

“Let’s do the Time Warp Again...”

Mike Hughes, Rob Lister
London Internet Exchange

A brief history of time

- Original Datum time servers installed in about 1999/2000
 - Was a “millennium”-type project
 - Preceded by simple Unix stratum 2 box
- Tymserve 2100 and CS Plus GPS
- Product discontinued 2006
- End of support 2010
- I had no photos of it, but a quick Google™ search found a picture of it...



← Tymserve 2100

← CS Plus GPS steered atomic clock

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← CS Plus GPS steered atomic clock

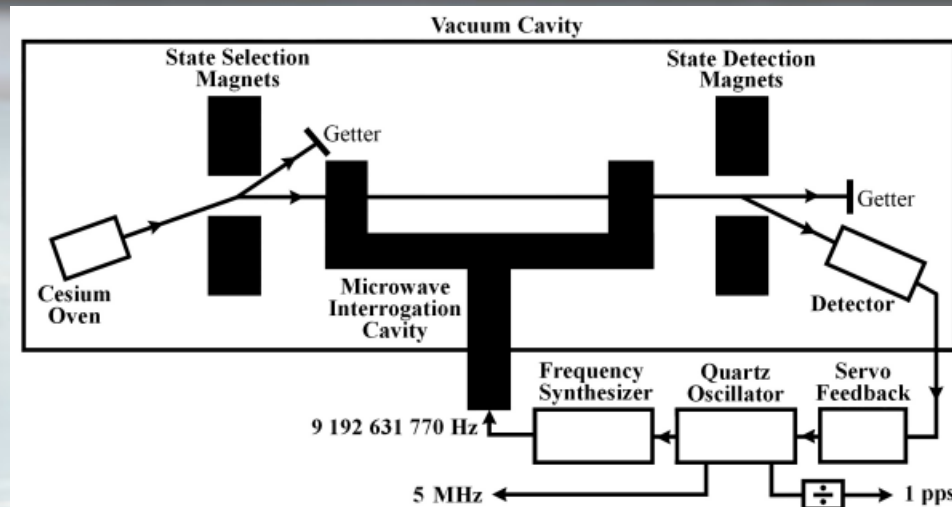
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Why Cesium?

- Good question. I'll ask an expert.
- The time anoraks at NIST say:
 - *“Cesium oscillators can be primary frequency standards since the SI second is defined from the resonance frequency of the cesium atom (^{133}Cs), which is 9,192,631,770 Hz.”*
- Cesium clocks work by manipulating energy states of gaseous Cesium atoms

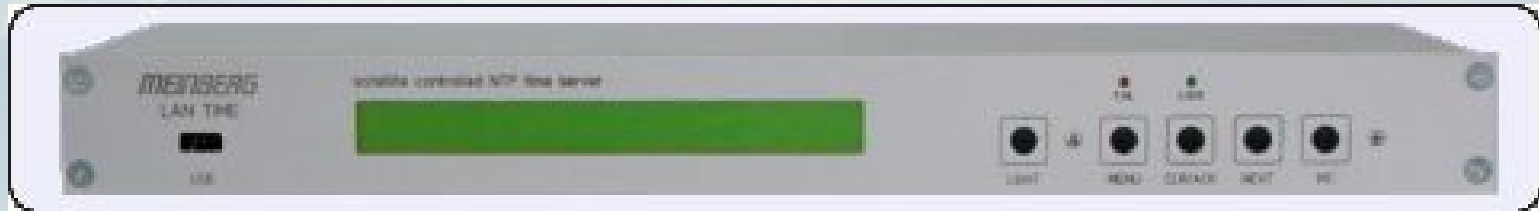
Issues and Annoyances



- Cesium Beam Tube life span limited
 - Cs supply exhausts after ~8 years use
- You start becoming a “Time Lord”
- This gear would give out wrong time if hit by power or loss of gps sync event!

Replacement Device

- Meinberg LANTIME SHS (Secure Hybrid System) – **ntp0** and **ntp1** (Telehouse)



- Uses GPS and DCF77 signal from Mainflingen, Germany
- Microsecond accurate timecode served
 - Without Cesium oscillator!

Mainfling-what?

- German standard time signal
- Administered by *Physikalisch-Technische Bundesanstalt*
- US equivalents
 - WWV, WWVB, WWVH



Basis of “Secure Hybrid System”

- The DCF77 signal uses PZF modulation
 - Pseudo-random phase noise (512 bit long)
- Allows receiver to generate a higher degree of accuracy compared to AM-only reception (such as the UK’s MSF)
- Can convey advance warning of things such as leap second data in addition
- Micro-second accuracy allows comparison with GPS time
 - Raises ntp stratum or stops service if clock drifts

Antennas

- Both GPS and DCF77 need roof-mounted antennas
 - Replacing existing antennas
- Quite a job to find the existing antennas
- Poor documentation meant nobody could remember where they were!
- Quite a few of them up there now
 - Wasn't the case back in 1999

Antennas – GPS



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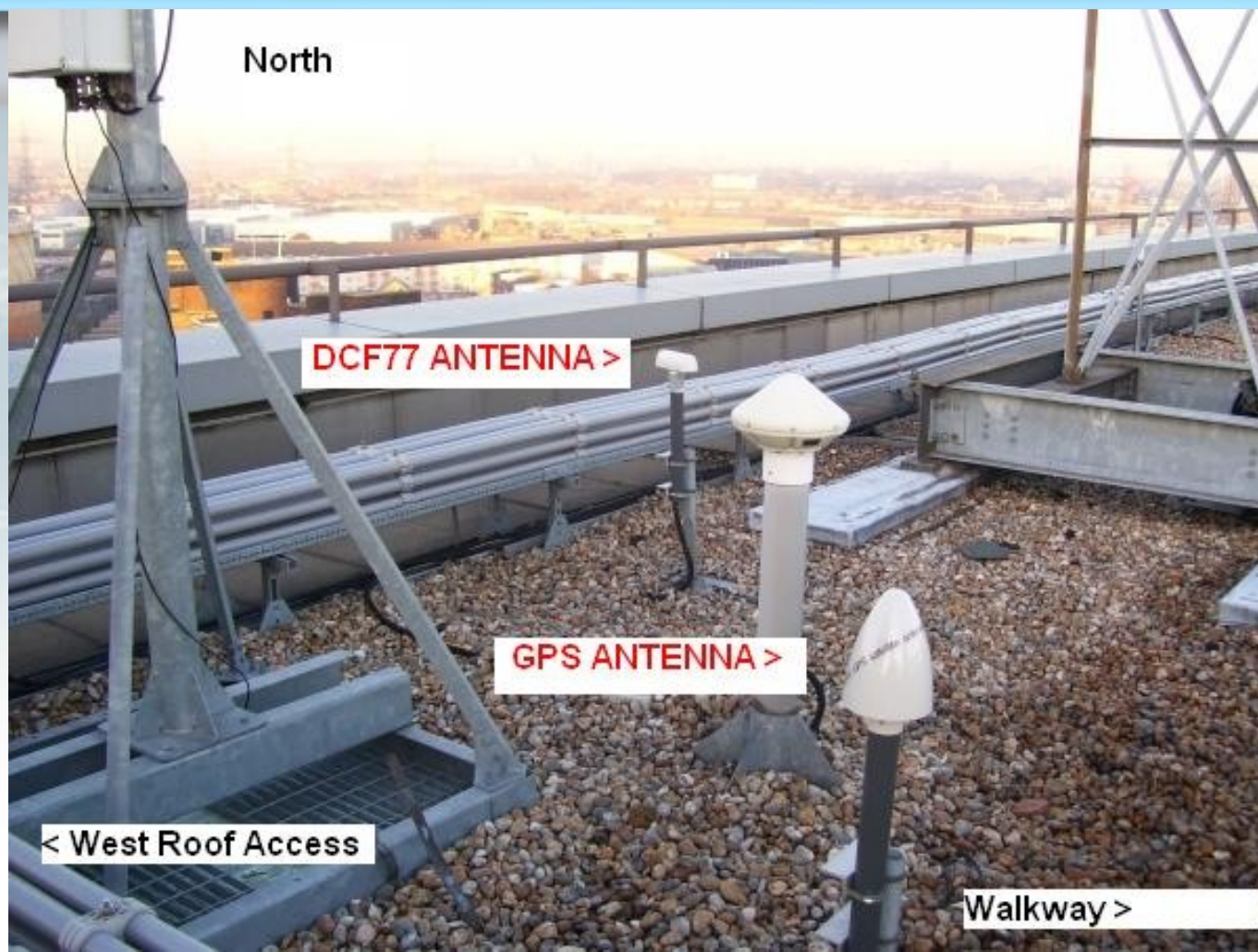
Antennas – DCF77



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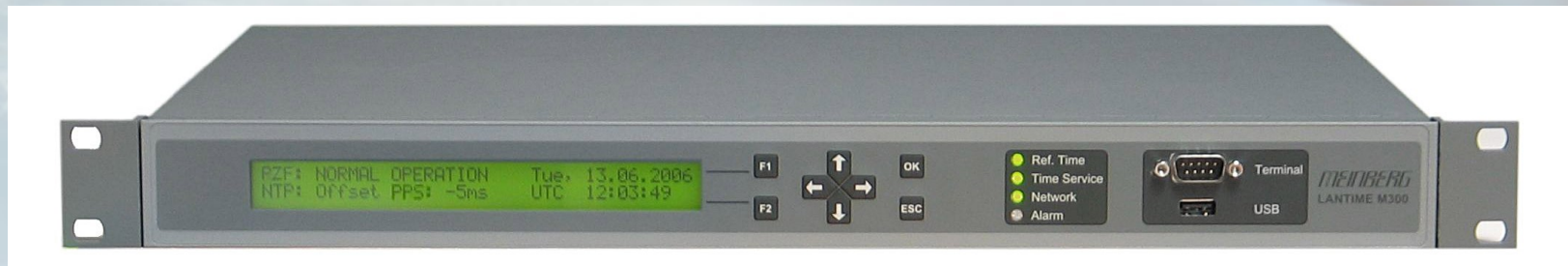
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Antennas in situ



TeleCity Millharbour

- LANTIME M300 / GPS+MSF (ntp2)



- GPS as primary time source with MSF as backup
- Couldn't receive DCF77 in this location
- Live in February 2008

MSF Signal

- “MSF” is the callsign of the UK NPL managed time service
- Commonly referred to as “Rugby”, but moved to Anthorn, Cumbria in 2007
- Simple On-Off keyed 60kHz signal
 - No PZF correlation
- NTP clock is “either/or” derived rather than hybrid



Meinberg LANTIME runs Linux ☺

```
ntp1.linux.net - PuTTY
>>>> -----<<<<
>>>      Meinberg Lantime      <<<
>>>> -----<<<<

      Meinberg Funkuhren
      Auf der Landwehr 22
      31812 Bad Pyrmont
      Germany

      Tel.:      +49 5281 93090
      Fax.:      +49 5281 93093
      EMail:     info@meinberg.de
      Homepage:  www.meinberg.de

type "setup" to enter configuration utility

ntp1:~ # ntpq -p
      remote          refid          st t when poll reach  delay  offset jitter
=====
LOCAL(0)             .LOCL.             12 l 10 16 377  0.000  0.000  0.002
+GENERIC(0)          .GPS.              0 l 12 16 377  0.000  0.000  0.002
oPPS(0)              .PPS.              0 l 7 16 377  0.000  0.001  0.002
+ntp0.linux.net      .PPS.              1 u 14 64 377  0.159 -0.002  0.007
ntp1:~ # █
```

Configuration Utility

```
ntp1.linx.net - PuTTY
| Lantime CONFIGURATION UTILITY 1.27 (ro:0) |
Lantime: ETXMGX/SHS 1HE V4.50          S/N: 030110147170
Host: ntp1                            Uptime: 34 days, 1:00
Domain: linx.net                       Notification: ENABLED

IPv4: 195.66.241.3      IPv6: fe80::213:95ff:fe00:baaa/64 (LL)

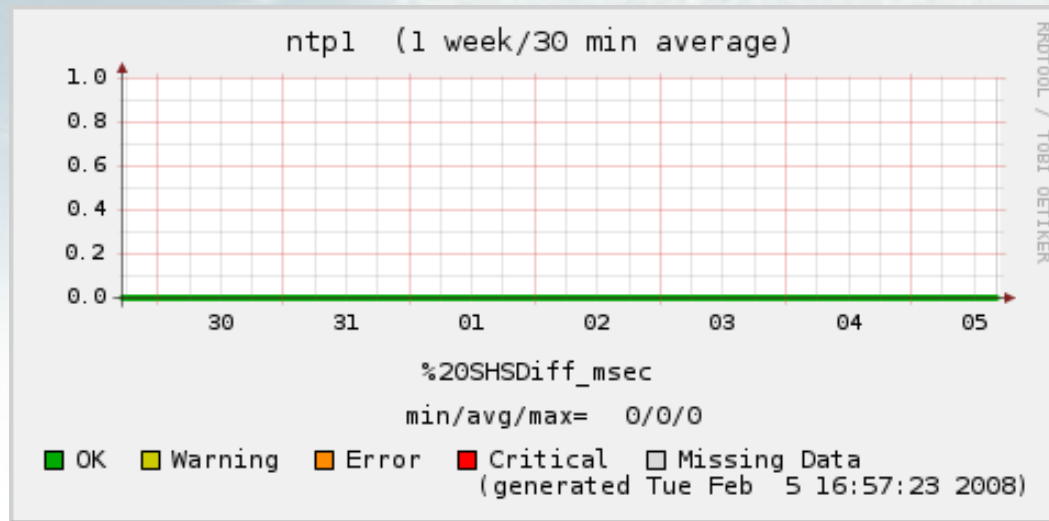
SHS STATUS: Normal Operation (L:20ms/D:0ms)      Date: Tue, 05.02.2008
GPS Status: Normal Operation (Inview:8/Good:7)   Time: 16:48:28
PZF Status: Normal Operation (Corr:73/Field:112)
NTP STATUS: Offset PPS: 0us

Last Messages:
05.02.08 05:50:03 UTC: lantime -> Second Refclock signal reconnected
05.02.08 05:49:28 UTC: lantime -> Second Refclock signal lost
05.02.08 04:58:29 UTC: lantime -> Second Refclock sync
05.02.08 04:57:54 UTC: lantime -> Second Refclock signal reconnected

Configuration & Management:
Ethernet Notification Security nTp Local eXit
```

Accurate or no time!

- Stops serving NTP if the time drifts or time sources not in sync
 - Or increases NTP stratum



SHS Diff
(Difference between
two time sources):
Should be zero!

Learning Experiences

- Running your own Cesium standards can be expensive, and really benefits from having local “time expertise”
- For NTP, equally good results can be gained from a simpler system
- Roof access in some buildings is a pain
- We used a specialist supplier even with the Meinberg gear

Questions?



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