None of us really knew what we were doing, we just made it up as we went along.

(Part 1 – There may be more)

_____

A lighthearted and hopefully informative meander around bits of the UK Internet in 1996 (ish)

Paul Thornton
paul@prtsystems.ltd.uk

UKNOF34
Manchester
21 April 2016

ECONET

How did I end up doing this?

Blame Acorn...

I ended up working at SJ Research during and after university. They made file servers for Acorn machines; and then were instrumental in the Cambridge IPTV over ATM trial.

But First: IP? What's IP

In my 2nd year at university, things changed from X25 to IP. This was most frustrating as I'd just started to properly understand the big-endian way of the world when it all changed.

I did however keep a tie to the past: My X.400 based E-mail address at home - A sister company of SJ Research (Interspan) ran a mail system for schools that dialed lots of modems overnight to collect and deliver mail.

The Magic of mhs-relay

Unfortunately E-mail addressing wasn't exactly standard in the 1990s. We had: UUCP, X.400, JANET and Internet addresses all trying to communicate with each other.

The solution: stick "@mhs-relay.ac.uk" on the end and 99% of the time, it would sort it out for you.

On the rare occasions it didn't, the resulting bounce message was normally breathtaking.

The Magic of mhs-relay

This did, however, lead to some fairly ugly headers:

```
Via: UK.AC.MHS-RELAY; Fri, 14 May 93   1:34 BST
X400-Received: by mta sun2.mhs-relay.ac.uk in /PRMD=uk.ac/ADMD= /C=gb/; Relayed;
             Fri, 14 May 1993 01:34:15 +0100
X400-Received: by /ADMD=INTERSPAN/C=GB/; Relayed;
             Fri, 14 May 1993 11:25:18 +0100
Date: Fri, 14 May 1993 11:25:18 +0100
X400-Originator: /G=Paul/S=Thornton/O=PRT-HOME/ADMD=INTERSPAN/C=GB/@uk.ac.mhs-relay
X400-Recipients: zhap019@uk.ac.rhbnc.vax
X400-MTS-Identifier: [/ADMD=INTERSPAN/C=GB/;ARM358-910514102528-2F56B706]
X400-Content-Type: P2-1984 (2)
From: /G=Paul/S=Thornton/O=PRT-HOME/ADMD=INTERSPAN/C=GB/@uk.ac.mhs-relay
Message-ID: <ARM358-910514102528-2F56B706*@MHS>
To: zhap019@uk.ac.rhbnc.vax
```

"The past is a foreign country: they do things differently there."

L.P.Hartley (1953)

Some things, however, prove to be surprisingly familiar 20 years later.

The Old: EUnet 1996 Services

An entry on the uk.net FAQ for January 1996 lists EUNet's offerings to unsuspecting customers:

UUCP, Full IP, mail feed, news feed, ISDN, SLIP, PPP, Leased-line, WWW.

Sadly, history doesn't reveal if you could purchase "Full IP" over UUCP. Undoubtedly, someone tried to sell that at some point.

How were these delivered?

UUCP, SLIP, PPP – Typically dial-up to a stack of Courier modems connected to a Netblazer router in the PoP.

I no longer have a Netblazer.

My life is enriched because of this.

UUCP, SLIP, PPP – Typically dial-up to a stack of Courier modems connected to a Netblazer router in the PoP.

CPE – None. Customer usually connected the modem at their end directly to a PC/ Unix machine. Some did use routers but this was comparatively rare.

How were these delivered?

ISDN – In most PoPs, a Cisco 2503 (or two) was pressed into action to terminate incoming ISDN calls.

CPE – An ISDN TA connected to a PC/Unix machine or there were some brave souls using Pipeline 25 ISDN routers.
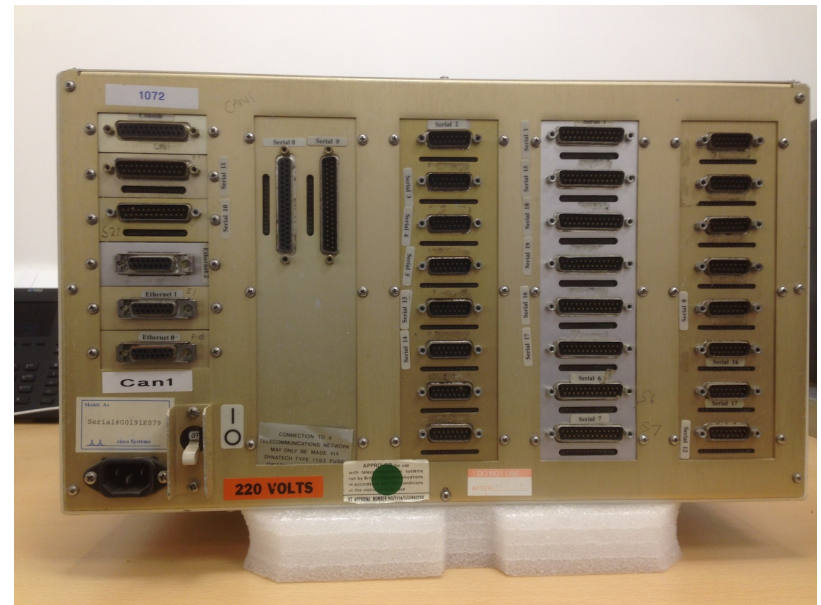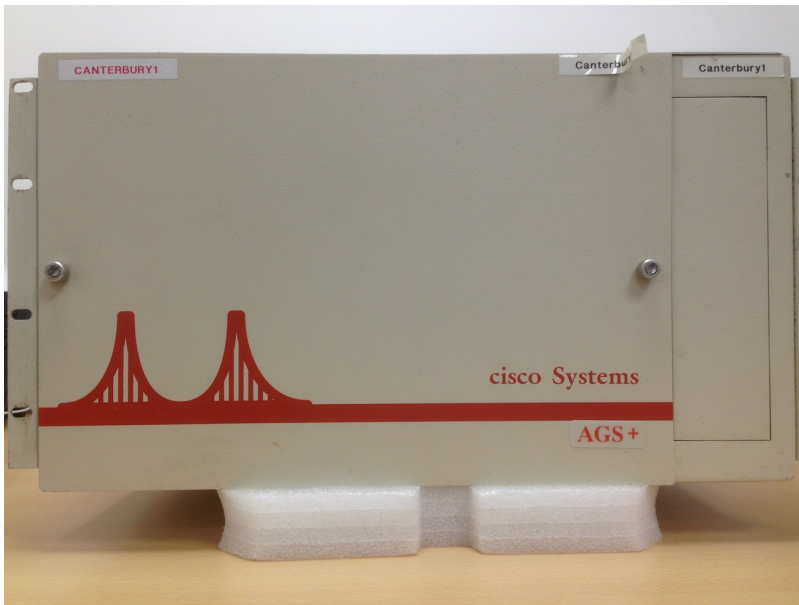
How were these delivered?

ISDN – In most PoPs, a Cisco 2503 (or two) was pressed into action to terminate incoming ISDN calls.

We also had a device in Whitstable that bridged ISDN directly to Ethernet. To this day, I don't think anyone knows who most of the customers were who used it.

Leased Lines – Older PoPs had Cisco AGS+ routers with about 25 serial ports each, one per X.21 connection.

Leased Lines – Newer PoPs had stacks of 2500s with a customer on each of the serial ports.

All interconnected with 10base2.

How were these delivered?

Leased Lines – Customers had a BT NTE and a router. Most of the time this was a 2501, however there were some surprises.

This was typical for most ISP's leased-line customers.

WWWhat..?

Web hosting back then had its own challenges too.

No HTTP Host headers – therefore one IP address per website if you wanted your own domain.

Apache was bleeding edge, we used NCSA.

Sadly, we don't have a map from 1995.

PoP locations: Aberdeen, Belfast, Birmingham, Bracknell, Bristol, Cambridge, Canterbury, Glasgow, Leeds, Letchworth, London, Manchester, Newcastle, Swindon.

384K link to EUNet Amsterdam.

When I say PoPs…

EUNet PoPs fell into three basic categories:

1. The office at Whitstable.

2. A pair of precarious racks in TFM2.

3. A rack wedged into the back room of a compliant customer, who happened to want a leased line faster than 64k somewhere in the country where they wanted to locate a PoP.

Much of 1996 was spent migrating customers from the EUNet legacy network to PSI's new shiny frame-relay network.

PSI's UK network was concentrated on three primary PoPs: Cambridge, Telehouse and Energis (Park St)

Dial up PSTN and ISDN numbers migrated to Energis, terminated on Ascend Max chassis with multiple E1s for incoming calls.

Migrating ISDN customers was a nightmare.

The Max was a temperamental beast.

PSINet UK Services

Leased line customers were delivered to the nearest physical PoP.

- All customer connections via frame relay.
- Terminated on Cascade BSTDX 9000 switch.
- 64k customers on E1 bearers.
- 128K-512K (and 1M) customers on X.21.
- 2M customers on E1 ports.

The three primary PoPs essentially consisted of two main components:

- Cascade (later Ascend) 9000 switch.
- Cisco 7507 router.

These were interconnected using HSSI connections (normally just the one).

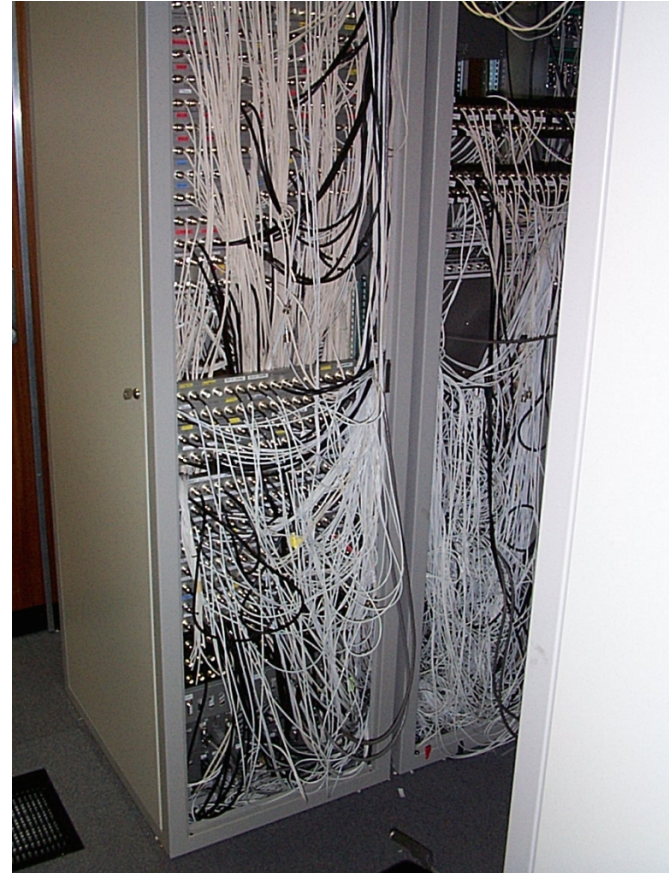CPE router was usually a Cisco 2501, connected to a BT NTU.

Frame relay PVC from customer router interface to PoP router's HSSI port.

This appeared as a timeslot on an E1 bearer from BT (or as an X.21 port for >64k).

The main problem with BT not providing bearers faster than E1 were PoPs that looked like this.

Doing anything in there was hazardous.

Leased Line Configuration

L3 routing between PoP router and customer router used RIPv1.

Which actually worked surprisingly well.

Not statically routing customers was one of those things that didn't seem a big deal at the time, but was the Right Thing ™.

Leased Line Configuration

It was all very well have L2 PVCs from customer to PoP router, however they were static and therefore never failed over elsewhere if there was a PoP router fault.

I don't recall any multi-homed customers in the sense that we'd describe them today.

Virtual PoPs

Early customers for Manchester, Edinburgh and Birmingham were delivered to their own routers (2501s!) in Cambridge via an X21 cable clocked at 2M.

At critical mass, the whole lot became a 2M leased line and the PoP moved to the correct city, and there were a lot of A-end shifts.

Troubleshooting (part 1)

I learned some things the hard way:

- Typing 'debug all' on the Telehouse core 7507 can liven up your afternoon no end.

- Multiple IGPs with lots of redistribution between them also leads to tears before bedtime.

- Customers don't always tell the truth.

Troubleshooting (part 2)

Some things I was very glad to bear no responsibility for:

- Shutting down the old 384K circuit to Amsterdam, only to have 6x ISDN B channels come up because it went down. For a month.

- When /var/named on strand.britain.eu.net corrupted without a viable backup. The resulting *fsck –y* ran all afternoon.

Challenges

The various EUNet service machines were all cross-mounted to each other in a Gordian knot of NFS.

If one machine hung, that was it; they all gradually ground to a halt.

We were all happy that services were migrating away from these boxes.

More Challenges

PSINet US had their own, unique, ideas.

We often took no notice of their diktats – as unlike other parts of the group, PSINet UK actually made a profit.

Remember folks, AS174 has been the go-to AS for peering spats since the early 1990s.
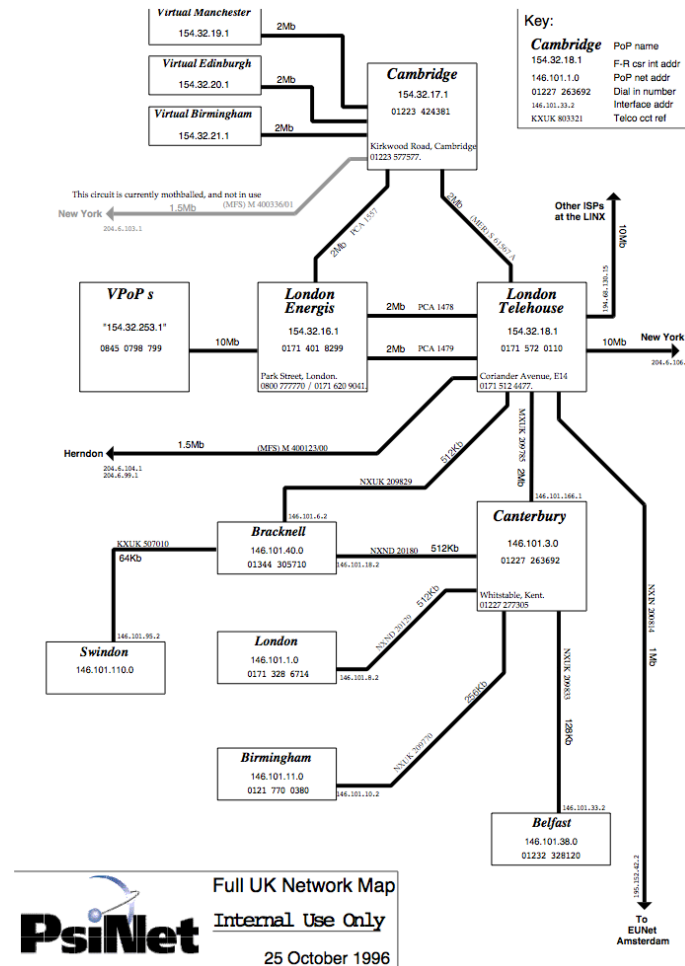
The Network

By late 1996, most key PoP interconnects were 2M. Legacy EUNet links 64k-512k.

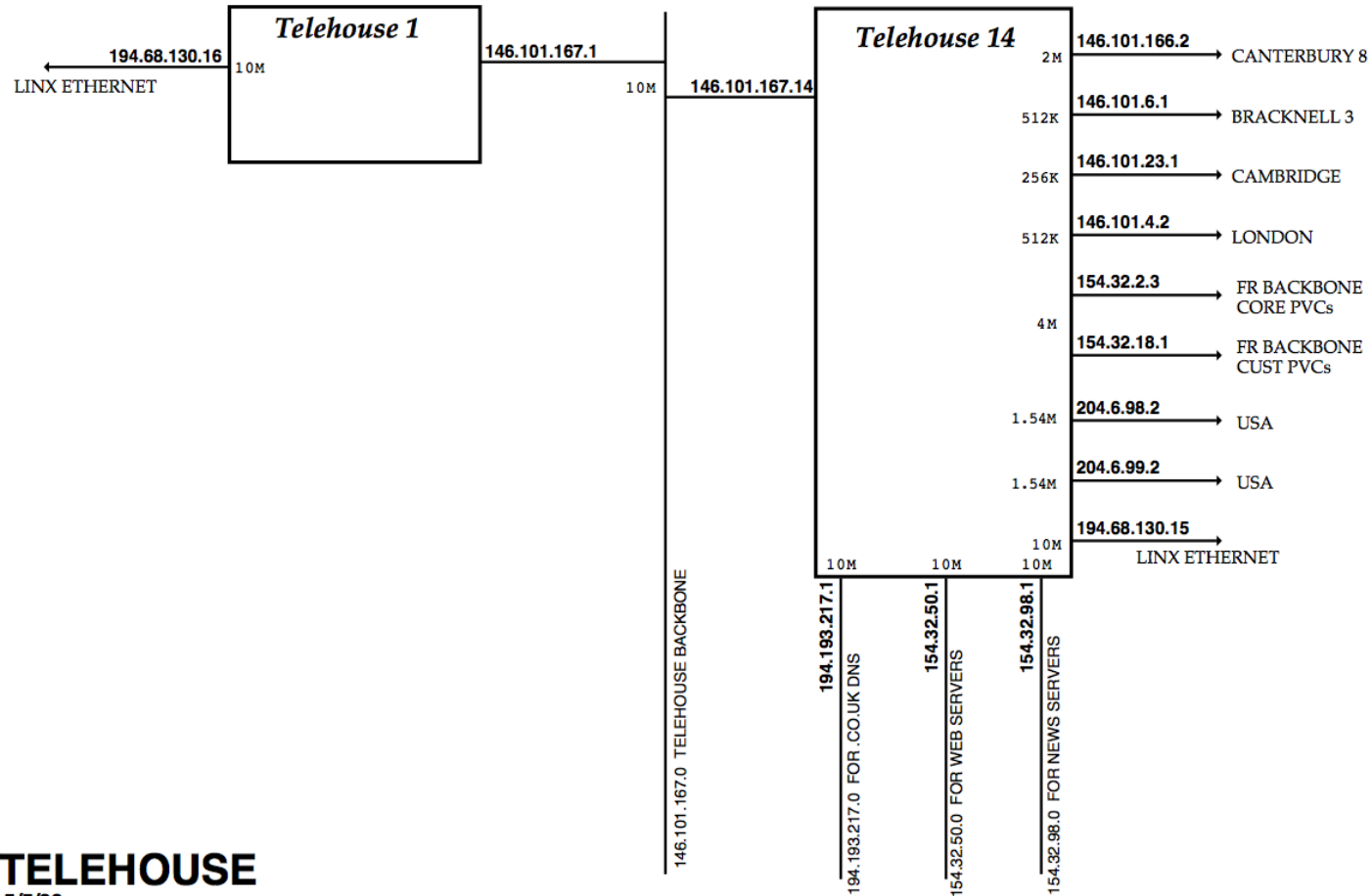Link to the USA were 2x 1.5M, plus the 10M borrowed from Demon.

Link to Amsterdam was 1M.

2x LINX connections at 10M each.

Full UK Network Map
Internal Use Only
25 October 1996

Telehouse PoP (1996)

Now you may be thinking "Telehouse1, that sounds like a big important router"…

Please don't. This is/was Telehouse1.

PSINet inherited the primary DNS for .co.uk

- It would have been very naughty to just add zones, so I'm sure we never did.

- A lot of .co.uk domains were submitted to the naming committee the day before Nominet took over though.

- Urgently requesting a reload of org.uk in the middle of the working day.

Usenet News

What a bandwidth and disk space hog that was/is/ever shall be.

Customers would frequently demand a full feed on a 64k leased line and then complain bitterly about their (lack of) bandwidth.

Moving news servers raised blood pressure.

Servers

Defaults then were not security conscious:

- SunOS 4 came with no shadow password file, rsh enabled and root's rhosts file consisted of '++'.

- SSH still being written, telnet was the only option.

- TCP wrappers was the pinnacle of filtering.

- Router-interface ACLs were the only protection, slowed the router down no end, and they weren't stateful.

Luckily, botnets hadn't been invented yet!

Automation

Configuration stored in loosely-structured text files (no open source SQL yet).

Mixture of sed, awk, perl created DNS zonefiles, mail server configurations and RADIUS entries; and ticketing was CLI-based written in awk.

UUCP was used to distribute to service machines for a long time (eventually replaced with SSH).

Outages

Early one morning the Letchworth PoP went down.

We called them to discover that it had been stolen in a burglary overnight.

We'd had a number of power cuts, so at great expense part of the loading bay was set aside for a generator and this was duly installed.

The next time the power failed, the PoP UPS blew up.

After that, the utility power was rock solid!

And Finally…

I wasn't the only one using Mustelidae-based placeholders:

```
cambridge#show conf
Using 18179 out of 130048 bytes
...
!
interface Ethernet0/0
 description stoat
 ip address 194.193.150.1 255.255.255.0 secondary
 ip address 154.32.105.1 255.255.255.0 secondary
 ip address 154.32.106.1 255.255.255.0 secondary
 ip address 193.112.253.1 255.255.255.0 secondary
 ip address 194.223.203.1 255.255.255.0 secondary
 ip address 154.32.111.1 255.255.255.0 secondary
 ip address 195.152.104.1 255.255.255.0 secondary
 ip address 154.32.109.25 255.255.255.252 secondary
 ip address 154.32.110.5 255.255.255.252 secondary
 ip address 154.32.49.1 255.255.255.0
 ip access-group 110 out ip route-cache sse
```

And Finally…

I wasn't the only one using Mustelidae-based placeholders:

```
cambridge#show conf
Using 18179 out of 130048 bytes
...
!
interface Ethernet0/0
 description stoat
 ip address 194.193.150.1 255.255.255.0 secondary
 ip address 154.32.105.1 255.255.255.0 secondary
 ip address 154.32.106.1 255.255.255.0 secondary
 ip address 193.112.253.1 255.255.255.0 secondary
 ip address 194.223.203.1 255.255.255.0 secondary
 ip address 154.32.111.1 255.255.255.0 secondary
 ip address 195.152.104.1 255.255.255.0 secondary
 ip address 154.32.109.25 255.255.255.252 secondary
 ip address 154.32.110.5 255.255.255.252 secondary
 ip address 154.32.49.1 255.255.255.0
 ip access-group 110 out ip route-cache sse
```

Any Questions?

This presentation, diagrams and the router configurations I managed to locate can be found at:

http://www.prt.org/history

PSINet

EUnet

Happy Birthday
Your Majesty

Thank you

🔲 PRTsystems

Paul Thornton

paul@prtsystems.ltd.uk

UKNOF34
Manchester
21 April 2016