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Best Practices for Secure PNT Management in a Multi-Vendor Environment

WSTS, March 13-16, Vancouver, BC

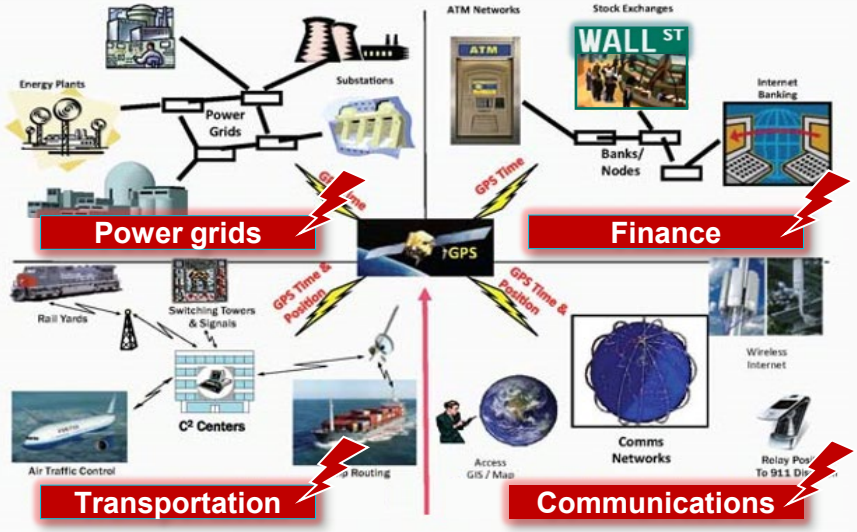
3/14/23 | 11:25-11:40a (15 min) | Chuck Perry, Sync Business Manager, NA Carrier/Defense, Oscilloquartz

What's the cost of GNSS/PNT service disruption?

PNT threats

$1B/day in economic cost*

GPS & US critical infrastructure under national security threats



All supported by

Data centers

*source: RTI & NIST 2019

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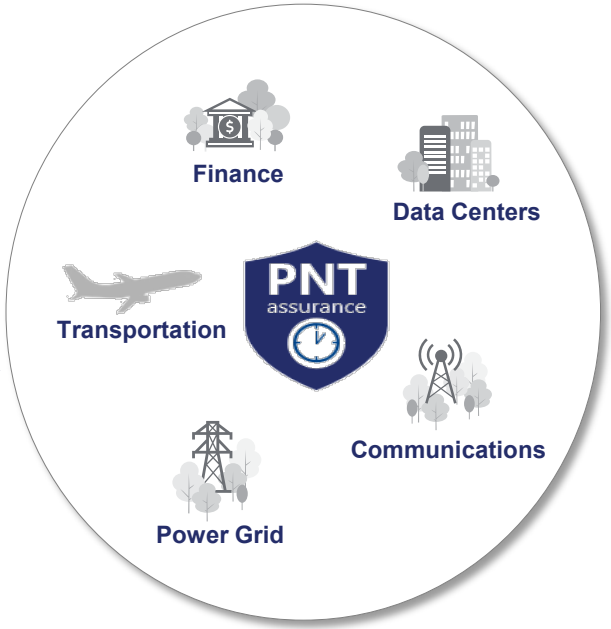
*US EXECUTIVE ORDER 13905: STRENGTHENING NATIONAL RESILIENCE THRU RESPONSIBLE USE OF POSITIONING, NAVIGATION & TIMING SERVICES

Federal* resilient PNT service requirements

aPNT - assured Positioning, Navigation & Timing

- **Focus**
  - On **Timing** as it enables **P** & **N**
- **Protect**
  - Critical gov/industry infrastructure against PNT services disruption from GNSS & network timing attacks - GPS/GNSS is a single point of failure
- **Deploy**
  - Resilient, multisource & self survivable PNT assurance systems
- **Target**
  - Critical infrastructure sectors under national security threats
- **Use**
  - Published PNT assurance guidelines & standard in progress
  - DHS Resilient PNT Conformance Framework
  - NIST Cybersecurity Framework for PNT Profile (NISTIR 8323 Rev 1)
  - IEEE P1952 Resilient PNT UE working group



According to RTI & NIST cost of PNT disruption is $1B /Day

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Five secure PNT assurance management principles

1) DHS Resilient PNT guideline specifies the use of **multiple sources vs. a user's risk profile**

2) NIST zero-trust PNT source strategy: "***never trust, always verify***"

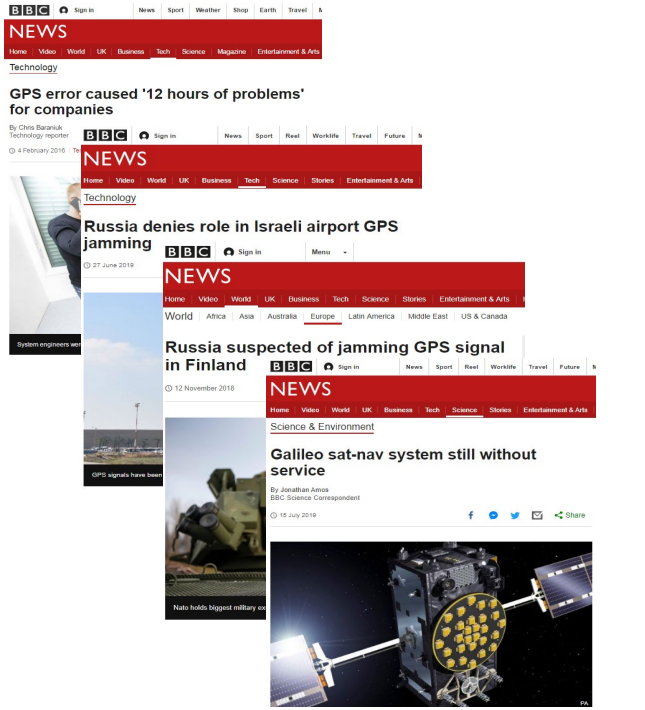
3) For secure PNT services, **GNSS is a single point of failure & needs 1 or more backup sources**

4) Secure, resilient & assured PNT needs **six 9's reliability**

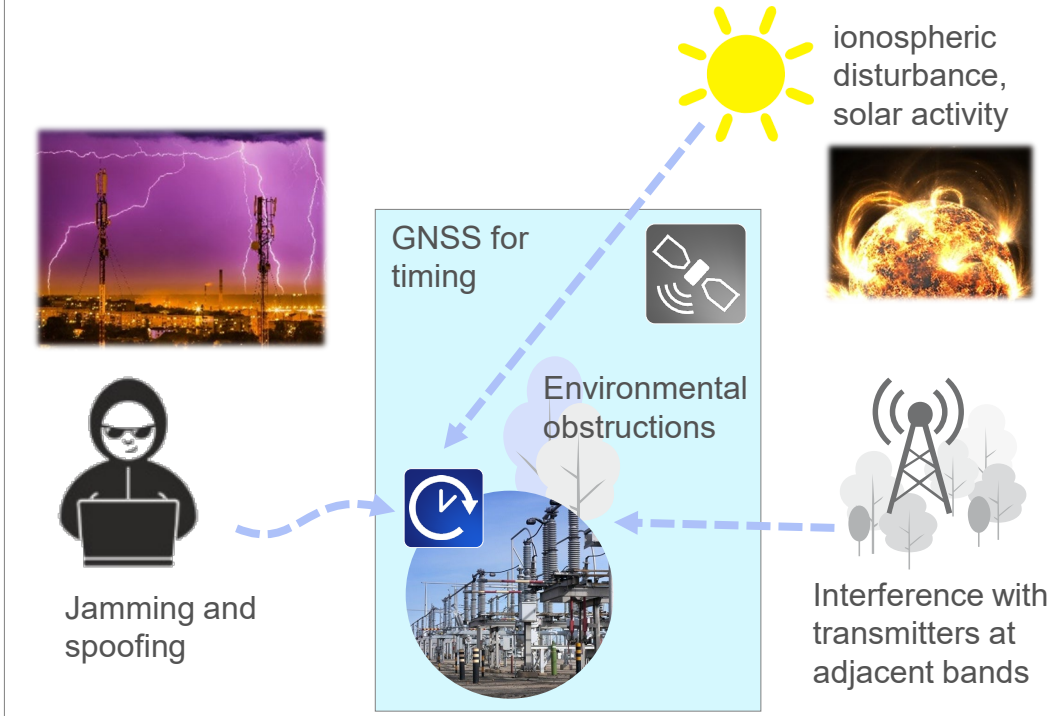
5) In a multi-vendor network environment, secure PNT can only be achieved with a **vendor-agnostic GNSS assurance system**

GNSS vulnerabilities and threats

GNSS disturbances



Multiple threat agents



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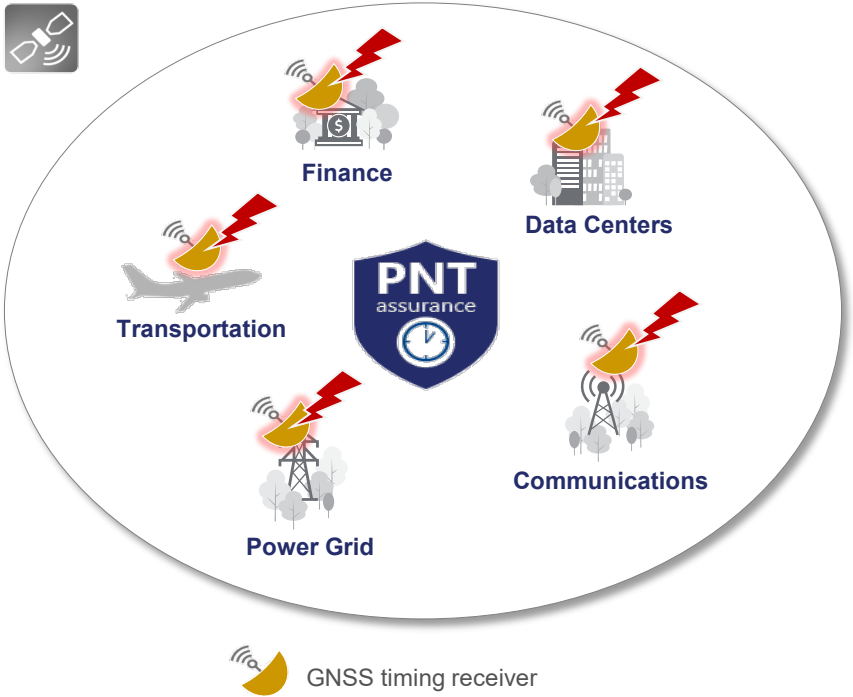
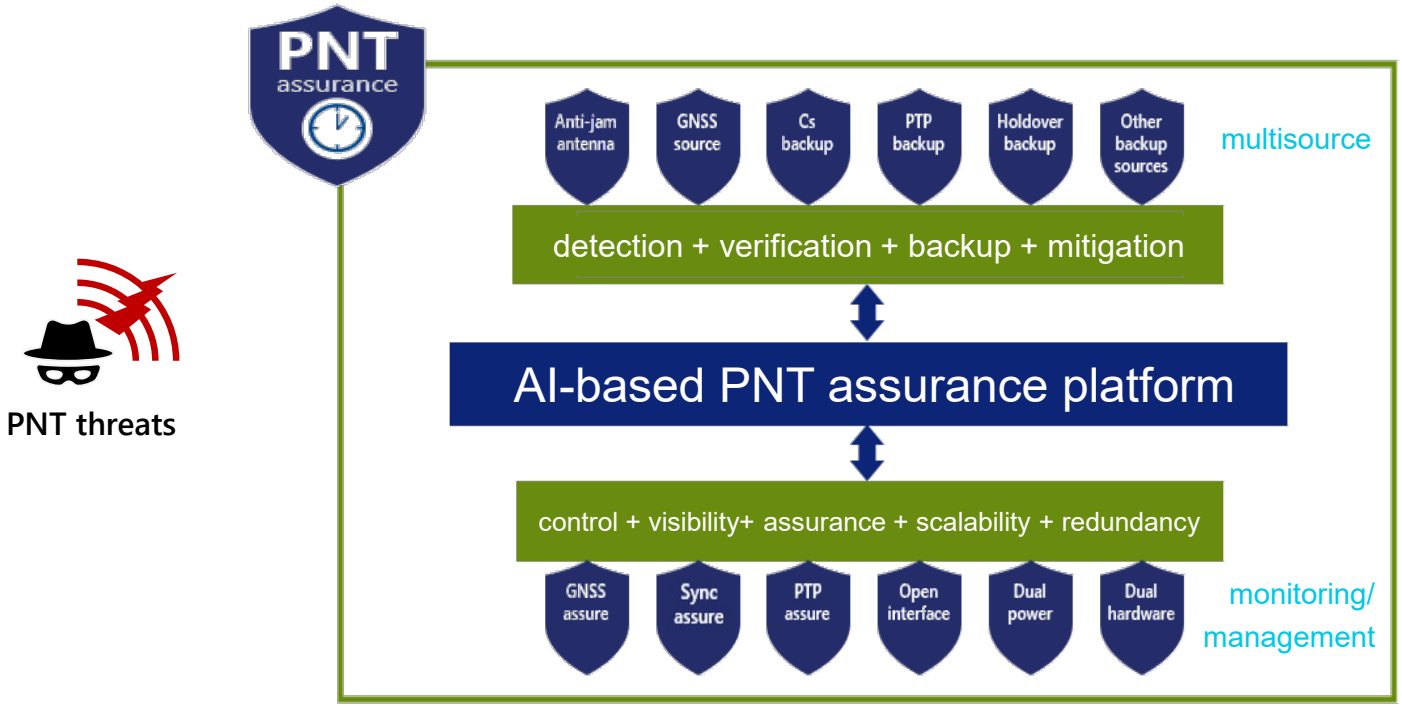
How to protect millions of GNSS in use worldwide?

PNT threats



GNSS timing receiver

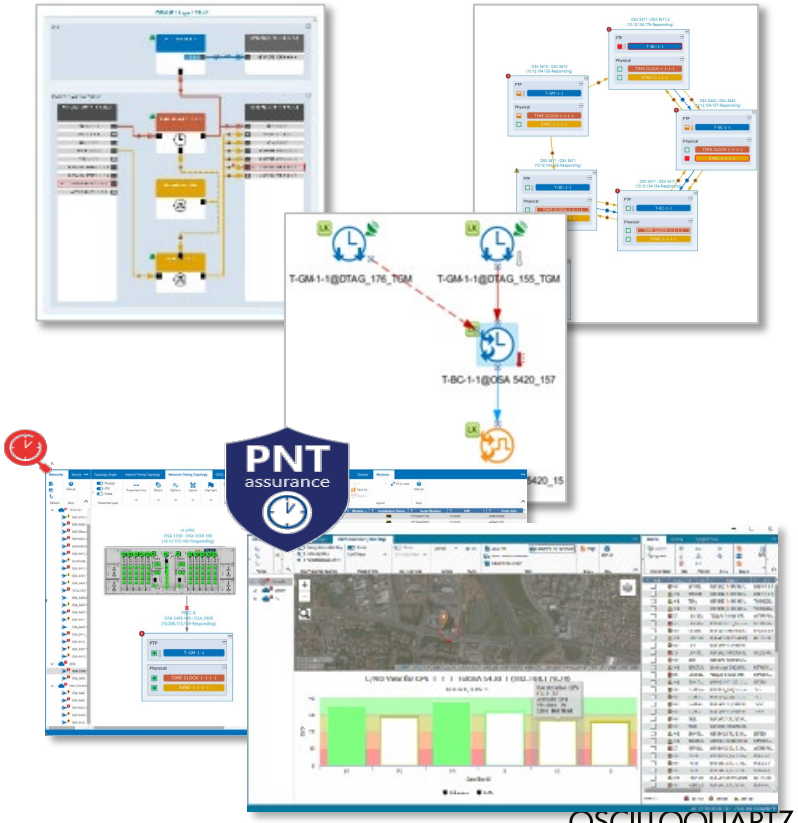
Zero-trust multisource PNT management architecture



AI-based centralized sync assurance

Key functionality

- Visualization of network-wide sync distribution routes
- Visualization of device-level internal timing topology
- Intelligent sync network health indicators and sync performance reports
- Probing of device-level clock references
- Remote PTP clients monitoring
- Vendor-agnostic GNSS assurance with AI-based threat detection and mitigation settings



AI-based GNSS observables and assurance

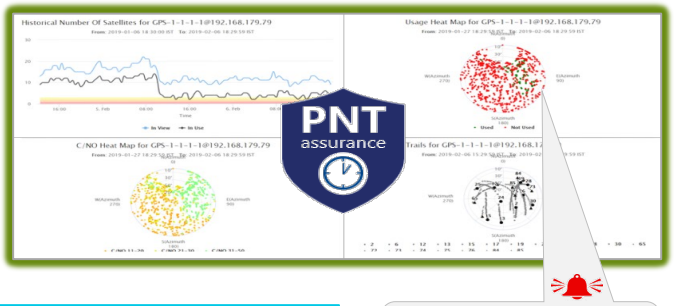
Data metrics from GNSS receiver's API

- Location
  - Latitude
  - Longitude
  - Altitude
- Satellites data
  - SV
  - Carrier to Noise
  - Health
  - Azimuth and Elevation
  - AGC

Location

Self-survey	: Enabled
Coordinate Latitude	: N32:11:32.094
Coordinate Longitude	: E34:53:8.706
Coordinate Altitude	: 85.3 m

AI-based vendor-agnostic analytics from all GNSS receivers across the network for GNSS assurance



AI-based GNSS threat detection

Satellite Entry Table

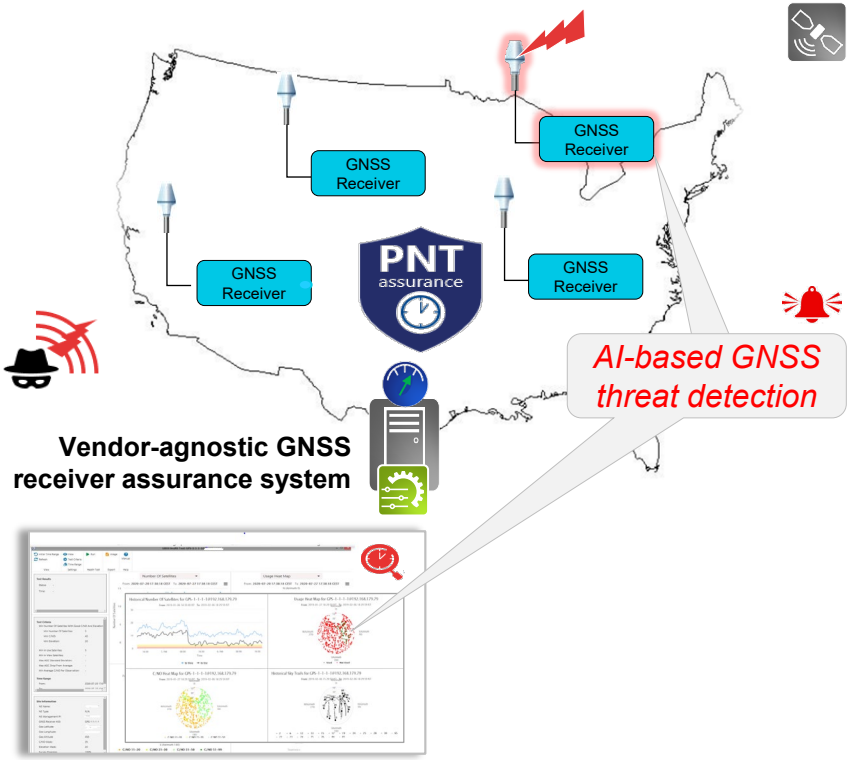
SV	In use	Constellation	C/No[dB-Hz]	Health	Azimuth[deg]	Elevation[deg]
2	Yes	GPS	36	OK	128	51
6	Yes	GPS	42	OK	77	42
12	No	GPS	31	OK	329	52
15	No	GPS	23	OK	205	13
17	No	GPS	41	OK	46	5
19	Yes	GPS	32	OK	42	27
24	No	GPS	26	OK	210	80
25	Yes	GPS	36	OK	298	24
29	No	GPS	28	OK	233	20
32	No	GPS	29	OK	316	7
78	No	GLONASS	36	NA	119	16
79	Yes	GLONASS	36	NA	77	59
80	Yes	GLONASS	17	NA	339	44
81	Yes	GLONASS	31	NA	32	46

AI-based GNSS site analysis & performance monitoring

AI-based vendor-agnostic GNSS receiver assurance

Key requirements

- Real-time monitoring of GNSS observables from all the GNSS receivers in the network
- Real-time analysis of relevant data from all the GNSS receivers in the network
- AI/ML-based algorithms to detect, alert and mitigate GNSS attacks and vulnerabilities
- Automatic re-routing of synchronization references across the network for sync assurance



AI-based threat detection and mitigation capabilities

Thank you!