

# Early LINX: From 1994 to 1997



ISP/IXP Workshops

# UK Internet – 1992

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- First network operator providing any kind of commercial TCP/IP based connectivity was UKnet
  - Operated out of University of Canterbury
- PIPEX started as first commercial ISP providing leased line and dial-up access
  - Parent company Unipalm based in Cambridge
  - Unipalm was required to have TCP/IP connectivity as a reseller of FTP Software's TCP/IP stack for Windows
  - Internet could be had from UKnet, or direct link to the US
  - Latter chosen → PIPEX launched in March 1992
- Demon Internet started as PIPEX reseller, but then split off to focus on the consumer market

# UK Internet – 1993

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- I joined PIPEX in January
  - Celebrated 25<sup>th</sup> leased line customer soon after I joined
  - Seventh member of staff, and first “real” PIPEX employee
  - Two PoPs, Cambridge & West London (Mercury Brentside)
  - 99% availability guarantee (!)
- UKERNA operated JIPS, the JANET IP Service
  - UK Academic & Research Network
  - JIPS was UK’s first IP backbone
- PIPEX peered directly with JIPS, UKnet and Demon
- British Telecom researching providing IP services
  - No BTnet yet

# Neutral Interconnect idea

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- May 1994
  - ULCC circulated a proposal to form a “low key neutral Interconnect” in UK – “not a D-GIX”
  - PIPEX independently considering an IX concept, inspired by SE-GIX
- 5<sup>th</sup> August 1994
  - First meeting to discuss creating an IXP in UK
  - Participants – representatives from:
    - UKERNA (JANET)
    - PIPEX
    - BTnet (newly announced)
    - Demon Internet
    - EUnet GB (UKnet joined EUnet alliance)

# Location

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- IXP principle agreed
- Meeting between competitors is never easy
- Location discussion:
  - PIPEX proposed Telehouse – neutral
  - BT suggested BT facility in central London
  - UKERNA suggested ULCC
- Telehouse was agreed
  - Concern about “remote” location
  - London Docklands was (re)generating then

# Telehouse (?)

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- ❑ Located in London's Docklands
- ❑ Owned by KDD Co Ltd (became KDDI in 2001)
- ❑ Disaster recovery centre for Japanese banks in City of London
- ❑ Trading floors, ready to go live at moment's notice
- ❑ Small Comms Room to serve trading floors
- ❑ After much persuasion, site of PIPEX's 2nd London PoP
  - Mercury Brentside was proving challenging/remote
  - PoP set up in June 1993 (only 1 rack with AGS+ & Netblazer)
  - Much puzzlement from staff about this "Internet" thing



# 10<sup>th</sup> August 1994

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## □ Looking at infrastructure:

Rack, 45U high, 600mm wide, 800mm deep

4 unit fan tray 4 fixed shelves in the rack

2 \* 6way PDUs

Glass front door Steel back and side doors

6 category 5 patch cables (to connect ethernet hub to routers in the rack).

Installation/delivery.

**The total price is £1100. Delivery will be about 10 days**

## □ Telehouse:

The rental of space for 2 19" racks is £7500 per annum, as per Kevin Still's informal quote at the meeting. The initial installation cost is between £800-£1000, depending on the power requirements (current drawn) of the installed equipment.

# 19<sup>th</sup> August 1994

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- Orders placed:
  - For equipment rack for LINX – from PIPEX supplier
    - To be installed by 31<sup>st</sup> August
  - For 2 rack spaces in Telehouse
    - One telco rack, one rack for switch and members
- JIPS to take over the PIPEX-JIPS 2Mbps peering link as their initial connection to LINX
- Discussion about suitable ethernet devices for the IXP now under way



# 25<sup>th</sup> August 1994

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- Second LINX Founders meeting
- Held at Telehouse
- Participants:
  - Kevin Hoadley & John Seymour (ULCC)
  - Kevin Still (Telehouse)
  - Nick Shield & Ian Smith (UKERNA)
  - Richard Nuttall & Keith Mitchell (PIPEX)
  - Nigel Titley (BT)
  - Peter Galbavy (Demon)
  - Deri Jones & Peter Houlder (EUnet GB)

# Initial draft MoU

[Last updated 26-Aug-94, version 0.1]

## Memorandum of Understanding

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This MoU is intended to help organisations who wish to join the LINX to understand what the LINX is, and what the requirements are for those who wish to join.

This MoU has accompanying documents which should be read by any potential members before they join. One details the legal basis for the LINX. The other is a prototype of a peering agreement to be used as a basis for a peering agreement between LINX Members.

### Aims of the LINX

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The LINX has two primary objectives.

1. To provide efficient interconnectivity for UK Internet Service Providers.
2. To further the cause of the UK Internet within Europe.

### Cost Recovery

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There are some costs associated with running the LINX. These costs will be recovered from the existing members on an equal share basis.

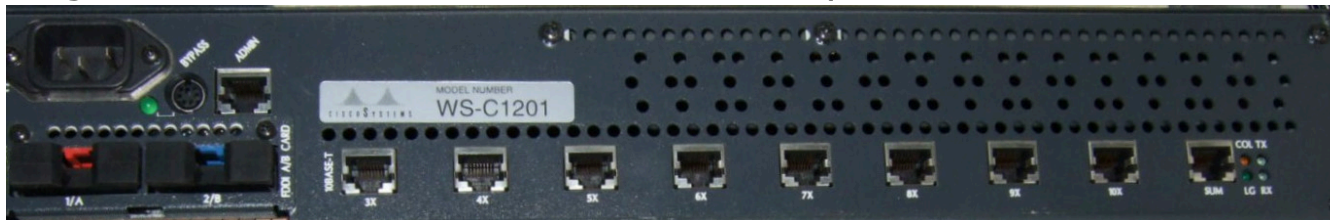
New members will pay on joining the agreed annual fee for existing members for that year. Members joining more than halfway through the year will pay half of annual cost. For the purposes of these calculations, the year starts on the 1<sup>st</sup> October.

The annual fee will be reviewed annually by the existing members, so as to cover costs during the year. The LINX will be run on a not-for-profit basis. The annual fee will provide for housing of one router at the LINX, not larger than a CISCO AGS+. If required, this can also include a megastream modem. If the member requires additional housing at the LINX, this will have to be paid for separately.

# Installing the rack

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- Work done by PIPEX network engineering staff:
  - Big boxes of cables, tools & parts in the back of my car, and off to London Docklands
  - Bits included:
    - 8-port 10baseT ethernet hub, with 10base2 “uplink” port at the back, external DC PSU
    - “rack mount” frame for ethernet hub – could accommodate 3 side-by-side
  - Link from PIPEX PoP to the LINX hub connected up too
- Ethernet Hub came out of PIPEX Cambridge PoP
  - We had just replaced the hub with a Cisco Catalyst WS-C1202 switch
  - “Rebadged” Crescendo which Cisco had acquired late in 1993



# Press Release – 12<sup>th</sup> September 1994

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## UK INTERNET PROVIDERS AGREE UK INTERNET HUB

The UK's Internet providers have agreed to cooperate in the provision of a neutral interconnect point which will increase the efficiency of Internet interconnection in the UK.

Called LINX, (London Internet Neutral eXchange) the agreement means that a single line to LINX is enough to carry interconnection traffic with any other LINX provider who agrees, rather than needing a network of links to each individual provider.

The connection point will be based in the Docklands, London, and will be managed by the founding members of the LINX: BT Internet Services, Demon Internet Services, EUnet GB, UKERNA and PIPEX.

This formal agreement follows an ad-hoc interconnect arrangement which has been operating for some time among the existing providers.

Membership requirements of the LINX are defined in a Memorandum of Understanding, and is open for any future new UK Internet providers, who have their own international links to the global Internet, have a published UK price list (including 64k leased line services), are a network registered with RIPE NCC (the European Internet network registration body), and can meet the technical requirements and routing protocols used.

The LINX hub will contain ethernet segments linking each providers own router sited there, and the members will pay an annual fee to cover the costs of the facilities management space and the central shared hardware.

For further information contact on email only: [membership@linx.net](mailto:membership@linx.net)

# 16<sup>th</sup> September 1994

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## □ Contract with Telehouse received

- Similar Ts&Cs to those which PIPEX had signed for its own PoP
- The equipment:

### 1. The Equipment

- The LINX ethernet hub
- BT - Cisco 2500 series router + Digital Link DL2048V "megastream modem"
- EUnet GB - Cisco 2500 series router + "megastream modem" but only if access line is to be G.703 terminated (e.g. 2Mbps BT megastream)
- UKERNA/JANET - Cisco AGS router

## ■ The term & fees:

### SCHEDULE 3

The Term is 30 September 1994 to 29 September 1997.

### SCHEDULE 4

The Co-ordination Fee is GBP 1,000.00, exclusive of VAT.

The Licence Fee is GBP 7,500.00 per annum, exclusive of VAT.

The Hourly Telehouse Service Fee is GBP 60.00 per man hour.

# October & November 1994

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- First LINX Website:
  - <http://www.linx.net:1080/linx/linx.html>
- 194.68.130.0/24 assigned to LINX from the D-GIX address block
  - Idea was that the future D-GIX addresses could be aggregated
- UKERNA installed JIPS Cisco AGS+ router in LINX rack at “Nowheresville” as Telehouse Docklands was fondly called
- PIPEX and JIPS move private peer to peering across LINX
- EUnetGB and Demon start to swing their Peering links with JIPS from ULCC to Telehouse
  - Links reprovisioned for peering with LINX members

# D-GIX note

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- There was a plan to set up a Distributed Global Internet Exchange (D-GIX)
  - MAE-East and CIX-West would be joined by SE-GIX in Stockholm and the Paris GIX
  - Paris didn't happen (politics?), and LINX was promoted as the 4<sup>th</sup> potential D-GIX site
- As we know today, D-GIX never took off

# Early 1995

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- PIPEX and EUnetGB bring up peering early in January
- Interest from first network operator outside the 5 founders to join LINX
  - NetKonnnect arrived in May 1995 as member #6
    - Cisco 2511 router
    - DSU for their 2Mbps link



# Hub usage

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- PIPEX
  - Two 10baseT ports to local PoP routers
- JIPS
  - Two 10baseT ports to AGS+
- Demon
  - One 10baseT port bridged back to London office
- EUnetGB
  - One 10baseT port to Cisco 2501
- BT Internet
  - One 10baseT port to Cisco 2501 router
- One port left for NetKonnnect – expansion now urgent

# Ethernet devices

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- The PIPEX donated Hub was a stopgap solution pending selection of an ethernet Switch
- Options proposed:
  - SMC TIGERswitch (24 port UTP) for about £4500
  - Networth PowerPipe (12 ports plus 2 expansion cards) for about £6400
  - Xylan switches (no specifications mentioned)
  - Cisco Catalyst (already in use at SE-GIX in Stockholm and MAE-East)
    - Expandable by FDDI ports (100Mbps)

# Ethernet devices

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- Discussion revolved around quality for national infrastructure
  - Looking at track record of devices at other IXPs (ie MAE-East and SE-GIX) – remember CIX was still a Cisco 7010 router!
  - Plus support for Multicast was considered essential
- Members worried about costs of ethernet switch but considered it essential
  - Unmanaged ethernet hub was dropping packets badly (PIPEX monitoring of peering traffic & network performance)
  - Political view in HE Funding Councils regards LINX with a bit of suspicion, that commercial ISPs want “easy” access to the Academic network

# Urgent upgrade

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- Hub was dropping so badly that upgrade became urgent
- PIPEX loaned a Catalyst WS-C1202 to LINX in May 1995
  - Proposed on Tuesday 16<sup>th</sup> May, and I installed it on Thursday 18<sup>th</sup> May during early evening (!) maintenance



London Science  
Museum Picture

- It didn't solve the "lack of ports" problem, but it meant that LINX could run at more than about 2Mbps!
  - The ethernet hub remained in the rack (just in case)

# So who could be a member?

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- On application, must have:
  - Their own address space
  - Their own AS number
  - Routing Policy registered in RIPE Routing Registry
  - Their own international leased line capacity to the US
    - (a *traceroute* had to be included in application)
    - Initially “own route to NSFNET that didn’t pass through a LINX member” until NSFNET was discontinued in 1995
  - Published tariff for domestic Internet connectivity
    - Including at least 64kbps leased line service

# Later on in 1995

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- Interest in membership increases
  - Applications from VBCnet, Technocom, INS, CableOnline, etc
  - Sprint International applies to join LINX
    - Connecting to MAE-East, the NY NAP, CIX, Ebone (Paris), SE-GIX, and at IXs in Asia-Pacific
- Annual membership fee of £2000 to contribute to the operation and hosting costs of the LINX
- And this in July 1995 from one member:

`It is very clear from the EOF and IEPG meetings here that the LINX is now a very strong candidate for being the second most important Internet interconnect point in Europe (after Stockholm), and it would be nice if we all acknowledged this is in our interest and that we get benefit from keeping it that way.`

# Growing LINX

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- **3<sup>rd</sup> LINX Member Meeting on 3<sup>rd</sup> August 1995 at BTnet NOC in Hemel Hempstead**
- 10.30 Start + Coffee
- 10.40 Proper Legal Framework
  - What do we want?
  - Are we happy with the GIX model?
  - Who is going to draw it up?
  - UK Operators forum?
- 11.30 Membership Criteria
  - Do we want to change them?
  - What about resellers (see Sprint situation)
  - Minimum international bandwidth?
  - How do we handle idiots?
- 12.30 Lunch (working)
- 13.00 Technical
  - Update on status of other exchange points
  - Where do we go from here (scaling)
  - Proposal for inter-provider e-mail address portability
- 14.00 Finance
  - Current financial status
  - Future financial basis
- 14.45 Administration
  - How do we organise proper administration?
  - Do we require permanent staff (and how do we finance them)
  - Pool contacts to try and sort out current mess.
- 15.30 AOB
  - Date of Next meeting

# Status of other IXPs (August 1995)

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- Taken from LINX 3 meeting minutes:
  - Paris EBS is bogged down with politics
  - It would be a good thing for Dante routes to appear at the LINX
  - Netherlands still needs to be sorted out
  - Irish Internet connection point will be coming on line. They like the LINX model
  - The Geneva interconnect point will probably be moving out of CERN
  - Small scale arrangement in Italy
  - MAE-East is far worse than Telehouse. Not purpose built.
  - MAE-West is going well.
  - CIX is still held up by lots of little providers.
- Where to go from here? MAE-East seeing 150Mbps, causing scaling concern for LINX



# August 1995

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- PIPEX orders second Catalyst WS-C1202 switch as the existing 8 port Catalyst was close to full
  - One member, one port:
    - EUnet(GB), BTnet, Demon, JIPS, PIPEX, NetKonect, INS
  - Planned FDDI link between the two switches
    - But FDDI interfaces on back-order (sigh!) so UTP cross-connect used as interim measure
  - “Switch 2” installed on 29<sup>th</sup>
- This now gives LINX sixteen switched 10Mbps ethernet ports
  - (fourteen ports really)
  - Prior to arrival of the 2<sup>nd</sup> Catalyst, the old Hub was daisy chained

# August 1995 – Port Assignments

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## □ Catalyst WS-C1202

Port	Operator
1	FDDI
2	FDDI
3	BTnet
4	Demon
5	EUnet(GB)
6	JIPS
7	PIPEX (doc-gw3)
8	NetKonect
9	INSNET
10	UTP Hub

## □ Ethernet Hub

Port	Operator
1	
2	
3	
4	
5	
6	PIPEX (doc-gwH)
7	PIPEX (doc-gw4)
8	Catalyst X-cable

# August 1995 – Port Assignments

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## □ Catalyst WS-C1202 #1

Port	Operator
1	FDDI (future)
2	FDDI (future)
3	BTnet
4	Demon
5	EUnet(GB)
6	JIPS
7	PIPEX
8	NetKonect
9	INSNET
10	Catalyst #2

## □ Catalyst WS-C1202 #2

Port	Operator
1	FDDI (future)
2	FDDI (future)
3	Sprint International
4	Cable Online
5	VBCnet
6	Technocom
7	
8	
9	PIPEX (backup)
10	Catalyst #1

# September 1995

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- Discussion about legal entity, a LINX Ltd, to replace the current “loose association”
- Discussion about what should LINX be?
  - Should it do UK naming too?
    - “co.uk” managed by loose committee with the same players...
  - Should it run a UKOF as well?
    - UK operators already meet at LINX members meeting...
- Leading on to the 4<sup>th</sup> LINX Members Meeting on 4<sup>th</sup> October 1995 at Telehouse

# Highlights from 4<sup>th</sup> LINX Meeting

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- Forming Limited Company
  - Name changed from London Internet Neutral eXchange to London INternet eXchange
- Discussion about purchasing Cisco Catalyst 5000 switch
  - 24 10baseT ports, 12 100baseT ports, 1 FDDI port
  - Concern about 100baseT as “untested technology”
  - Supplements the two Catalyst WS-C1202s
  - Also investigating Wellfleet and 3COM options
- New rack needed for new members and new switch
- Membership fee increased to £5000 per year with £5000 joining fee

# Switches

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- Alantec made offer to donate Alantec 7000 switch to LINX
  - Could do 10baseT, 100baseT and FDDI
- Discussion about merits of Alantec versus Catalyst 5000
  - Some members wanted the freebie, other members wanted Cisco because it was a known quantity
- SE-GIX had already evaluated Alantec and found it lacking
- At 5<sup>th</sup> LINX meeting in November, LINX membership agreed to get the Alantec to evaluate, and agreed to purchase the Cisco on confirmation that it could switch 100Mbps ethernet ports individually (rather than bridge them)

# 6<sup>th</sup> Member Meeting

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- Held on 16<sup>th</sup> January 1996 at CableTel HQ in Luton
- Election of first LINX Ltd Board Members
  - Cliff Stanford, Keith Mitchell, Richard Nuttall (Company Secretary), Richard Almeida, Javed Mirza, Nigel Titley
- Proposed purchase of Cisco 4500 router as a route collector for LINX
  - Became Cisco 4700 (replaces 4500)
- LINX logo registered
- LINX T-shirts!

# Planned Cisco purchases

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- New Switch: Catalyst 5000
  - Catalyst 5000 £10720
  - WS-C5008 Redundant power supply £1785
  - WS-X5010 24 port 10baseT card £8935
  - WS-X5113 12 port 100baseT card £8935
  - WS-X5155 FDDI Switching module (Multimode) £8935
- Route Collector: Cisco 4700
  - CISCO4700 Cisco-4700 Multiprotocol Router, AC £7595
  - SW-G4C-11.0.3 IOS IP only Feature Set £360
  - NP-6E 6 port Ethernet 10base-T NP module £5365
  - MEM-NP32M-M 32MB Upgrade £2680
  - ACS-NPPN 19 inch Rack Mount Kit £105
- 55% discount offered on above prices – Total: £26300



# Scaling through 1996

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- New member connections
  - Running out of ports on the two WS-C1202 switches
  - Cisco loaned a WS-C1200 temporarily ("Switch 3")
    - UTP cross-connect to the existing 1200s
- Catalyst 5000 delivery in April
  - Finally!! It was desperately needed
  - Became "Switch 0".

Catalyst 5000  
(Paul Thornton – LINX97)



# Scaling through 1996

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- Alantec switch offered vanished early in year
  - Alantec Inc bought by FORE Systems
  
- International transit rules starting to cause arguments
  - Members must have their own independent international (US?) connectivity
    - LINX members could not sell transit to other LINX members
    - Which caused issues with the likes of Sprint International joining (some of their customers were existing LINX members)
  - Initial idea in 1994 was to stop resellers joining LINX independently of their transit provider
  - Big ISPs didn't want their smaller ISP customers to join LINX <sup>34</sup>

# Scaling through 1996

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## □ Staffing

- Full time employee considered mid-1996
  - Keith Mitchell started in mid-July 1996
- Various committees and various members taking on responsibilities for the many activities within LINX
- Felt (to me) like too many cooks in the kitchen!

## □ BGP

- BGP community attribute had just appeared, with Internet Drafts leading to RFC1997 and RFC1998 being published
  - Proposal to introduce the community attribute at LINX
- Route flap damping introduced by Sprint, adopted by PIPEX as well

# Catalyst 5000 – July 1996, finally!

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- WS-C5010 24 port 10Mbps Ethernet had two RJ21 to RJ45 break out cables (no built-in RJ45 sockets!)
  - RJ45 patch panel needed in LINX rack
  - Delayed deployment until July
- New Switch proved very popular:
  - 24 10baseT ports – 3 spare
  - 12 100baseT ports – 3 spare
  - FDDI link to the two Catalyst 1202s (and the loaner 1200 from Cisco)
- More members asking for 100baseT ports
  - Discussion about getting another 100baseT line card
  - (port cost is only 2x that of 10baseT)



# Major tidy up – August 1996

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- The advantage of having dedicated staff!
- Original “rats nest” rack tidied up:
  - By month end, all members connected to the Catalyst 5000 and one Catalyst 1202 (Switch One) ☺
    - Original PIPEX Ethernet hub finally removed and returned to Cambridge
    - (Sorry we misplaced it!)
  - Out-of-band access to switches via PIPEX terminal server pending LINX procuring one
- I was added to the “Rack Committee” mailing list
  - (After doing most of the LINX tech work in the first year of its existence)

# 10<sup>th</sup> LINX Member Meeting

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## □ September 1996

- A lot less about the infrastructure, and a lot more about everything else...
- IXPs in other places:
  - Munich, MAE-Frankfurt and DE-CIX Frankfurt
  - F-GIX vs MAE-Paris vs Telehouse Paris
  - Telehouse NYIIX activity – for-profit IX
  - MINX in Madrid
- Content regulation, SafetyNet, Oftel, Havard PR Ltd...
- Proposal to increase LINX staffing to be more than “one man band”

# And the aftermath

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- A lesson for many IXPs – this piece of advice from one member in September 1996:

I am very concerned that the LINX is now taking on the face of a trade association. The intent of an exchange point is really to switch packets efficiently. This transformation is a little disturbing to say the least. The ISPA is really the trade association where these types of matters should be taken up. If people are not happy with the ISPA for whatever reason, then start another trade association with that as its agenda. Please don't drag the exchange point into it

- Even though a majority of LINX members over previous 4 LINX meetings were keen for LINX to be involved in non-IX activities

# Followed by:

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- The debate goes on:

The CIX was ripped apart by flame wars over its routers. These lasted for months, generating thousands of news group articles and filling many mailing lists. In effect the CIX combined the roles of the ISPA and the LINX, and the result was chaos.

<snip>

The CIX is a broad-based trade association, like ISPA. Anyone can join. Its primary role is lobbying.

The LINX is primarily a peering point. It does not and cannot represent the full spectrum of the UK Internet industry without doing serious harm to its primary function.



# Peering Matrix

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- From the start, LINX maintained a peering matrix
  - Listed all the members
  - And whether they peered with each other or not
- Maintained by hand
  - Frequent requests to mailing list for updates from members
  - Often and usually out of date
  - And getting more and more inaccurate as more members joined
- Oh for the PeeringDB back then 😊

# Growth continues

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- By end of 1996, LINX had:
  - Two equipment racks – for IX switches and members' routers (for those not with their own Telehouse PoPs)
  - One telco rack – where members terminated their circuits
- Catalyst 5000 needing 2<sup>nd</sup> 100baseT card
- LINX Collector router in AS5459
  - All members are required to peer with it
- Debate/discussion about root nameserver in Europe
  - Part of advice to IANA for more root nameservers outside US
    - One proposed host was WIDE in Japan
    - The other proposed location was LINX in UK – under RIPE NCC custodianship

# Growth continues

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## □ LINX:

- Ebone, Telecom Italia, Dircon interested in LINX membership
- ANS and AOL approached by LINX
- Frankfurt DE-CIX considering link to LINX
- MSN asking about peering at LINX (November 1996)

## □ Other IXPs

- SURFnet operate the new AMS-IX in Amsterdam (at NIKHEF and SARA)
- SFINX in Paris considering move to Telehouse Paris
- Spanish ISP Association operating MINX (Madrid)
- New IXes in Moscow and St Petersburg
- Telehouse New York marketing their NYIIX to LINX members

# In to 1997

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- First discussion about implementing a Route Server at LINX
  - To be Unix based using (multiview) RSd
  - All members peer with it
  - Redistributes routes according to members' published policy
- Also Cisco 7200 for LINX Office network connectivity
  - Carries full BGP table to provide LINX office with global Internet
- Updated MoU
  - Inevitable huge debate...
  - Joining fee now £10000, annual membership £5000
- Job adverts for full time Network Engineer, full time Administrator, plus part time Marketing, Sales Support, and Bookkeeper
- Running out of rack/floor space!
  - Proposal for LINX to move to its own 400sqft (122sqm) private suite

# 1997

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- March proposal for a Manchester Exchange Point (MaNAP)
  - U-Net and Manchester University Computing Centre
  - Complementary to LINX
- Discussion about 2<sup>nd</sup> site for LINX
  - Telehouse proposed their new location (Clifton Street – Telehouse City)
- Discussion about FDDI switch
  - Plaintree WaveSwitch 4800 – 8 slot switch (up to 8 FDDI interfaces)
  - (DEC GigaSwitch is 32 port – considered too big for LINX)
  - Would members use FDDI still?
  
- Meanwhile in Amsterdam:
  - 2<sup>nd</sup> AMS-IX Technical Meeting on Jan 20<sup>th</sup> at NIKHEF, Kruislaan 409, Amsterdam
  - 1<sup>st</sup> AMS-IX Organisational Meeting on 5<sup>th</sup> March at SURFnet, Utrecht

# Internet Down

Date: Fri, 25 Apr 1997 11:44:11 -0400 (EDT)  
From: Jun (John) Wu <jun@wolfox.gsl.net>  
To: Multiple recipients of list <bulletin@gsl.net>  
Subject: internet currently is partially down

There seems to be a major problem on the whole internet at this moment. A network called FLIX (AS7007) is having a major routing malfunctioning, and seems to have announced all major provider's blocks as more specific. (probably because of a classic mistake of redistribute BGP into IGP and then IGP into BGP while the IGP does not know VLSM)

This has currently brought SprintLink and UUNET to non-operating status, perhaps other networks as well that I can not verify without connectivity. (at the time this email is sent). I just called FLIX and they have shut down all their peering sessions. The network should stabilize in a few hours.

Jun

- ❑ AS7007 was operated by MANAGEMENT ANALYSIS INCORPORATED (mai.net)
- ❑ Caused by customer leaking full BGP table to AS7007 (no incoming filters), and AS7007 Bay Networks router reannouncing the table as specific originated from AS7007 (software bug)

# LINX Staffing

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- Peterborough office occupied from 27<sup>th</sup> May
  - Carole Cole Administrator
  - Nic Lewis Sales & Marketing Support
  - Gerry Reilly Contract Engineer
  - Margaret Sauntson Part-time Bookkeeper
  - Paul Thornton Network Engineer

# Busy month of May 1997...

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- Telehouse Down
  - 8th May 1997, power to (south) half of Telehouse was switched off due to human error following power surge from external supply
  - Affected LINX and several LINX members housed in Telehouse for a few hours
  - Caused one line card in the Catalyst 5000 to “modify” its configuration
- LINX started move to 4th floor suite (TFM6)
  - 10 racks!
- K-root server arrived, and hosted at LINX
- PlainTree Waveswitch 4800 FDDI switches (x2) arrived
  - 5x FDDI and 1x FE port (eight 100Mbps slots per switch)



# More...

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- LINX collector router runs out of memory in June
  - Cisco 4700 only has 32Mbytes of RAM
  - 50000 routes in BGP table, learned from members (jumped 5000 routes overnight due to a route leak by AS2041 in the US)
  - Replaced with 64Mbytes RAM Cisco 4700-M in early July
- LINX move to 4<sup>th</sup> floor planned for 4<sup>th</sup> – 6<sup>th</sup> July
  - Then delayed to weekend of 11<sup>th</sup> – 13<sup>th</sup> July instead
  - Final part of the move on 26<sup>th</sup> & 27<sup>th</sup> July
  - Seemed to go mostly okay as far as moves go...

# LINX 16

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- Member meeting and EGM in Leeds on 15<sup>th</sup> September 1997
  - Changes to Memorandum and Articles of Association
  - Changes to requirements for Quorum
  - New Memorandum of Understanding
  - By-Laws of Non-Core Activities
  - ..etc..
- Technical bits:
  - UK 6bone status
  - Additional/backup site (after Telehouse North)
  - Server status (incl root/tld servers)

# End of 1997

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- ❑ Skipping over LINX 17 meeting...
- ❑ Original LINX /23 address block from SUNET not sufficient any more
- ❑ LINX becomes LIR and obtains 195.66.224.0/19
  - Discussion about “so much address space for an IXP”
  - Needs are more than IXP LAN
    - ❑ Support services, hosted nameservers, looking glass (Ed Kern’s) etc, all need to be globally routed
- ❑ And the rest you know! 😊
- ❑ See:
  - <https://www.linx.net/uploads/assets/LINX97-LINXHistory-PaulThornton.pdf>

# Today's LINX

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- One of the world's biggest IXPs
- Multiple sites across London
- Industry leading Ethernet Switches
  - Double ring topology
  - Two vendors (Juniper and Extreme)
  - Connections from 100Mbps to over 10GE
- Over 760 network operators present from 75 countries
  - One of the "go to" peering points in Europe
- LINX organisation
  - Not-for-profit
  - Technical and operational staff

# Conclusion

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- LINX was major enabler of Internet growth in the UK
- At least three of original founders believed they'd lose commercially
- In reality all three grew rapidly as local peering unleashed the market
  - Local content
  - More smaller providers
  - Richer interconnections
  - More datacentres
  - More opportunity