OSCILLOQUARTZ
A division of Adtran

75 YEARS
TIMING EXCELLENCE

NO TRUSTED TIME, NO TRUSTED NATION.

Sovereign Time Critical Infrastructures

A Story of Sovereignty, Security and Precision

Frédéric Silva June 3rd 2026

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What Time is it ?

What time is it ?

Time Perception for Individuals

Individuals experience time biologically through circadian rhythms and socially via calendars and time zones. Personal devices synchronize time for daily coordination.

Time Coordination in Buildings

Buildings use internal clocks to coordinate HVAC, lighting, security, and safety systems, requiring consistent and accurate timing to ensure efficiency and safety.

Precise Time in Critical Infrastructure

Critical infrastructures rely on precise, traceable time from atomic clocks and GNSS to synchronize telecom, power grids, and financial systems, where microseconds up nanoseconds or more matter.

Time Sovereignty is the Cornerstone of Digital Sovereignty

3
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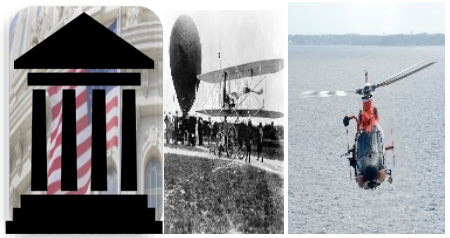
TIME SENSITIVE CRITICAL INFRASTRUCTURES

75 YEARS TIMING EXCELLENCE

Market Segments Critical Infrastructures

Telecom / Cable	Government (Aerospace / Defense)	Power Utilities	Data Center & Cloud Financial Institutes	Transportation
				

….and many more: Aviation, Industry4.0, Broadcast, Healthcare, Research & Education

Spectrum efficiency, reliable 5G data transmission, reducing latency and supporting advanced technologies (5G, IoT)	Vital for accurate and secure communication, navigation and coordination of critical networks and military mission Electronic warfare and drones	Provides grid stability renewable energy integration smart grids, digital substation	Ensures data consistency and optimal performance across distributed systems, critical for real time services, reduces power consumption	Ensures efficient, reliable, and coordinated operations, provide on board 5G services and regulatory compliance autonomous driving, and vehicle connectivity

Needs

< 500 - 1.000 nano sec Time accuracy at Application Layer; Service Level Agreements

Relevant Technology

Cesium Clock to back up GNSS vulnerabilities

Core, Edge & Access Time & Sync devices enabling NTP / PTP services, probing, jam/spoofing protection on Zero Trust Architecture

Time & Frequency dissemination with high accuracy using WR PTP

FCAPS Sync Mgt System, Service Assurance Tool, SLA reporting

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EU Standards and Cyber Regulations

NIS2:
continuity and cyber resilience

MiFID II:
traceable nanosecond timestamps

CRE / RTE:
secure PMU synchronization

ESA / EUSPA:
resilience to PNT disruption

Cybersecurity now starts with time security.

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Hey Europe,
it’s TIME to take control!

- Time powers telecoms, energy, banking, defence.
- 90% of that time comes from space.
- What happens when satellites stop?
- GNSS can be jammed, spoofed or blocked.
- Seconds slip → systems drift → services fail

It’s time to bring Europe’s time back to Earth.

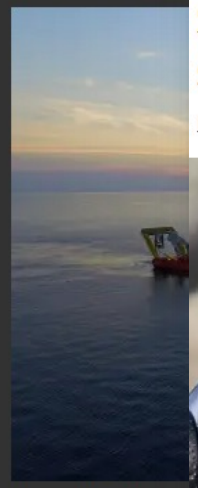
The Hidden Vulnerability

- Weak GNSS signals = easy targets.
- Low-cost jammers everywhere.
- Spoofing creates fake positions.
- When time fails, everything follows.

Invisible risk. Massive impact.

Jamming: Polish researchers suspect GPS jammers on ships in the Baltic Sea

According to a study, the GPS interference observed in the Baltic Sea is technically sophisticated and apparently also originates from the Russian shadow fleet.



(Image: Korn Srirawan

Mar 4, 2025 at 10:49 p

By Stefan Krempl

BALTIC SEA

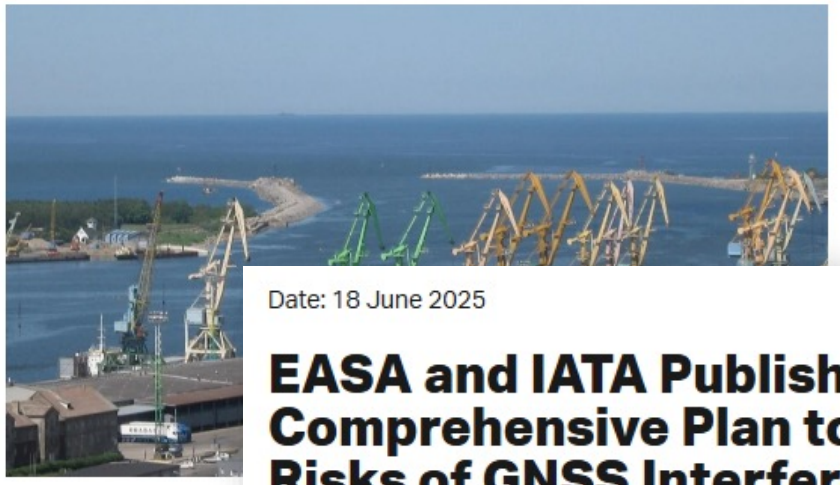
Swedish Maritime Administration warns of large-scale GPS disruptions

Hauke Schmidt · 28.06.2025

In a current warning, the Swedish Sjöfartsverket points out that GPS interference is to be expected in large parts of the Baltic Sea. The Finnish authorities provide recommendations for action.

Lithuanian port hit by GNSS interference

June 11, 2025 - By Tracy Cozzens



The port of Klaipėda hanc
domain)

Russia's war with Ukr
the Baltic Sea, report
seaport of Klaipėda a
shield its Kaliningrad
Skvernelis, speaker o

Date: 18 June 2025

EASA and IATA Publish Comprehensive Plan to Mitigate the Risks of GNSS Interference

Cologne — The International Air Transport Association (IATA) and the European Union Aviation Safety Agency (EASA) have published a comprehensive plan to mitigate the risks stemming from global navigation satellite system (GNSS) interference. The plan was part of the conclusions of a jointly-hosted workshop on the topic of GNSS interference.

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Economic Impact

- GNSS outage → **€1B loss/day**
- Data drift → **operational paralysis**
- Sovereign time → **national insurance**

Resilience costs less than recovery.

Global Context: GNSS Fragility

- U.S. has a national PNT strategy.
- Asia builds terrestrial time networks.
- Europe still relies mostly on GNSS.
- Some Critical sectors are unaware of their single point of failure.

Resilience isn’t a luxury. It’s policy.

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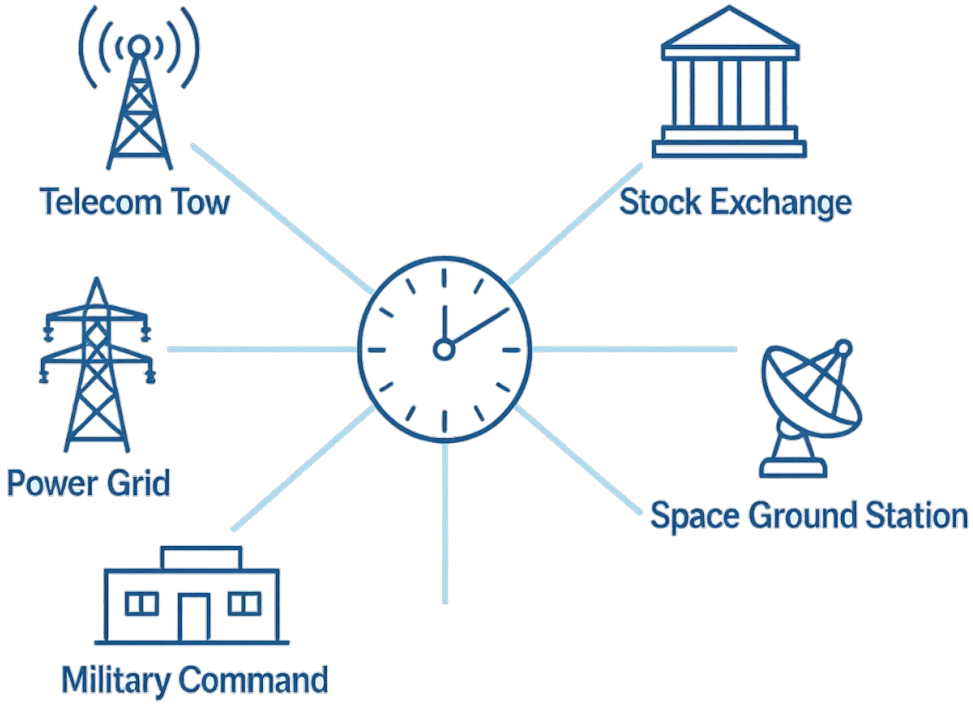
Why National Time Matters

Every national service relies on trusted time: telecom, energy, finance, defence, space.

Without traceable UTC(k), data integrity and sovereignty collapse.



Time is the invisible backbone of critical infrastructure.

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75 YEARS
TIMING EXCELLENCE

Oscilloquartz Suite Overview

Innovation with Operational Simplicity

Oscilloquartz at a glance

75 YEARS TIMING EXCELLENCE

An ADVA division, became Adtran

Focused on sync and timing solutions for communications, government and enterprise applications

Longstanding relationships with customers worldwide since founding in 1949, Neuchâtel, Switzerland

- 100+ sync focused partners in 80+ countries worldwide
- Customer satisfaction driven

State-of-the-art time phase and frequency solutions

Most innovative and scalable end-to-end solutions for all markets

Excellence in PNT timing delivery and assurance

aPNT+™

Oscilloquartz PNT Product line proudly EU Made

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Operators' Real world Timing challenges

- **Timing Loops & Asymmetry Issues**
  Packet delay variation, asymmetry and incorrect timing path configurations affect synchronization quality.
- **Lack of End-to-End Timing Visibility**
  Operators often lack centralized monitoring tools to detect timing degradation before service impact occurs.
- **Cybersecurity Risks on Timing Infrastructure**
  Timing sources are increasingly becoming targets for cyberattacks due to their critical role in national infrastructure.
- **Remote Site Operational Challenges**
  Rural and unmanned sites make GNSS troubleshooting, antenna maintenance and fault isolation difficult.
- **Environmental Impacts on Timing Performance**
  Temperature variation, humidity, vibration and power instability can affect oscillator and GNSS receiver performance.
- **Network-Wide Impact of Timing Failures**
  A single GNSS timing issue can cascade across thousands of synchronized mobile network elements.
- **Operational Complexity of Synchronization Assurance**
  Continuous monitoring, analytics and root-cause analysis are required to maintain synchronization SLA compliance.

Multi Vendor integration to provide end to end Timing visibility

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Operators' Real world Timing challenges

- **GNSS Jamming Attacks**
  Intentional or accidental RF interference can disrupt synchronization across mobile base stations, impacting LTE and 5G network stability.
- **GNSS Spoofing Threats**
  Fake satellite signals can manipulate timing references, leading to phase and frequency synchronization errors in RAN infrastructure.
- **Loss of Satellite Visibility**
  Urban canyons, indoor deployments, tunnels and dense infrastructure can obstruct GNSS reception at cell sites.
- **Antenna Installation Issues**
  Poor antenna placement, cable losses, multipath reflections and inadequate grounding degrade timing accuracy.
- **Dependence on Outdoor Antennas**
  Mobile operators rely heavily on rooftop GNSS antennas exposed to weather, lightning and physical tampering risks.
- **Multi-Path Signal Reflections**
  Reflected satellite signals from buildings and towers introduce timing inaccuracies and phase instability.
- **Vulnerability During Geopolitical Conflicts**
  Military activities and electronic warfare can severely affect GNSS availability and integrity over large region.

AI Powered GNSS Assurance to detect & mitigate GNSS Anomalies

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OUR MISSION

- **Maintain Time traceability, performance and stability**
  In regulated and latency-sensitive environments, **inconsistent time equals operational and regulatory risk**. Whether exposed to Solar Flare or GNSS interferences, an essential timing infrastructure **must not fail**.

- **Enhance Timing infrastructure protection**
  Europe and Middle East are currently the most exposed locations, as of today. Local Timing infrastructures are the most protected and deployed in many more locations, maintaining digital infrastructure continuity.

- **Compliance reduction and operational simplification for time-critical, multi-location systems**
  Timing Service Reporting traceability, GNSS Signal interference monitoring

- **Supply chain traceability**
  Limiting Supply chain risks to avoid and control components and innovation bottleneck.

- **Share PNT Timing Know How**
  Time Sovereignty is not merely a technical sub-discipline; it is the fundamental foundation upon which digital sovereignty and national security are constructed.

You are welcome to join ！

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Oscilloquartz products overview

MNC *sync*Director™

aPNT+™

75 YEARS TIMING EXCELLENCE

accessSync™

OSA 5401 XG-MB

NEW

OSA 5405-I/O/MB/P/S

edgeSync™

OSA 5410 XG

OSA 5412

edgeSync™ +

OSA 5422

coreSync™

OSA 5430 NG GM/SSU

OSA 5440 NG GM/SSU

coreSync™

OSA 3300/50 optical Cs

HP,SHP/ SePRC/SePRC+

3200/3250 optical Cs

SP/ePRC

NEW

OSAinside™*

OSA 5400

NEW

SyncModule

STL Module

TimeCard

OSA SoftSync

OSA 5510

NEW

TimeScale

5G

O-RAN/edge DC

Data center

911 center

front/backhaul

PNT cyber threats

Smart power grids

Aviation radars

Defense comm

TV studio

Financial trading

Core network

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OSA Optical Cesium: The Heartbeat of Sync

- **OSA 3300 HP/SHP**: world's first commercial optical cesium standard.
- **Optical pumping** → higher SNR, better stability, >10-year lifetime.
- **Delivers accuracy**: 1×10^{-14}; ADEV down to 8×10^{-15}.
- **Holdover performance** : 100 ns time accuracy up to 150 days, fully autonomous
- **Maintenance**: Fully modular and remotely managed.

Atomic precision, national confidence.

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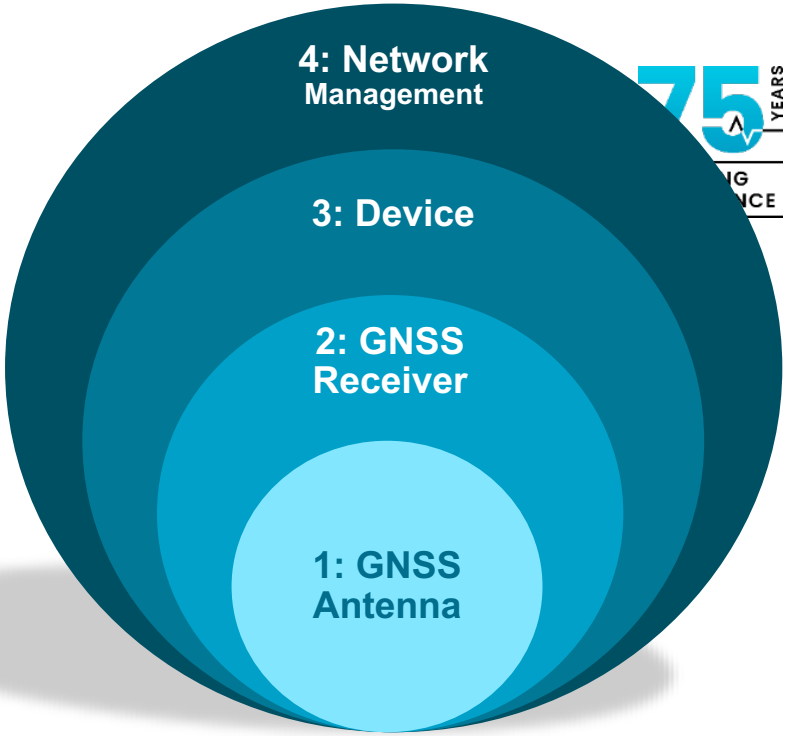
Multilayer Detection

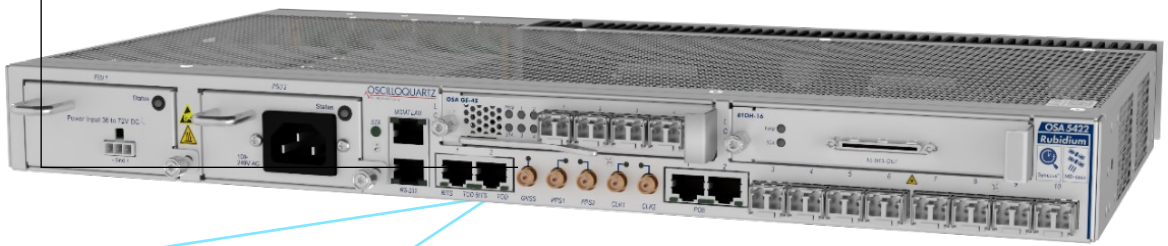


Layer 1

Layer 4

Layer 3

Sync Jack™



Layer 2

OSA 54x2/5430/40

GNSS Multi-Band receivers

NR	Jamming Detection	Near	NA	NSA
MJ	Spoofing Detection	Near	NA	NSA
MJ	Advanced Jamming Detection	Near	NA	NSA
MJ	Advanced Spoofing Detection	Near	NA	NSA

Layer 1: GNSS Antenna

- Use anti-jam/spoof antennas, with threat alarms

Layer 2: GNSS Receiver

- Use multi-constellation/-band receivers, with jam/spoof & satellite count monitoring, jam mitigation, spoof detection, GNSS M-Code/PRS, and threat alarms.
- Use advanced spoofing detection as Layer 2+

Layer 3: Device Level

- SyncJack to mitigate spoofed GNSS vs PTP signals
- Compare two GNSS receivers, in fixed & nav mode, to detect location/phase/time change

Layer 4: Network Management

- Manage/monitor/compare/verify all network clocks (GNSS/PTP/ etc.) in real-time, with performance threat alarms/analytics

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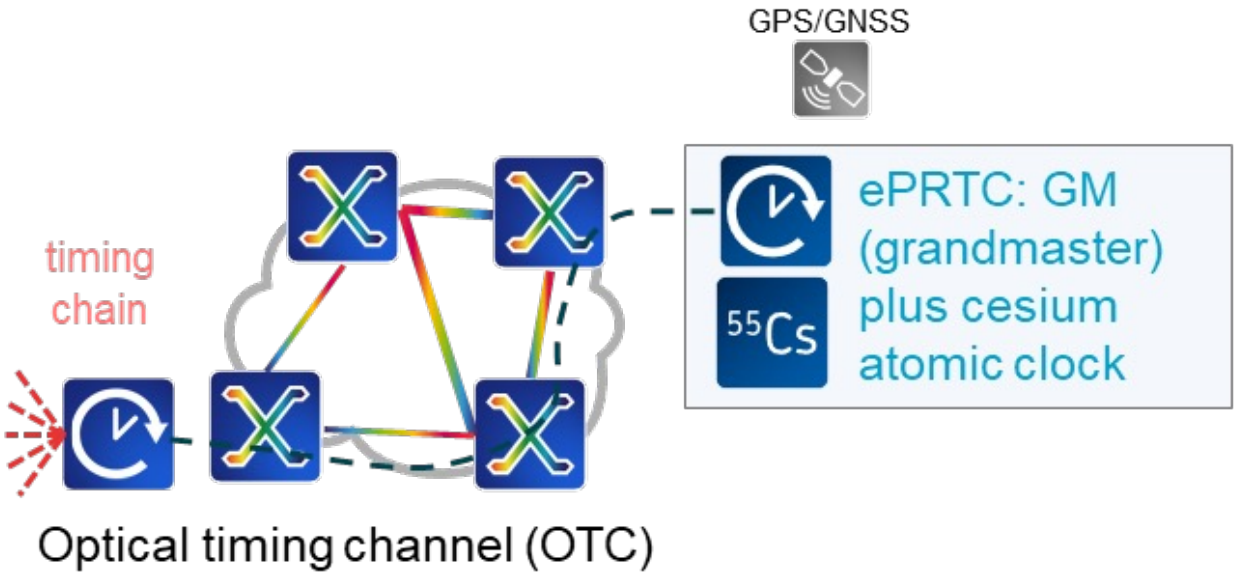
Optical Transport

- OTN/WDM backbone distributes protected time & frequency.
- Enables nationwide reach with redundancy.
- *Seamless integration of sync + data transport.*
- *E2E Solution*



Data + Time + Assurance = One Protected Layer (Adtran OTN/WDM)

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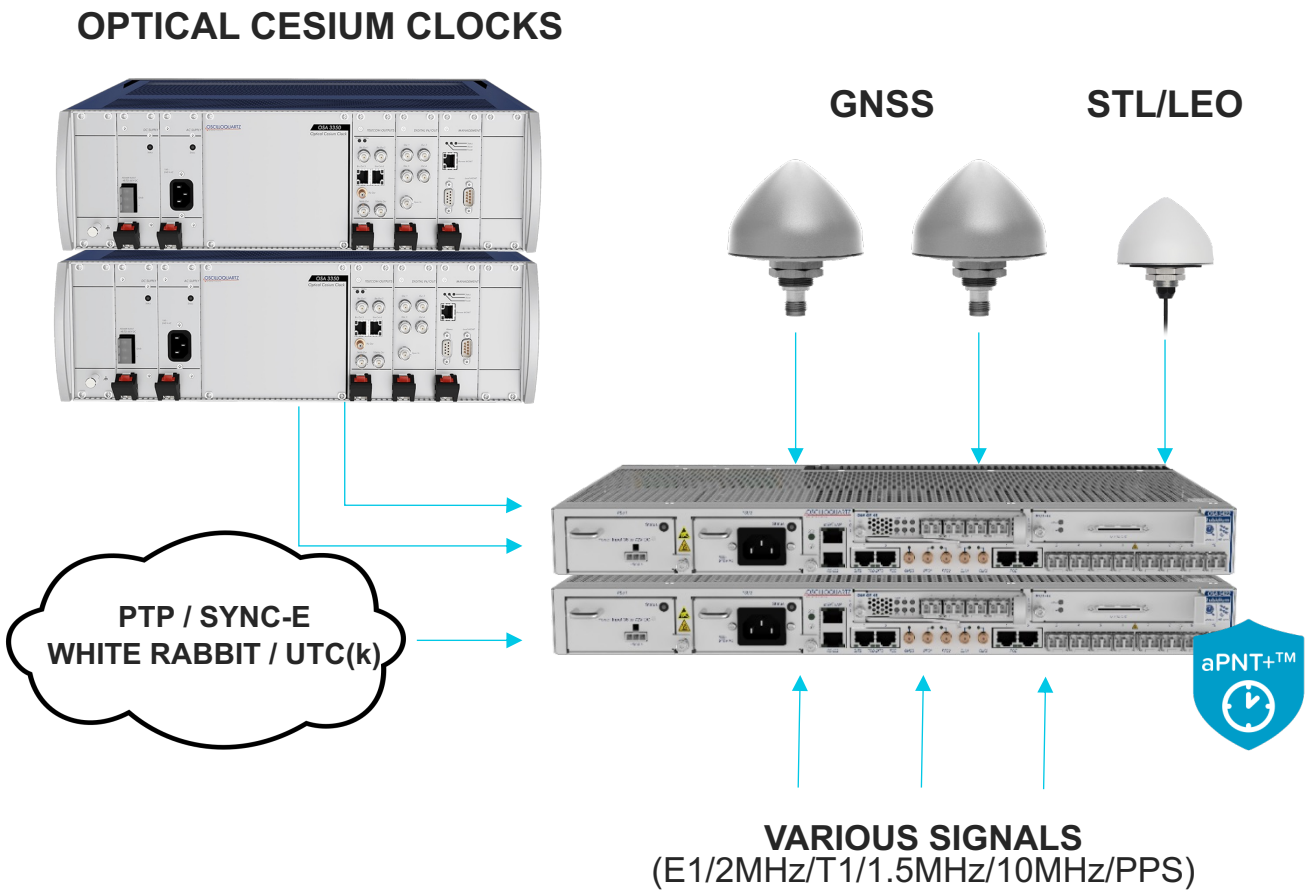
RESILIENT, REDUNDANT AND WEIGHTED

Regional Timing Nodes

- Enhanced cnPRTC-class node with dual Optical Cesium for redundancy
- Multi-source ensemble: Optical Cs + GNSS + terrestrial references
- Automatic weighting of inputs for optimal performance and resilience
- Provides regional UTC(k) robustness even during GNSS outages
- Scales the national time scale into resilient regional domains



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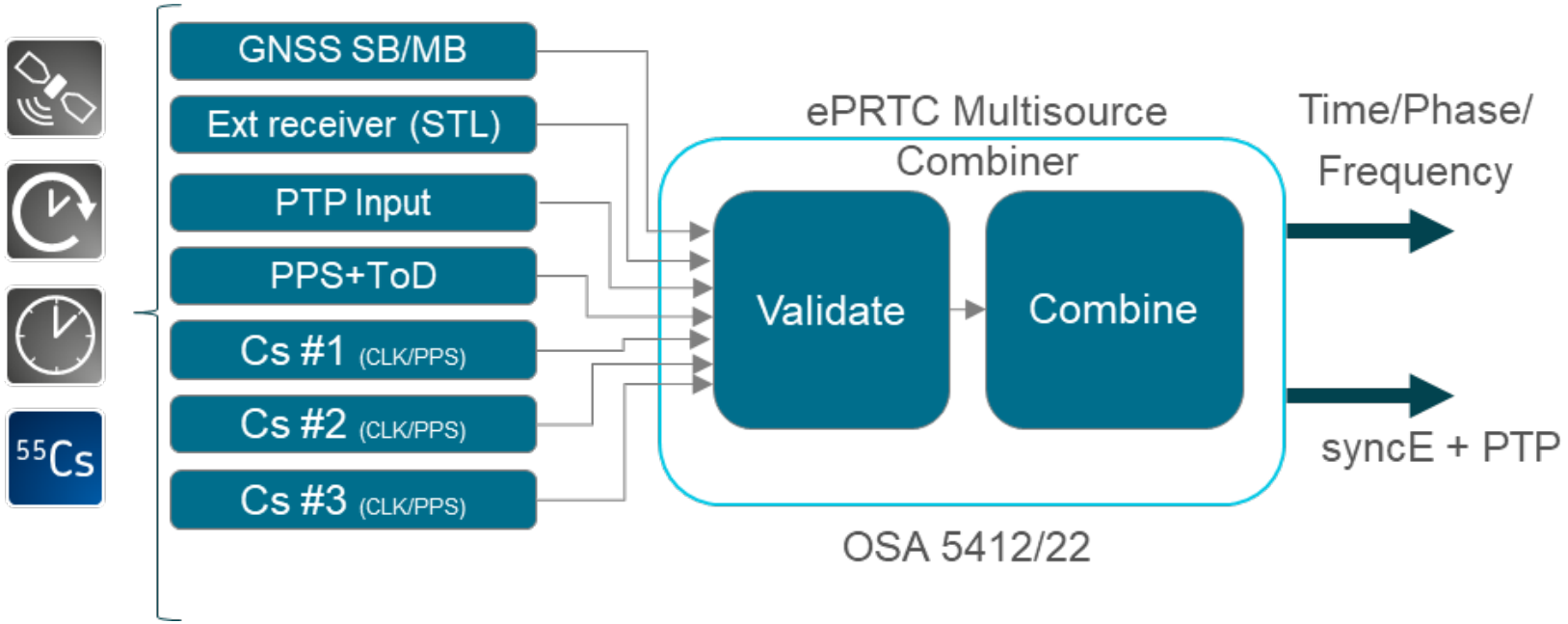
Timescale System

- **Multi-source Time Scale hubs**: Optical Cs, calibrated GNSS.
- **Combiner + weighting** = robust, resilient national reference.
- **Real-time monitoring** with TICs and phase comparators.



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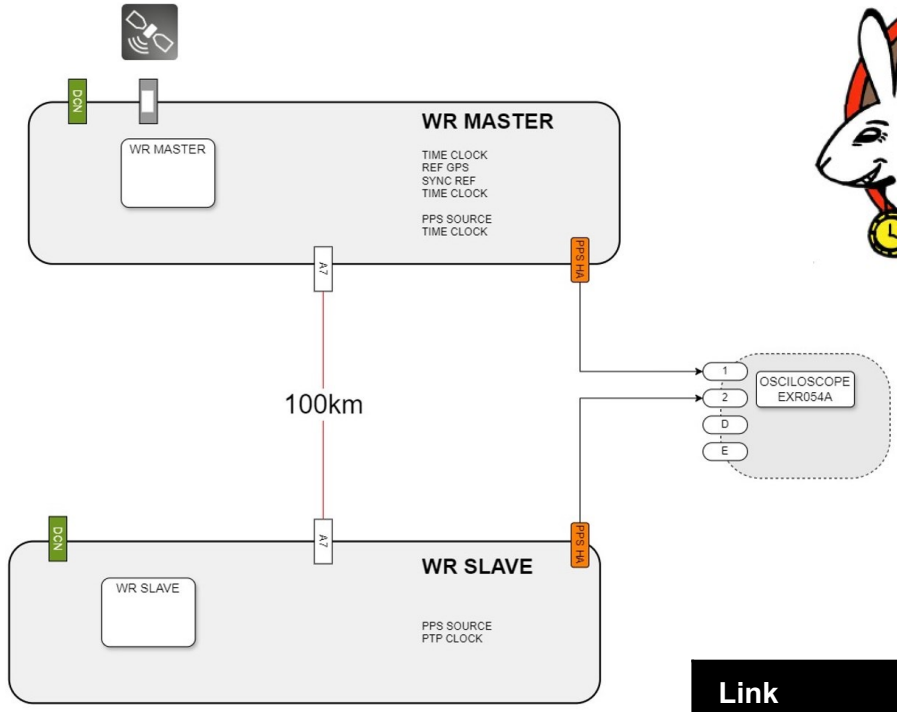
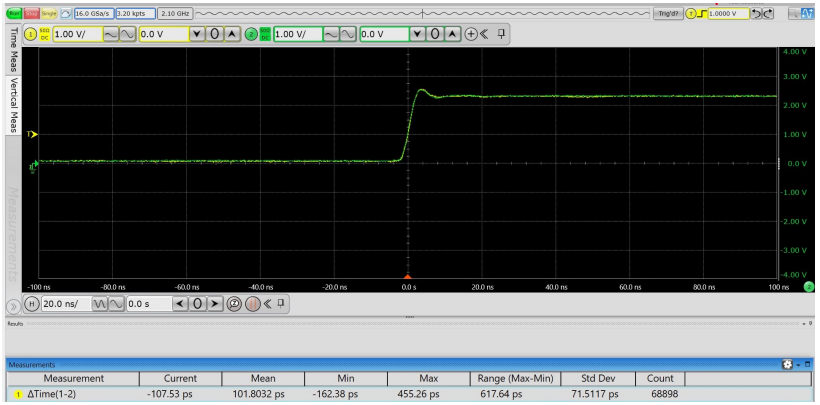
White Rabbit & HA-PTP

- <1 ns accuracy over optical fiber
- Research labs, defence networks, and ground stations
- Fully supported across the OSA 54xx family



WR-PTP BC

< 1ns



Link	100km
Duration	19h
Max - Min	617,64ps
Mean	101,8ps
Std Dev	71,51ps

White Rabbit brings sub-nanosecond precision to science and defence

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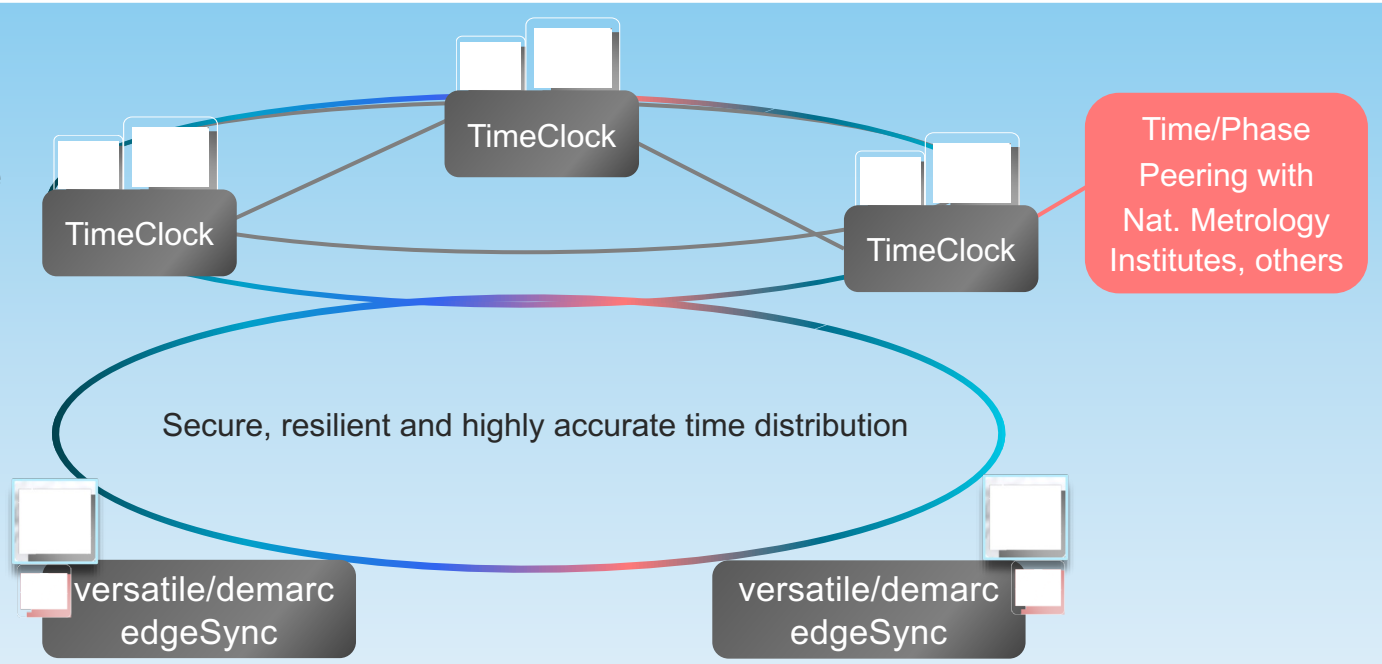
National SovereignTime Architecture
Highly accurate and redundant timekeeping, distribution and assurance

TaaS Network Operator

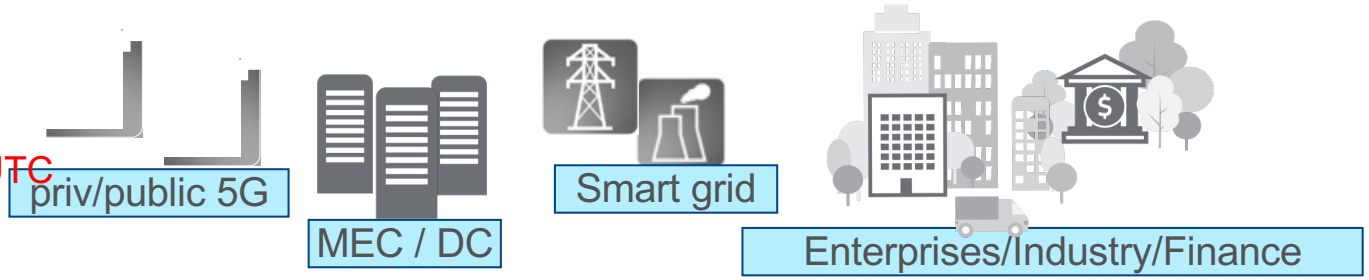
Core TimeClock to mitigate
GNSS vulnerabilities / dependency
- Ensemble of highly precise and accurate Time Clocks
- Better +/-30ns to UTC
- Timing guarantees if GNSS goes down

WR PTP - Optical Layer Transport
- Disseminate T&F with ns sec accuracy

Timing Demarcation
- Better +/- 100ns / 40ns (PRTC-A / -B)



User Applications Customer
- Better +/- 1000ns to UTC



SLA enabling sync architecture for Critical Infrastructure

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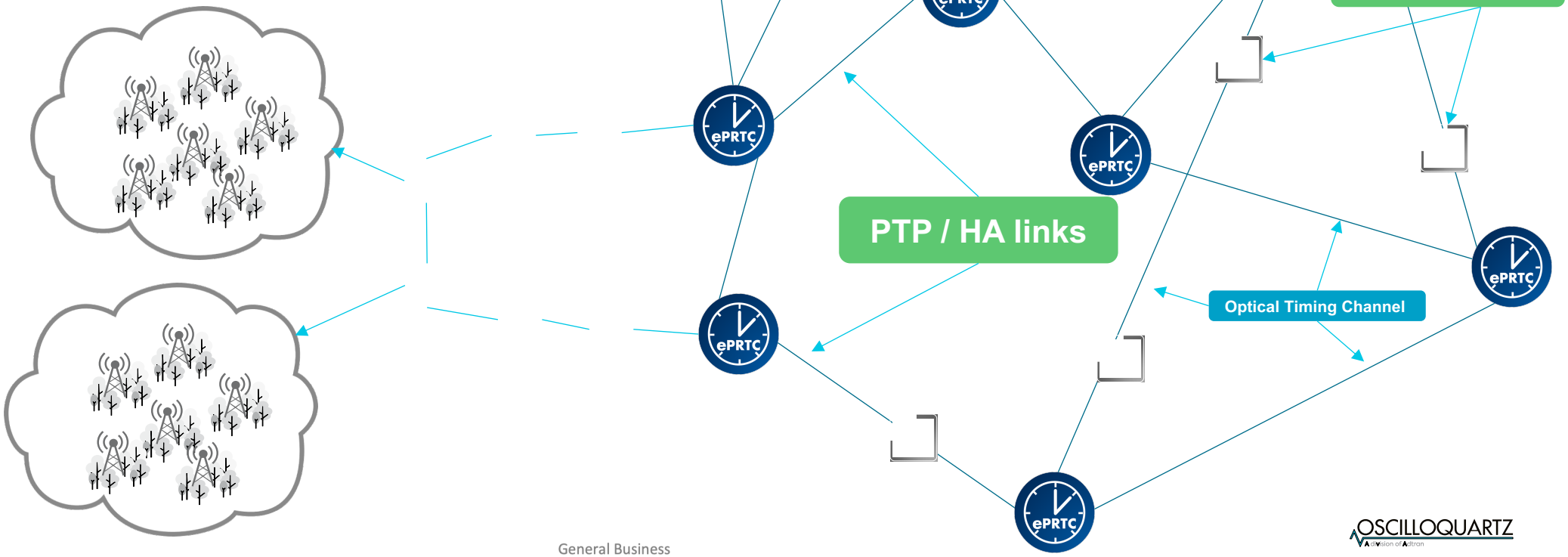
HIGH ACCURACY PTP

Next gen sync networks with HA links

- ePRTC systems interconnected with High Accuracy links (PTP-HA, WR)
  - HA link < 1 ns accuracy
- High Accuracy Boundary Clocks with sub-ns precision



*UTC from NMI - optional

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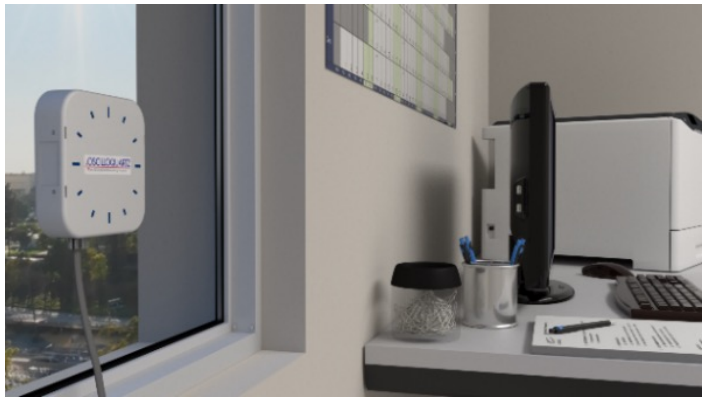
OSA 5405 Series – Product overview

Product description

- Dual GNSS antenna with receiver and PTP grandmaster
- Ruggedized outdoor variant for wall, pole and cabinets
- Small footprint variant for indoor window or wall mounting
- Spoofing and jamming detection
- Optimized variant for power utilities



Key benefits

- Unique indoor dual GNSS antenna, no clear sky view
- Supporting PTP power and broadcast profile
- Simple installation and maintenance without RF cable feeds (powered over Ethernet)

Enabling precise synchronization everywhere

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SFP-BASED PTP WITH BUILT-IN GNSS RECEIVER

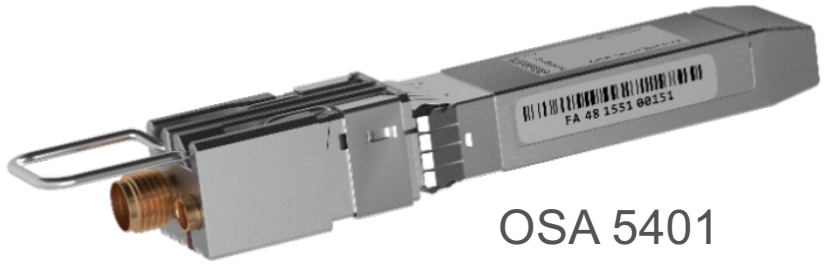
OSA 5401 – Product overview

Product description

- Small form-factor pluggable (SFP) with integrated PTP grandmaster and GNSS receiver
- PTP grandmaster, boundary & slave clock and APTS modes
- Multiple PTP profiles e.g. power utilities, professional broadcast, telecom

Key benefits

- Highly-accurate timing delivery and assurance with the smallest footprint on the market
- Multiple fallback options for extended holdover
- Syncjack™ technology for in-service sync monitoring



OSA 5401

Enabling PTP synchronization in the most space-restrictive environments

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Defense and PMR segments
Inertial Navigation

- Requires time be maintained during the duration of missions, typically months as GNSS is not available underwater.
  - Vessel gets the Direction from a Gyroscope
  - Vessel gets the acceleration from an Accelerometer
  - Vessel combines Acceleration with **time** to calculate speed

    *<**s**peed = Initial Speed + **a**cceleration * **t**ime interval>*
  - Actual position = f (Initial Position, Time, Speed)
- The more precise time, the more precise the position,
- Time reference by a TCXO for a few seconds (e.g. ballistic),
- Time reference by a Cesium clock for long time missions (submarines).

Clock Requirements:

- Long term accuracy and stability (Tau = months)
- Rugged, compact and Low power

→ OSA 3030B EUDICS

References:

✓French and UK navy (submarines and surface vessels)

OSA 3030B EUDICS

Ideal for Defence applications

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Meeting Defense and Military Needs

- Battlefield synchronization for secure communication
- Mobile command operations in GNSS-denied environments
- Military-grade secure time distribution for defense networks
- Timing/Sync support in harsh conditions

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OSA 5510 – Embedded resilience

- Ruggedized grandmaster with GNSS + Cesium + PTP
- Portable, SWaP-optimized, full aPNT+ stack
- Seamless integration with vehicle comms & sensors

Bring trusted time onboard

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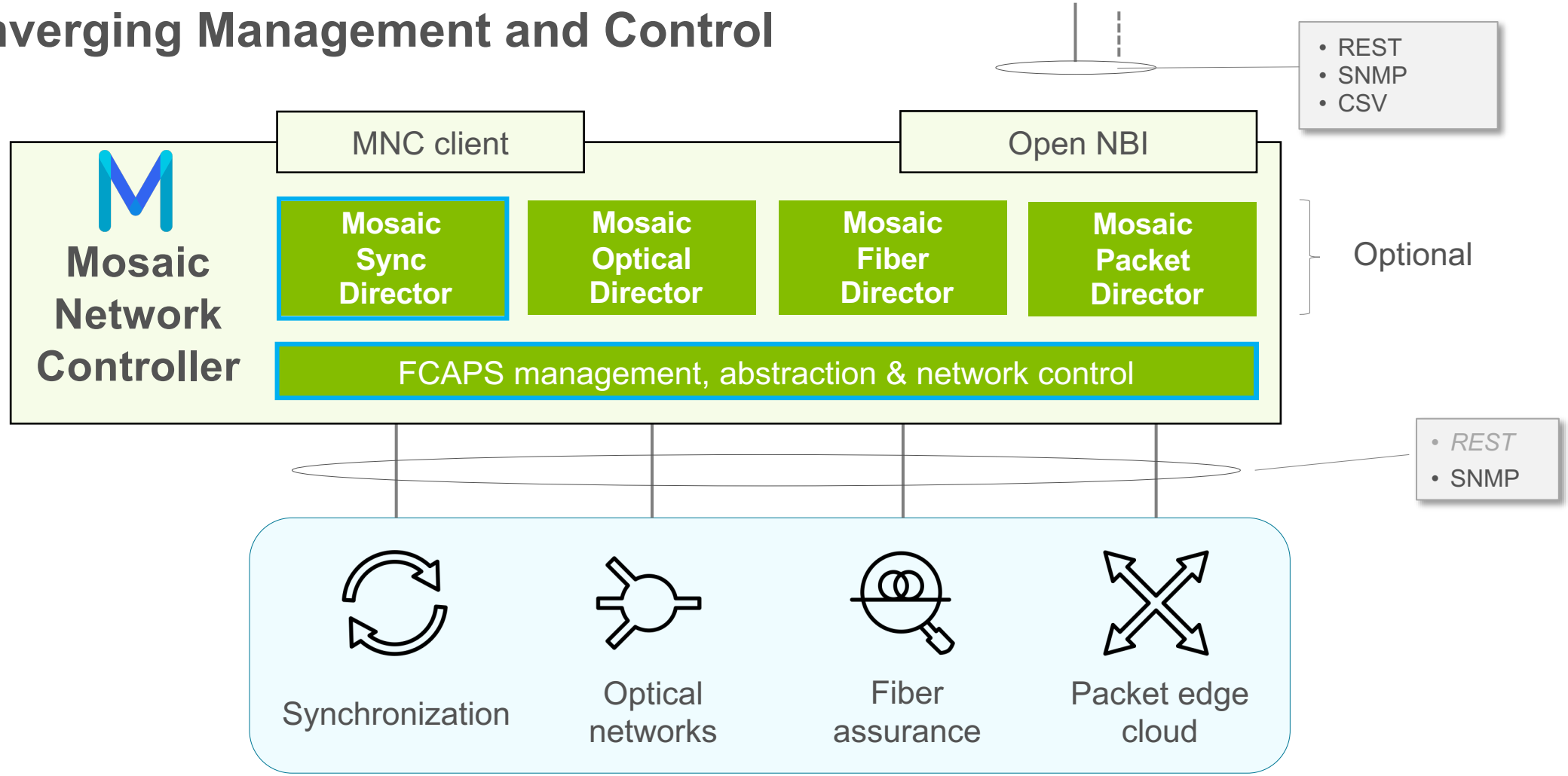
Oscilloquartz Mosaic Network Controler

Innovation with Operational Simplicity

MOSAIC NETWORK CONTROLLER

Converging Management and Control



AI Powered GNSS Assurance to detect GNSS Anomalies

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Online troubleshooting and long-term assurance and analytic tool

Advanced PTP Assurance

Key features

On-demand Advanced Analytics - to calculate sync metrics **MTIE/TDEV demand** based on user configuration (mask, period, etc.)

Allow user to create **custom Quality Masks on ENC** for MTIE and TDEV

Allow "**debug mode**" for Raw TE/TIE data collection with maximum resolution for high precision analysis (up to 10 SJ Probes in "debug mode")

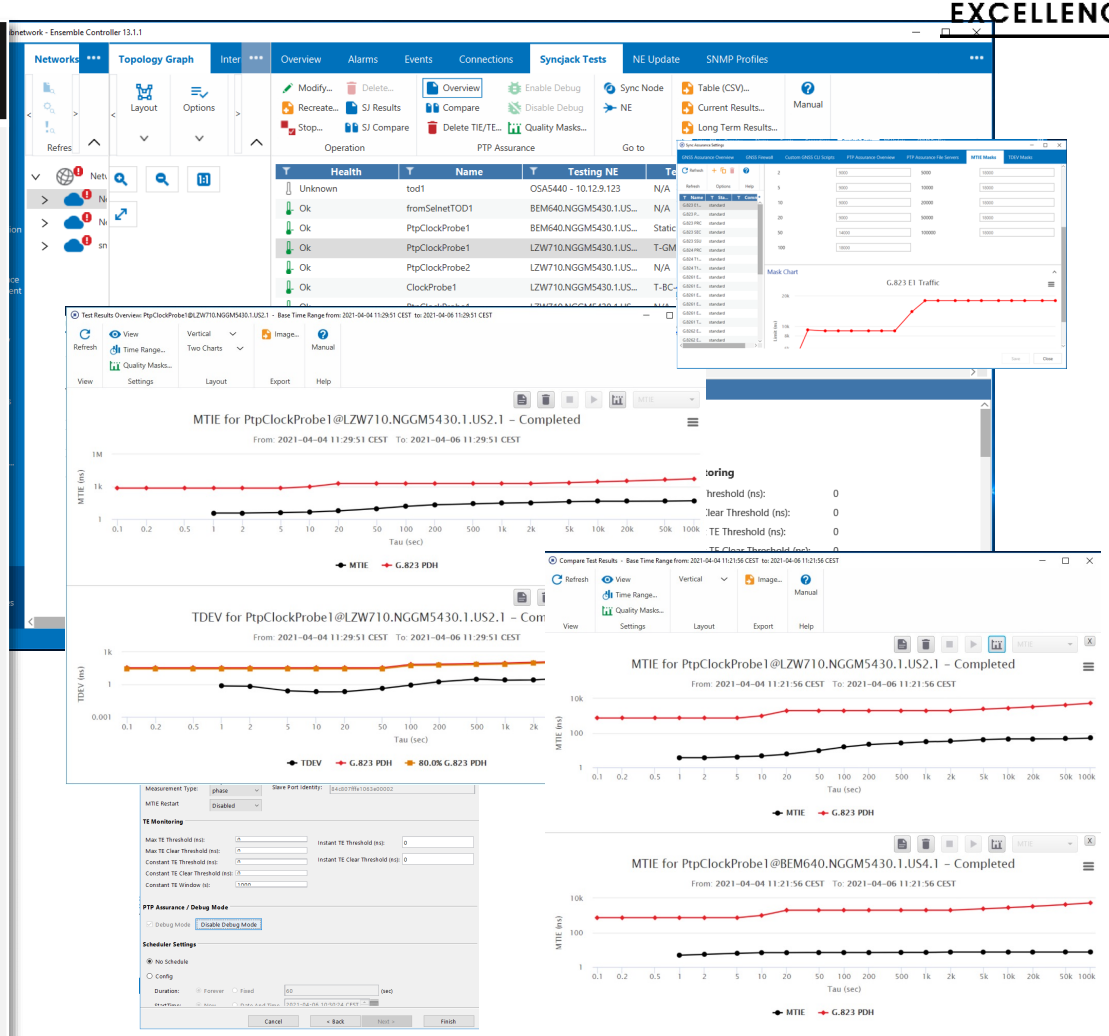
PTP Assurance default data retention (configurable):

90 days history for regular probes and 14 days history for probes in debug mode

Overview MTIE/TDEV results on graphs with option to export results to file

Allow user to **compare MTIE/TDEV results**

- for different probes / different time intervals
- allow user to compare results to any standard and/or ENC custom Quality Masks (for MTIE and TDEV) , also to user configurable Margin



In-service PTP clock distribution monitoring in timing network

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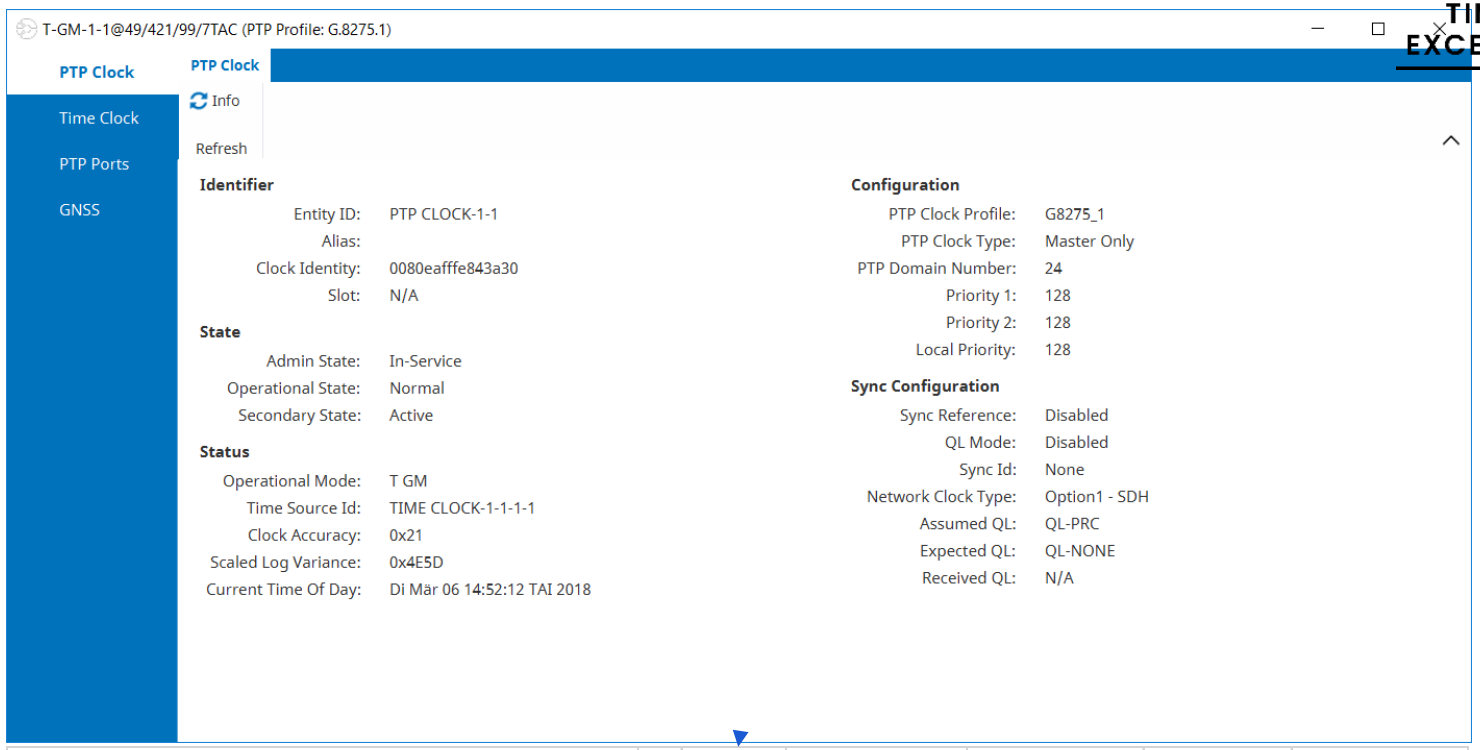
Mosaic Network Controller (MNC) – Sync Director Reports

Sync Director Reports

- Sync Topology Report
  PTP Clocks Hierarchy
- PTP Remote Slaves Report
  Reports Slaves on 3rd party devices
- Sync Performance Report
  Gathers current sync data (snapshot) per Sync Node on a regular basis (interval is user configurable)
  User control of device types to generate Sync Performance report
- Reports are available via CSV NBI



SyncPerformance20171030_1135.csv, created on 17-10-30 11:35:38

Connection	Granularity	Type	Unit	Aggregation	NE	Entity	Period	Value
	0	Node Selected Time Source		other	49/421/10/7TAC	TIME CLOCK-1-1-1-1	20171030113538	GPS-1-1-1-1
	0	Node UTC Offset Valid		other	49/421/10/7TAC	TIME CLOCK-1-1-1-1	20171030113538	TRUE
	0	Frequency Quality Level Advertised To Next Node		other	49/421/10/7TAC	SYNC-1-1-1-1	20171030113538	QL-PRC
	0	Node Effective Received Quality Level		other	49/421/10/7TAC	SYNC-1-1-1-1	20171030113538	QL-PRC
	0	Node Frequency Clock State		other	49/421/10/7TAC	SYNC-1-1-1-1	20171030113538	Locked
	0	Node Time Clock State		other	49/421/10/7TAC	TIME CLOCK-1-1-1-1	20171030113538	Locked
	0	GNSS Number Of Tracked Satellites		other	49/421/10/7TAC	GPS-1-1-1-1	20171030113538	8
	0	Node Selected Frequency Source		other	49/421/10/7TAC	SYNC-1-1-1-1	20171030113538	TIME CLOCK-1-1-1-1
	0	Node UTC Offset		other	49/421/10/7TAC	TIME CLOCK-1-1-1-1	20171030113538	37

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Nationwide GNSS Threat Detection and Heat Map

- **OSA 5405 units** deployed across critical sites **monitor GNSS health**
- **Real-time detection** of jamming, spoofing and meaconing, at national scale
- Spoofing detection capabilities **at a national level**
- **GNSS/PNT Heat Map** (Jam & Spoof) with granularity of tens of thousands of monitored sites
- Alarms aggregated at Mosaic Sync Director for situational awareness and response

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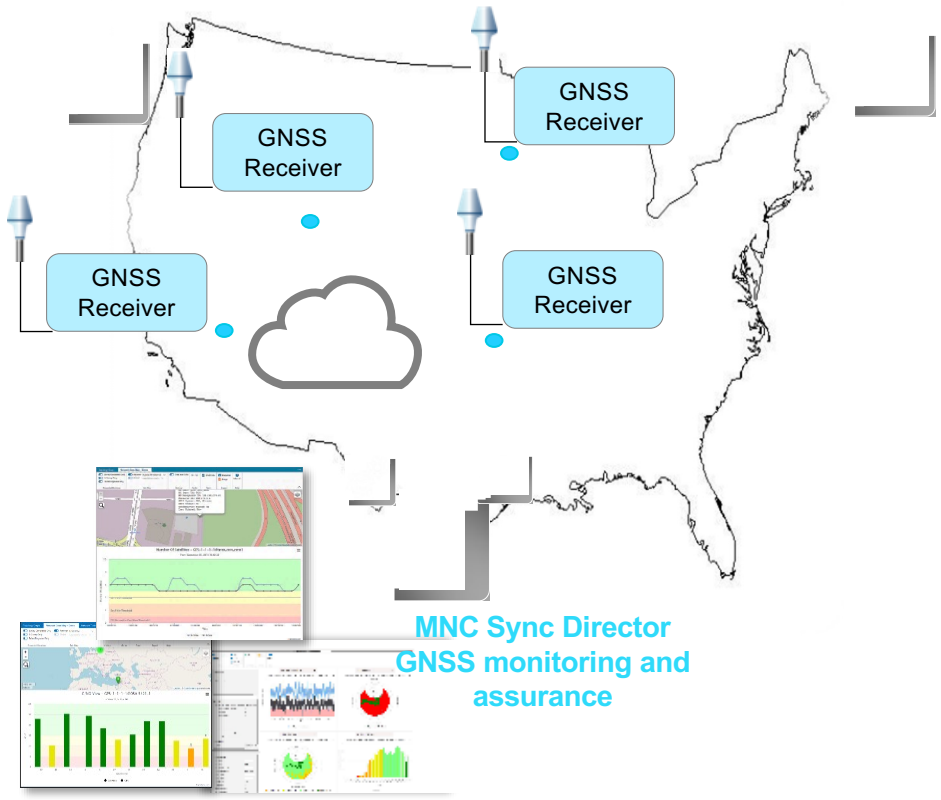
Centralized GNSS monitoring and assurance

Key features

- Geomap GNSS site's location and health visualization
- GNSS data collection from sync devices; various dashboard views, live and historical
- "Smart" graphs for GNSS stats presentation and comparison between sites and time intervals (per receiver/ per satellite/ per constellation/ per band)
- Built-in health test – GNSS installation acceptance
- AI/ML-based predictions of obstructions/jamming/spoofing
- Root Cause analysis for GNSS failures
- GNSS Assurance Firewall - SW based solution for OSA products

Benefits

- Short term: active monitoring, identification of GNSS installation/blocking issues
- Long term: optimized antenna positioning for perfect time synchronization across a transport network
- Advanced jamming/spoofing detection and mitigation



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Conclusion and Next Steps

This is about… Time…

TOP FIVE OSA PNT TRENDS IN 2026




- 📡GNSS authentication goes mainstream (OSNMA)
- ⚙️Terrestrial and LEO timing layers become standard
- ⏱️ Optical cesium holdover scales up
- 🔗White Rabbit sub ns precision gains traction (PTP HA next)
- 🌐Sovereign time systems gain momentum (Hyperscalers too !)

Desynchronization is the new cyber weapon.

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Why France Needs a Time Backup as a TaaS

- GNSS disruptions already observed in Europe.
- Critical infrastructures share the same clock source.
- A national timing backbone ensures:
  - Sovereign traceability
  - Secure continuity
  - GNSS interference awareness

Backup timing = backbone of sovereignty.

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European Projects Momentum

UK: National Timing Centre (NPL).
Germany, Italy: ePRTC clusters.
Finland, Spain: fiber-based UTC networks.

France has what others need: a nationwide optical backbone ready for sovereign time.

Europe moves - France must lead.

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The Vision

- Build a Sovereign TaaS DWDM Network to protect Timing Infrastructures
- Provide trusted timestamps for all sectors.
- Contribute to the future European Time Cloud.

“Make time French again… Actually, it already is with BIPM”

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