



# Redefine Time Sync

The heartbeat for network resilience and monetization

# Net Insight come with 20+ years experience in network sync from the media industry



DVBT

Live in **20 national mission-critical** TV networks



5G

Optimized for **5G TDD networks**

EBU



ROGERS



Türk Telekom

TELUS

CBS



BBC



Telstra

Net Insight is trusted by **500+ Customers** in **75+ countries**

# GNSS outages rose massively between 2017 and 2018 by well over 2,000% and remain high<sup>3</sup>



**European Commission** has issued a call for tenders for **GNSS independent timing**<sup>4</sup>

**Swedish regulator PTS mandates GNSS independence** for operating the 5G network<sup>5</sup>



**GPS outage** could cause a loss in US economy of more than **1 Billion USD** per day. Up to half of that in the telecom sector<sup>1</sup>

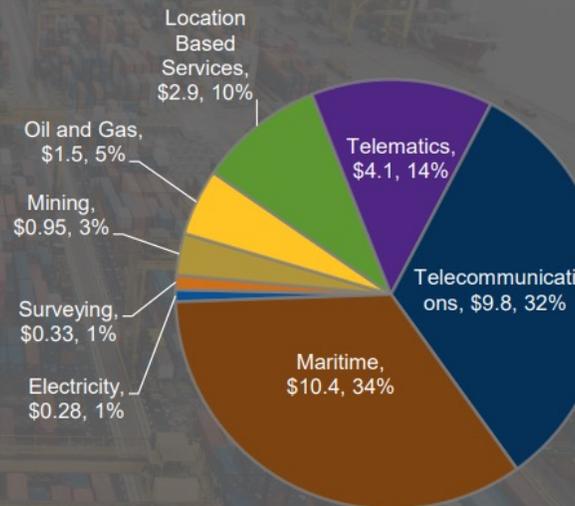
**US Executive Order** on Strengthening National Resilience with guidance for **GNSS independent timing**.<sup>2</sup>

1. 2019 Report sponsored by National Institute of Standards and Technology (NIST)
2. US Executive Order 13905 of February 12, 2020
3. Eurocontrol Think Paper, 2021
4. European Commission, Alternative Position, Navigation and Timing (PNT) Services
5. The Swedish Post and Telecom Authority Dnr: 18-8496 "Additional terms in the auction of frequency bands 3.5 GHz and 2.3 GHz": 2020-10-20

# Prediction of US Economic Erosion

- A widespread outage of GPS would result in \$30.3 billion in economic damages over 30 days.
- During planting season, economic damages in the **agriculture** sector could increase 30-day losses to \$15 billion due to lower yields.
- An outage in the **maritime** sector could initially bring some ports to a standstill.
- Wireline **telecommunications** services would be largely unaffected, but wireless networks would slowly degrade in performance over the course of the outage.
- Loss of GPS-based navigation and **telematics** would result in lost efficiencies and increased fuel consumption in commercial fleets.

Damages by Sector (\$billions)



**A 30-day widespread outage could erode >1 BUSD in economic value per day**

- Many markets are heavily dependent on GPS/GNSS for Time Synchronization
- Time and frequency distributed by GPS/GNSS can easily be spoofed or interrupted
- The impact of a widespread outage of GPS/GNSS in the US has been calculated to erode \$1 Billion of economic value per day
- The current Geopolitical situation means that dependency on GPS/GNSS for Time Synchronization is highly volatile

# Overcoming challenges with traditional time synchronization



**Sensitive to weather**



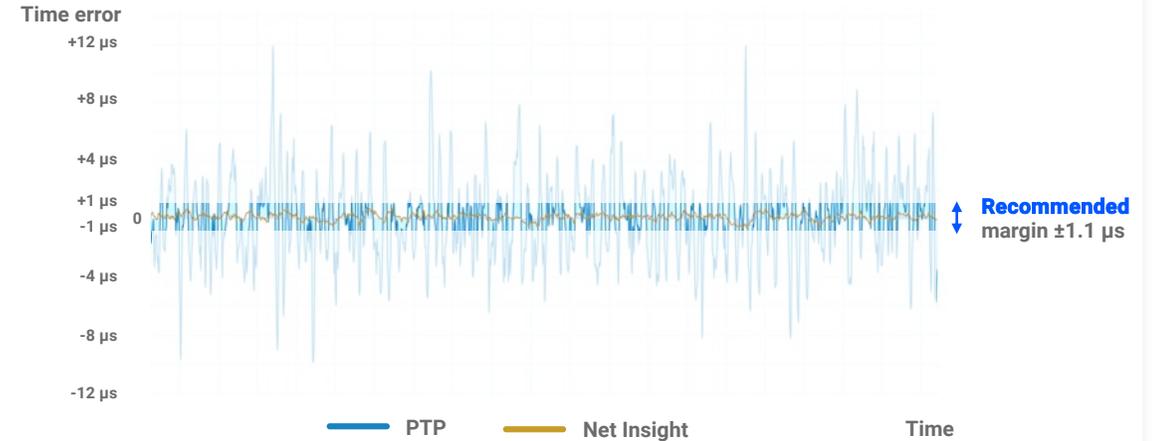
**Vulnerable to jamming & spoofing**



**Limited to deploy at certain sites**

**GNSS/GPS**

Field test in live network over congested line



**Hardware support required in every node**



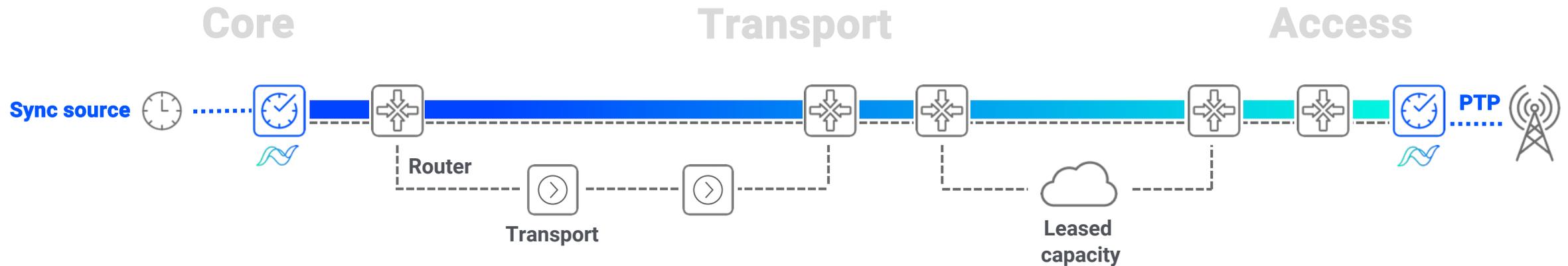
**No support over leased capacity**



**Performance issues after multiple hops**

**PTP**

# Our disaggregated hardware-independent solution distributes time synchronization over any IP network



## In-network sync

Overlay distribution on top of any IP network

## Advanced real-time control nodes

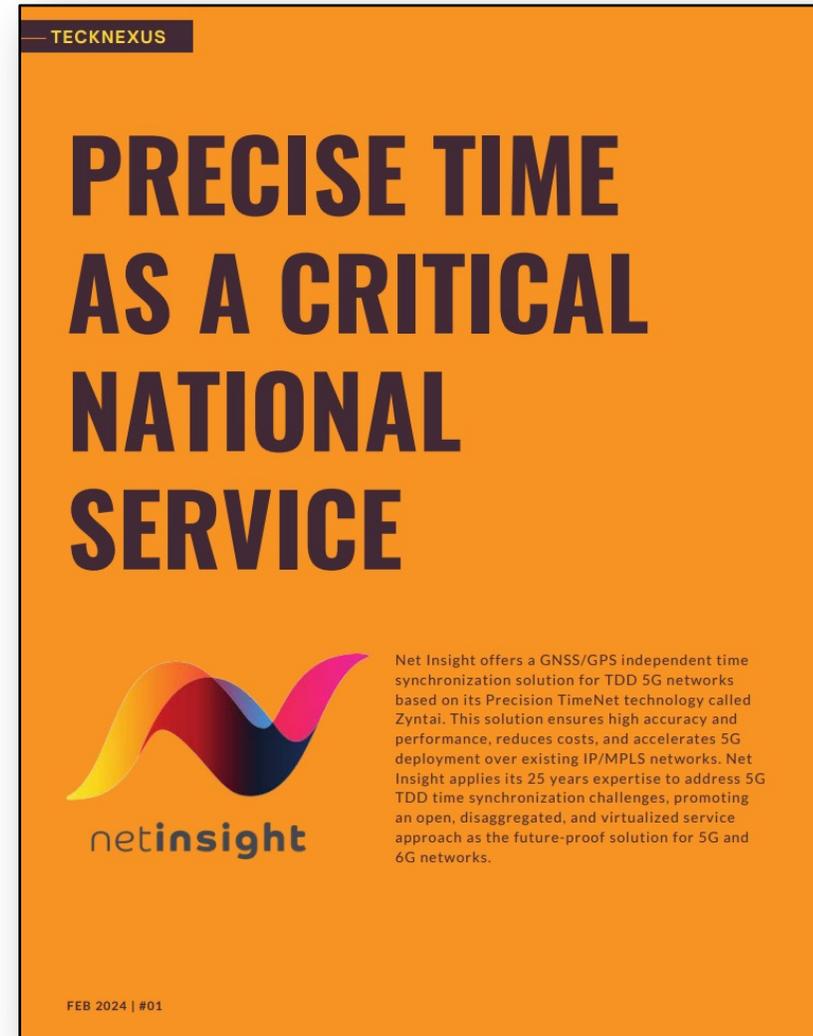
Edge compute to optimize sync performance

## Centralized intelligence

End-to-end observability and orchestration

# The Swedish model, presented in 5G magazine

- Sweden has developed one of the world's leading national time infrastructures
- Secures critical national services from an over-dependence on GNSS
- Article features:
  - Netnod (the neutral organization working to develop core technical infrastructure in Sweden)
  - Net Insight



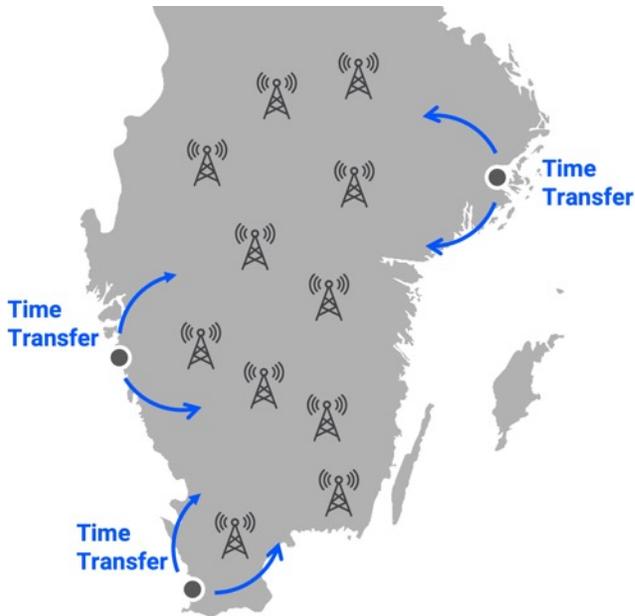
# National distribution of time

Netnod provides time traceable to Swedish national time and offers free and commercial services with different SLAs and accuracy on 6 locations.

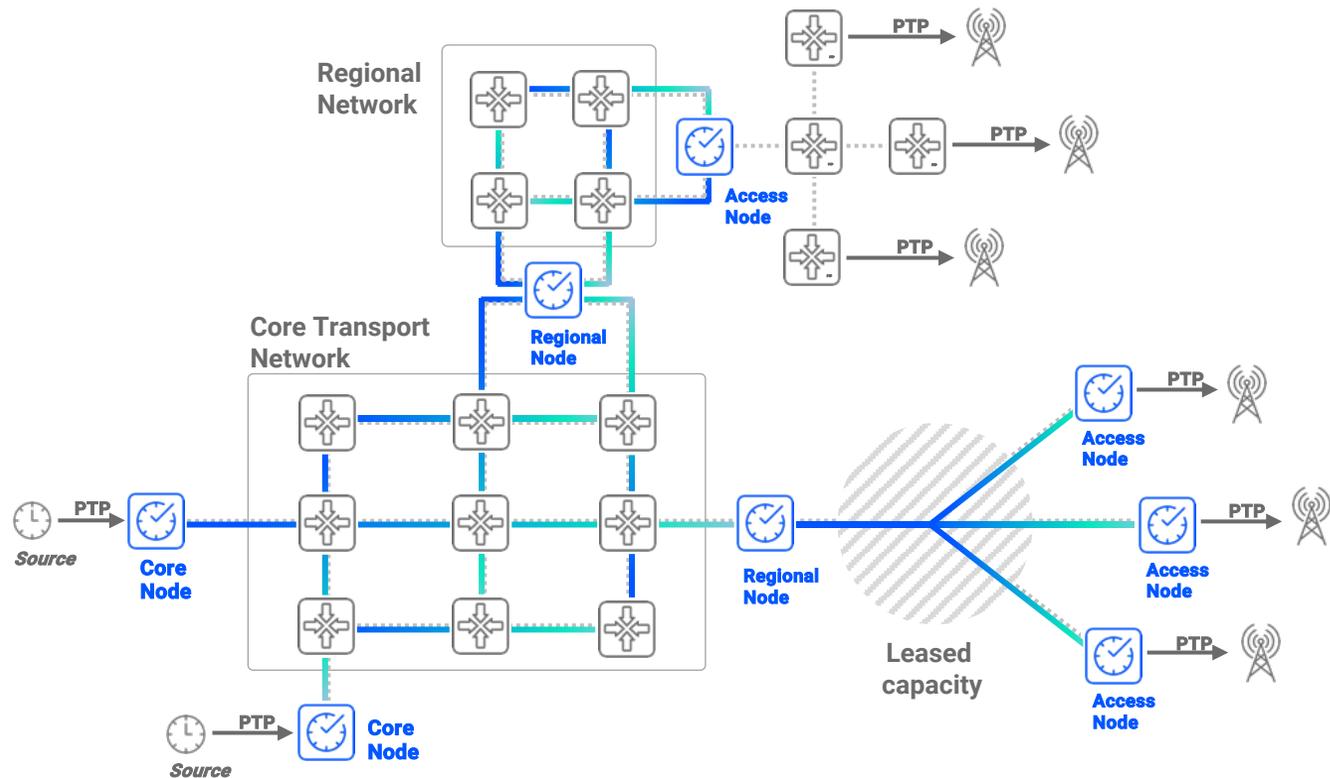
Each of these nodes is redundant from the others and has all critical equipment doubled in a dual node setup to ensure local redundancy. The time nodes are housed in secure bunkers in 6 locations throughout Sweden.

The task of the operators is then to distribute time (Time Transfer) from the national clock sources provided by Netnod to their 5G radio access networks efficiently, without GNSS or other satellite synchronization methods.

Net Insight's Precision TimeNet solution facilitates GNSS independent time distribution using existing infrastructure, including over leased lines. The result is a significant reduction in costs and an acceleration of 5G deployment across both urban and rural areas.



# Precision TimeNet used to distribute PTP on any IP/MPLS



Zyntai  
Director

## Advanced time algorithms

Sends high quantities of time stamp packages and filters out relevant packages for minimum confidence interval

## Real-time Assymetry Correction

Dynamically detects and eliminates synchronization assymetries

## Synchronization Mesh overlay

Uses collaborative clocks and multi-link routing for redundancy

## Observability in real-time

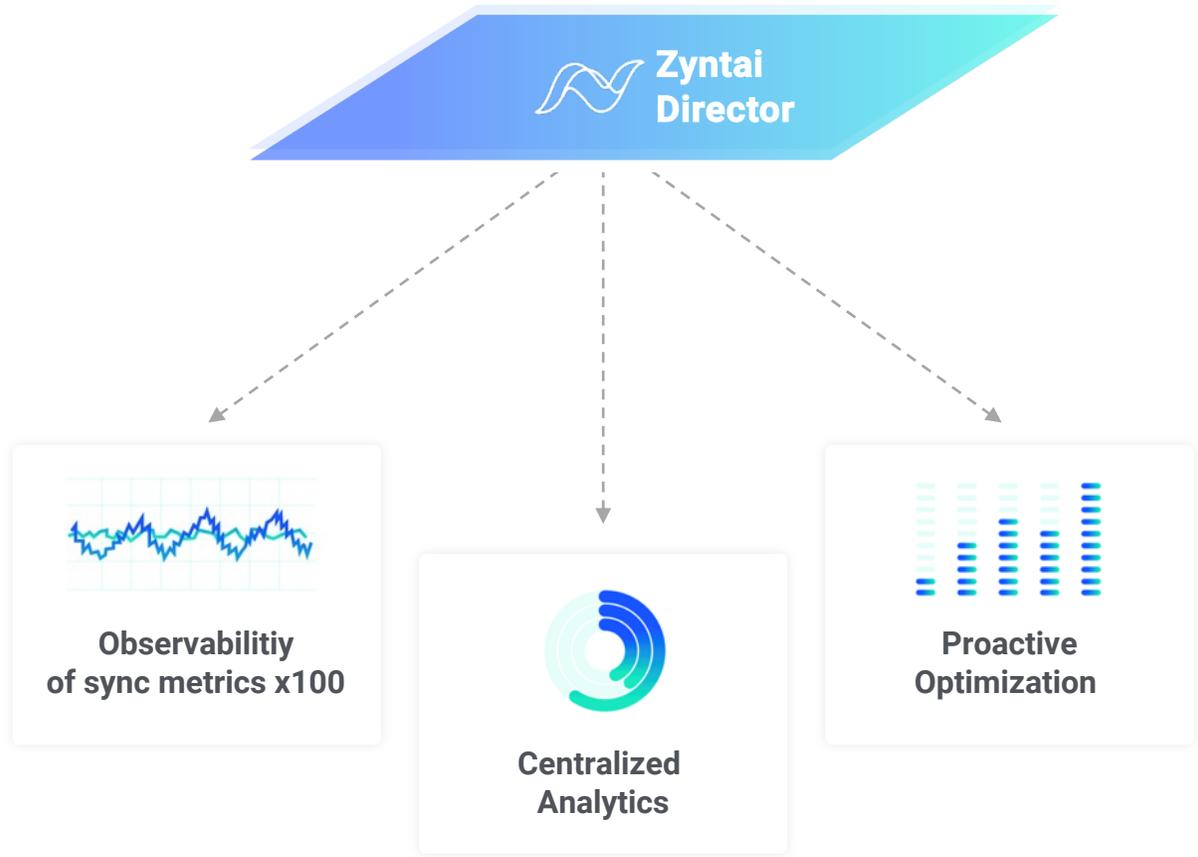
Real-time insights into sync and transport network KPI:s



” *Net Insight light up the network from a synchronization perspective* ”

Håkan Andersson,  
Mobile Transport System Specialist at Three Sweden

# Centralized intelligence improves sync performance



# 5G monetization examples for CSP:s when delivering time sync directly to enterprises



Time stamps for video/audio when transmitted over leased capacity

**Live media production**



Precise time and positioning for private networks (e.g. manufacturing or mining)

**Industry 4.0**



Time stamps for stock exchange transactions

**Finance**

*Time sync delivered on Network slice over NR air interface*

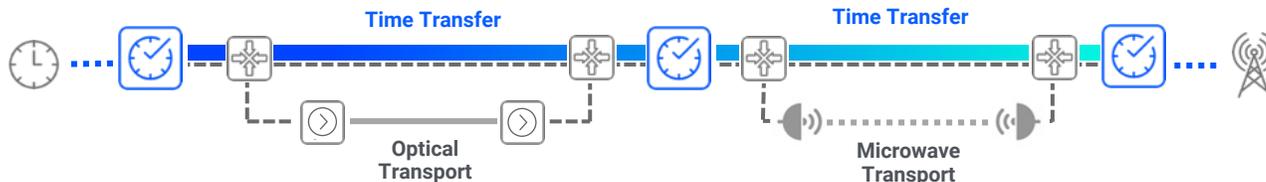


# Customer Cases

# Frame agreement with Teracom for time synchronization of critical mobile network

Teracom's mobile network, focusing on critical services, requires a **robust and secure time synchronization solution** that is independent of GPS/GNSS. After a thorough evaluation process, Teracom has chosen Net Insight as its supplier.

“We need a GPS/GNSS-independent solution that is robust and **easy to implement over our existing infrastructure**, which Zyntai can provide,” says Gunnar Bergman, head of networks at Teracom.



# 3 Sweden select overlay sync as nationwide GPS backup



- Swedish regulator Post and Telecom Authority (PTS) requires non GPS/GNSS sync backup
- Deadline: January 2025



- Three Sweden has 70% leased capacity
- Incompatible with PTP Full Timing Support (G.8275.1)

Three Sweden evaluated:

PTP with dark fibre and new routers/switches

Net Insight overlay sync

Cesium clocks

*Main motivations for selecting Net Insight*

Fulfils requirements for 5G TDD

Open and vendor-agnostic

Provides increased visibility

Most cost-efficient alternative

Read full case [here](#)



# GNSS independent 5G sync achieved with Türk Telekom



GNSS disturbances in Turkey disqualified GNSS as 5G sync solution



PTP Full Timing Support required costly HW and SW upgrades and inter-operability challenges



**Net Insight time sync used over existing IP/MPLS and DWDM networks**

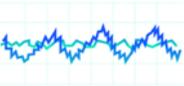


**5G**

Faster 5G rollout

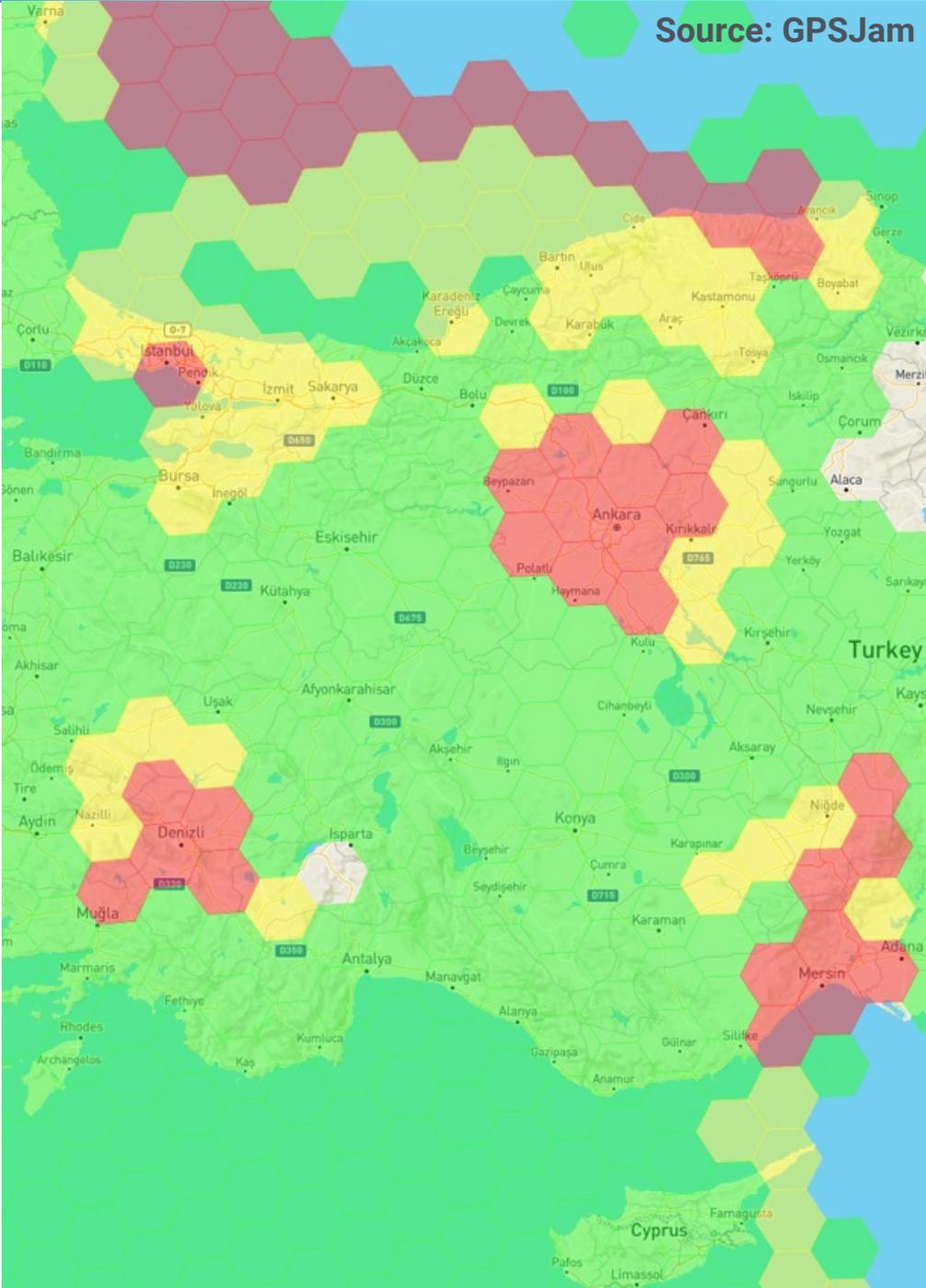


Cost efficiency



Sync observability

Read full case [here](#)



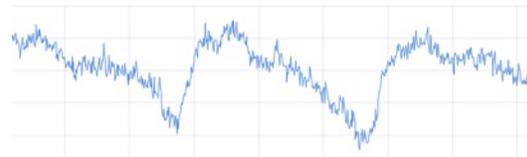
# Technical Description

# Central and node level control for complete observability

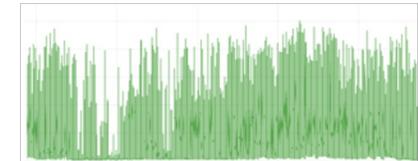
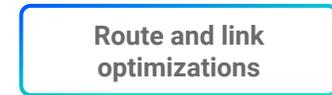
## Central level



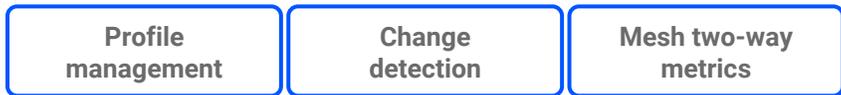
Asymmetries



Diurnal variation



Packet delay variation

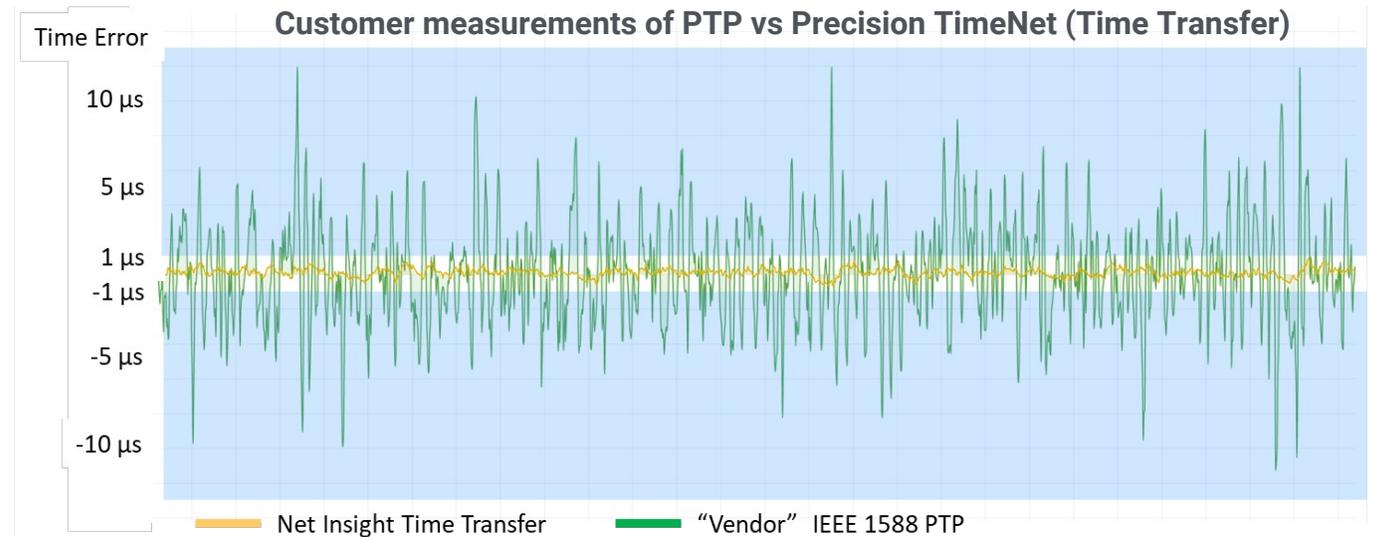


## Node level



# Improving Time Accuracy over Congested Networks

- Adjustable sync packet rate to handle network jitter (suppress noise)
  - **500-40,000+** (vs 16-128 in PTP)
- Adjustable sync packet sizes (MTU)
- Intelligent **lucky packet** filtering algorithms with adjustable filter bands
- Multi-link routing – combine multiple paths into a TimeNode to further improve accuracy



▪ **PTN Time Transfer:**  
within  $\pm 500\text{ns}$

▪ **PTP (G.8275.2, PTS):**  
 $\sim 10\text{-}100 \mu\text{s}$

# Asymmetry detection and calibration

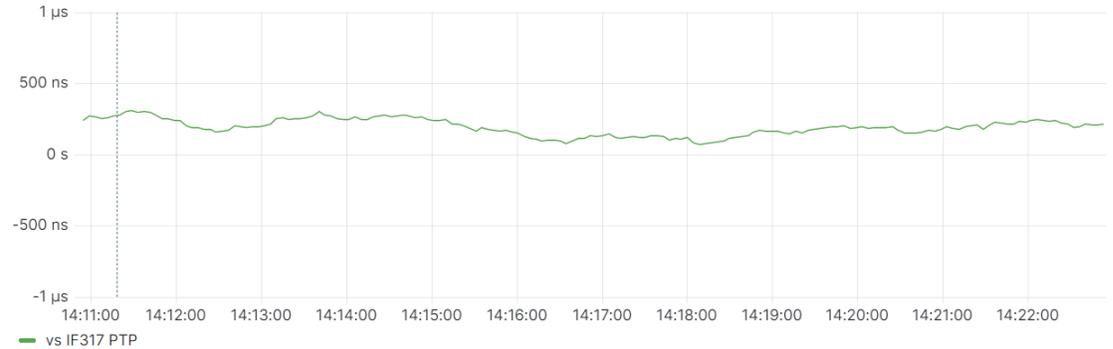
## DETECT

1. Detect sudden change in Round-Trip Times (RTT) and/or unidirectional latency i.e. change between local clock (slow) and link clock (fast)
2. Detect interruption of packets
3. Detect sudden change in link characteristics – Jitter, packet loss
4. Detect difference in Spread (Calculations from different incoming sync links)
5. Detect change in TE (if GNSS input)

## MANAGE

1. In case of 2 or more valid incoming sync links, disable changed sync link. Otherwise enter short Holdover
2. Recalculate new TE offset for affected Link and store new Link Profile
3. Activate sync link and continue two-way time transfer calculations with new sync link parameters

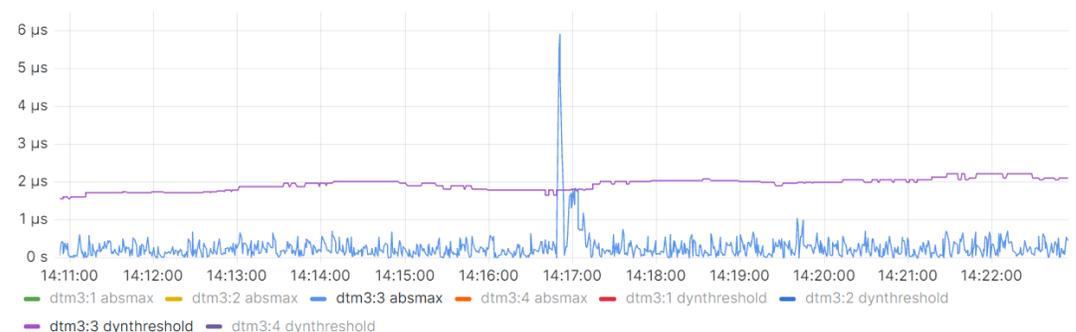
Time error according to IF317 (GNSS or PTP)



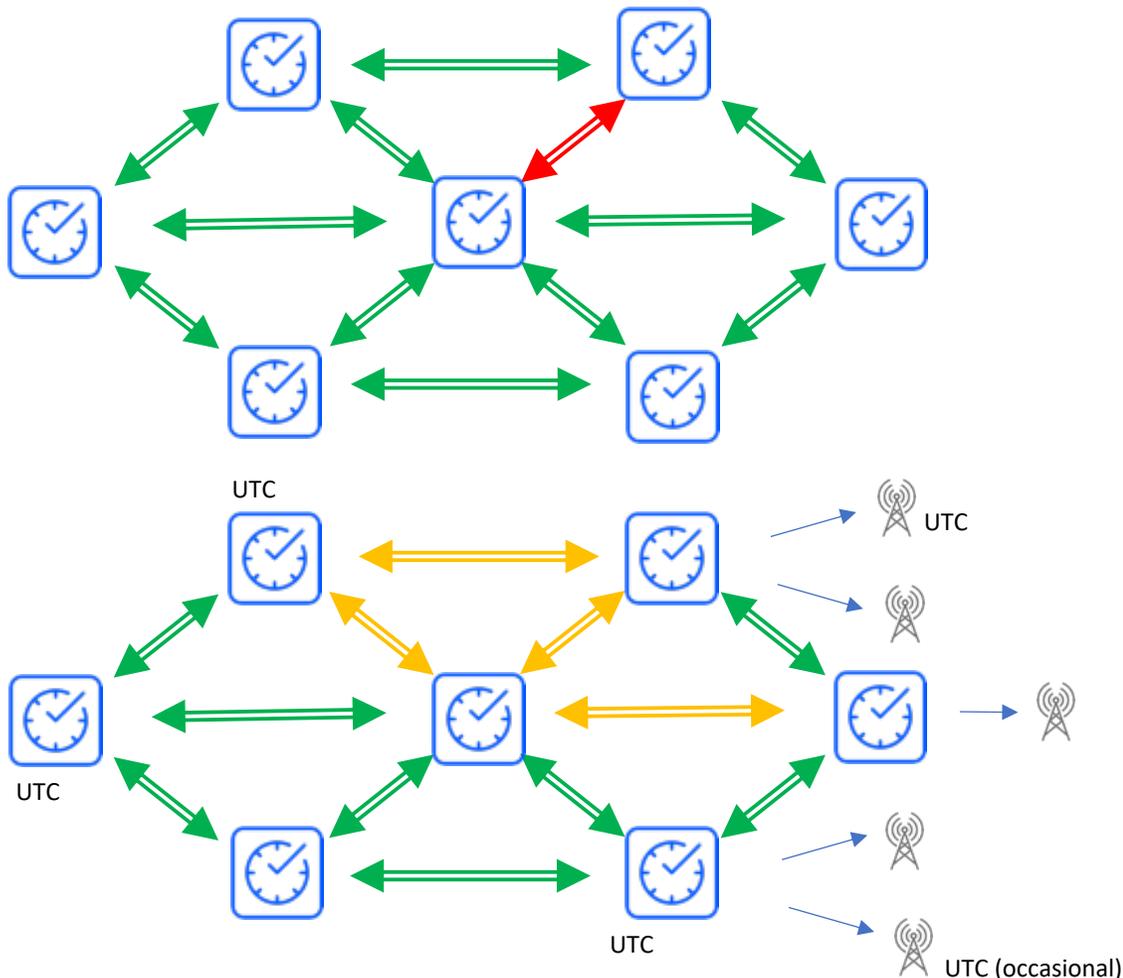
Round-trip time (filtered)



link change detection (recv)



# Mesh optimizations



- An orchestrated network optimization
- Explicit situation, such as spread could be analyzed and explicitly handled.
- More elaborate calibrations uses strategies to optimize and estimate asymmetries
- This is for example run in Turkey since June with very good results with about 20% of the sites have UTC reference in best cases.

# Product Description

# Zyntai TimeNode



**Core node**  
(TimeNode 3100)

**Access node**  
(TimeNode 3040)

## Time Transfer

**Core node:**  
32 simultaneous Time Transfer sessions

**Access Node:**  
4 simultaneous Time Transfer sessions

## PTP

- ITU-T G.8275.1 Telecom Profile (full timing support)
- ITU-T G.8275.2 Telecom Profile (partial timing support)
- ITU-T G.8265.1 Telecom Frequency Profile
- IEC 61850-9-3 Power Utility Profile
- IEEE C.37.238 Power Profiles
- SMPTE ST 2059-2
- AES67 Broadcast and Media Profiles

## Interfaces

**Core node:**  
N3100: 10x 10G/GbE SFP/SFP+  
2x RJ-45

**Access node:**  
N3040: 4x 10G/GbE SFP/SFP+  
2x RJ-45

## Synchronization interface

PPS in/out, 2x HDBNC, 10MHz in/out, 2x HDBNC  
2.048 MHz and 1.544 MHz in/out ITU-T G.703

## Synchronous Ethernet

ITU-T G.8261, G.8262 (EEC) and G.8264 Ethernet Synchronization Messaging Channel (ESMC)

## GNSS receiver

Multiband GNSS receiver for GPS, Galileo, GLONASS and BeiDou

## Syslog

Local and remote syslog (RFC 5424)

## Power

2 x -48 VDC (-60 to -40 VDC) or 2 x 100-240 VAC.

## Operating temperature

**Core node:**  
5 to 40 oC (41 to 104 oF)  
EN 300 019-1-3 Class 3.1  
Temperature controlled locations

**Access node:**  
-40 to 65 oC (-40 to 149 oF)  
EN 300 019-1-3 Class 3.3 Not  
temperature-controlled locations

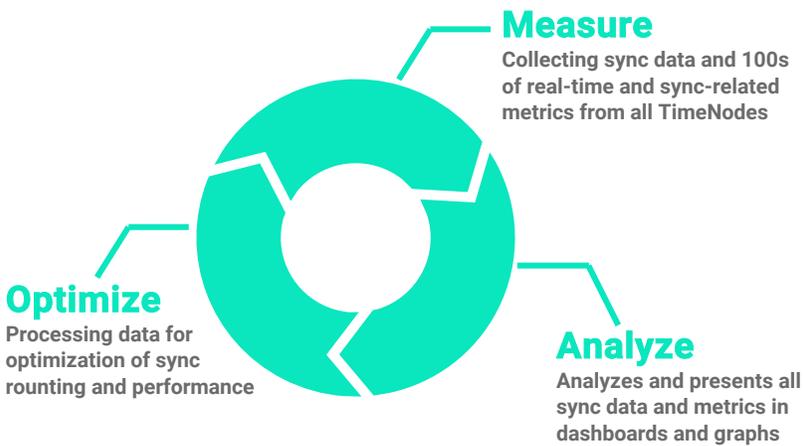
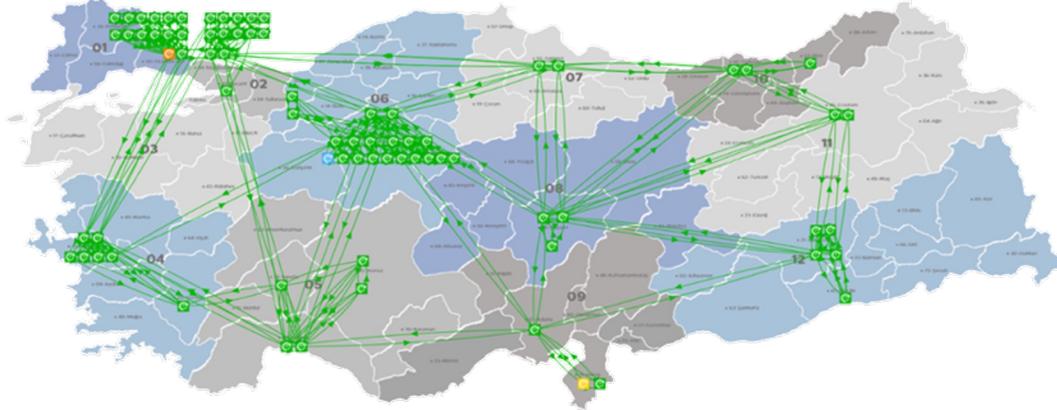
## Safety compliance

IEC 62368-1

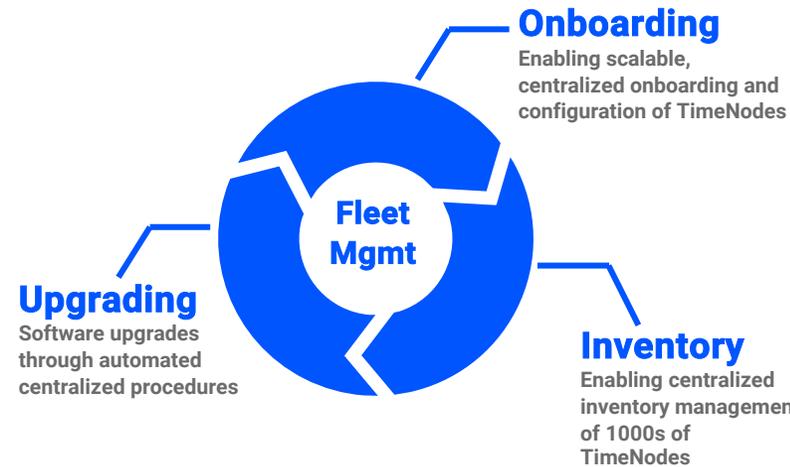
## ERM/EMC compliance

FCC 15 Class A, EN 300 386

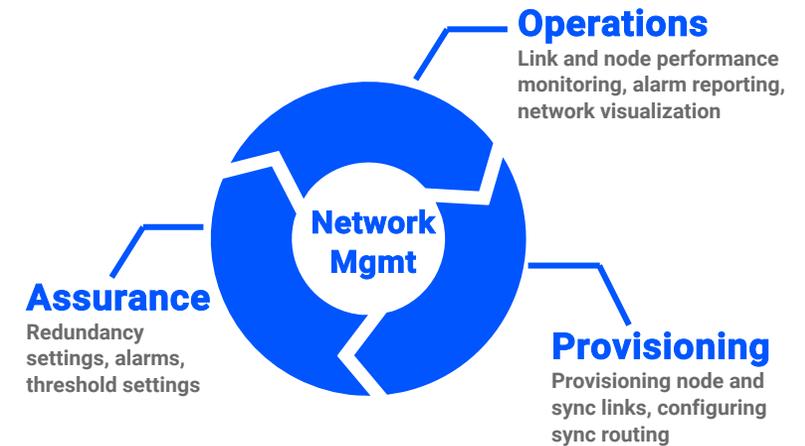
# Zyntai Director



## Telemetry Analytics



## Sync Orchestration





Thank you