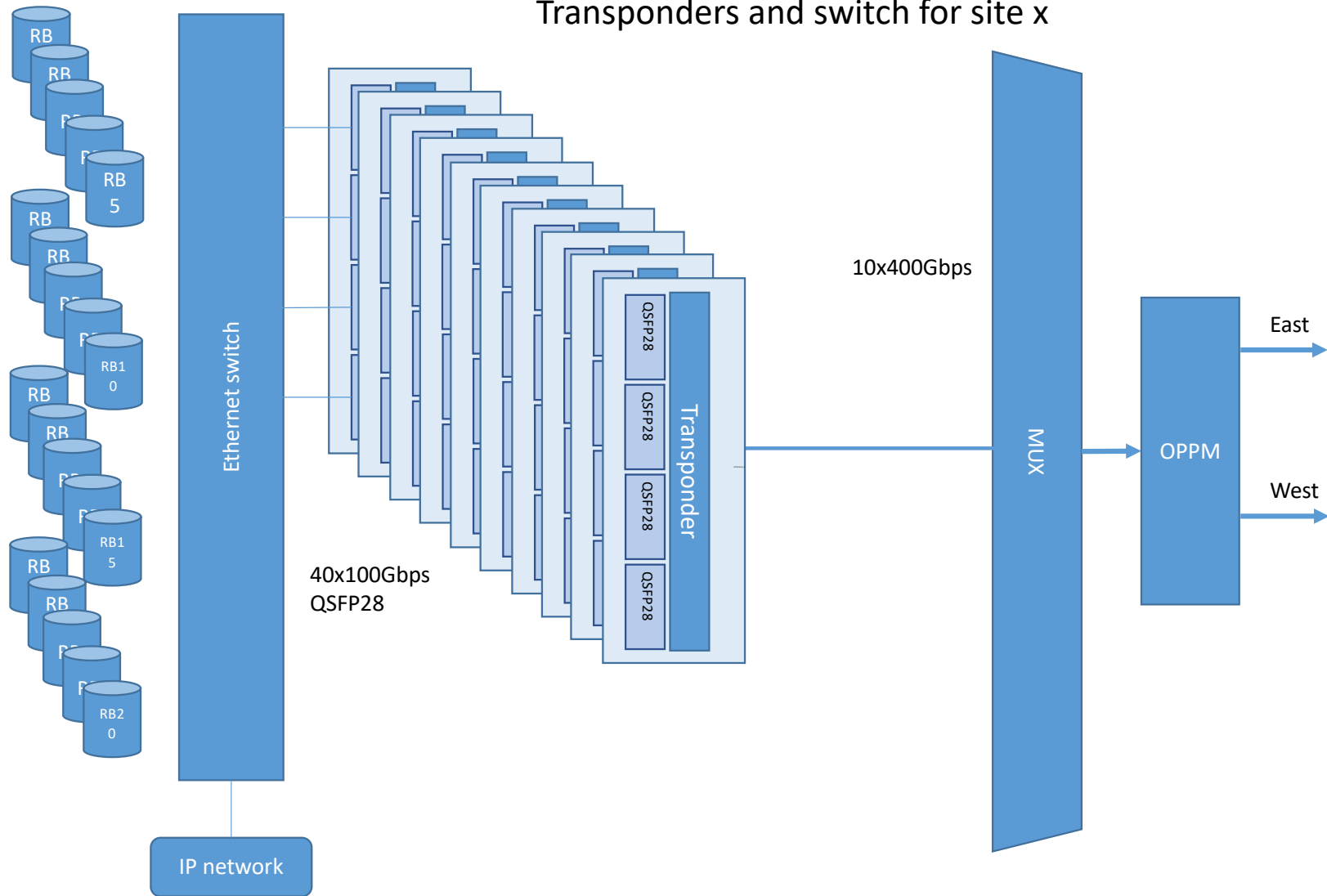


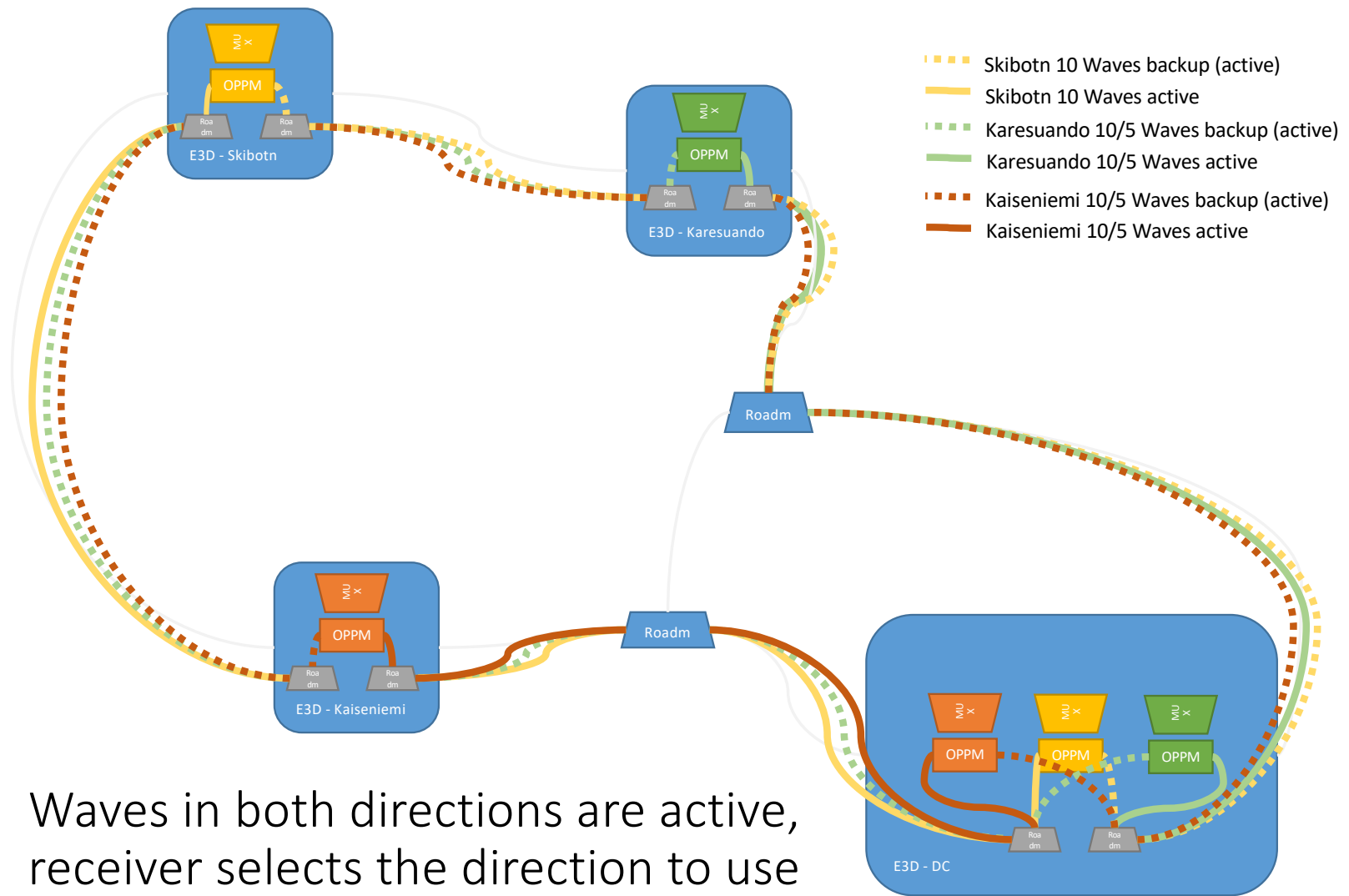
- Sends the light in two directions at the same time
- Receiver switches source if the preferred direction goes away
- Gives sub second redundancy switch between long and short path on the DWDM ring



DC Optical setup
 one optical protection per site.

DC
Transponders and switch for site x





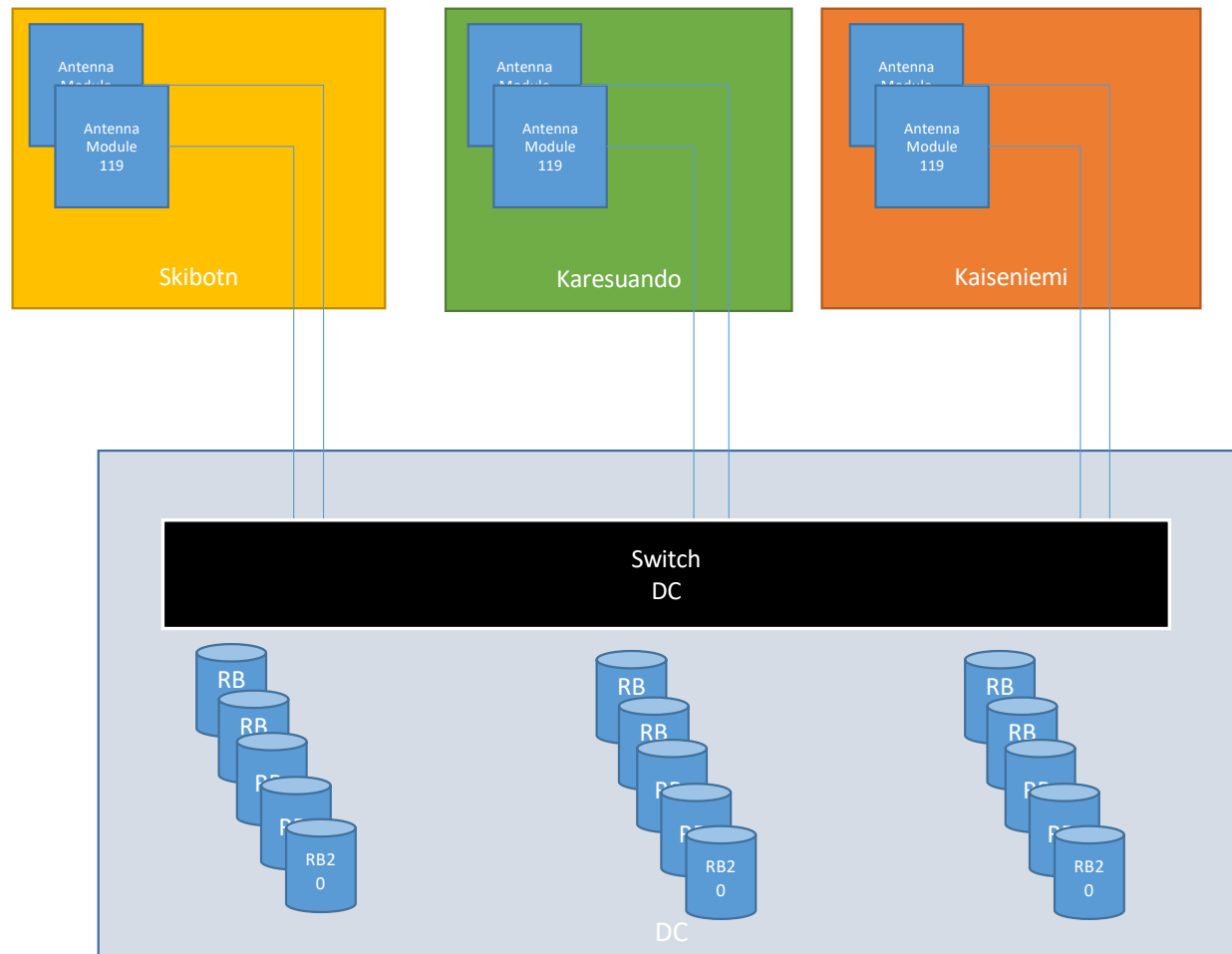
Waves in both directions are active,
 receiver selects the direction to use
 Needs spectrum in the whole ring

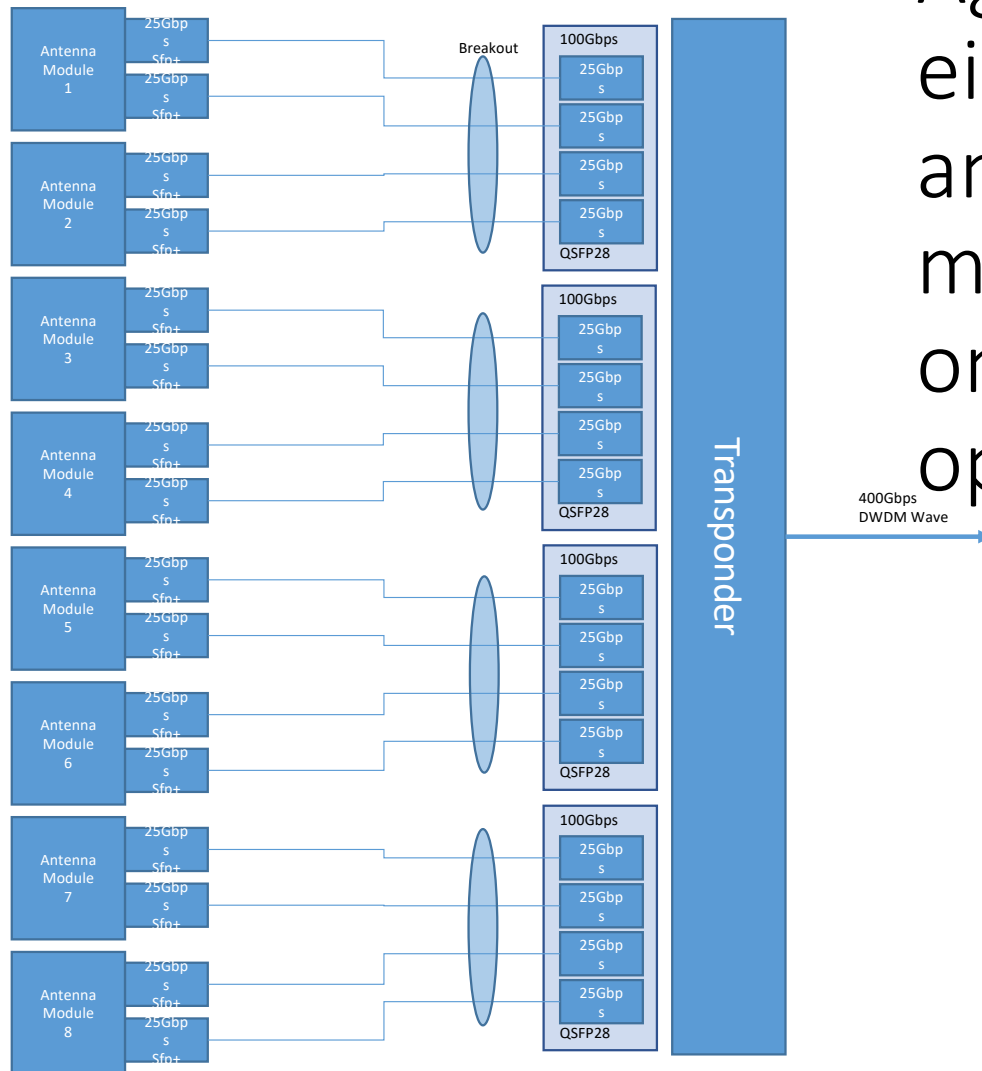
Extend Receivers ethernet ports to DC

- The receiver modules, 119 at each site, has 2x25Gbps SFP+ ethernet ports.
- The the ethernet ports are terminated in a switch and the ring buffer servers are connected to the same switch.
- The switch and ring buffer servers can be moved to a DC and the optical network is used to forward the raw Ethernet from the receivers to the DC.

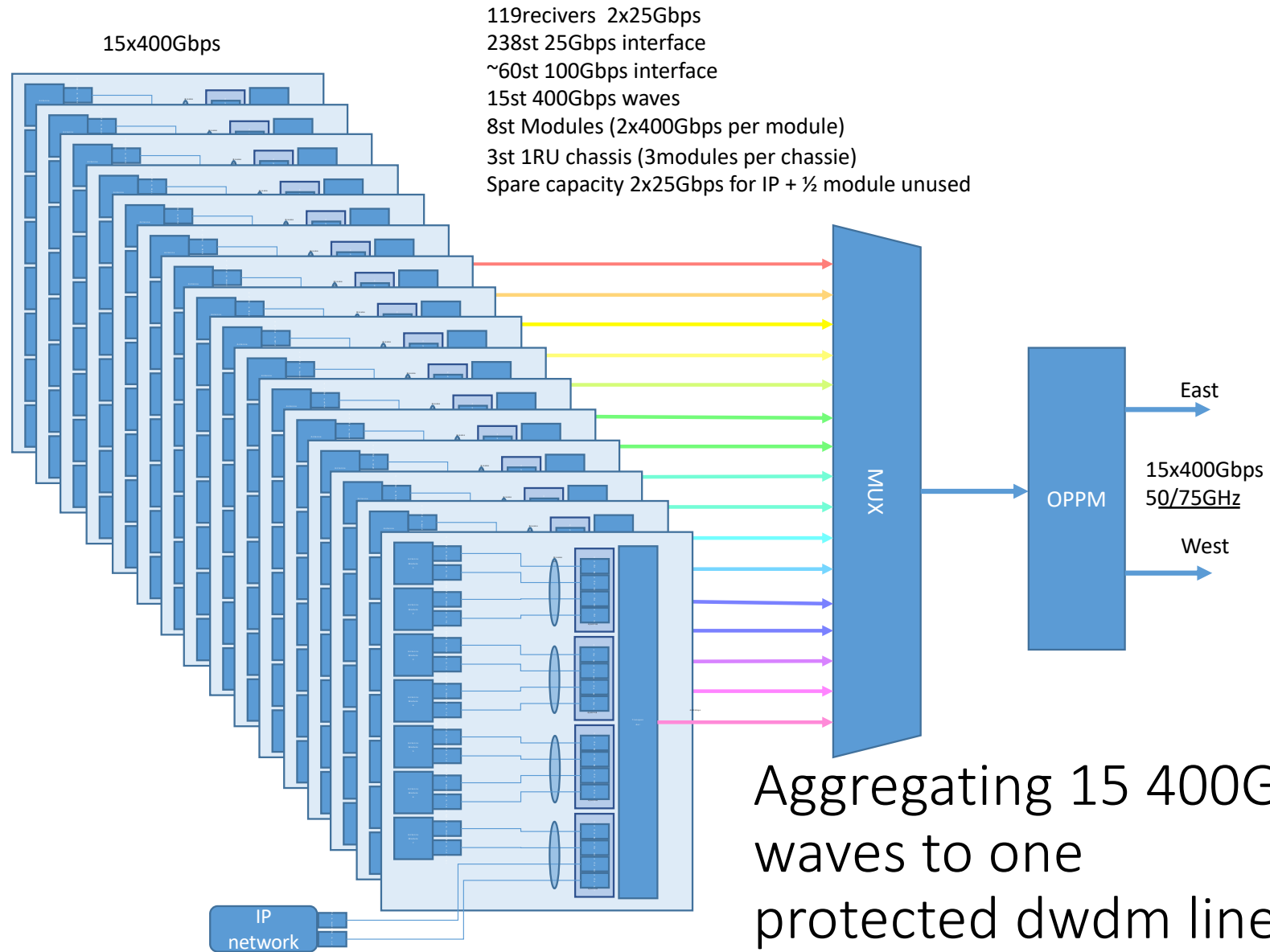
Antennas at site, switch and Ringbuffer at DC

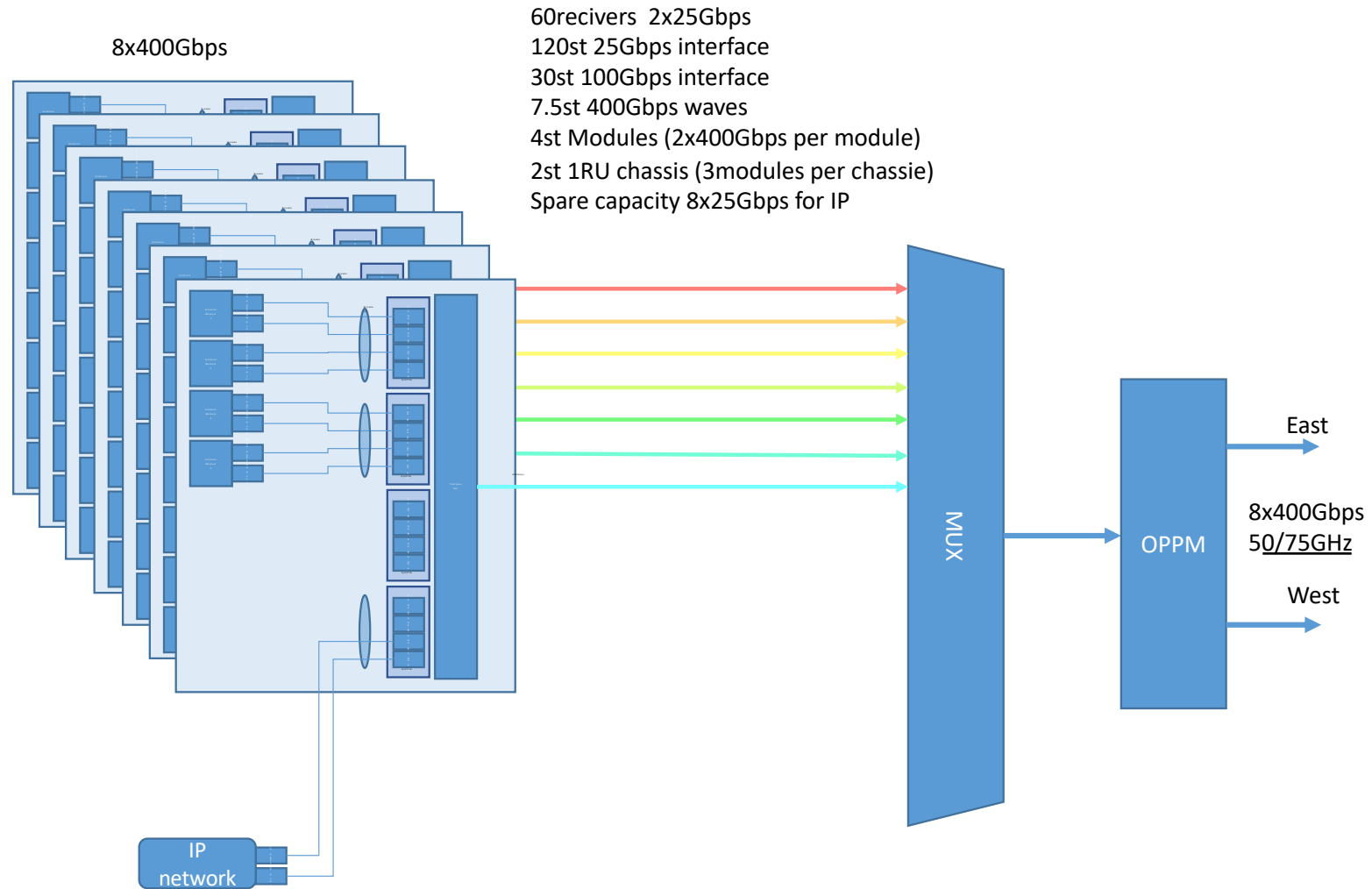
Logical view





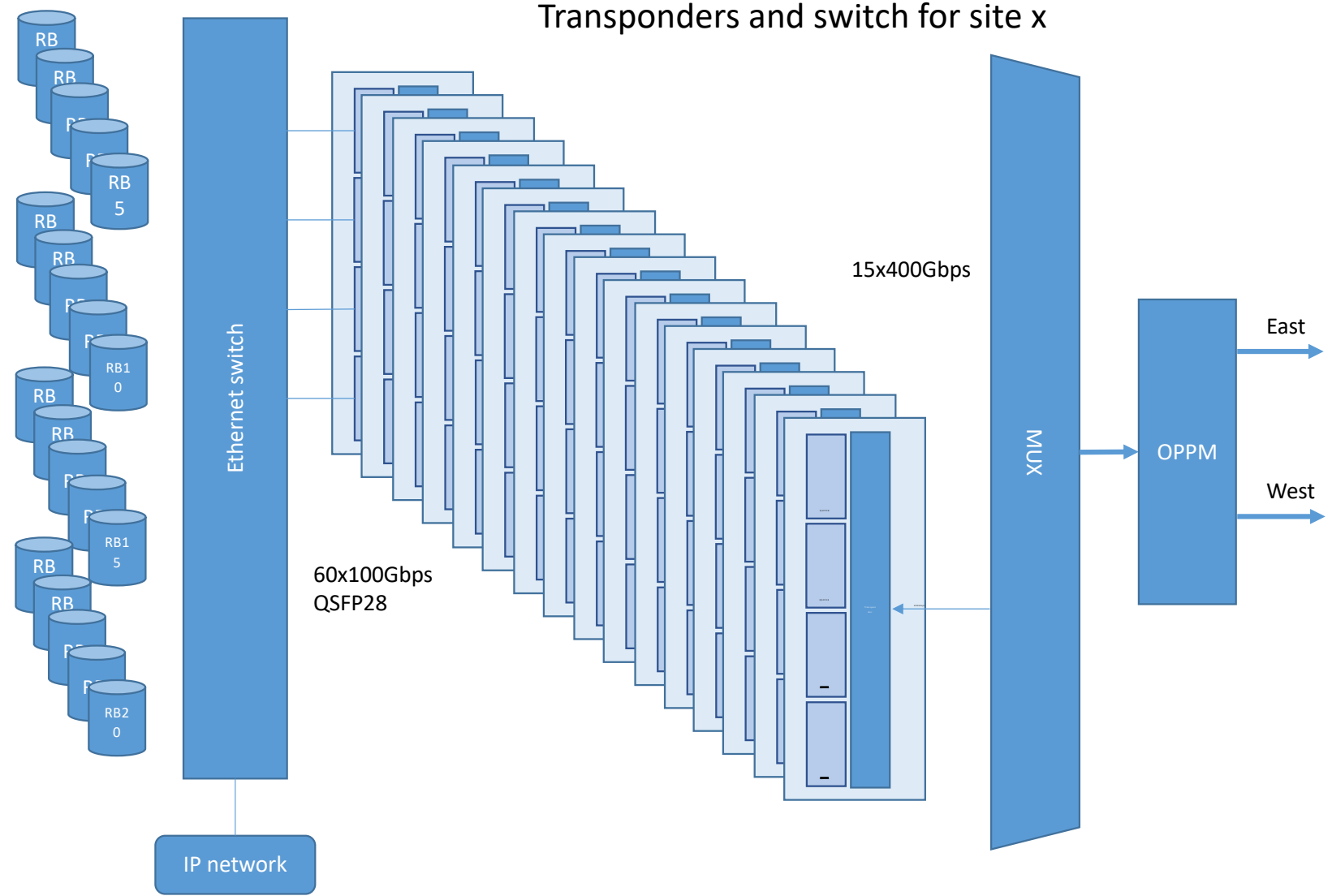
Aggregating
eight
antenna
modules to
one 400G
optical wave

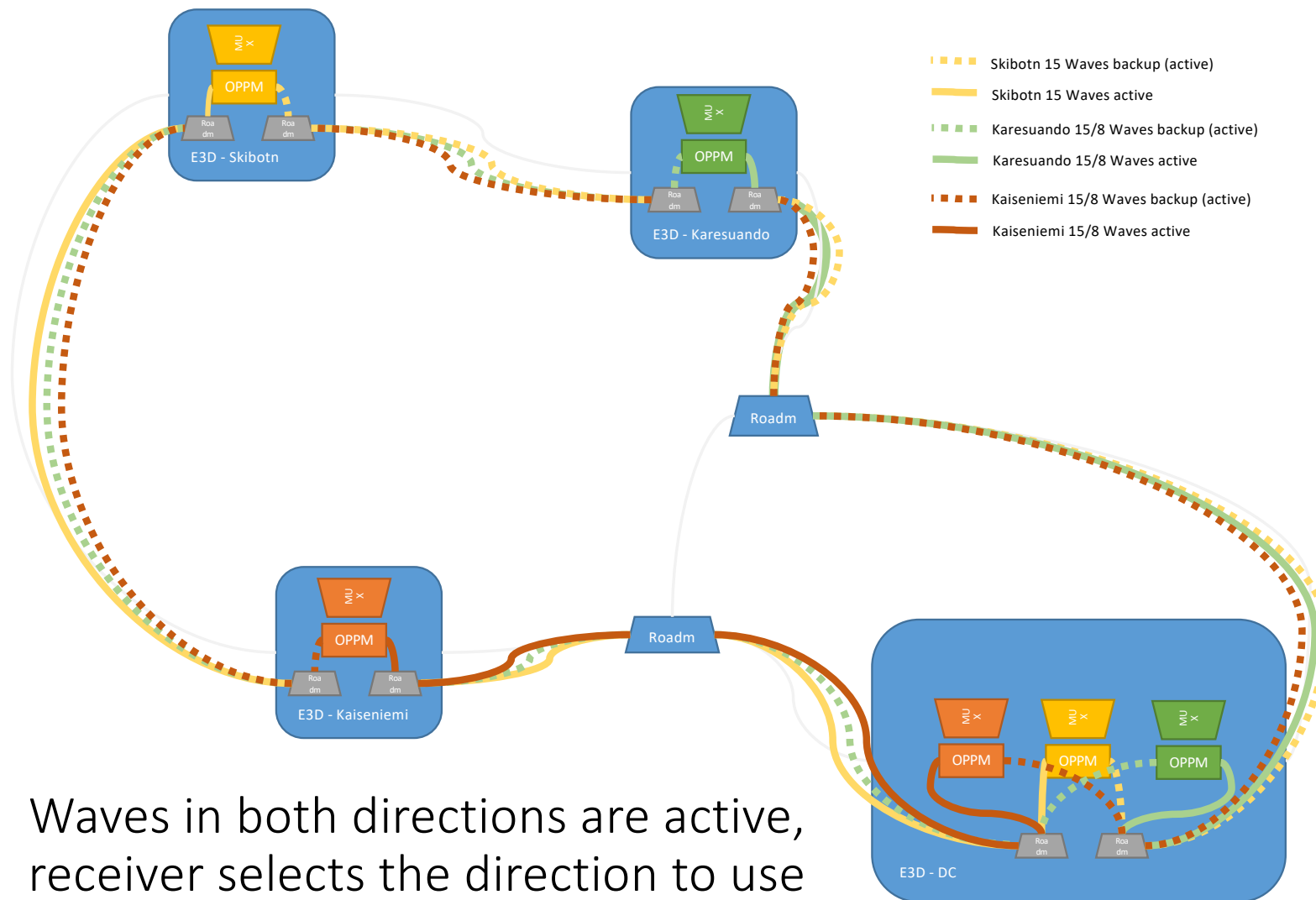




Receiver site with only 60 antenna modules
 Aggregating 8 400G waves to one protected line

DC
Transponders and switch for site x





Waves in both directions are active,
 receiver selects the direction to use
 Needs spectrum in the whole ring