US Dept Of Transportation and Innovate UK Complementary PNT Field Testing With Hoptroff

Richard Hoptroff, Justin Moore and Jack Daly, Hoptroff Inc, www.hoptroff.com

Critical National Infrastructure Relies on Resilient Connection to UTC

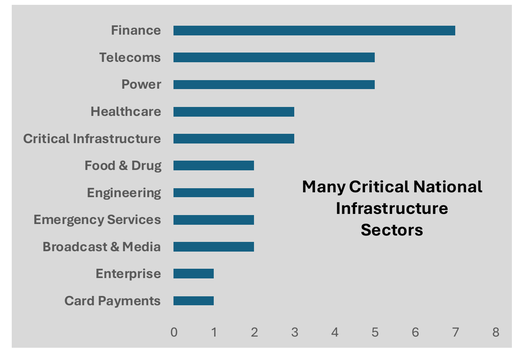
Dependent Infrastructure

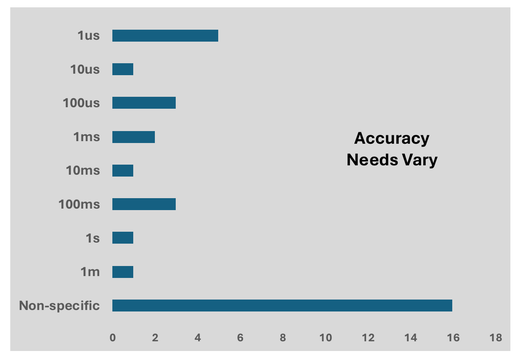
Many Critical National Infrastructure industries are reliant on time that is traceable to UTC. The reasons are varied: System interoperation; A record of events; Security & data integrity; Sensing & measurement; Signaling & Control

US Executive Order 13905

US Exec Order 13905 requires all critical national infrastructure to find alternative UTC sources to GPS for resilience against spoofing & jamming

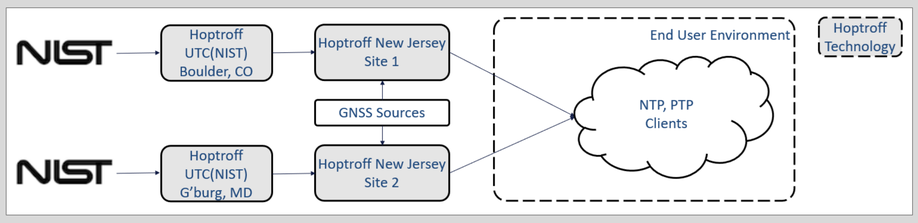
Regulation / Standard	Accuracy	Sector
IETF v4, RFC 5905 (NTP)	Traceable	Engineering
HIPAA	Traceable	Healthcare
HL7	1s	Healthcare
Gramm-Leach-Bliley Act (GLBA)	Traceable	Finance
Sarbanes-Oxley (SOX)	Traceable	Finance
IEEE 1588-2008 (PTP)	Traceable	Engineering
FINRA CAT NMS	100us	Finance
IEC 61850-5 - Synchrophasors	1us	Power
IEC 61850-5 - Fault Recording	100us	Power
IEC 61850-5 - Transient Events	1ms	Power
IEC 61850-5 - Power Quality	10ms	Power
IEC 61850-5 - Slow Events	100ms	Power
EENA NG112	1ms	Emergency Services
JCAHO/JCI EHRPI (Q) 482.24(c)(1)	Traceable	Healthcare
IOSCO FR04/13	By country	Finance
MiFID II	100us	Finance
21 CFR Part 11	Traceable	Food & Drug
NENA STA-026.5-2022	100ms	Emergency Services
EU Annex 11	Traceable	Food & Drug
SMPTE 2110 / SMPTE 2059-2	1us	Broadcast & Media
ITU-T G826x LTE/5G-NR FDD - Frequency Generation	50 PPB	Telecoms
JT-NM TR1001-1	100ms	Broadcast & Media
ITU-T G827x LTE/5G-NR/eMBMS - TDD Slot Alignment	10us	Telecoms
ITU-T G827x LTE/5G-NR TDD - Carrier Alignment	1us	Telecoms
ITU-T G827x LTE/5G-NR TDD/eCIC- Interference Mgmt	1us	Telecoms
ITU-T G827x LTE/5G-NR TDD CoMP/LBS - Cell coordination	1us	Telecoms
US Exec Order 13905	Traceable	Critical Infrastructure
ISO27001 / ISO27002 / ISO17799	Traceable	Enterprise
PCI-DSS 10.4	Traceable	Card Payments
NIS2 OPS1.1.5.A4	Traceable	Critical Infrastructure
DORA	Traceable	Finance
UK Risk Register	Traceable	Critical Infrastructure
CFTC 17 CFR 23.202	1m	Finance
RIS-6702-DST Appendix F	Not specified	Rail
NENA STA-026.5-2022	100ms	Emergency Services



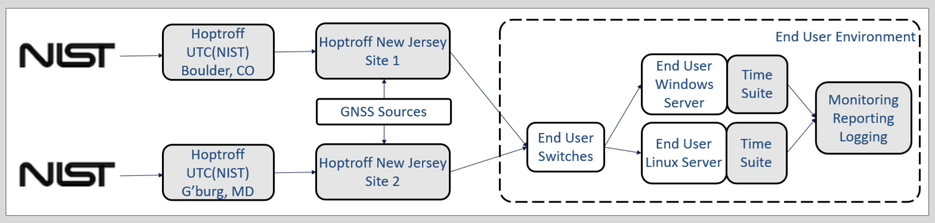


Testing With US Dept Of Transportation And NIST (in progress)

Test Harness Use Cases



Use Case 1: Pure Fiber NIST to Legacy End Devices



Use Case 2: Additional Sync, Monitoring & Alerting

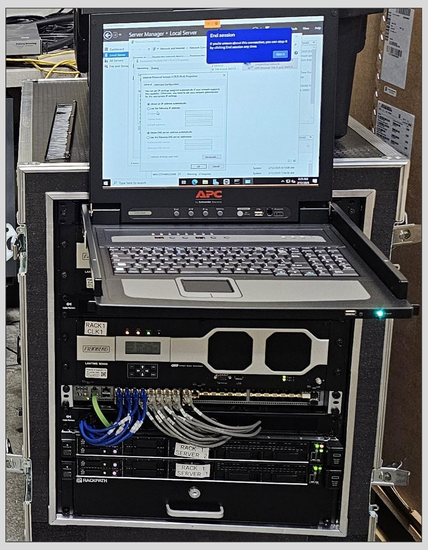
Test Criteria & Initial Results

Accuracy:
<1ms over VPN/IPSec
<100us over layer 3 fiber
<10us over layer 2 fiber

Integrity & Continuity:
100% over redundant networks

Availability:
Where existing IP fiber exists

Cost:
$3K - $12K / year / site + connectivity

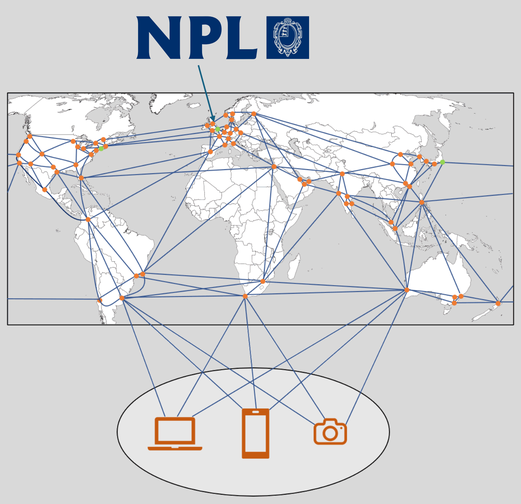


Test Harness

Testing With Innovate UK And NPL (complete)

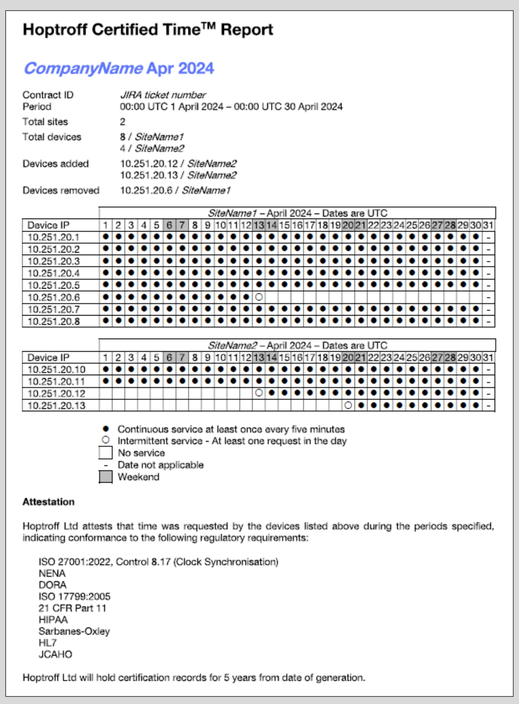
Cloud-Based Mass Time Dissemination

To distribute traceable time at mass scale, the best solution is to establish a global cloud-based software boundary clock network. We demonstrated a network that could achieve single digit microsecond accuracies



Certified Time Delivery Over NTP

Many standards, e.g. ISO27001, NENA, DORA do not require great accuracy, but do require provable traceability to UTC. An NTP server developed by Hoptroff records which devices are requesting time and produces monthly compliance certificates



Hoptroff Certified Time™ Report

CompanyName Apr 2024

Contract ID *JIRA ticket number*
Period 00:00 UTC 1 April 2024 – 00:00 UTC 30 April 2024
Total sites 2
Total devices 8 / *SiteName1*
4 / *SiteName2*
Devices added 10.251.20.12 / *SiteName2*
10.251.20.13 / *SiteName2*
Devices removed 10.251.20.6 / *SiteName1*

SiteName1 – April 2024 – Dates are UTC

Device IP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
10.251.20.1	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	-
10.251.20.2	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	-
10.251.20.3	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	-
10.251.20.4	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	-
10.251.20.5	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	-
10.251.20.6	●	●	●	●	●	●	●	●	●	●	○																					-
10.251.20.7	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	-
10.251.20.8	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	-

SiteName2 – April 2024 – Dates are UTC

Device IP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
10.251.20.10	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	-
10.251.20.11	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	-
10.251.20.12													○	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	-
10.251.20.13																				○	●	●	●	●	●	●	●	●	●	●	●	-

● Continuous service at least once every five minutes
○ Intermittent service - At least one request in the day
No service
- Date not applicable
Weekend

Attestation

Hoptroff Ltd attests that time was requested by the devices listed above during the periods specified, indicating conformance to the following regulatory requirements:

ISO 27001:2022, Control 8.17 (Clock Synchronisation)
NENA
DORA
ISO 17799:2005
21 CFR Part 11
HIPAA
Sarbanes-Oxley
HL7
JCAHO

Hoptroff Ltd will hold certification records for 5 years from date of generation.

HOPTROFF SMART TIMING™