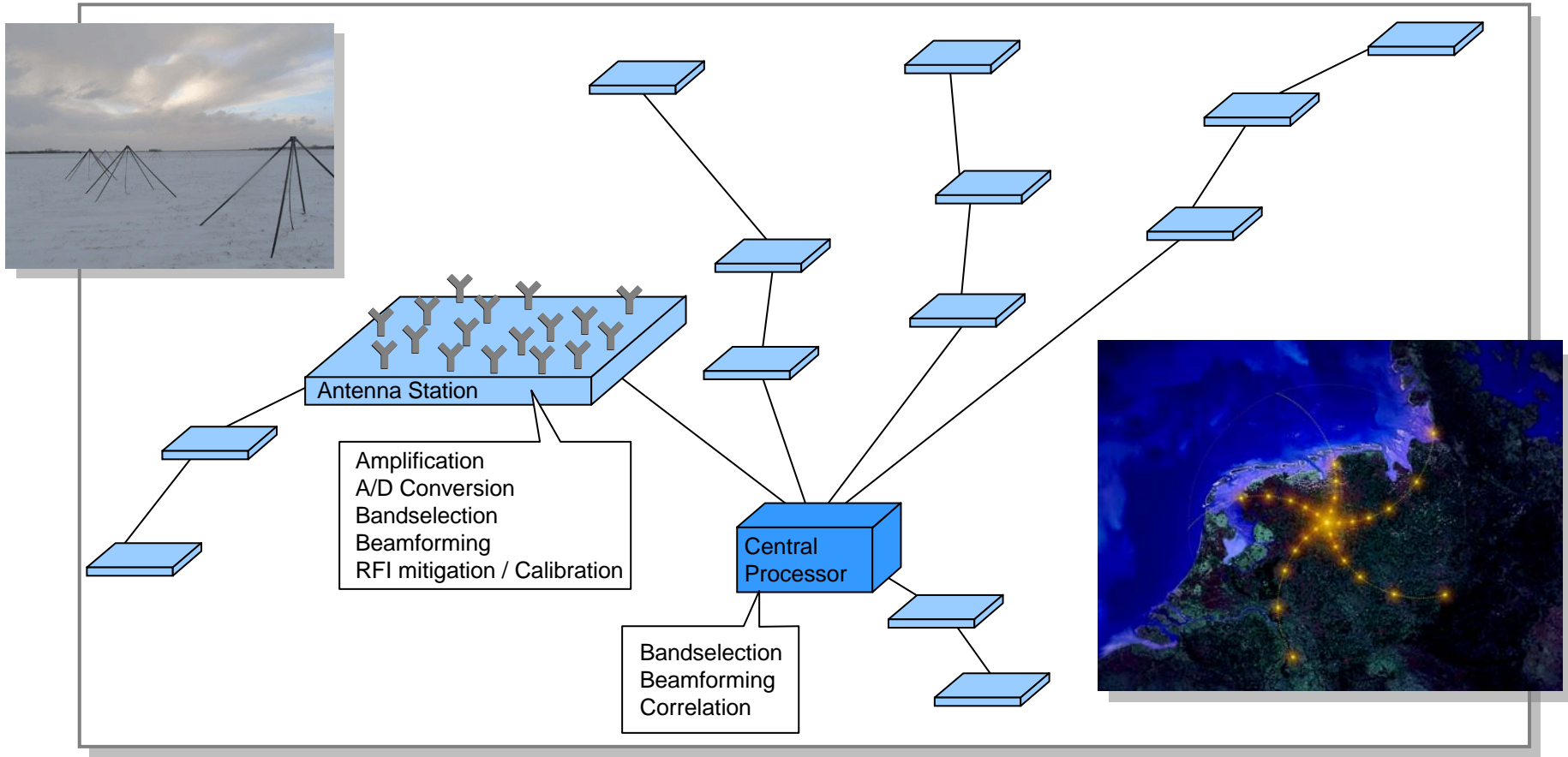


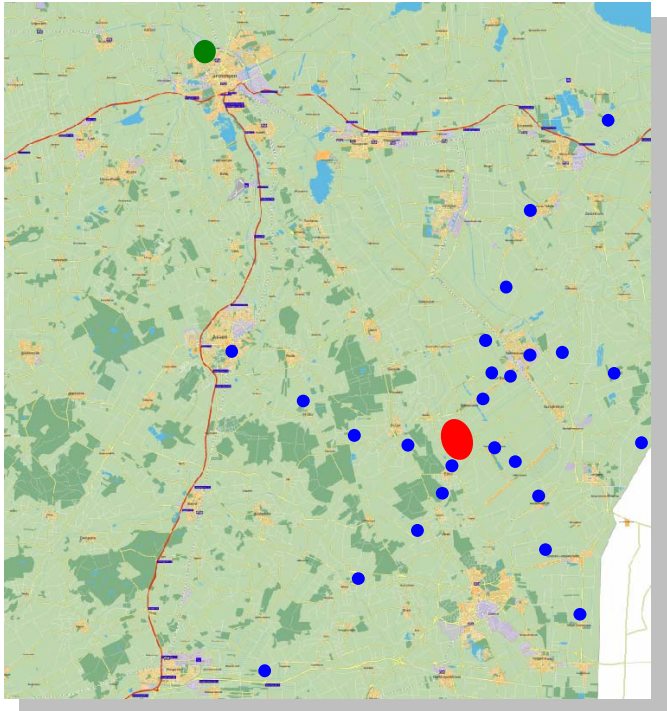


LOFAR – Data Transport Network




Peter Maat

- LOFAR – Wide Area Network
- LOFAR links for European LOFAR stations















LOFAR - arms

-  ~ 45 stations
-  2 Gb/s per station
-  Distance to LOFAR - Core < 80 km

LOFAR - Core

-  ~ 32 stations
-  2 - 20 Gb/s per station
-  Intra - Core distance < 5 km

-  Monitoring and Control ~ 100 Mb/s
-  LOFAR – Partner data ~ 100 Mb/s
-  Latency ~ 10 ms
-  Availability ~ 95%
-  Upgradeable
 -  Longer arms
 -  Higher data rate per station

→ **Data transport technology: COTS 1 GbE & 10 GbE**

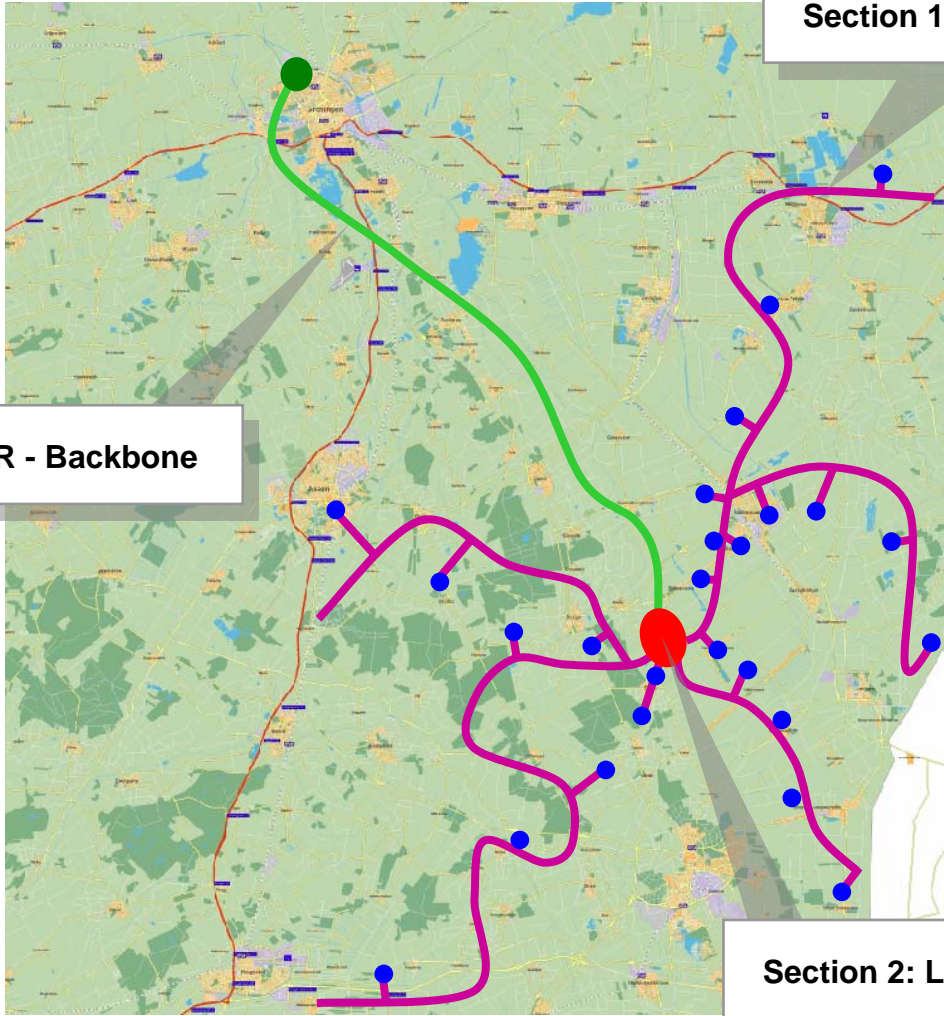
- Low cost
- Most suitable for point-to-point connections
- Easy to handle

LOFAR - WAN characteristics

- Unidirectional data transport
- No data routing
- Relatively low availability required
 - No routing needed
 - Protection network is not needed
 - Only relatively simple network management
- Upgradeable

Ethernet physical layer standards

- 1 GbE
 - 1000BASE-SX (MMF; < 500m)
 - 1000BASE-LX (SSMF; <10km)
 - 1000BASE-ZX (SSMF; <120km)
- 10 GbE
 - 10GBASE-S (MMF; < 300m)
 - 10GBASE-L (SSMF; <10km)
 - 10GBASE-E (SSMF; <40km)

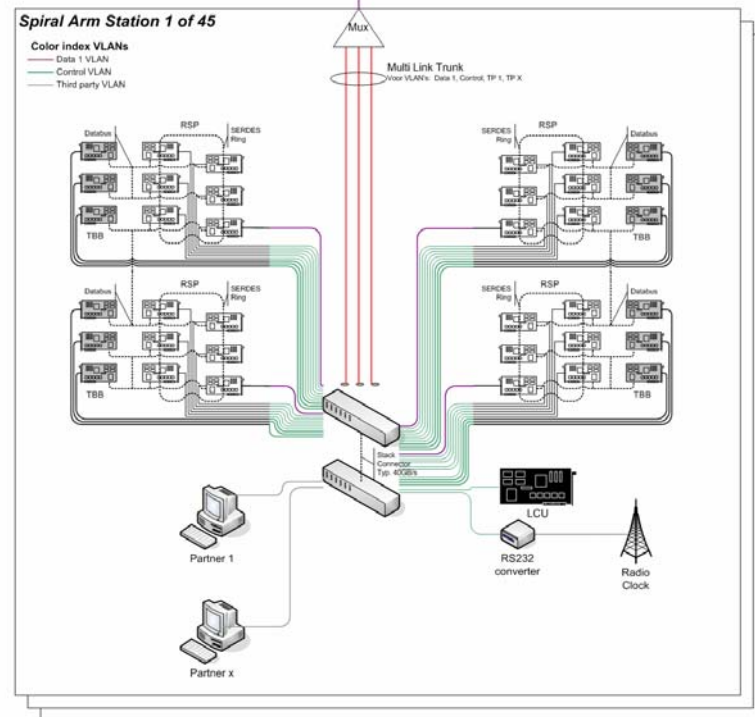
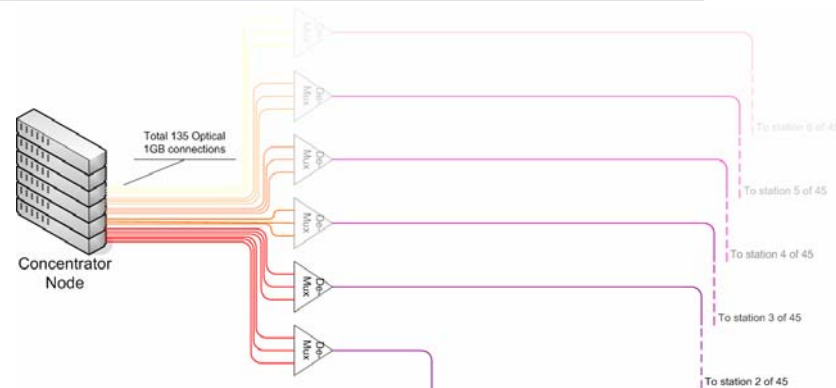
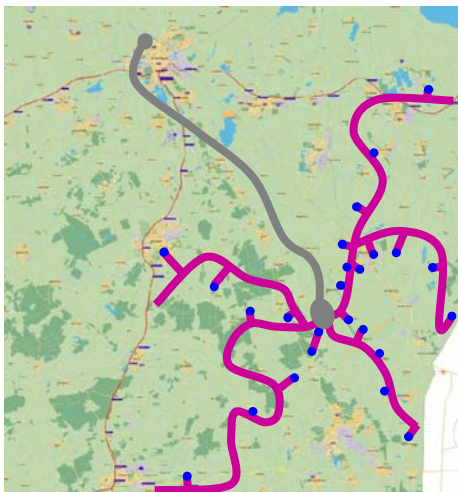









Section 3: LOFAR - Backbone

Section 1: LOFAR - Arms

Section 2: LOFAR - Core

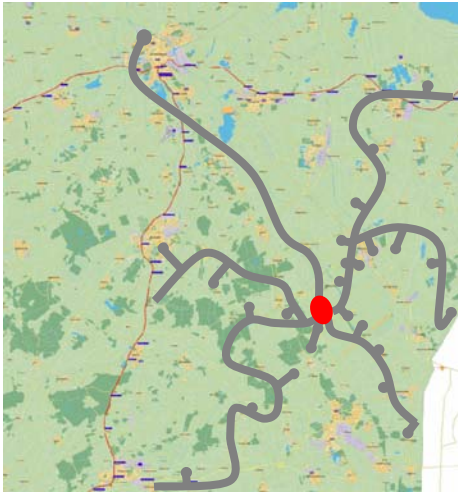
WAN Topology: the LOFAR - Arms










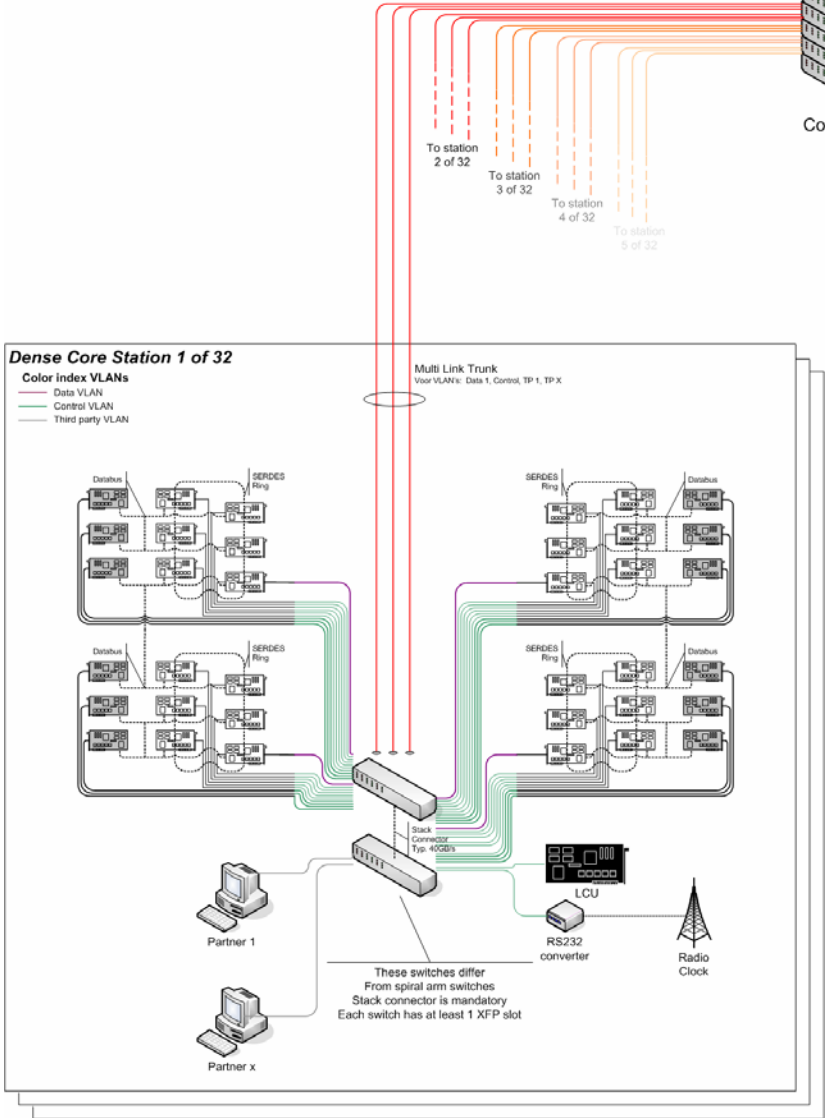
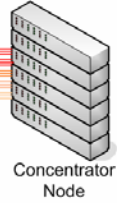
-  Intermediate and Long-haul links (10 – 80 km)
-  ASTRON owned fibre and leased lines (G652-C)
-  (Stackable) switches
 -  20 – 40 100/1000BASE-T port
 -  2 – 4 1000Base-X pluggable optics ports
-  SFP transceivers (1000BASE-LX, 1000BASE-ZX)
-  CWDM mux



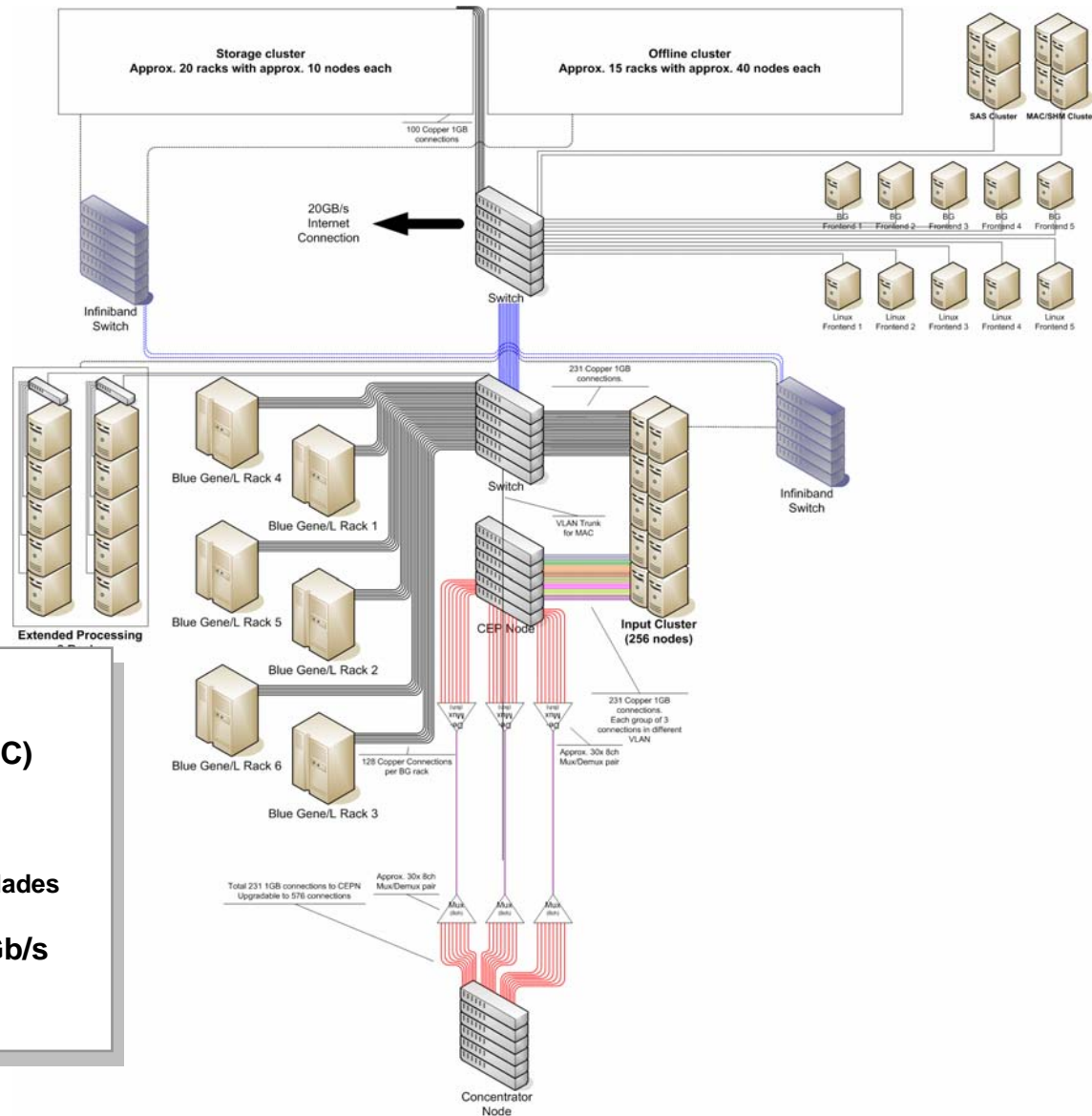
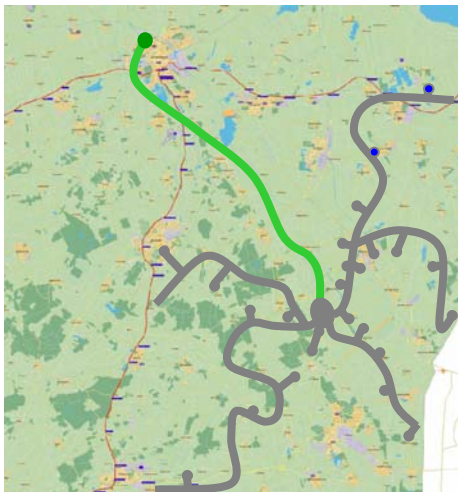
WAN Topology: the LOFAR - Core



-  Short-haul links (<10 km)
-  ASTRON owned fibre (G652-C)
-  (Stackable) switches
 -  20 – 40 100/1000BASE-T port
 -  2 – 4 1000BASE-X pluggable optics ports
-  SFP transceivers (1000BASE-LX)
-  Upgradeable (10GbE, 1GbE/CWDM)



WAN Topology: the LOFAR - Backbone



- Long-haul link (65 km)
- Leased cable with 72 fibre pairs (G652-C)
- Switches / switch frames
 - (option 1) 1000BASE-ZX (80 km) SFP's
 - (option 2) 1000BASE-ZX (80 km) switch blades
- CWDM 8 channel 1GbE, allowing 576 Gb/s
- Upgradeable (10GbE, 1GbE/DWDM)

Data format

- 9k byte jumbo frames
- IP/UDP traffic

Switch requirements

- Layer2+ / Layer3 switch
- Support for:
 - Jumbo frames
 - VLAN
 - Multicast
 - QOS
- Controllable by SNMP (with MIB availability)



Approach

- **Realise connectivity via Research Networks**
 - National
 - European
- **Connection to CEP via Surfnet**
- **Data format: GbE + TBD**



LOFAR – Data Transport Network