

# Zyntai

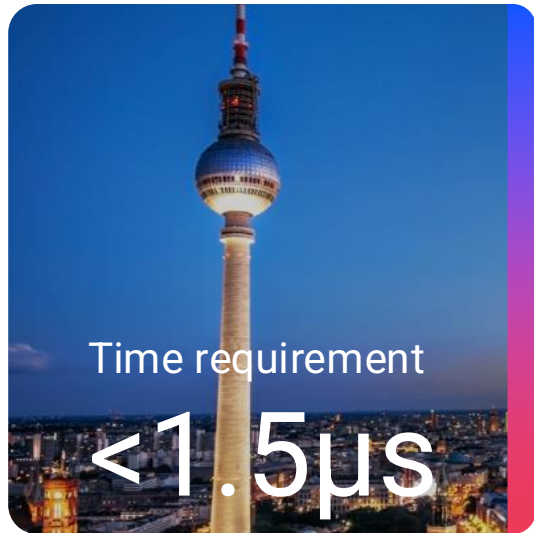
cost-effective time transfer at scale

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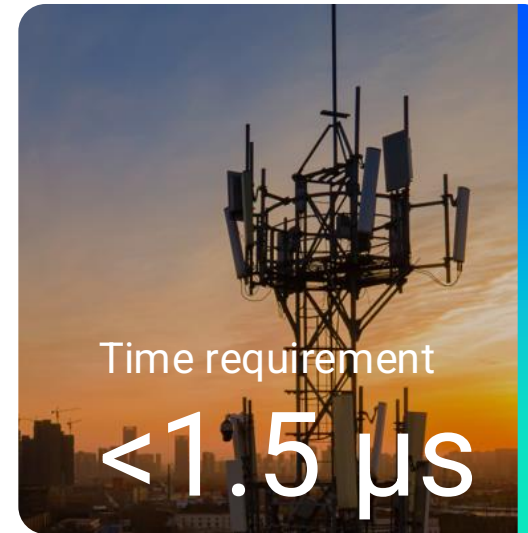
Fredrik Sundling  
10 March 2026



# Net Insight comes with 20+ years experience in network time synchronization



We are live in **20 national mission-critical** TV networks



Our solution is now optimized for **5G TDD networks**

EBU



ROGERS



Türk Telekom

TELUS

CBS



BBC



Telstra

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



# GNSS as single-point-of-failure in networks is problematic



GNSS is sensitive to jamming and spoofing (large-scale from eg foreign power, or small-scale at certain sites)



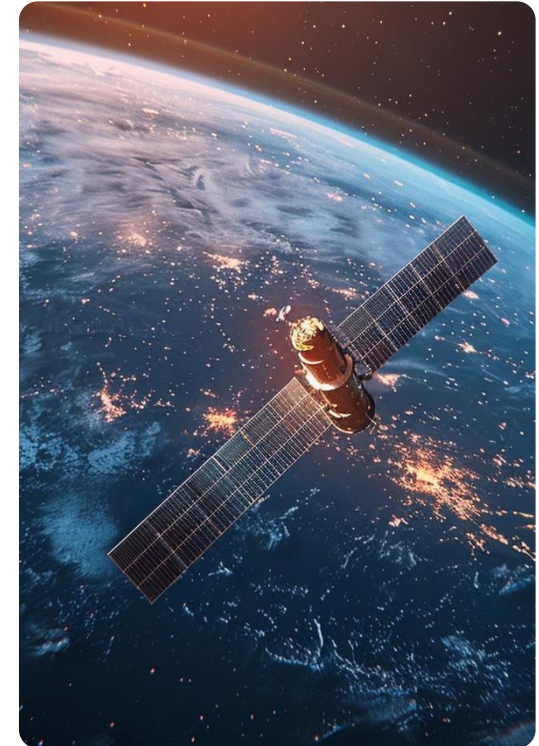
Attacks have become more common in recent time due to geopolitical situation



Regulatory initiatives globally are looking to strengthen synchronization resilience



On certain sites it can be costly and complex to install GNSS

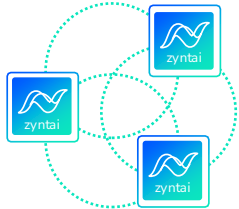


# Resilient time distribution to enhance PTP for WAN



## PTP Distributed Grandmaster

- High capacity and telecom grade
- Cost-efficient since no need for rubidium
- Advanced Algorithms to handle network impairments



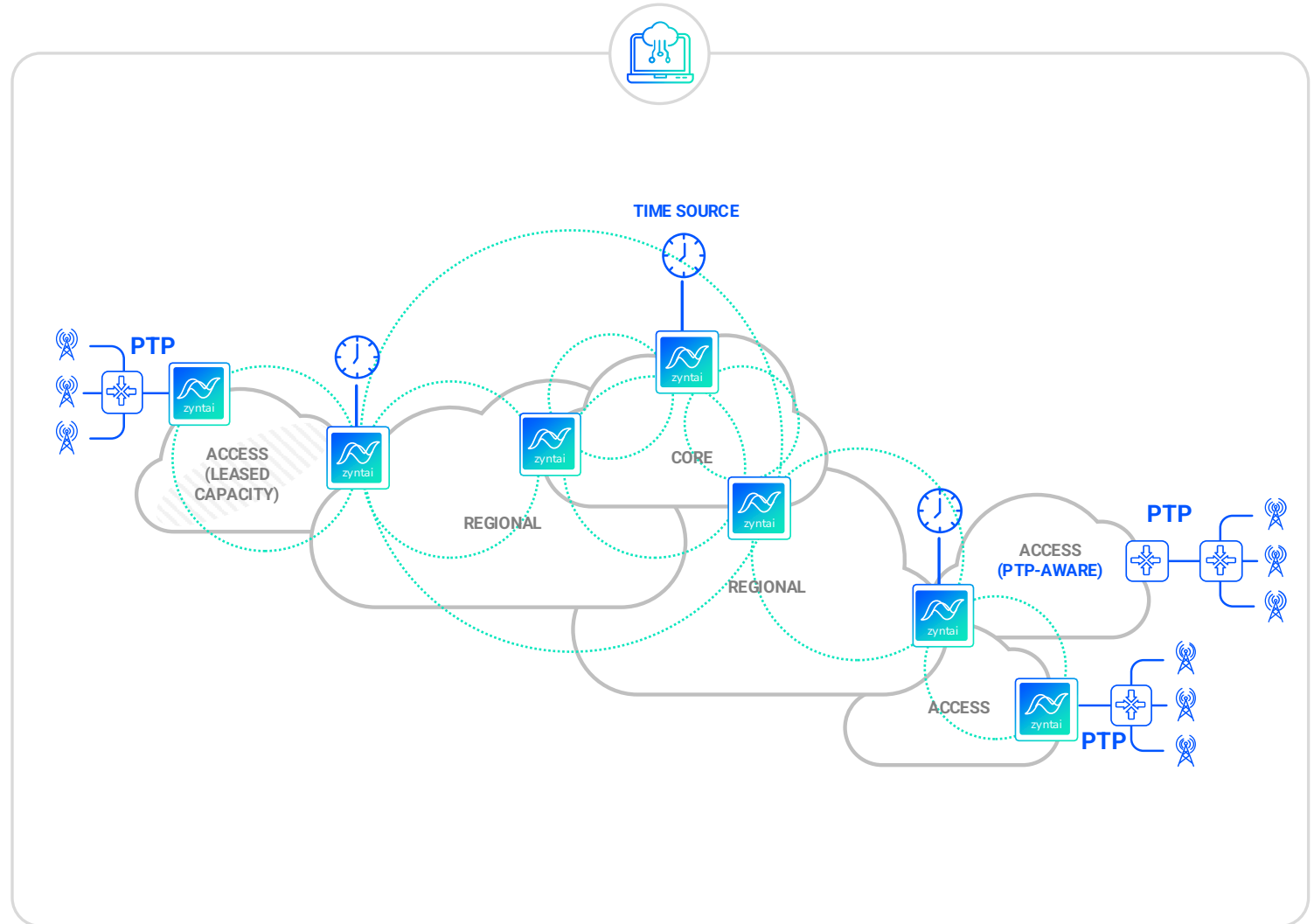
## Mesh technology

- Nodes talk to each other to ensure resilient sync
- Provides service over long distances and over leased capacity
- Since built as a service through the network, it works regardless of underlying hardware

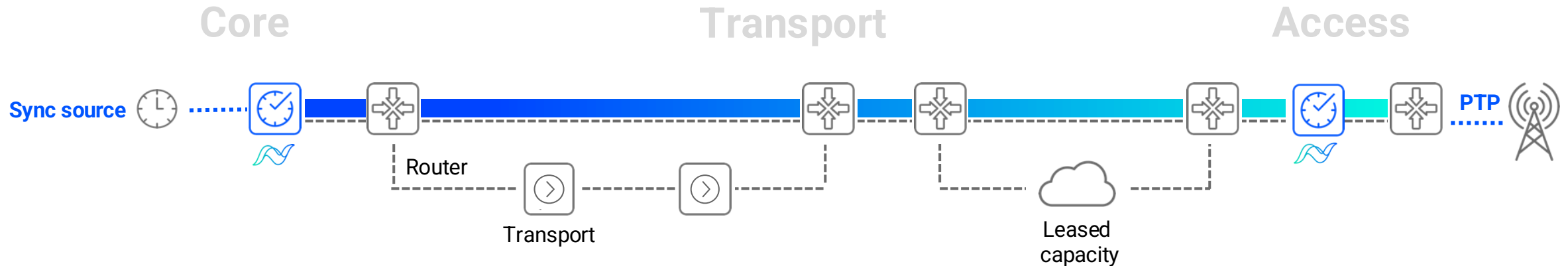


## Cloud-native orchestration

- Orchestration of e2e synchronization network with self-healing capabilities
- Enhanced life-cycle management and zero touch provisioning for improved operations
- Open API:s to integrate synchronization seamlessly into existing ecosystem



# Our disaggregated overlay sync distributes time synchronization over any managed IP network



## In-network sync

Overlay distribution on top of any managed IP network

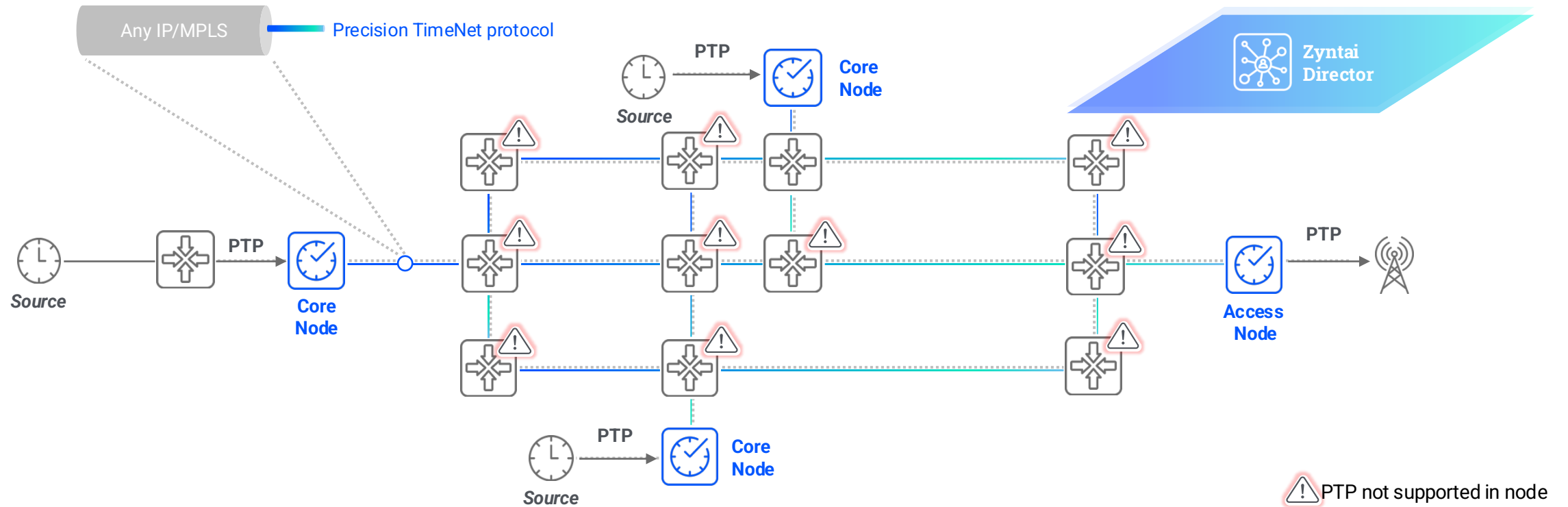
## Advanced real-time control nodes

Edge compute to optimize sync performance

## Centralized intelligence

End-to-end observability and orchestration

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



## 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

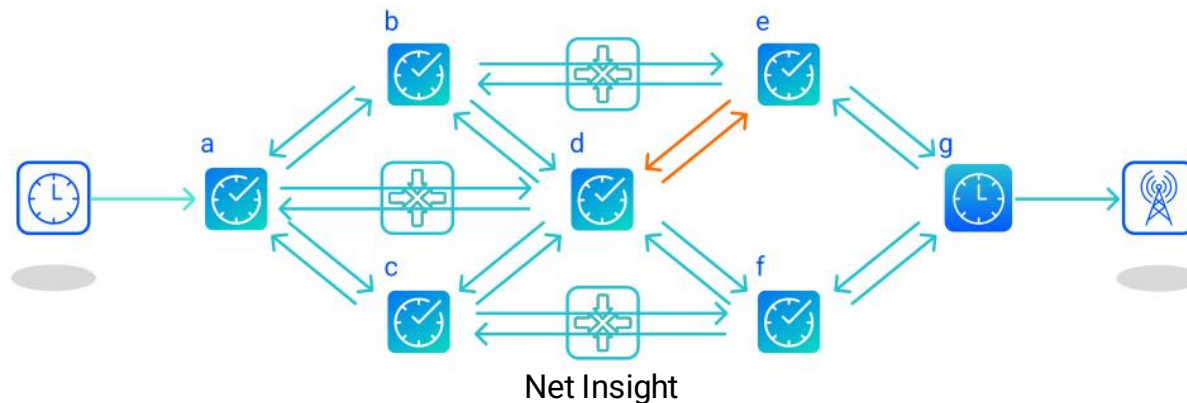
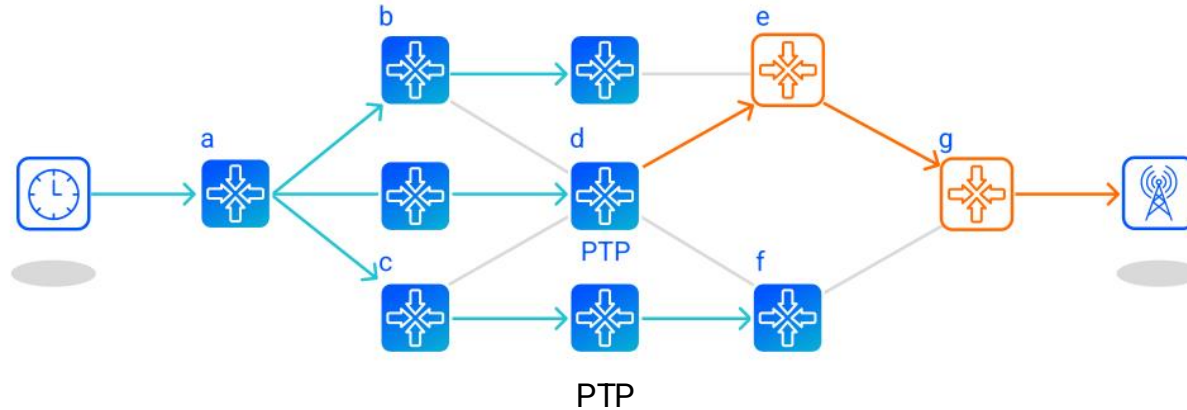
## Synchronization Mesh overlay

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 uses bi-directional mesh functionality to handle asymmetries

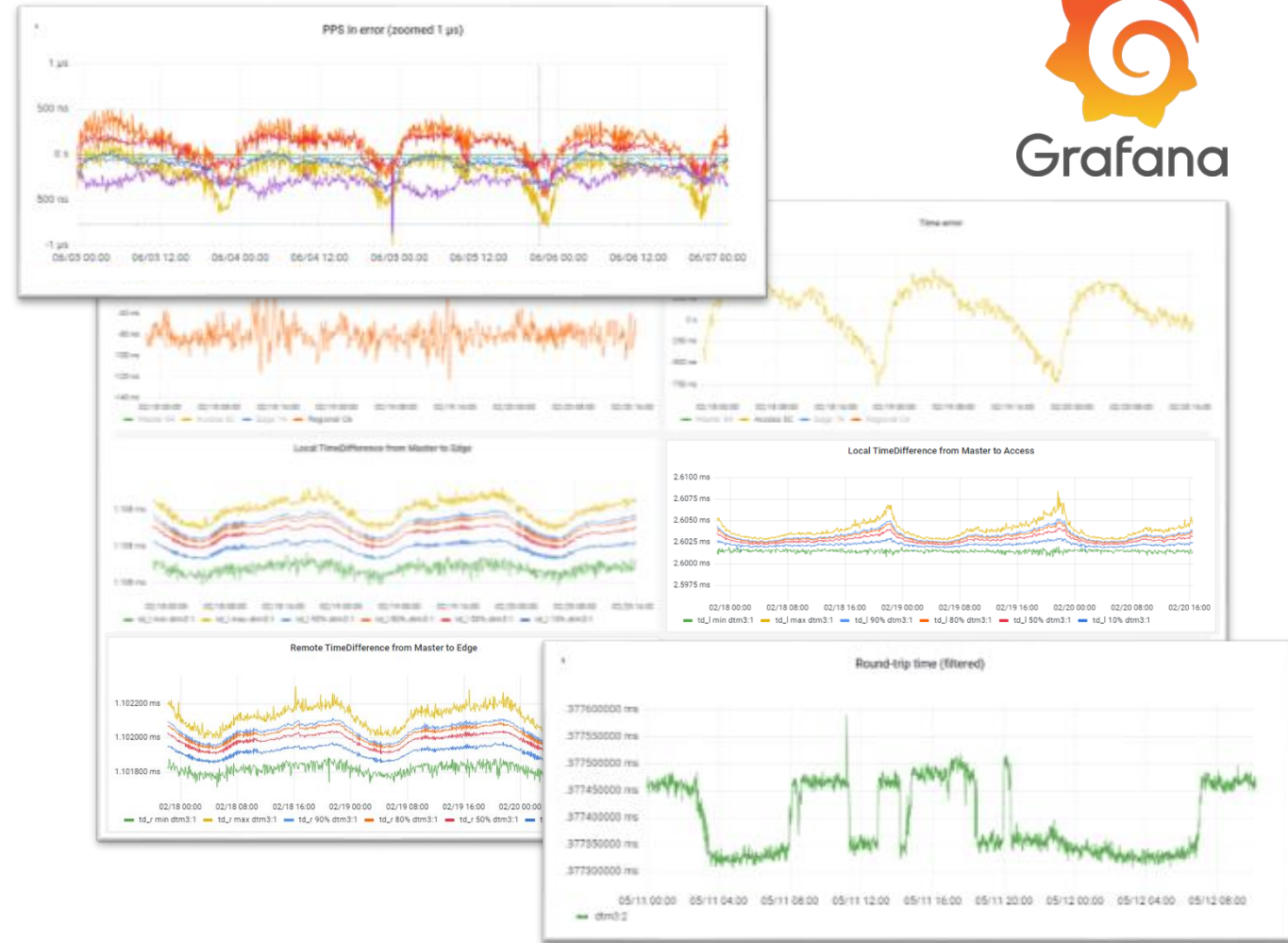


- There is a change of delay profile, a new asymmetry, in the link between Nodes d) and e)
- PTP will follow the delay change over the troublesome link and time at end-point g) will be wrong
- Net Insight has active time transfers from several nodes and will determine that the time over the troublesome link is wrong and therefore handle new asymmetries

# Telemetry Analytics for Optimized Performance

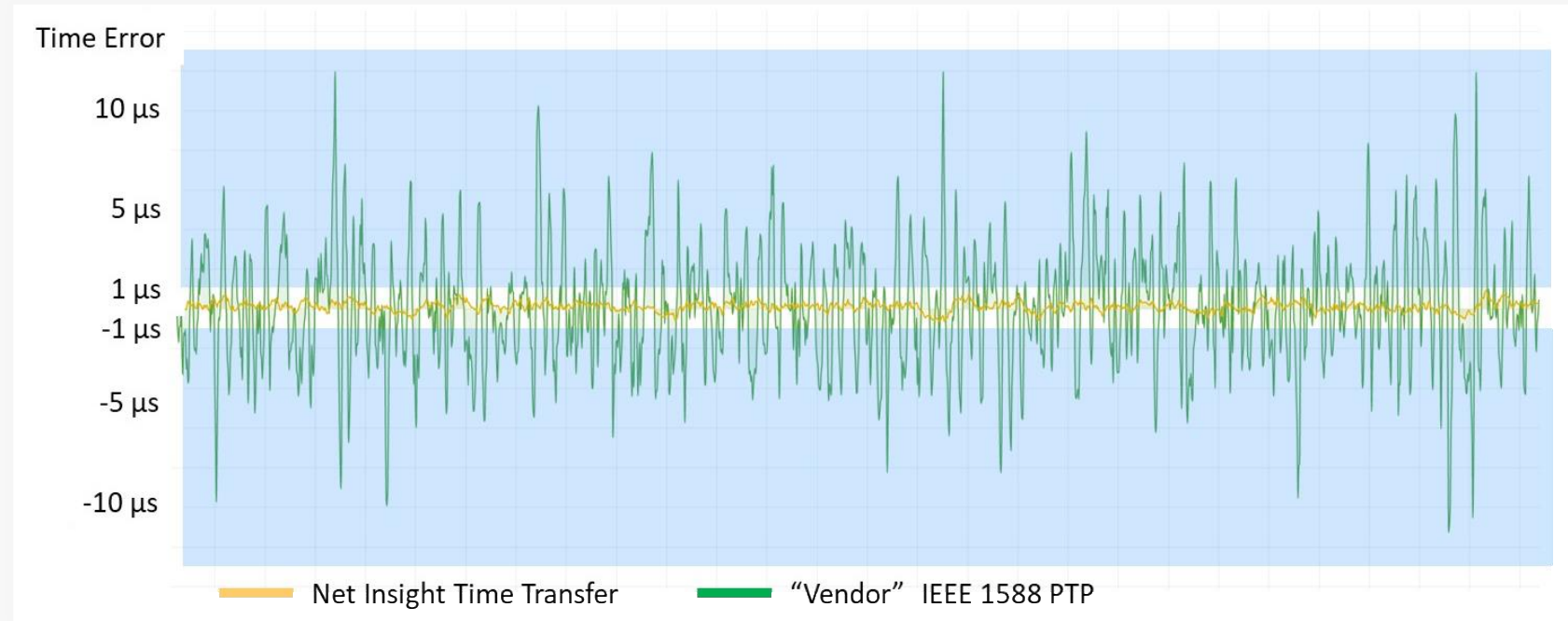
## Zyntai Director

- **100 synchronization metrics**
  - Absolute Time Errors, Total Time Errors, RTT, Unidirectional delays, Delay percentiles, Delay and Time Error variations, control state, temp, etc.
- **Measure, Analyze, Optimize**
  - Centralized analysis complements PTN and sync routing to optimize sync performance
  - Resolution down to nanosecond, every second, enables data-driven network analysis.
- **Realtime network probing**
  - For optimized sync service
  - For optimized network service



# Improving Time Accuracy over Congested Networks

- Adjustable sync packet rate to handle network jitter (suppress noise)
  - **500-20,000+** (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



▪ **Net Insight within ± 500ns**

▪ **PTP ~ 10-100 μs**

# Asymmetry compensation is a key feature in ITU-T Supplement on Enhanced Partial Timing Support

## ePTS Framework

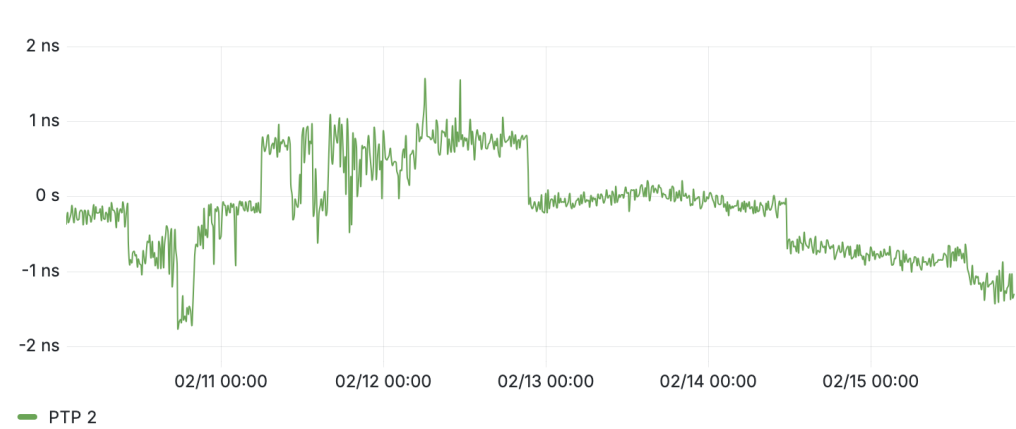
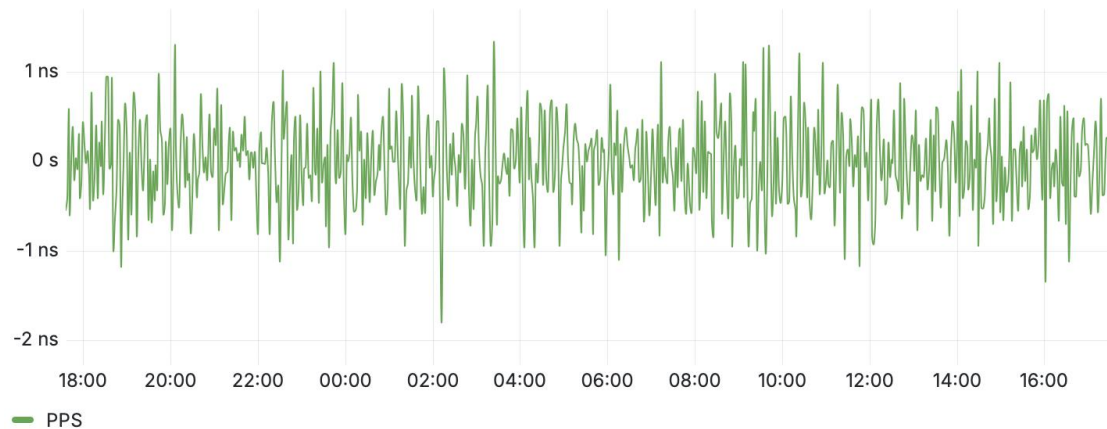
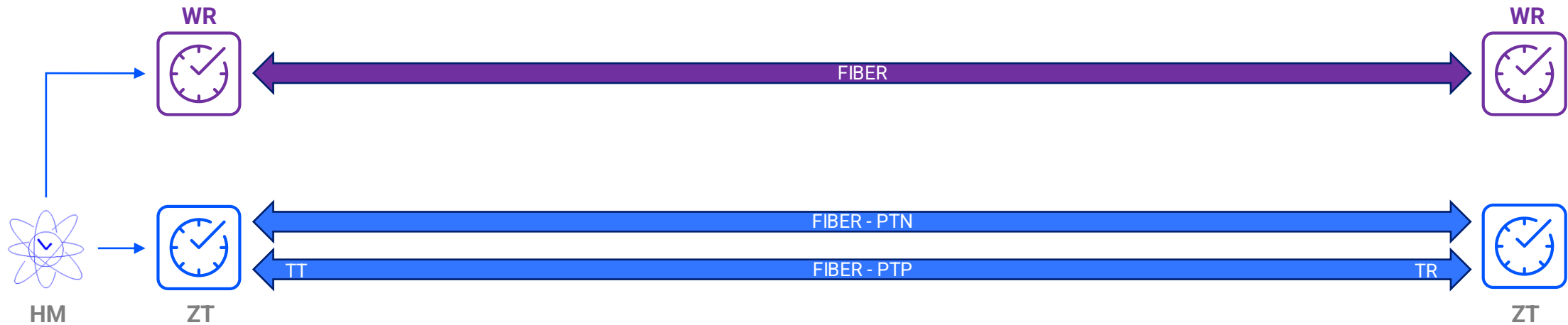
- Challenges in an WAN overlay time transport network without timing support from the network nodes
- Asymmetries equally applies to PTP Full Timing Support as proposed in the October ITU-T SG15/Q13 meeting
- Bring your asymmetry challenge into the ITU-T work to guarantee an industry wide specification

“This Supplement provides a framework for enhancement to partial timing support, i.e., timing carried over an overlay time transport technology without timing support from the network nodes”



ePTS

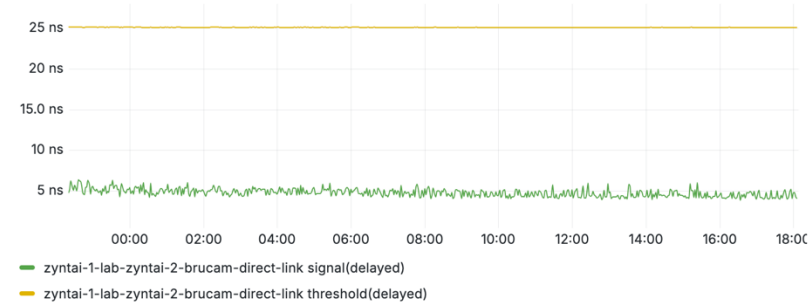
# Time transfer over fiber with asymmetry compensation



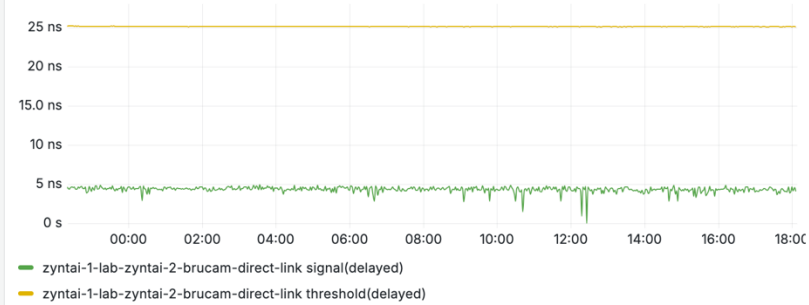
WR	White Rabbit	TT	Time Transmitter	HM	Hydrogen Maser
ZT	Zytai TimeNode	TR	Time Receiver	PTN	Precision Time Net / ePTS – Enhanced Partial Timing Support

# Telemetry: Fiber

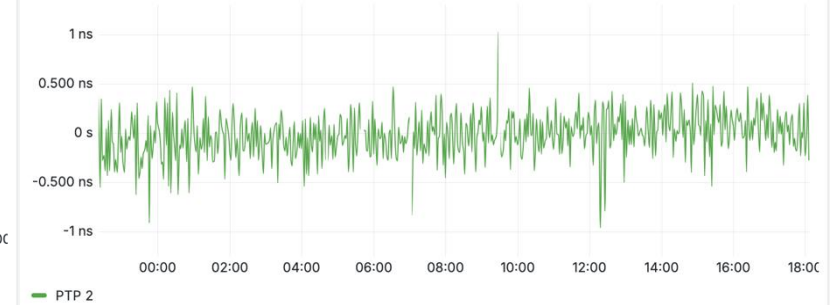
link change detection (recv) ⓘ



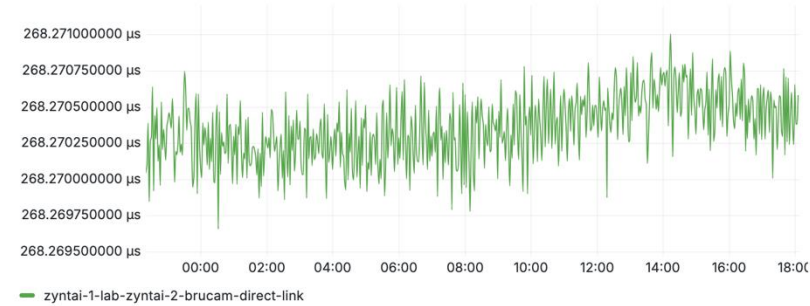
link change detection (send) ⓘ



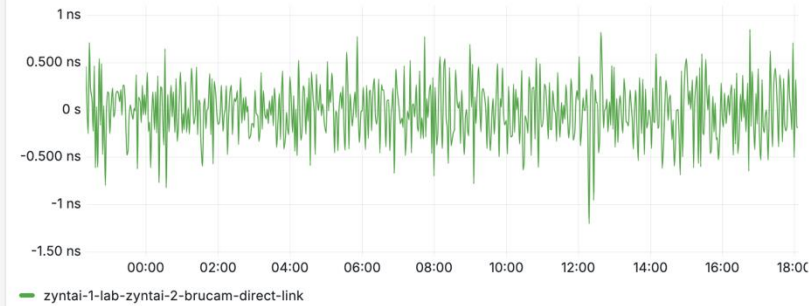
PPS, GNSS and PTP receiver errors ⓘ



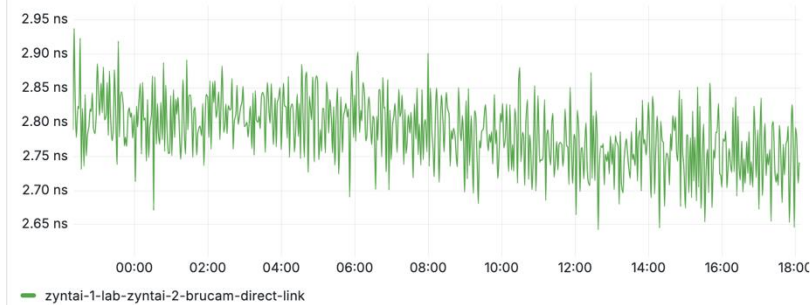
Round-trip time (filtered) ⓘ



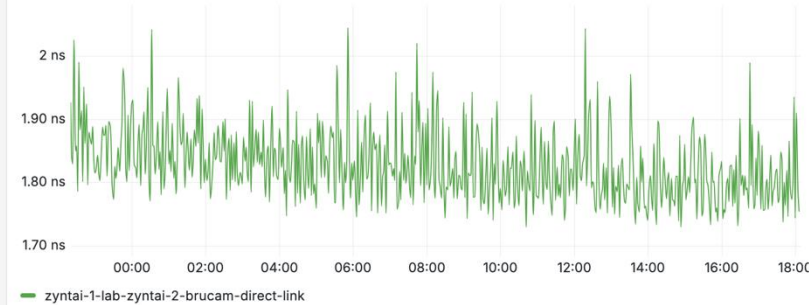
link time error ⓘ



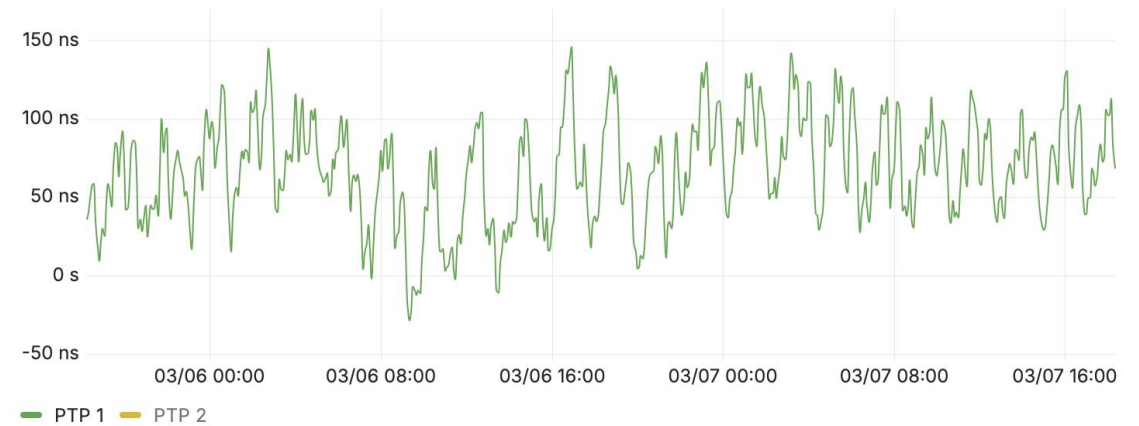
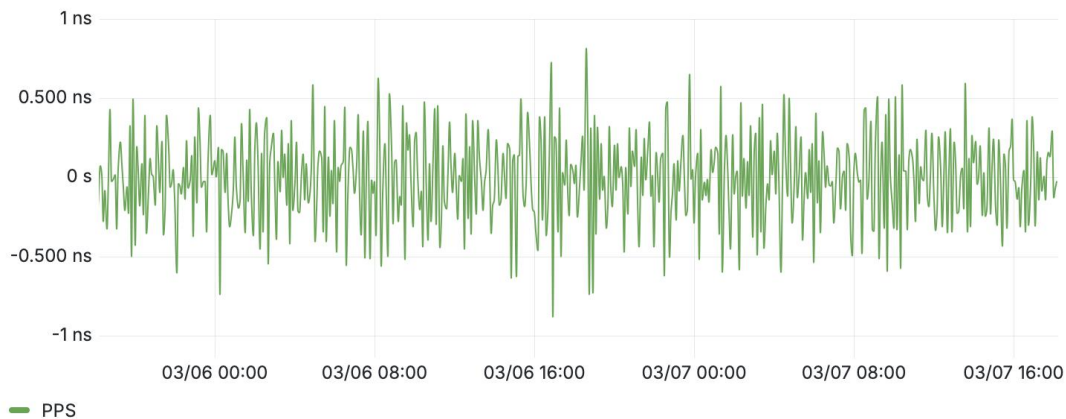
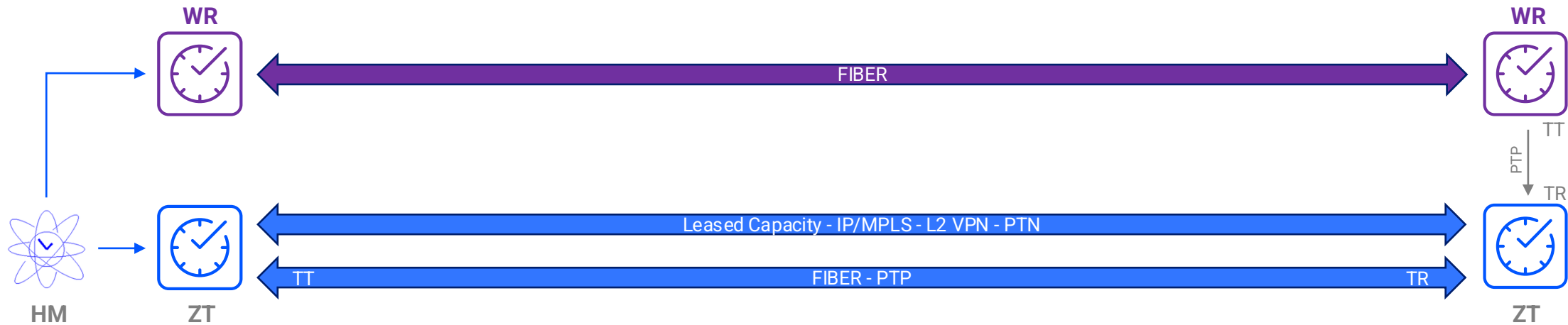
raw td std (recv) ⓘ



raw td std (send) ⓘ



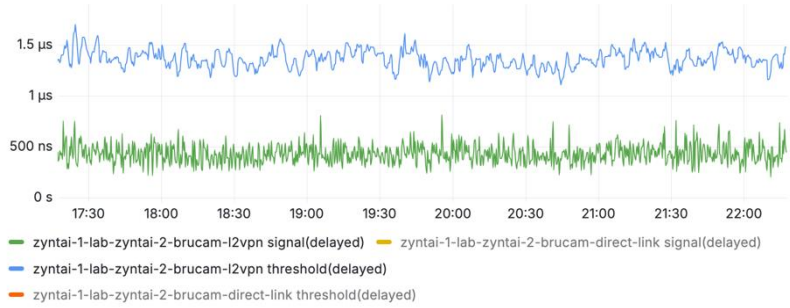
# Time transfer over leased capacity with asymmetry compensation



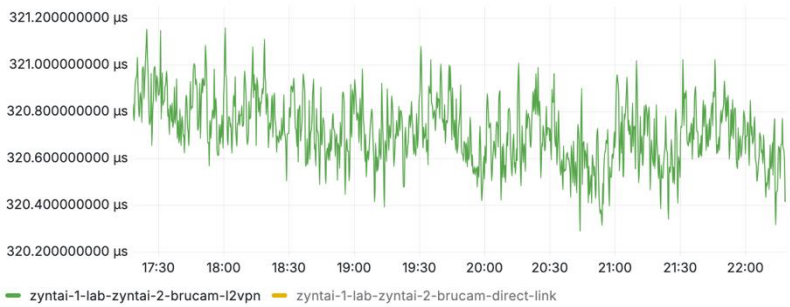
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ZT	Zytai TimeNode	TR	Time Receiver	PTN	Precision Time Net / ePTS - Enhanced Partial Timing Support

# Telemetry: L2VPN

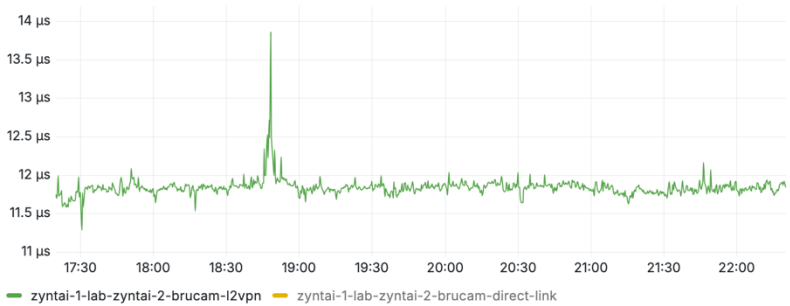
link change detection (recv) ⓘ



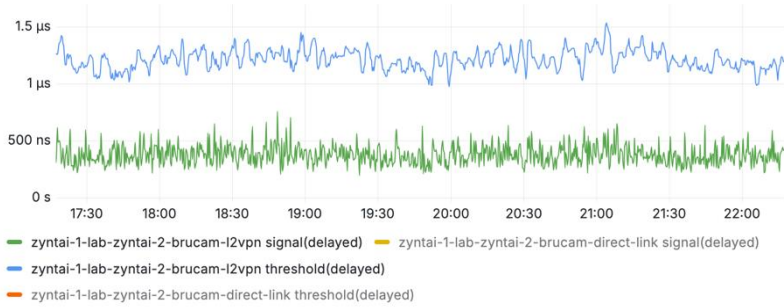
Round-trip time (filtered) ⓘ



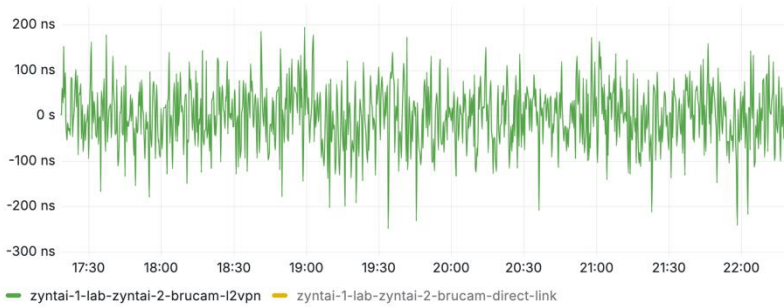
raw td std (recv) ⓘ



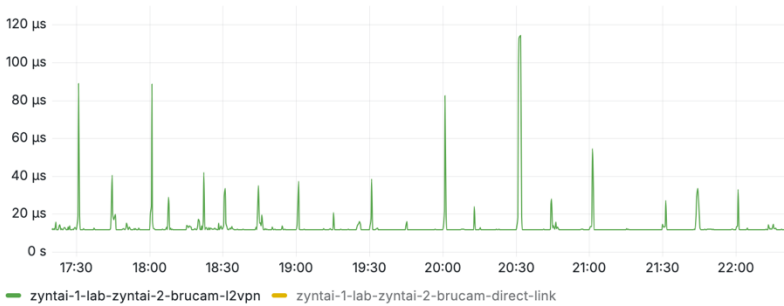
link change detection (send) ⓘ



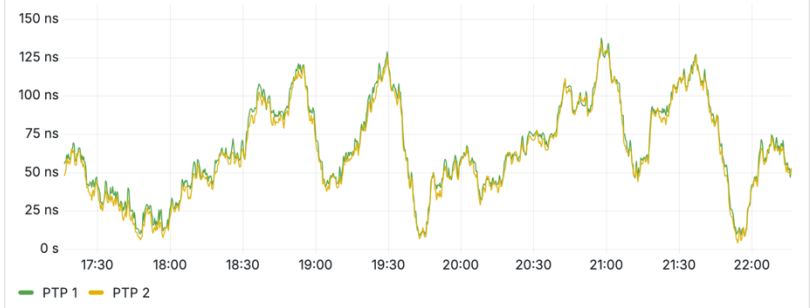
link time error ⓘ



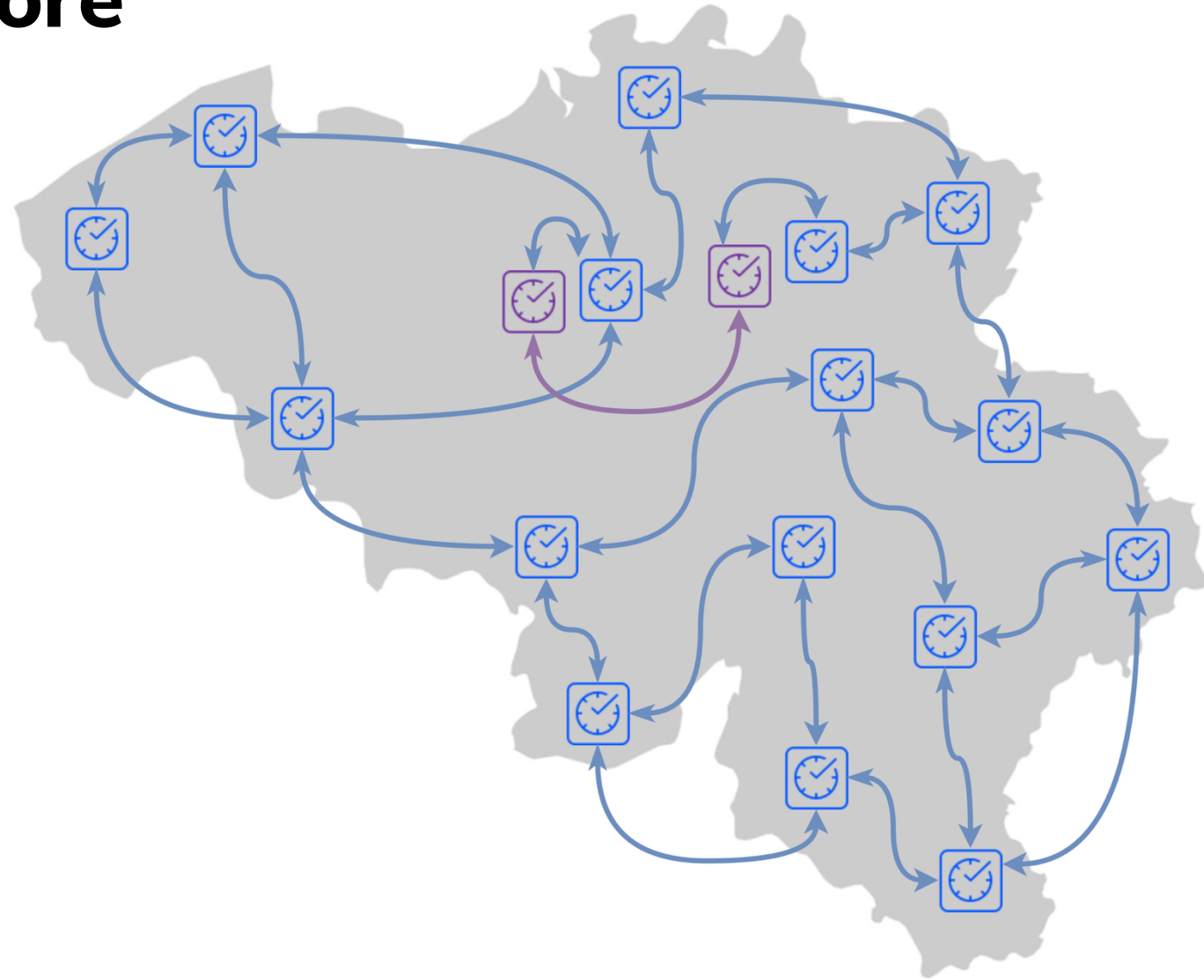
raw td std (send) ⓘ



PPS, GNSS and PTP receiver errors ⓘ



# White Rabbit Core Zyntai for scale



Zyntai TimeNode

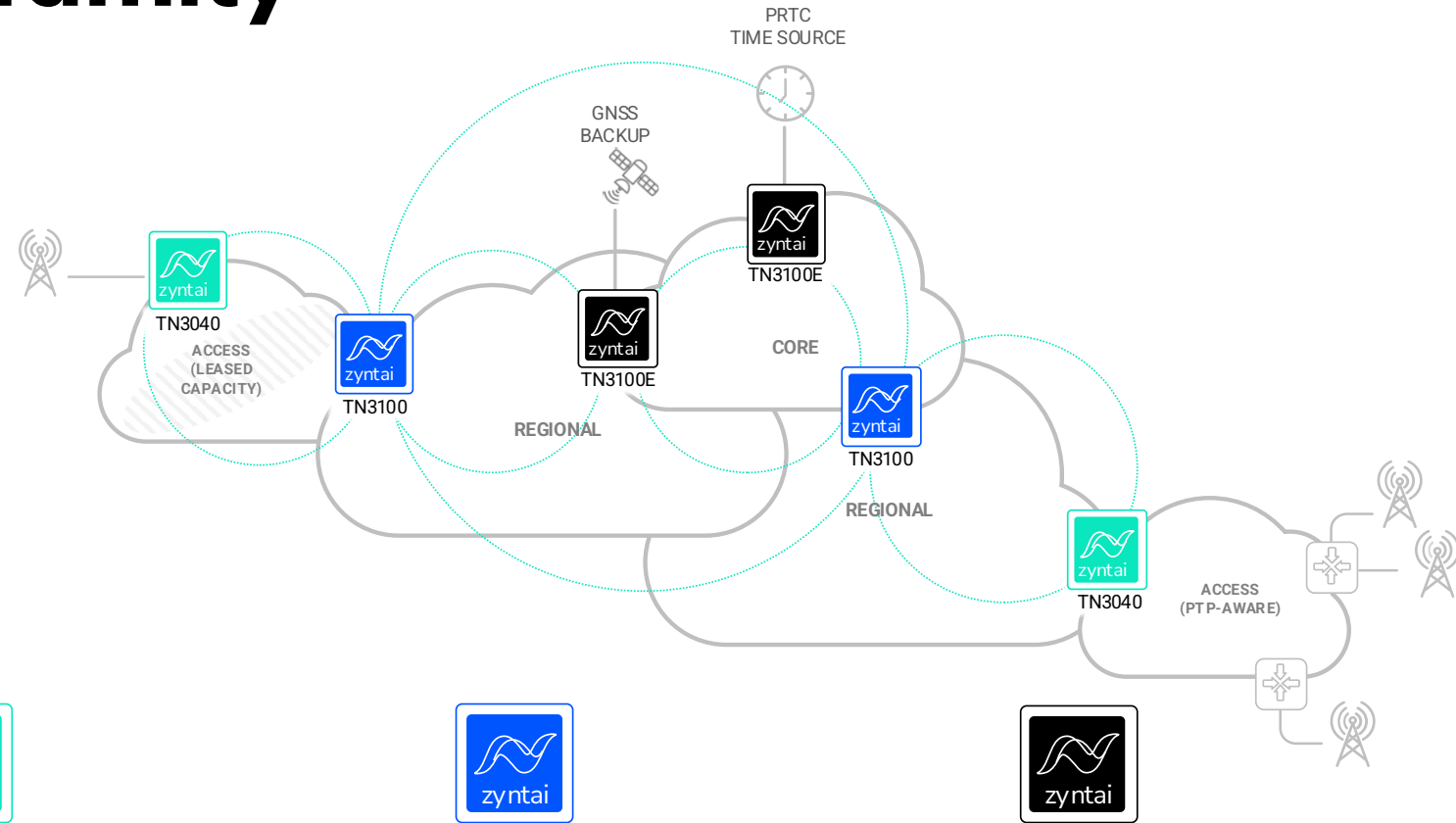


White Rabbit

# Zyntai TimeNode family

## PTP Distributed Grandmaster

- Telecom, power, and media timing profiles
- Advanced algorithms for managing jitter and asymmetries
- Full PRTC/ePRTC performance
- Mesh for resilience and network-assisted holdover
- AES encryption



<p>TN3040 Access node</p>	<p>TN3100 Core node</p>	<p>TN3100E Enhanced core node</p>
<ul style="list-style-type: none"> <li>• Slim capacity PTP client</li> </ul>	<ul style="list-style-type: none"> <li>• High capacity PTP client</li> </ul>	<ul style="list-style-type: none"> <li>• High capacity PTP client</li> <li>• Advanced jamming and spoofing detection and mitigation</li> </ul>

# Datasheet



<b>Time Transfer</b>	<b>TN3040</b> 4 Time Transfer sessions	<b>TN3100 / TN3100E</b> 32 Time Transfer sessions	<b>PRTC</b>	<b>TN3040 / TN3100</b> G.8272 PRTC-A / PRTC-B compliant G.8272.1 ePRTC compliant with Cs-assistance	<b>TN3100E</b> G.8272 PRTC-A / PRTC-B compliant G.8272.1 ePRTC compliant (holdover compliance requires Cs-assistance)
	Regional Routing and multilink synchronization 1.000 - 32.000 Timestamps/s per Time Transfer session AES-256 encryption Differentiated Service Code Points (DSCP)				
<b>PTP</b>	<b>TN3040</b> 256 PTP clients with full message rate	<b>TN3100 / TN3100E</b> 2048 PTP clients with full message rate	<b>NTP</b>	Single Stratum 1 NTP server NTPv3 / NTPv4, SNTPv3 / SNTPv4 100 000 TPS (transactions per second).	
	ITU-T G.8275.1 Full Timing Support ITU-T G.8275.2 Partial Timing Support ITU-T G.8265.1 Telecom Frequency Profile IEEE 1588 Default Profile SMPTE ST 2059-2 and AES67 Media Profiles Support for multiple profiles simultaneously		<b>Management</b>	Electrical GbE/FE (RJ-45) Inband management USB-C port for onboarding	
<b>Interfaces</b>	<b>TN3040</b> 4x 10G/GbE SFP/SFP+ 2X GbE/FE RJ45	<b>TN3100 / TN3100E</b> 10x 10G/GbE SFP/SFP+ 2X GbE/FE RJ45	<b>Power (PSU)</b>	Hot-swappable, modular and load-balancing 2 x -48 VDC (-60 to -40 VDC) 2 x 100-240 VAC.	
	BASE-T, BASE-SX/SR (300m), BASE-LX/LR (10km), BASE-ER (40km), BASE-ZR (80 km DWDM) Link Layer Discovery Protocol (LLDP) IPv4 and IPv6 support		<b>Environmental</b>	Operating temp. <b>TN3040</b> -40 to 65 °C -40 to 149 °F EN 300 019-1-3 Class 3.3 Not temp-controlled	
<b>Synchronization interface</b>	PPS in/out, 2x HDBNC 10MHz in/out, 2x HDBNC E1/T1 in/out, ITU-T G.703.			Storage temp -40 to 70 °C (-40 to 156 °F)	
<b>Synchronous Ethernet</b>	ITU-T G.8261, G.8262 (EEC), G.8262.1 (eEEC), and G.8264 Ethernet Synchronization Messaging Channel (ESMC)		<b>Regulatory compliance</b>	Safety CB Scheme International Safety CE EU Safety IEC 62368-1 EN 62368-1	
<b>GNSS</b>	<b>TN3040 / TN3100</b> Singleband L1 Multi-constellation GPS, Galileo, GLONASS, BeiDou and QZSS.	<b>TN3100E</b> Multiband L1 + L5 Multi-constellation GPS, Galileo, BeiDou, QZSS and NavIC OSNMA authentication		ERM/EMC FCC Part 15 (Class A) ETSI EN 300 386 ETSI EN 303 413 V1.2.1	
	SBAS supported. T-RAIM Advanced jamming and spoofing detection and mitigation			NEBS EU Directive NEBS Level 3 2014/30/EU Low Voltage Directive 2014/30/EU EMC Directive 2011/65/EU RoHS Directive 2014/53/EU Radio Equipment Directive	
			<b>Dimensions</b>	43.5 mm (1.75" / 1RU) x 444 mm (17.5") x 302 mm (11.9") 5.8 kg (with dual power supply units)	



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