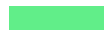




Technology Update

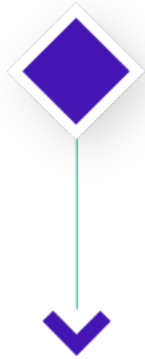
Operations, Route Server and Engineering
Projects



Anne Bates, Mo Shivji, Mark Lloyd

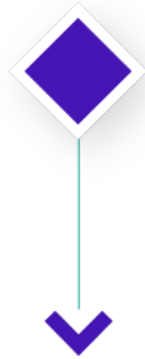
Wednesday 23 November 2022

LINX 117



Operations Update

Availability, Service Issues, Maintenances, NOC Performance



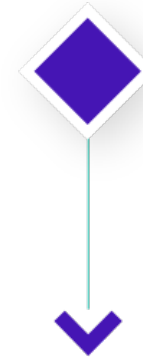
Route Server Update

OpenBGPd 7.4, BIRD 1.6, BIRD 2.0.8 and other route-server related Items



Engineering Projects

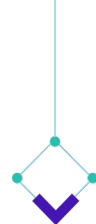
Equinix Slough Redesign LON1, Smartoptics DWDM Solution, 400G LON2, LON1 LSP Topology Re-design





Operations Update

Availability and Service Issues



Network Availability



- Since the LINX mini meeting, we have continued to see high service availability and minimal service issues affecting members.

LAN	August 2022	September 2022	October 2022
LON1	99.9969%	99.9969%	99.9998%
LON2	99.9975%	99.9977%	99.9992%
LINXManchester	99.9905%	99.9933%	99.9998%
LINX Scotland	100%	100%	100%
LINXWales	99.9996%	100%	100%
LINXNoVA	99.9998%	100%	100%
JEDIX	99.9998%	100%	100%





Service Issues

LON2

- 8/September/2022 - BGP session for IPv6 on our "collector1-tch-lon2"
 - Lost BGP session for IPv6 on our "collector1-tch-lon2" 2001:7f8:4:1::1553:1
 - There was a duplication of the IPv6 address which caused the session to drop

LINX Manchester

- 20/October/2022 - rs2-tcj-man1 - Storage Controller Failure
 - Issue on our storage controller on rs2-tcj-man1 (195.66.244.231 - 2001:7f8:4:2::220a:2)
 - Had to do a full upgrade of firmware causing member BGP sessions to rs2-tcj-man1 to go down.
 - rs1-tcw-man1 (195.66.244.230 2001:7f8:4:2::220a) was still available





Service Issues

NoVA

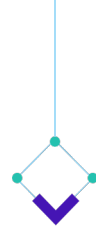
- 27/October/2022 - Outage in Equinix Ashburn - NoVA
 - Lost connectivity for members connecting via EQA (Equinix DC2) to DFT
 - There was an administrative issue in the data centre where power was shut off to the cage.
 - Escalated and restored.





Operations Update

Maintenances



Upcoming Maintenances

LINX LON1/LON2 Upgrade the iLO firmware on Captains

- There should be no effect on the server itself so no downtime or impact to member peering is expected.

LINX LON1 (195.66.224.0/21) Migration of ISLs to LAGs

- Work is nearing completion on the LON1 LSP Redesign project and will see a couple more maintenances

LINX LON1/LON2 (195.66.224.0/21) Migration of Equinix Slough - Telehouse North Dark Fibre from Passive Mux

- At risk upcoming maintenance to migrate dark fibre from a passive MUX to the Smartoptics solution





Change Freeze

NoVA Thanksgiving Change Freeze

- From 17:00 EST today to 09:00 EST on Monday 28 November, 2022



Christmas and New Year Change Freeze

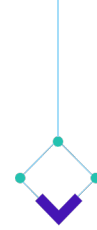
- From 12:00 UTC on Friday, 16 December through to 09:00 UTC Tuesday, 3 January 2023





Operations Update

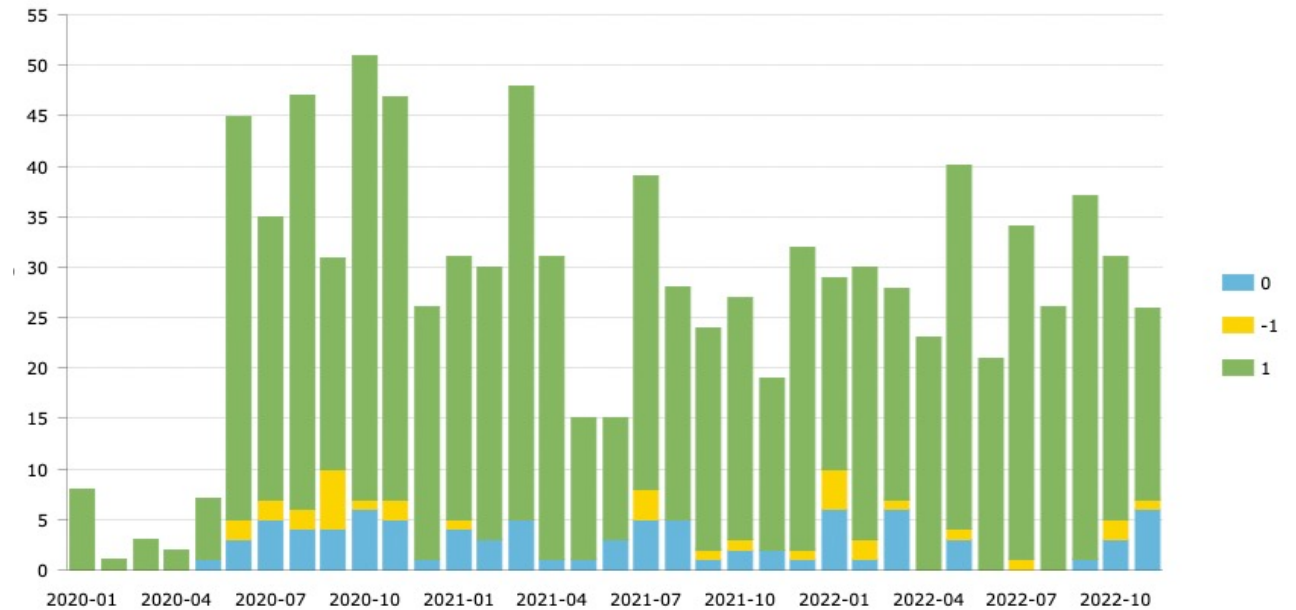
NOC Support Performance



NOC Support Performance

Measured through

- Ticketing feedback
- Member Survey
- Member interviews



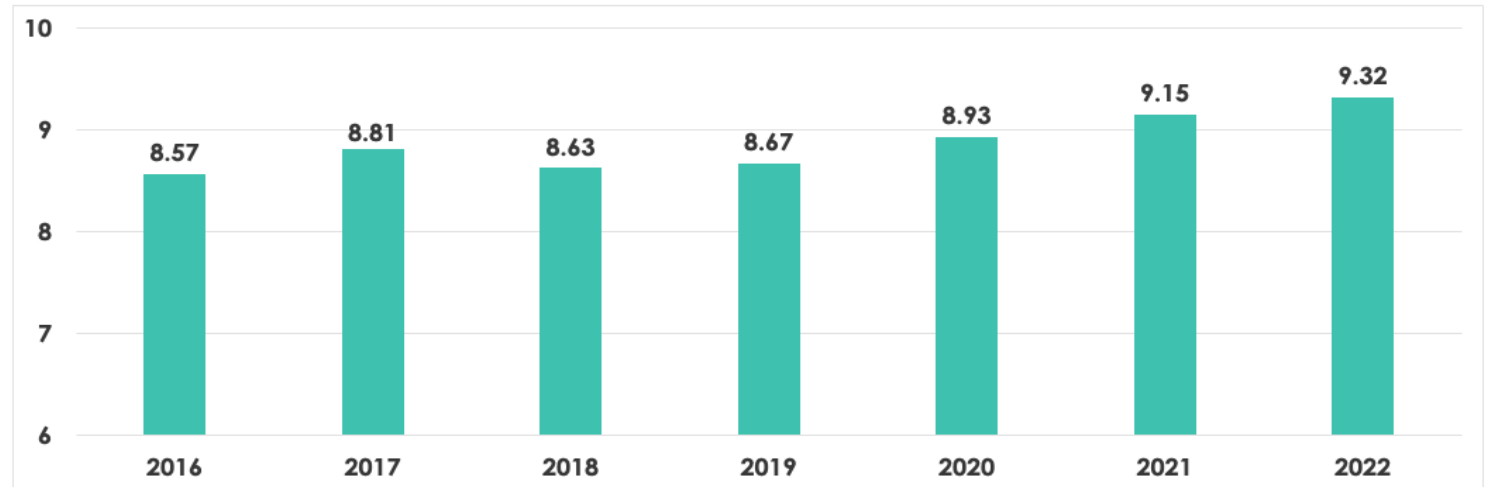


NOC Support Performance

Measured through

- Ticketing feedback
- Member Survey
- Member interviews

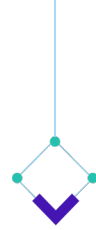
Have you been in contact with LINX's NOC - Technical Support team? Do you think they are doing a good job?





Route Server Update

OpenBGPd 7.4



OpenBGPd 7.4

- Currently running OpenBGPd in 2 sites:
 - LINX Wales
 - LINX Scotland
- Both have had good operational uptime with no issues.
- Will migrate OpenBGPd in 2023 to other regional sites (replacing rs2's):
 - LINX NoVA
 - LINX Manchester
- Will also aim to migrate to LON2
- More likely upgrade to OpenBGPd 7.7 or greater if testing is successful.





Route Server Update

BIRD 1.6



Bird 1.6

- Currently BIRD 1.6 is running at all LINX sites.
 - Running BIRD 1 since 2010
 - Since IRRDB/RPKI validation introduced stability/performance improved
 - Will continue to run BIRD 1.6
 - All rs2 route-servers running BIRD including LON2 will be replaced with OpenBGPd.
 - LON1 will remain with 2 X BIRD route-servers
 - LINX Collectors will continue with BIRD 1.6





Route Server Update

BIRD 2.0



BIRD 2.0

- BIRD 1.6 is no longer developed and has only small bug fixes.
 - 1.6.8 released in 2019
 - BIRD 2.0.10 released in June 2022
- Currently preparing BIRD 2.0 for production.
 - Delay to both in lab and production due to new hardware/OS refresh.
 - Summer Intern laying some groundwork for testing.
- Plan will be to replace BIRD 1.6 (rs1 's)
 - RS3.lon1 will remain on BIRD 1.6
- Will start with a deployment in one site then deploy to other sites later if successful just like we plan with OpenBGPd.





Summary of Plan

- Deploy OpenBGPd on other LAN's except LON1
 - BIRD1.6 + OpenBGPd setup
- Deploy BIRD2 on all LAN's
 - LON1 – BIRD2 + BIRD1.6
 - All other LAN's – BIRD2 + OpenBGPd





Route Server Update

Other Route Server Related Items



Other Route-Server related Items

- Alice Looking-Glass
 - Will tag more communities on route-server for prohibited prefixes
 - Bogons/Martians/IXP etc.
- Extended Communities
 - Plan to remove them from Route-Servers for
 - Policy Control
 - AS-Prepending
 - Will work with members who use Extended Communities





Equinix Slough Redesign



Equinix Slough LON1

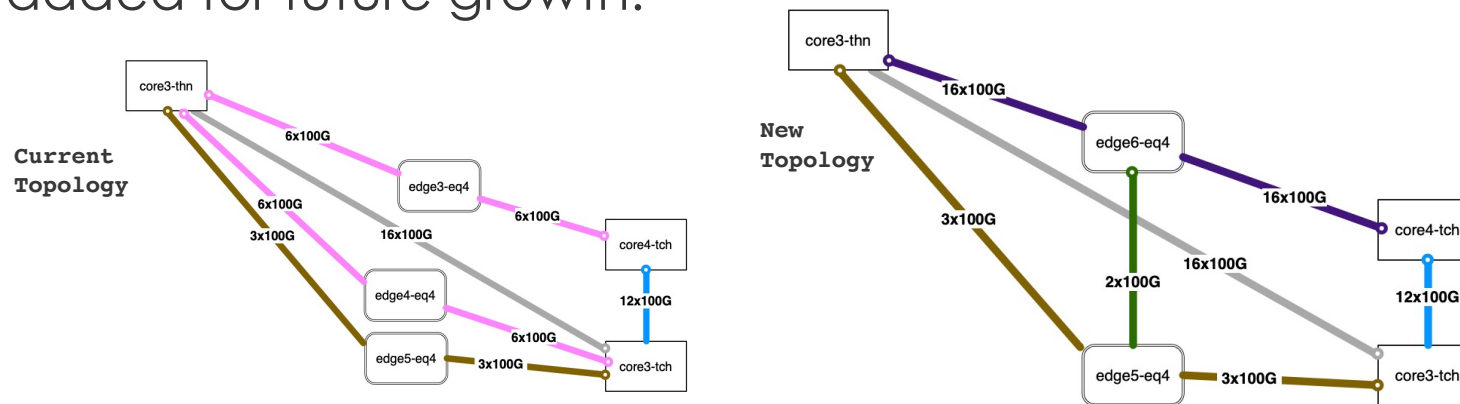
- Currently LON1 Equinix Slough members are split over 3 MX960s. 2 with Enhanced Backplanes utilizing MPC7s for 100G member connectivity.
- 2 edges with 100G member connectivity are now close to fully populated.
- ISL capacity redundant 6x100G to each 100G switch and 3x100G to each 1/10G switch.
- Equinix Slough Traffic between switches currently goes via THN/TCH.
- 800G combined max ISL utilization.

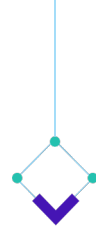




Equinix Slough LON1

- Migrate all 100G members off both MX960s replacing with Nokia SR-7s with 4.8T 36 port XMA.
- Will enable 400G member capability at Slough.
- All Equinix Slough traffic to be switched locally, with an additional ISL built to existing 1/10G Juniper switch.
- ISL capacity consolidated to 1.2T diverse from 2x600G with additional 400G capacity added for future growth.

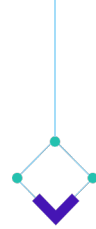




Smartoptics DWDM Solution DCP-404 & DCP-M

- ISL capacity upgraded using DCP-404 transponder card, which allows for 4x100G connectivity on the client/switch side, with a 400G wavelength utilized on line side going via the Smartmux.
- Fibre distance from Slough to Docklands has prevented us from utilizing Smartoptics 100G Inphi solution previously
- This solution can be used across dark fibres up to 120km using 400G ZR+ transceivers.
- Also allows for an easy upgrade path to use 400G DWDM pluggables directly on the switch when we move to 400G in the core.





Smartoptics DWDM Solution DCP-404 & DCP-M



- Smartoptics DCP-404 and DCP-M to be used to increase LON2 ISL capacity from Equinix Slough too. Doubling from 4x100G diverse to 8x100G diverse.





Equinix Slough - Progress

- Equinix Harbour Exchange to Equinix Slough Dark Fibre migrated to Smartoptics DCP-M.
- 200G Coherent wavelengths via Ciena Waveservers still used to deliver ISL capacity over the DCP-Ms
- Diverse fiber to Telehouse to be migrated shortly.
- Enables us to add the additional 400G capacity on LON1 and LON2 via DCP-2 using 400G coherent.
- Nokia SR7 installed in EQ6
 - Working to bring live at 2x4x100G prior to change freeze.
- In New Year 100G members will be migrated to the SR7s with ISL capacity migrated from the MX960s to the SR7
- Slough LON2 capacity to be increased to 8x100G shortly.





400G LON2



400G LON2

- Currently testing the Edgecore AS7946-30XB.
 - Broadcom Qumran-2C silicon
 - 4 x 400G QSFP-DD, 18 x 100G QSFP-DD, 4x100G QSFP-DD
- Short term solution for delivering 400G member connections.
- Initial order expected at Slough.





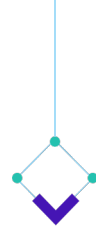
400G LON2

- OcNOS SP 6.1.0 released 1st November with support for the AS7946-30XB
- In process of evaluating new software currently.
- Working through some issues identified with transceiver support with IP Infusion but looking to support the following:
 - QSFP-DD FR4-400G
 - QSFP-DD LR4-400G
 - QSFP-DD LR8-400G





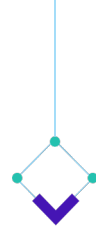
LON1 LSP Topology Redesign



LON1 LSP Topology Re-design

- As a result of load balancing issues on the PTX5Ks, ISLs between switches are run as single links rather than as LAGs
- 64 primary and secondary LSPs are then configured to each end point striping through each link in the ISL to ensure traffic over each link is utilized and balanced.
- 26 edge routers in network, so each edge has $(25 \times 64 \times 2)$ 3200 LSPs configured (excluding the 2 Nokias that both have $(25 \times 32 \times 2)$ 1600 LSPs configured)
- Around 83k LSPs in total throughout network.
- Have in-house tool that helps generate these, LSPs but creates overhead as every ISL bandwidth increase requires regeneration of LSPs.

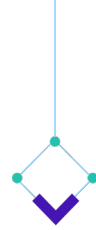




LON1 LSP Topology Re-design

- As all PTX's have been removed from the network, the LAG restriction is no longer there.
- We are now in process of migrating all ISLs to use LAGs.
- Will significantly decrease the amount of LSPs on the network, simplifying the design, and decrease churn on the network in the event of ISL flaps.
- All edges will require only a single primary and secondary LSPs.
- Each edge will have 50 (2x25) rather than 3200 LSPs configured.





LON1 LSP Topology Re-design - Progress

- Maintenances carried out through November, first migrating the Edge ISLs to LAGs
- Core ISLs migrated on a per core basis, to keep maintenances non service impacting.
- 1 maintenance outstanding to migrate final 3 ISLs next Monday.
- This will then able us to perform a final maintenance to reduce the LSPs down a a single primary and secondary path.



Thank you