

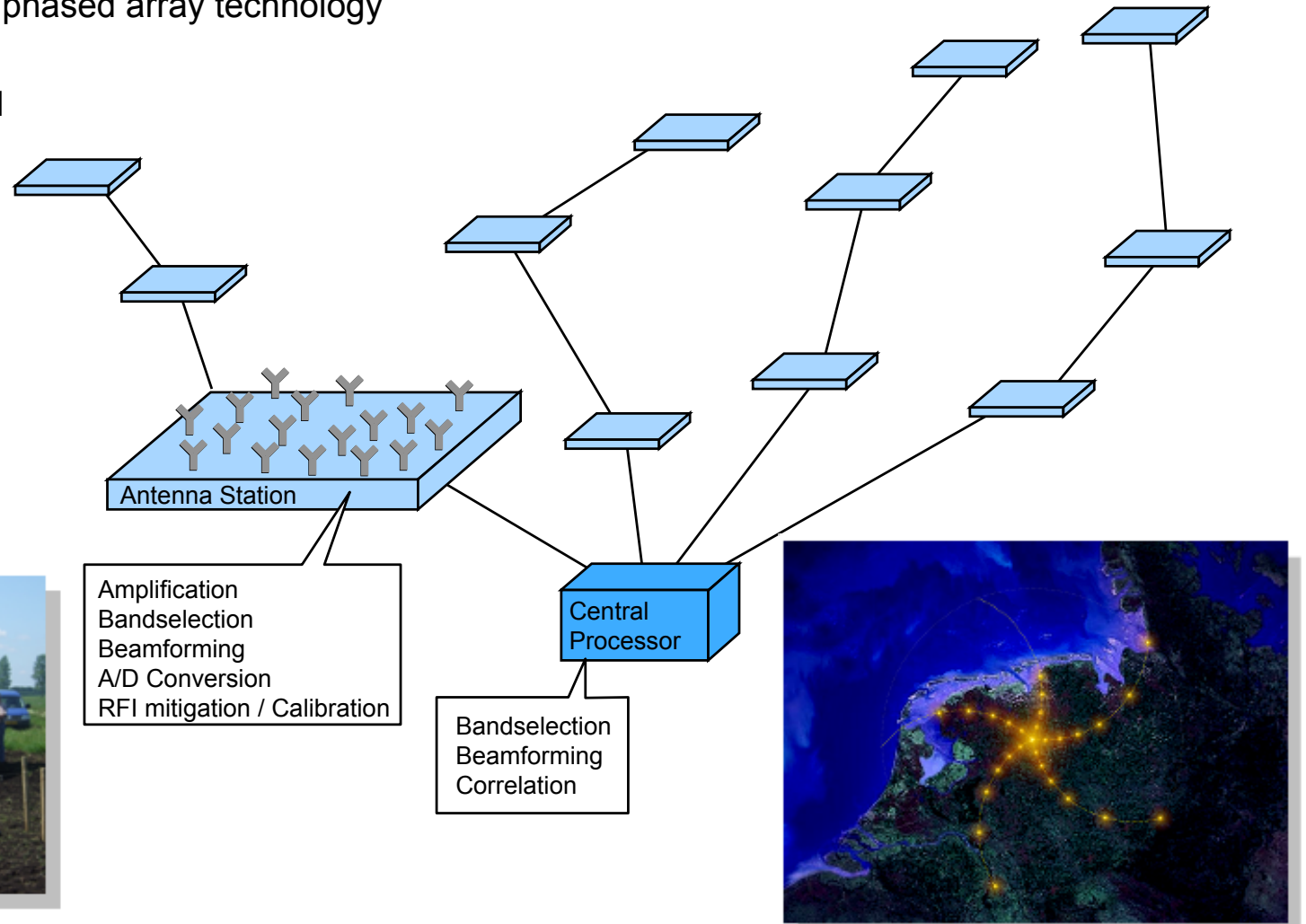
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LOFAR



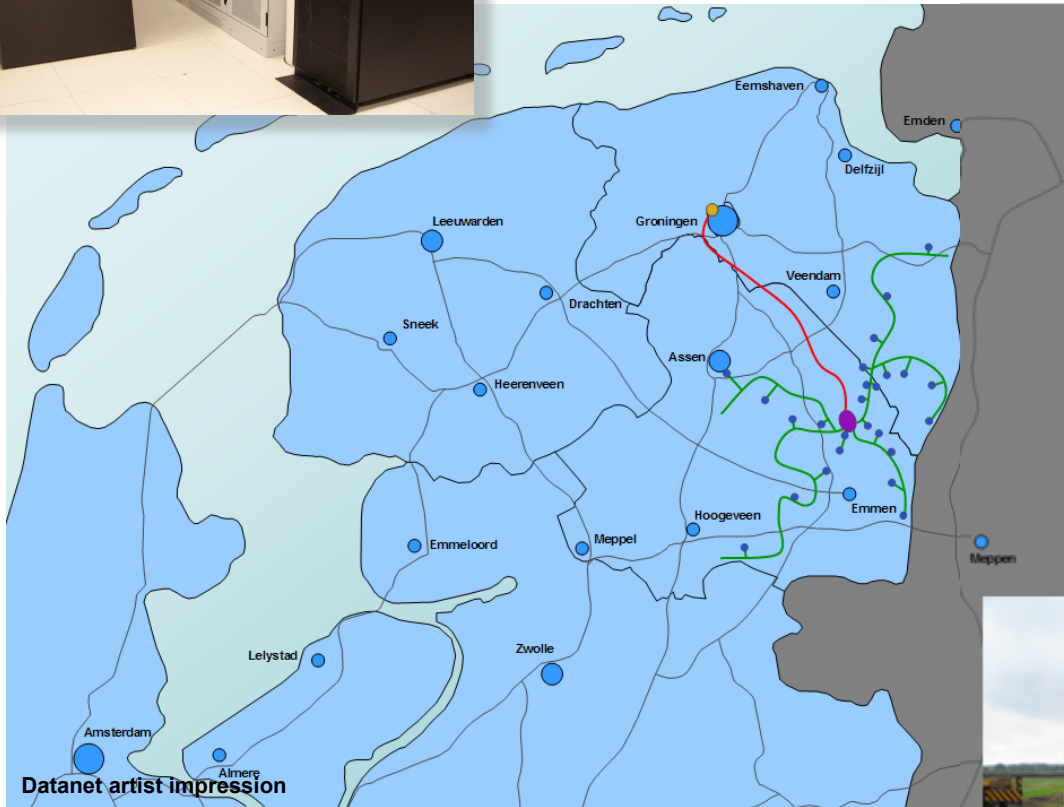
- Novel approach: employ phased array technology
- $\Delta\nu = 10 \text{ MHz} - 250 \text{ MHz}$
- Currently being deployed
- Budget: $\sim 100\text{M}\text{€}$



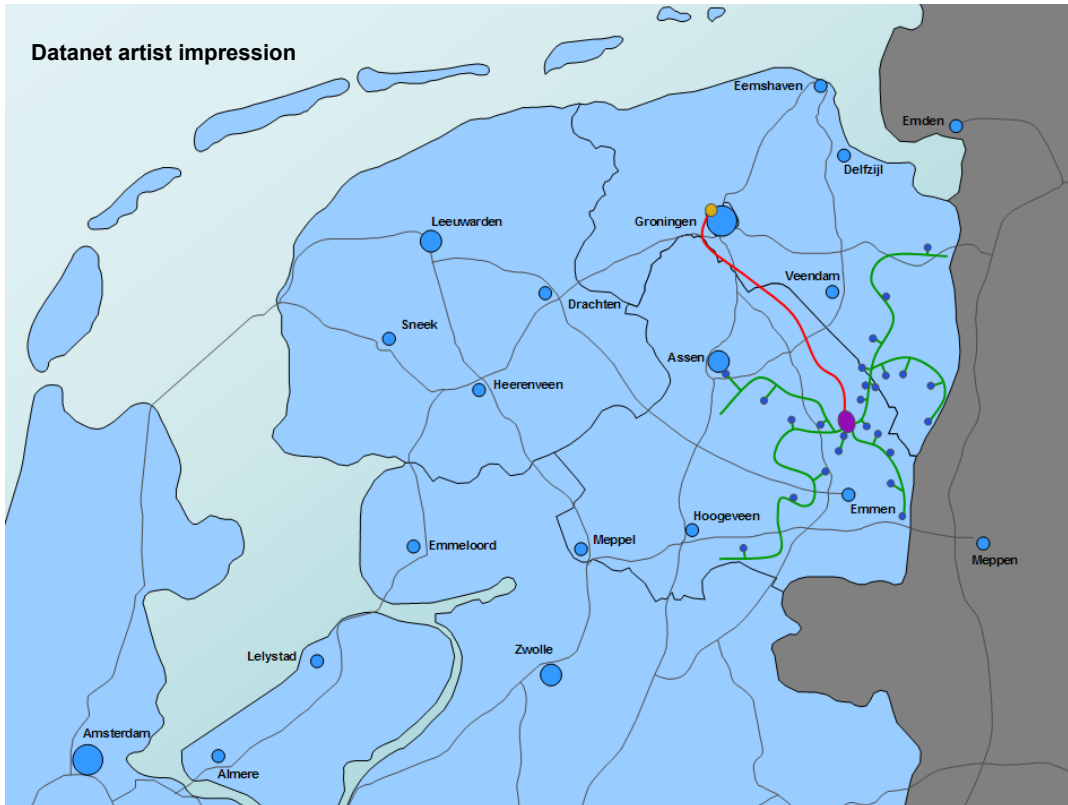
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LOFAR - Datatnet

IBM Blue Gene/P



Datnet artist impression

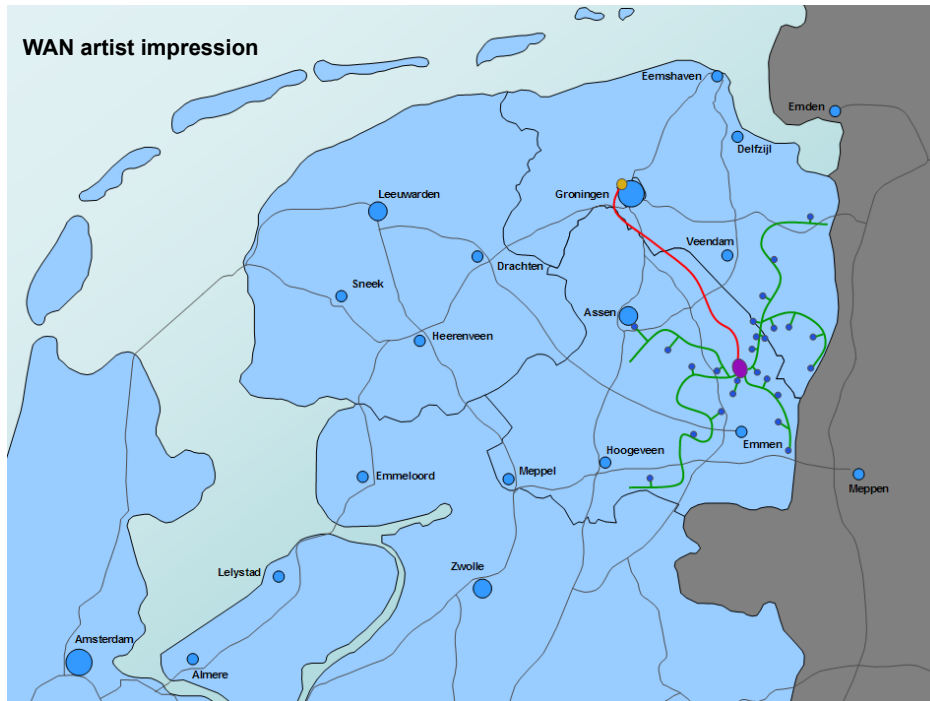


Core Stations

- 18 stations
- 3 Gb/s per station
- Intra Core distance < 5 km

Remote Stations

- 18 stations
- 3 Gb/s per station
- Distance to LOFAR - Core < 120 km



- Monitoring and Control ~ 100 Mb/s
- LOFAR – Partner data ~ 100 Mb/s
- Latency ~ 10 ms
- Availability ~ 95%

LOFAR - WAN characteristics

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

Data format

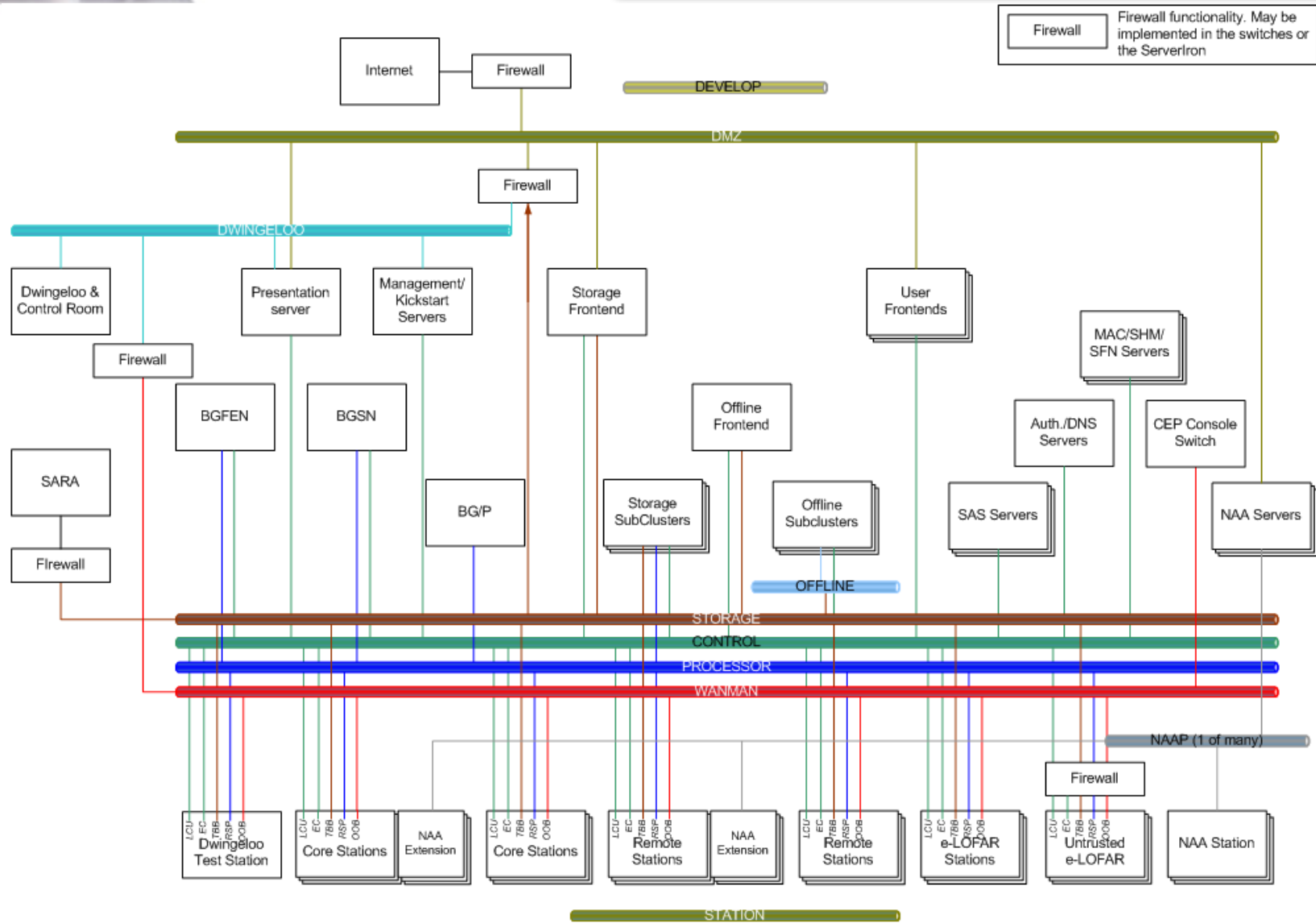
- Ethernet based data transport
- 9k byte jumbo frames
- UDP/IP based traffic (no retransmit)

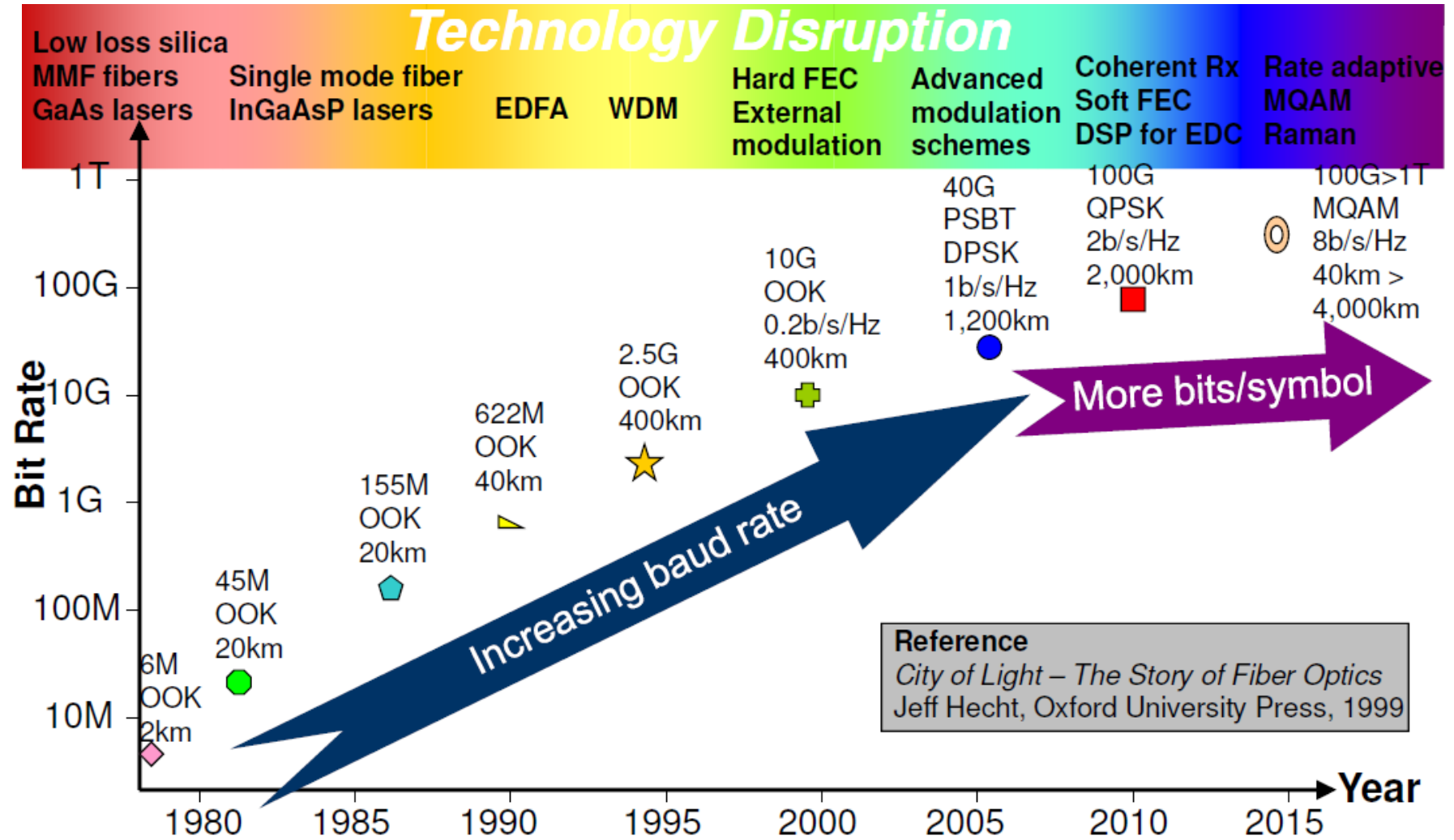
Investigations

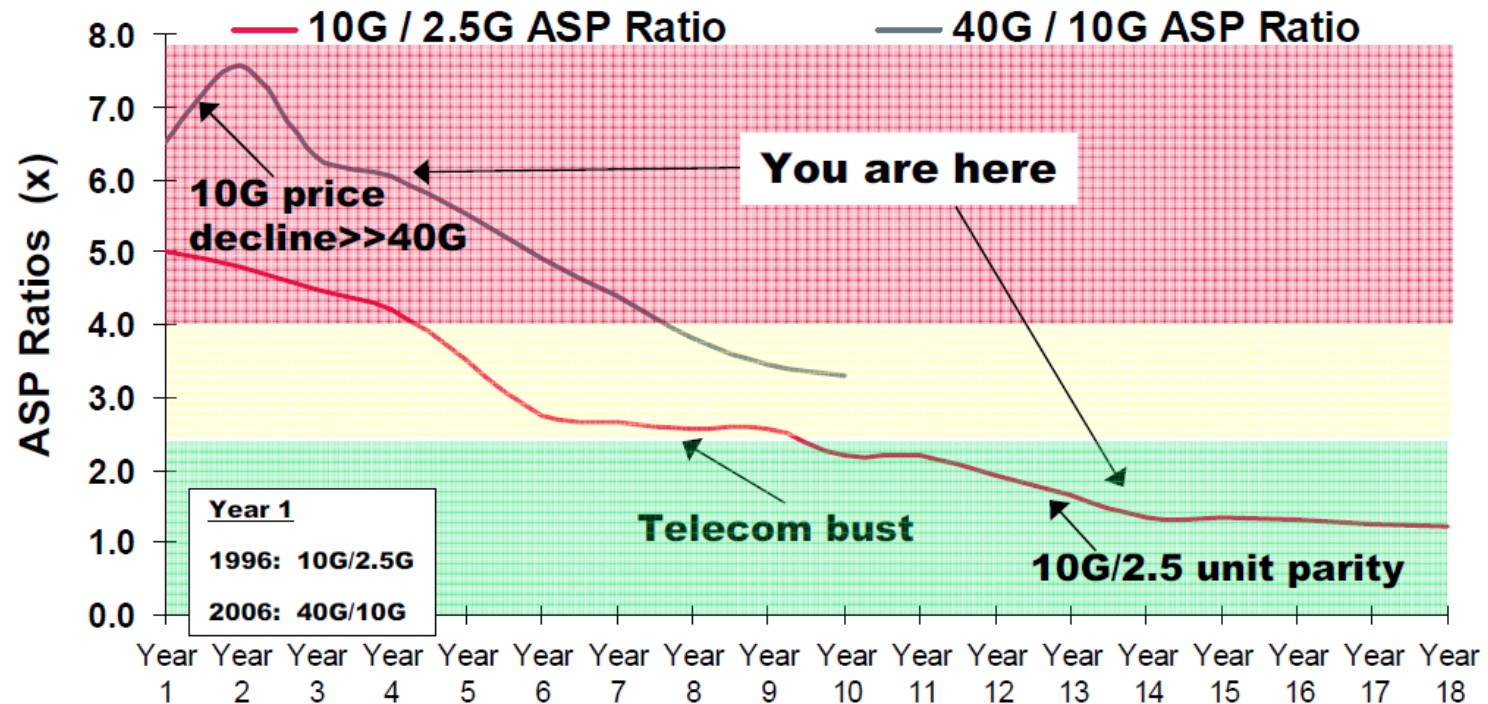
- Active equipment inventory (technology and costs)
- Active equipment tests
- Network design (Layer1 and Layer2+)

Active Equipment requirements

- Layer2+ / Layer3 switch
- Support for:
 - MAC based traffic
 - VLAN's
 - 9kB jumbo frames
 - Multicast (transients)
 - QOS
- Controllable by SNMP
- Sufficient backplane speed
- Sufficient 1000BASE-T and SFP/XFP ports
- Out-of-band management

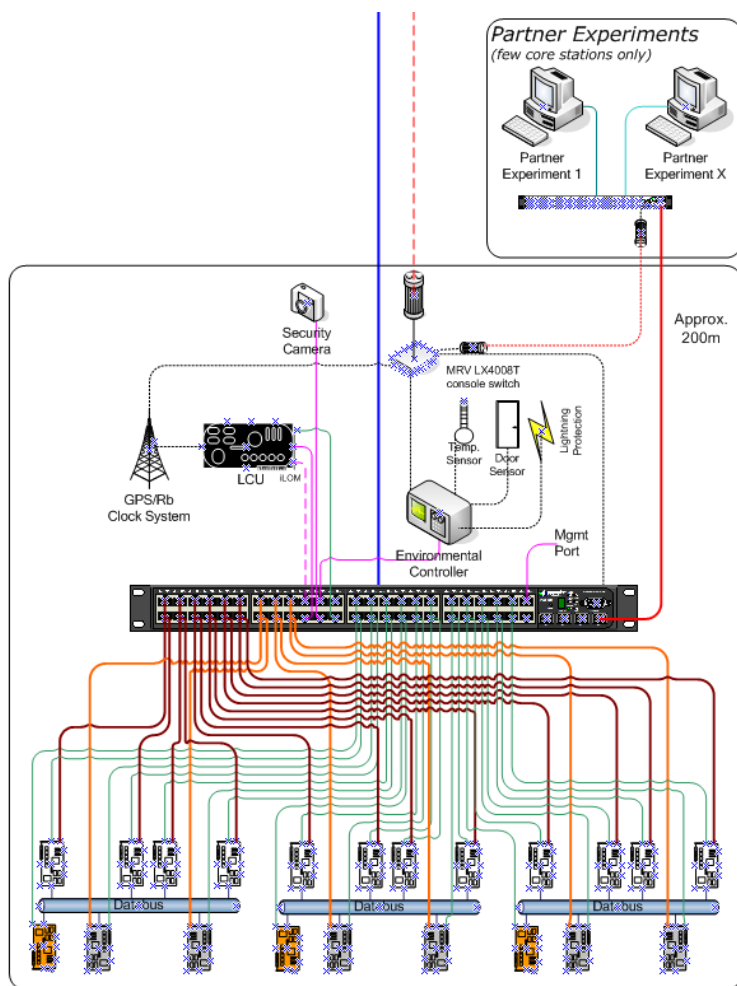






Source: Ovum
ASP = Average Sales Price

- Red zone: Heroes, hype, haggling, and headway
- Yellow zone: Economics move in favor of higher-capacity signal
- Green means go: Volume parity is likely to happen.
- Too early to graph 100G curve, but highly likely to improve on 40G's timeline
 - WDM transponders will benefit from datacom's use of 40GE/100GE



Station to CN

- Foundry FLS 648
- XFP transceivers (10 – 120 km)
- OOB: MRV - LX4008/MC
- G652C/D fibres
- NAA: Foundry FLS 648

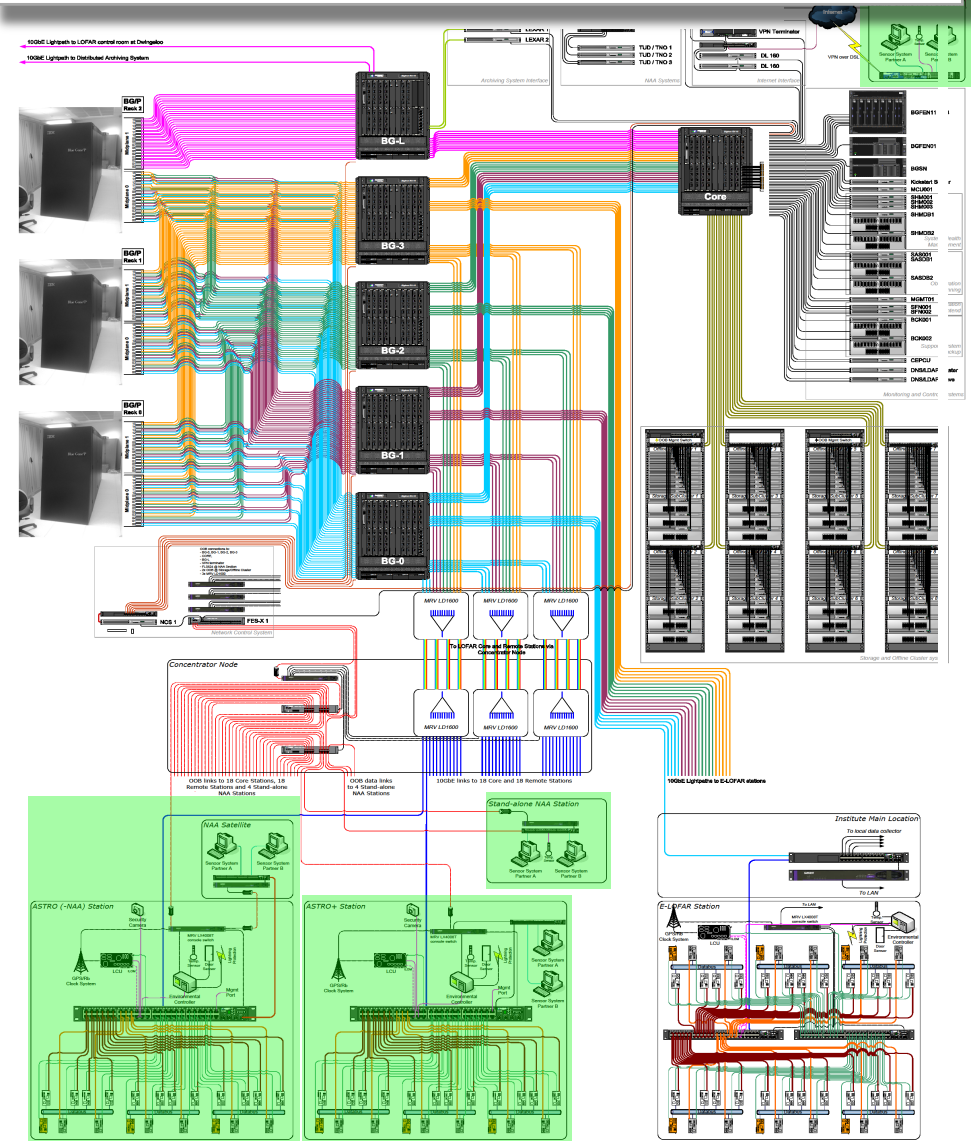
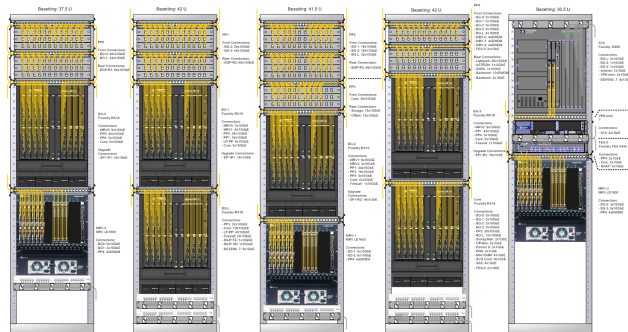


CN to CEP

- CN to CEP: 65 km
- Cable with 72 fibre pairs (G652-C)
- Data transfer technology:
 - 10GbE DWDM, MRV-LD1600
 - 1 GbE

CEP

- 6 x Foundry RX-16
 - Intra - CEP data transport
 - Lightpath interface
- DMZ
 - DL-160 NAT / L3 Firewalling
 - Juniper 6350 DSL / VPN interface
 - DNS, SMTP, Authentication Servers
- Intrusion detection system



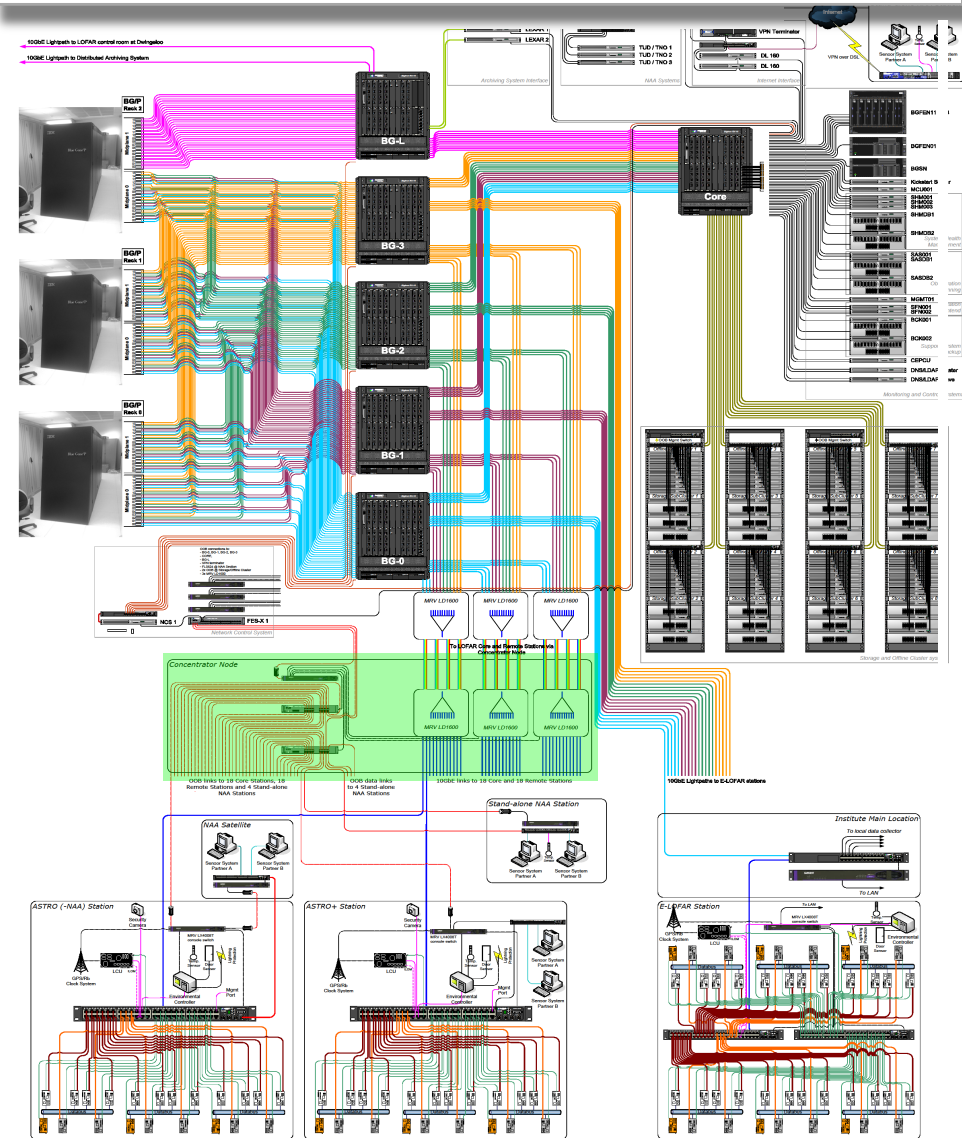
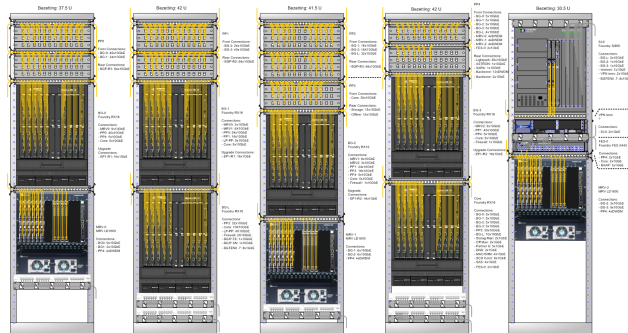
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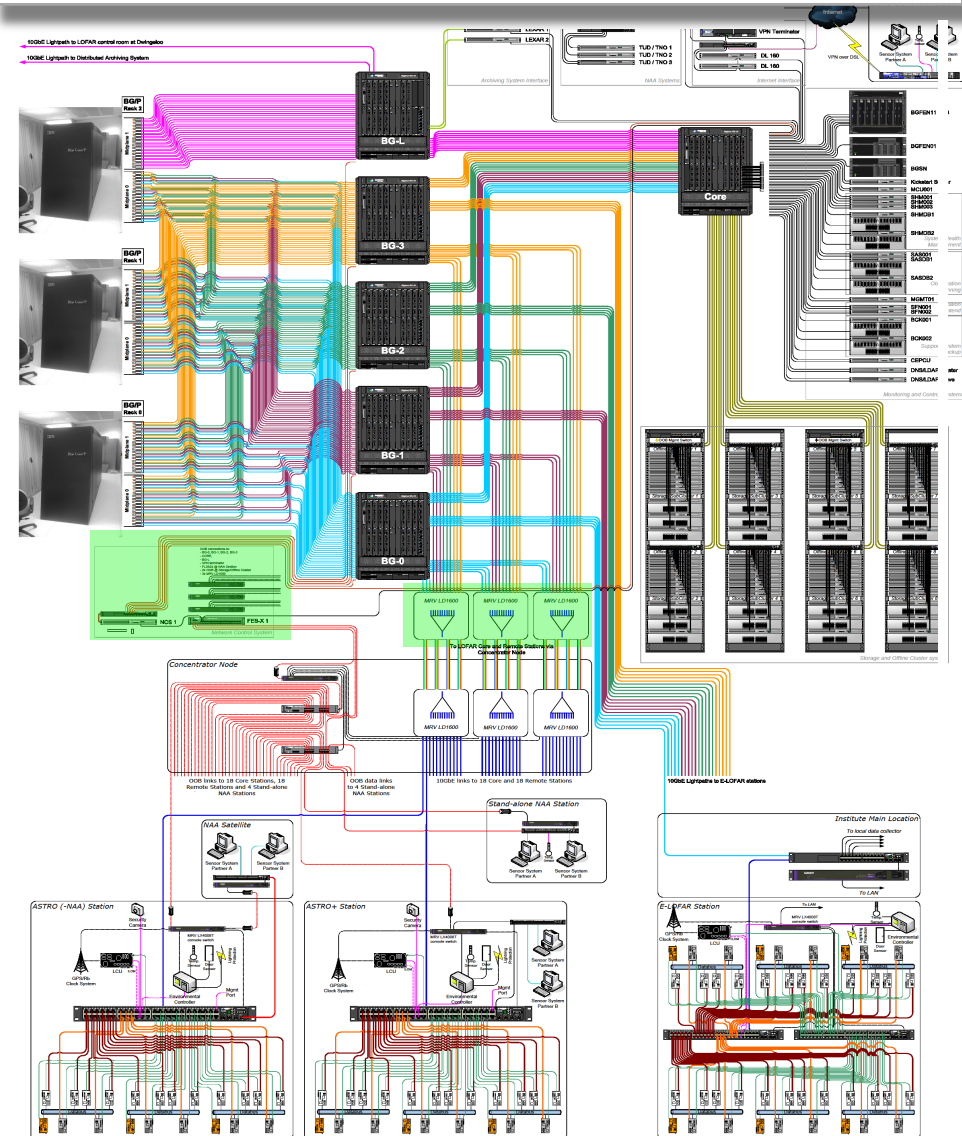
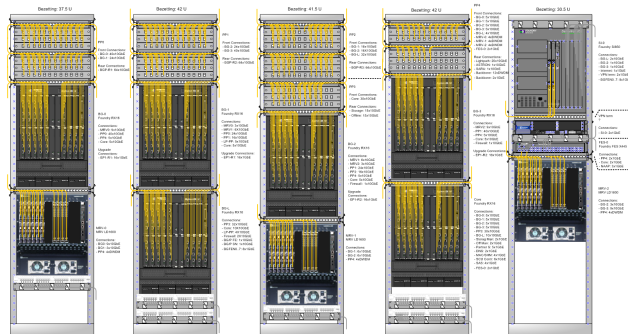
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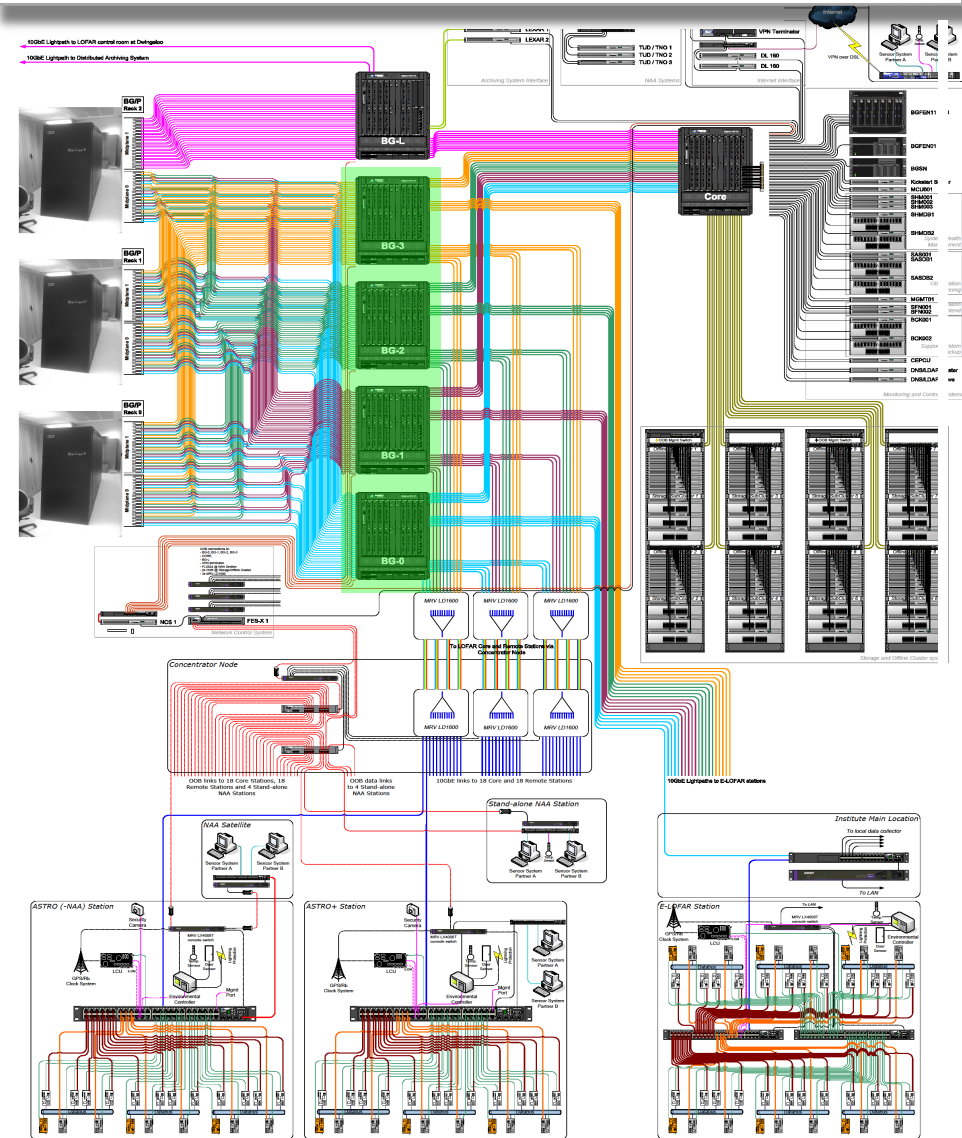
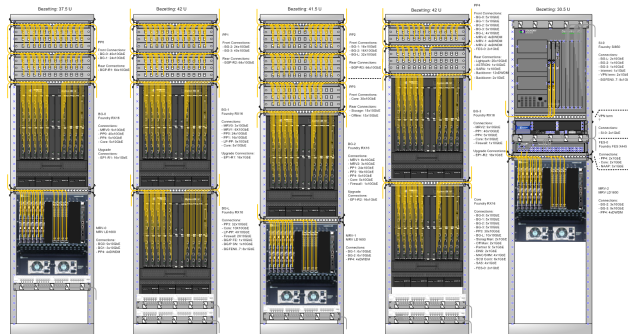
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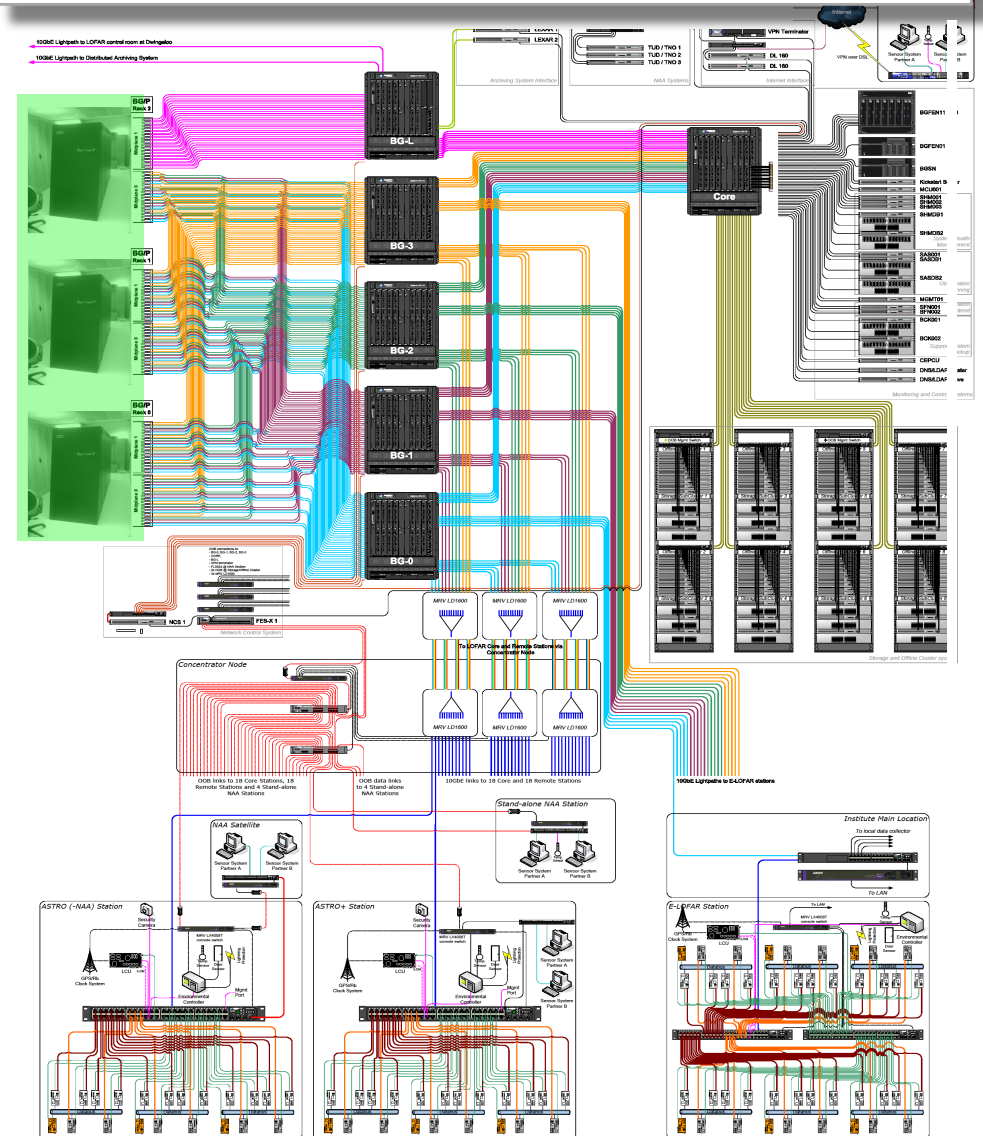
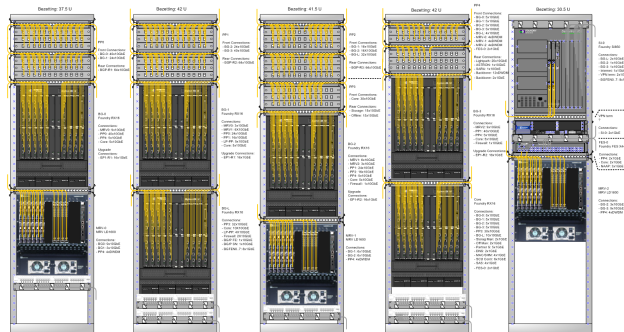
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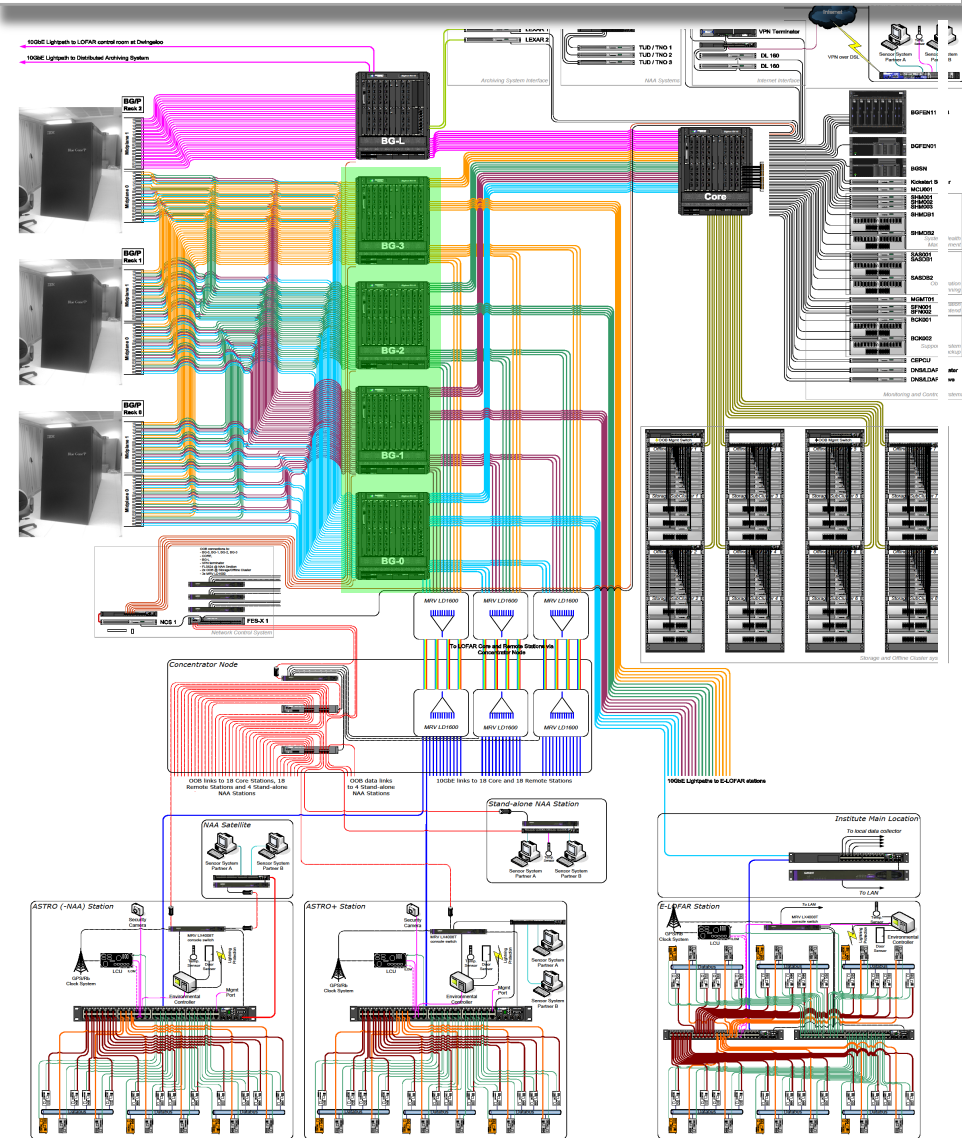
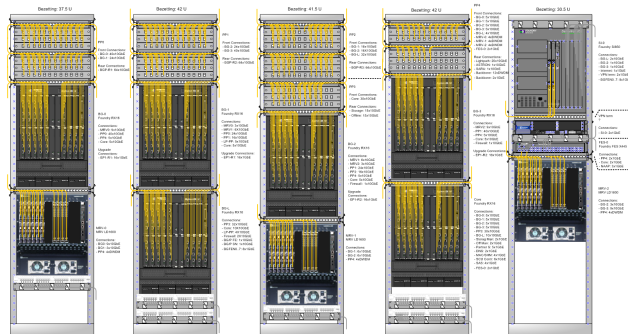
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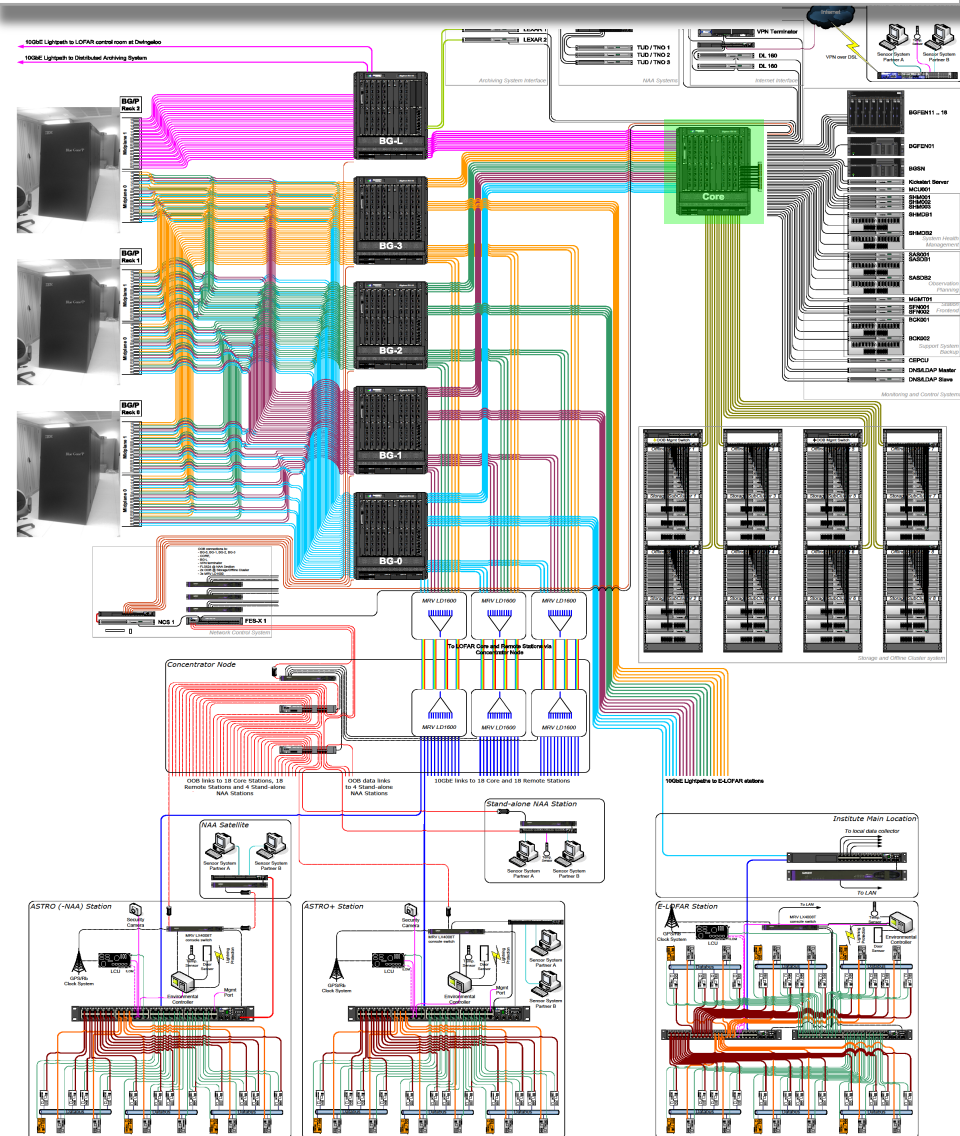
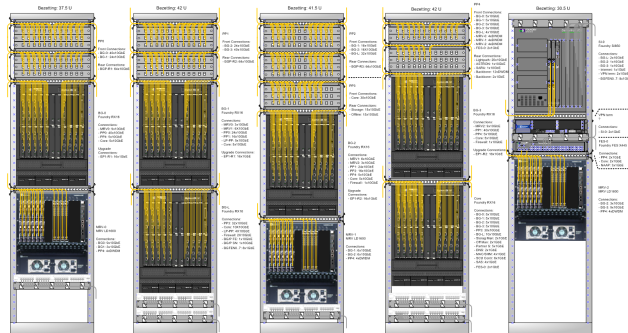
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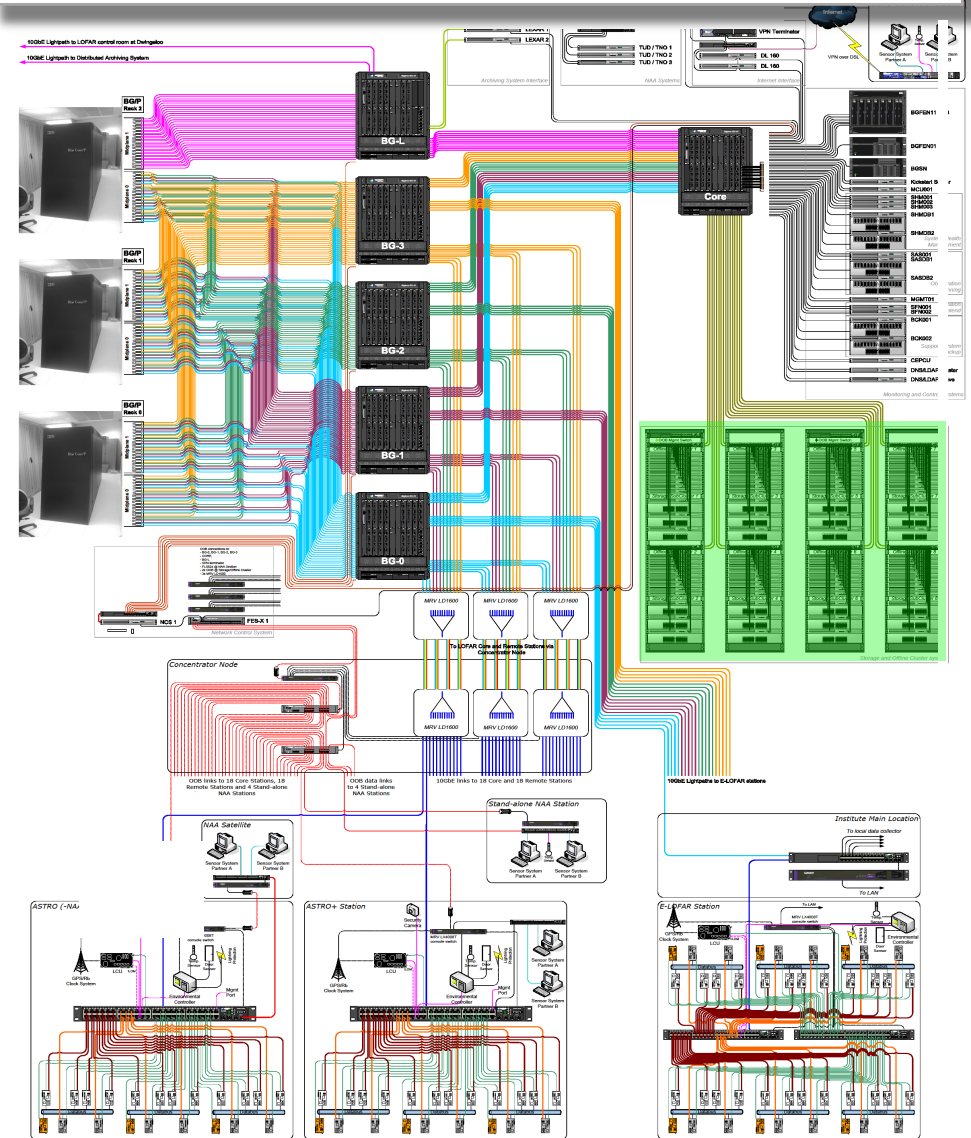
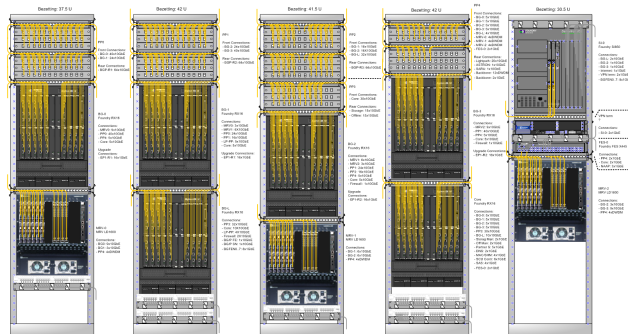


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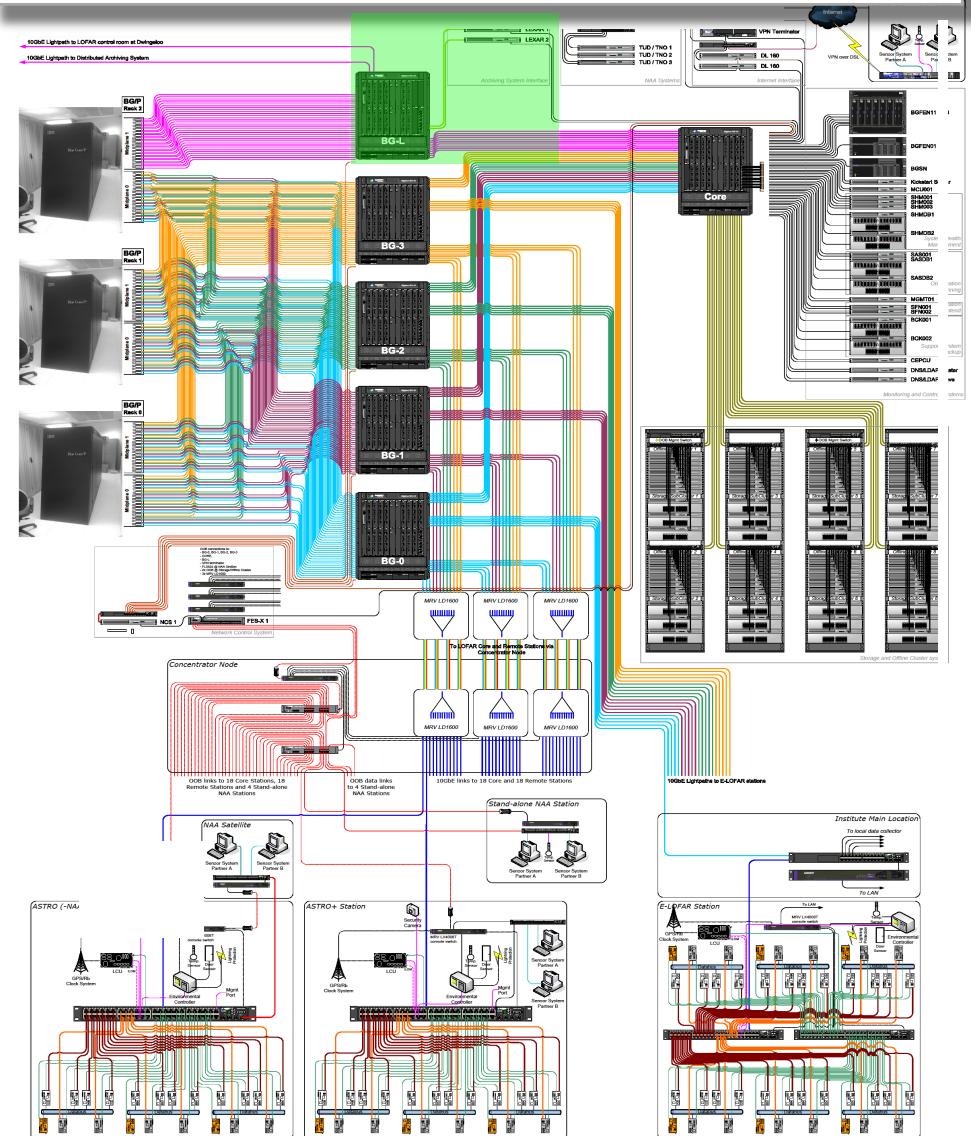
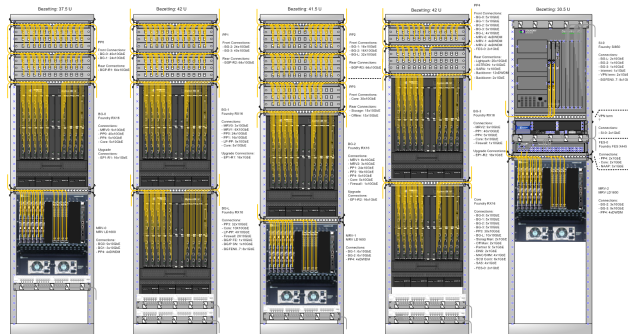
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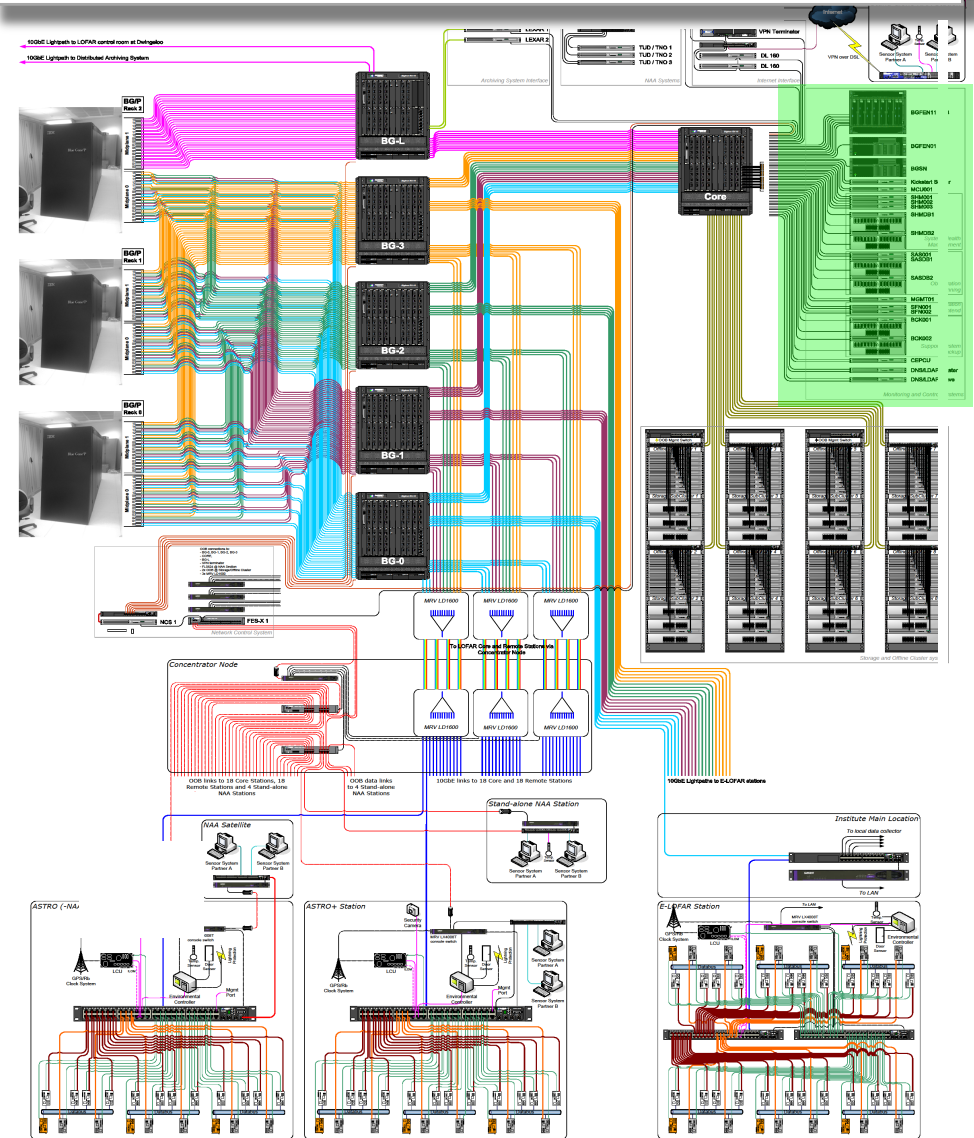
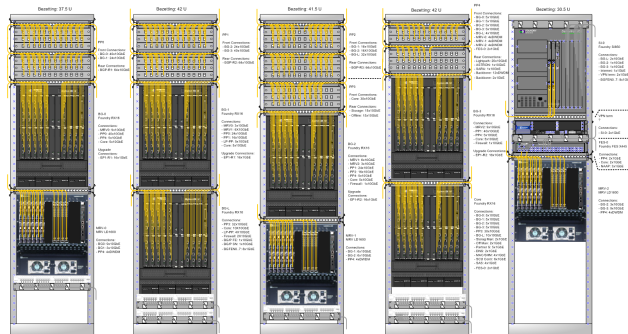
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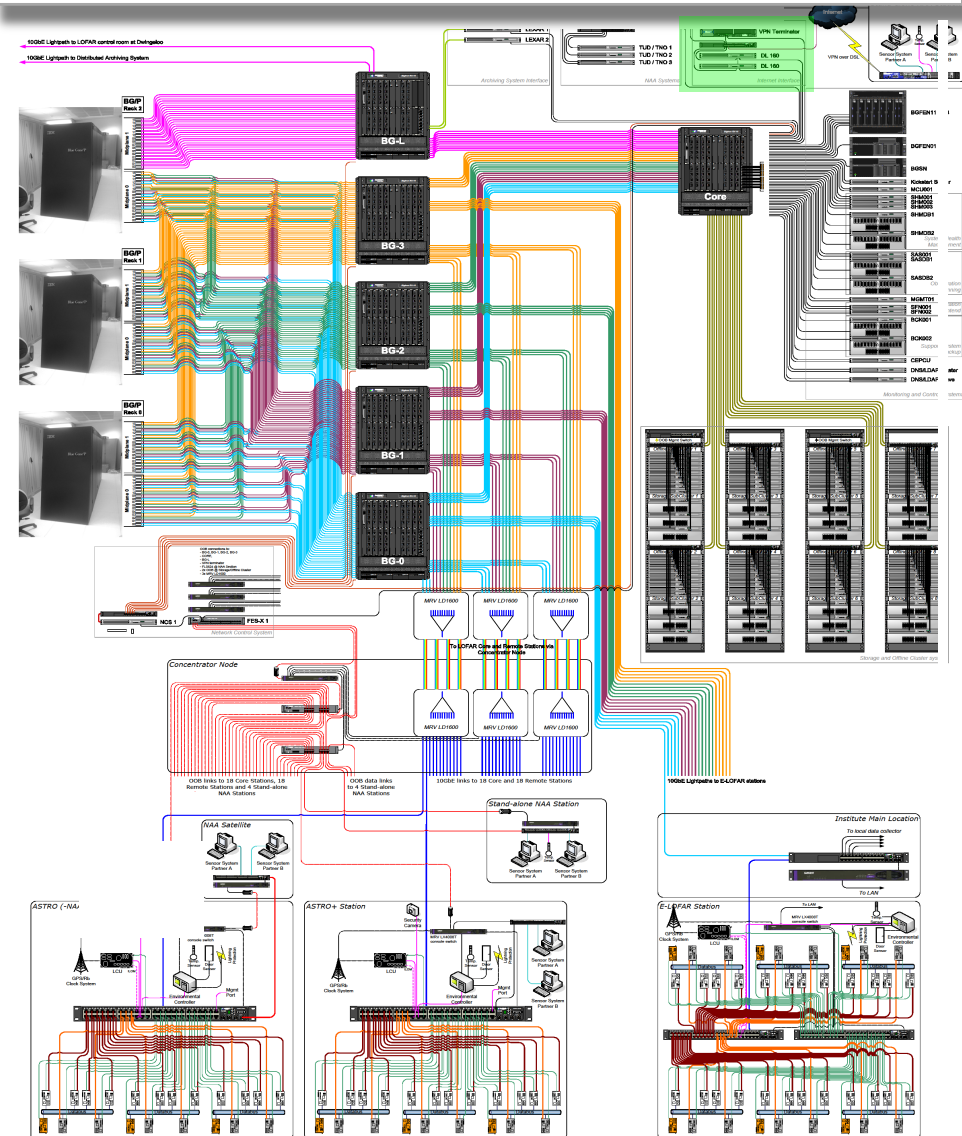
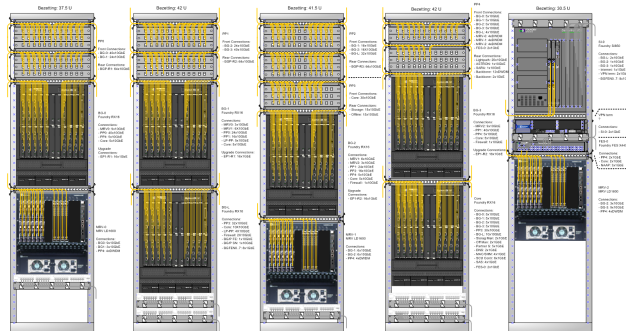
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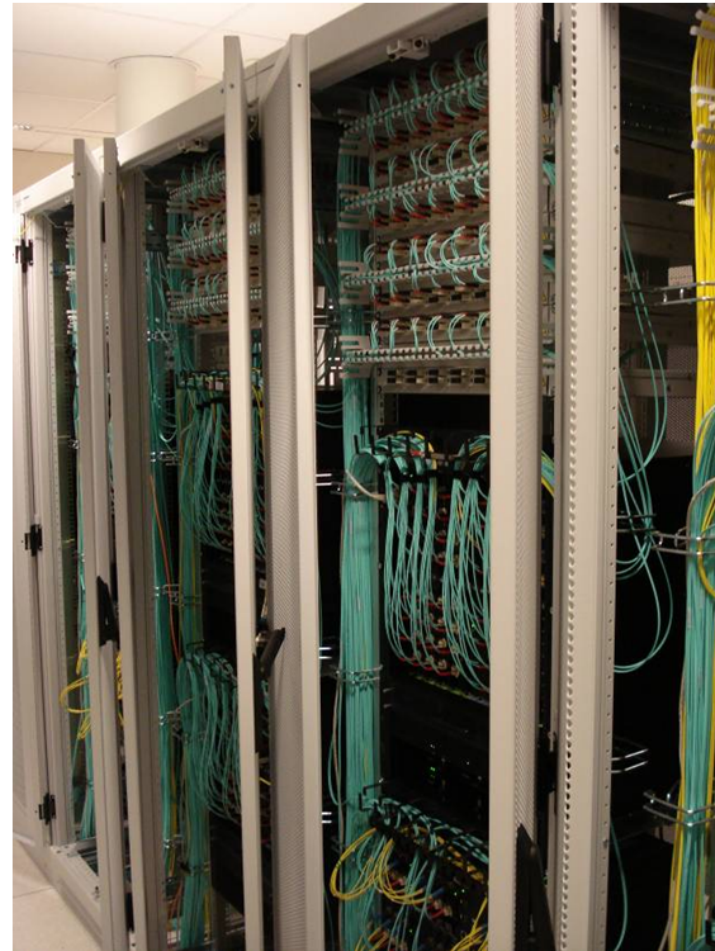
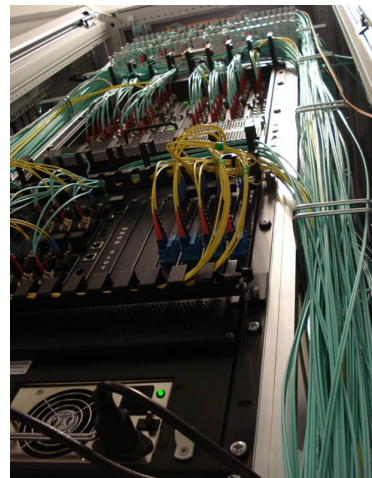
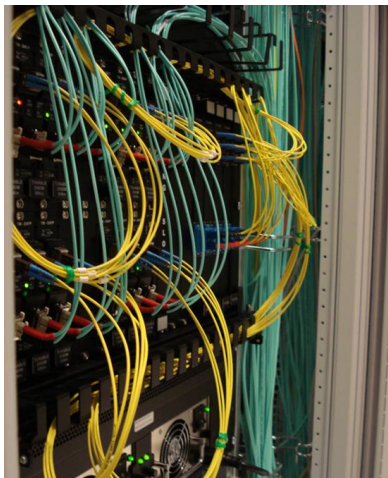
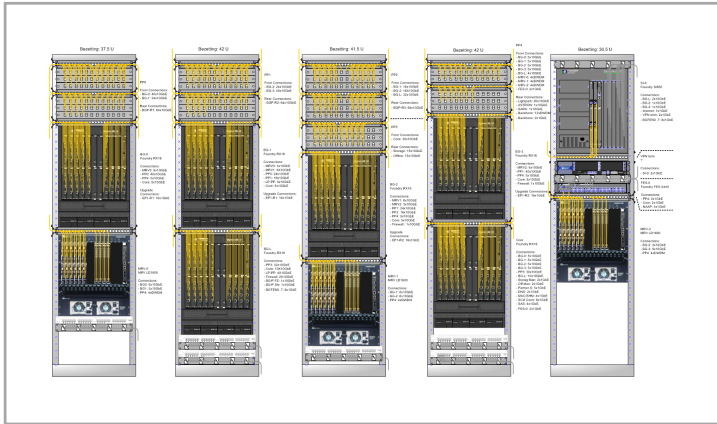
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Approach

- **Realise connectivity via NREN's**
 - National
 - European
- **Connection to CEP via Dutch NREN**
- **Transportation via 3 x 1 Gb/s or 10 Gb/s lightpaths**



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