SEVEN Solutions

When every nanosecond counts

Time at your service

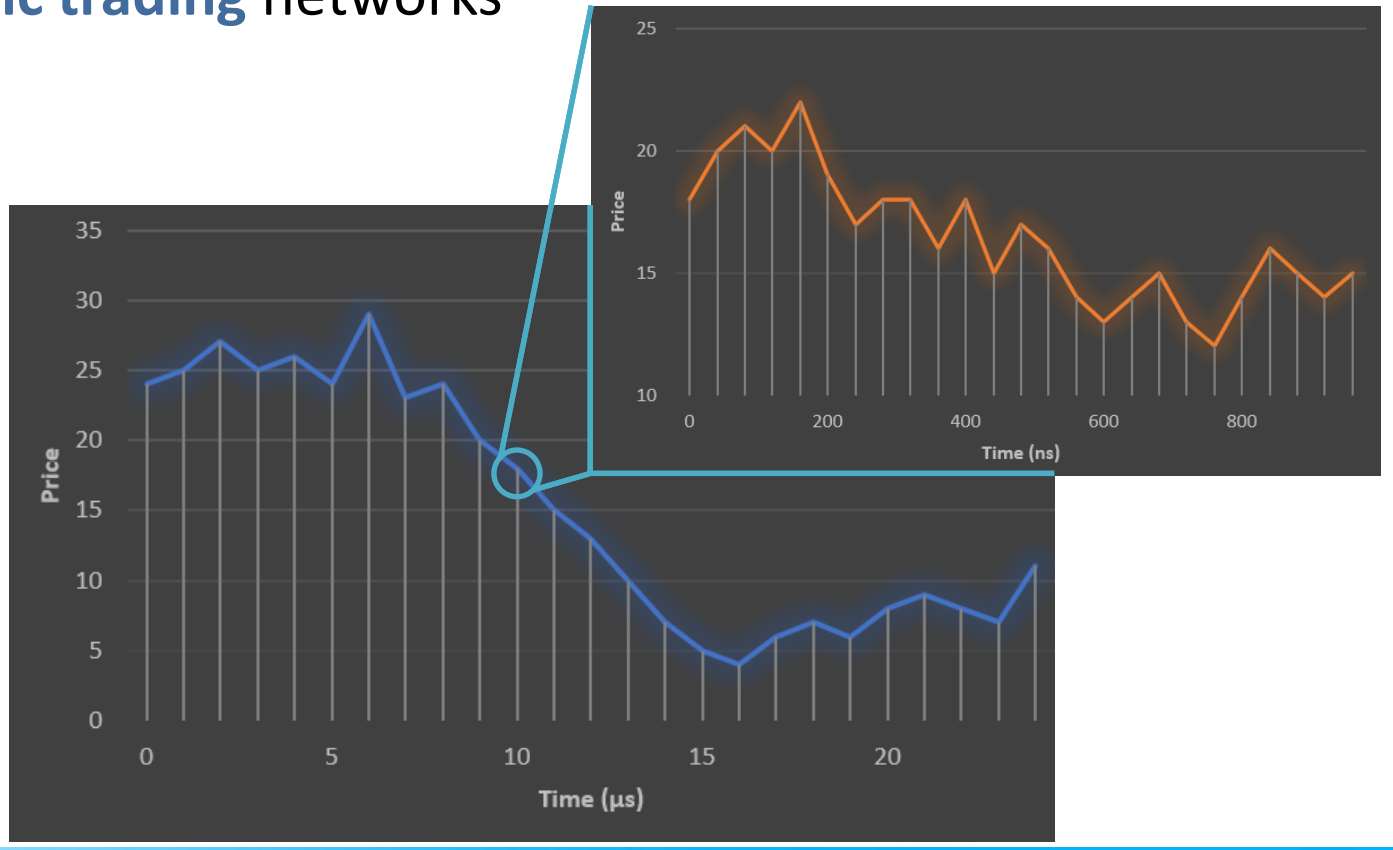
Francisco Girela @ Global STAC Live

www.sevensols.com

SEVEN Solutions

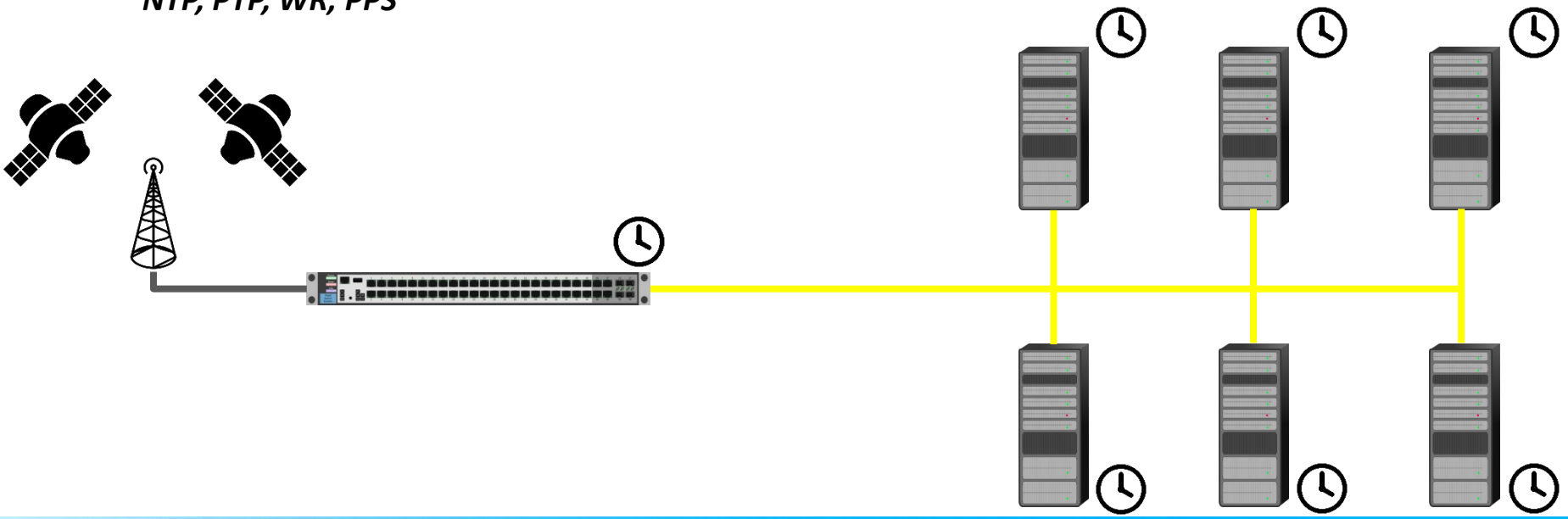
At the **core of electronic trading** networks

- Latency
  - Optimization
  - Network visibility
- Data quality
  - Timestamping precision
  - Distributed strategies
- Regulations
- Resiliency

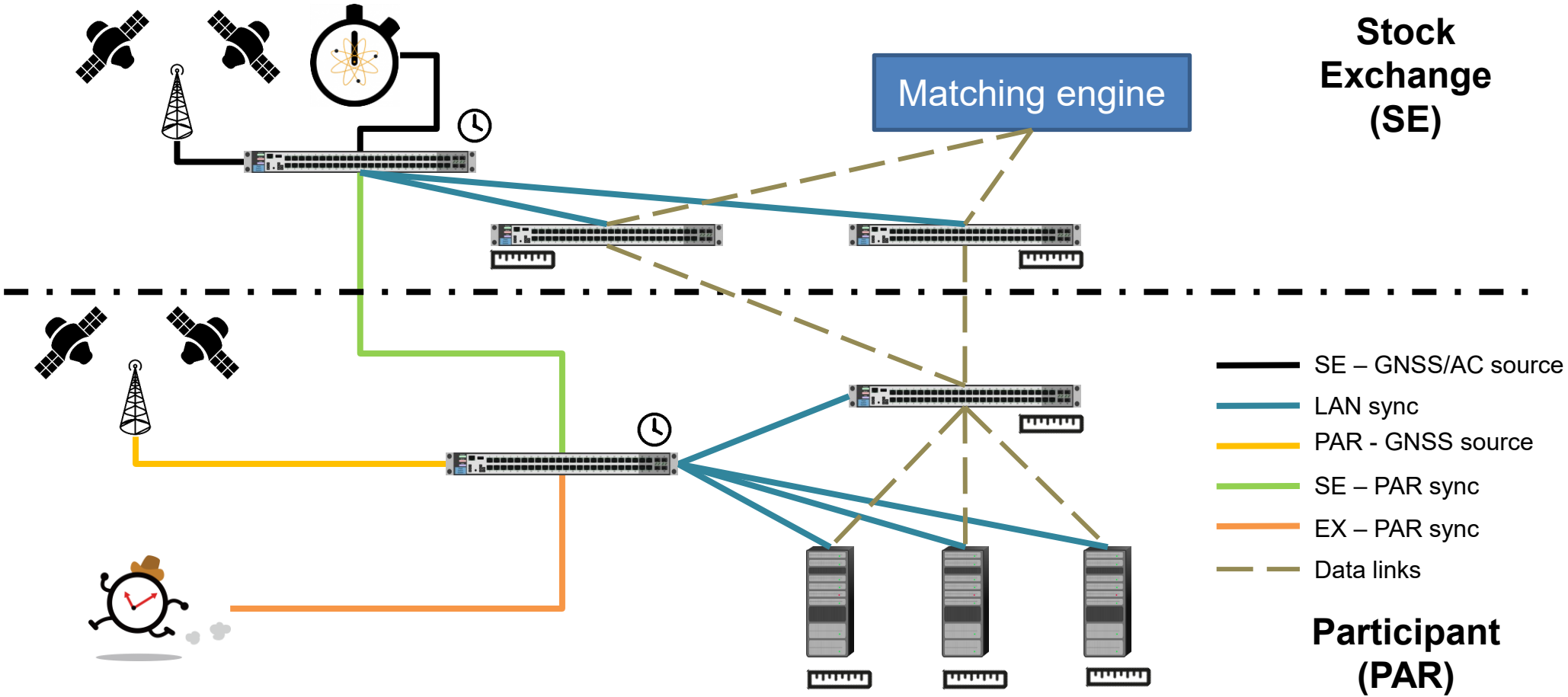


Time Synchronization in Trading

- **Traceable time synchronization** is the capability to maintain a shared notion of time related to an official time reference between different devices located in the same or different locations.
  - **Generation:** is the capability to obtain a notion of time.
    GPS, atomic clocks
  - **Distribution:** is the capability to propagate a notion of time to a different device.
    NTP, PTP, WR, PPS



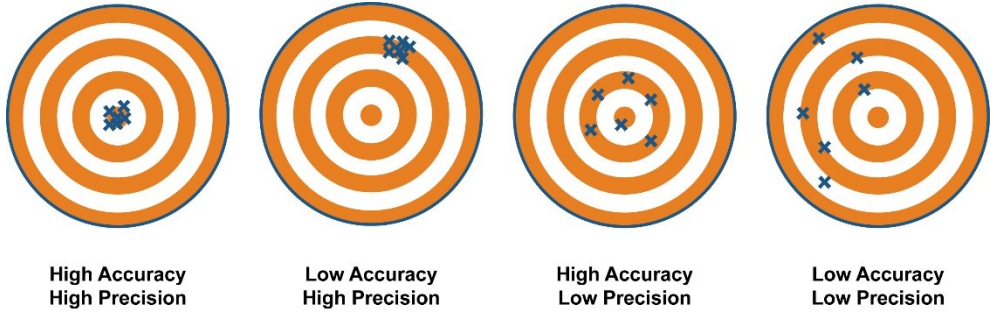
Time Synchronization in Trading

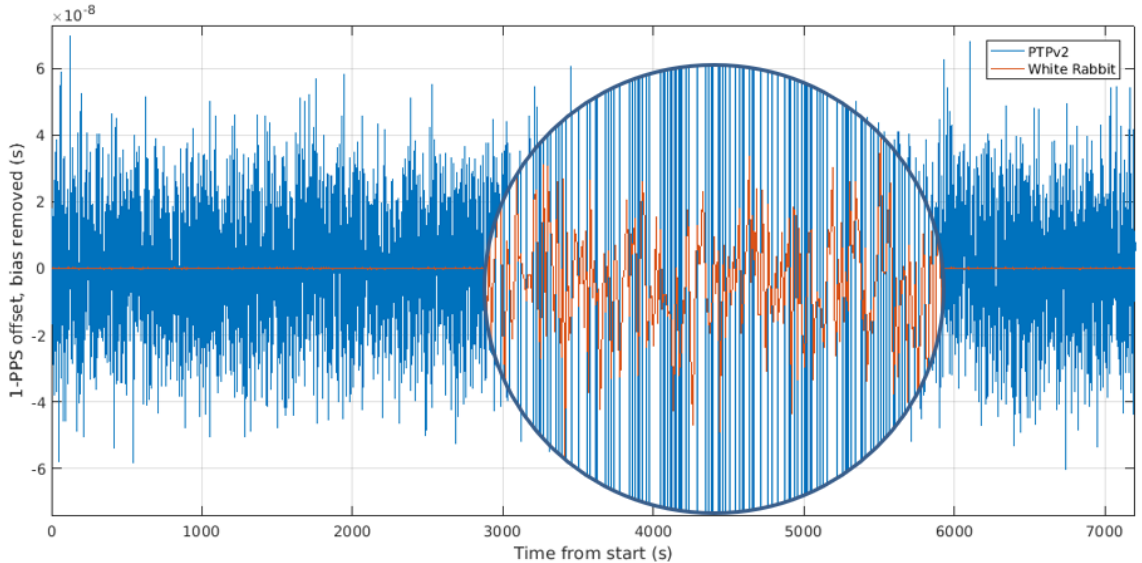


Ref: https://navisp.esa.int/opportunity/details/55/show
https://www.pinclipart.com/maxpin/xJmwRx/

Time Synchronization in Trading

- **Accuracy:** The degree to which the result of the time conforms to the correct value or a standard.
- **Precision:** The degree of repeatability of different results of the time.



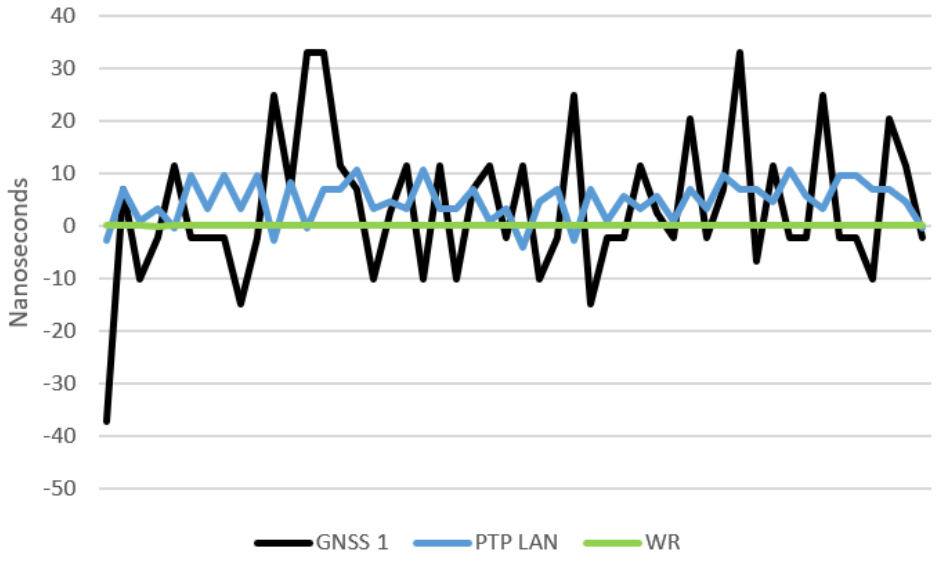


Not STAC benchmark

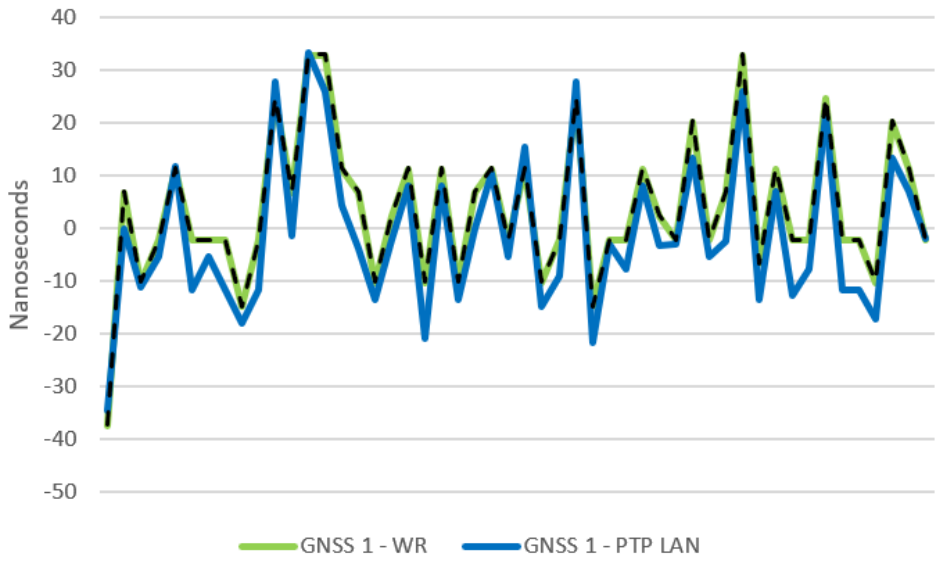
Time Synchronization in Trading

- **LAN synchronization:** Primary timing **source** is a calibrated GNSS with <15 ns RMS jitter.
  - Monitoring timing **source** is a fiber IEEE 1588 PTPv2 with <10 ns RMS jitter.
  - Monitoring timing **source** is a fiber White Rabbit – PTP High Accuracy with < 1 ns RMS jitter.

Timing sources



Comparison results



Not STAC benchmark

SEVEN Solutions

White Rabbit technology

White Rabbit (WR) is an ultra-accurate IEEE 1588 (PTP) implementation that achieves **sub-nanosecond** accuracy.

- Easy to integrate in **Ethernet** networks
- **NTP, PTPv2, PPS** and sub-nanosecond **WR**
- **Resilient** to GNSS disruption
- **Avoid calibration** and complex deployments
- **Scalable** to thousands of nodes in **metro areas**
- **Unprecedented** trading capabilities

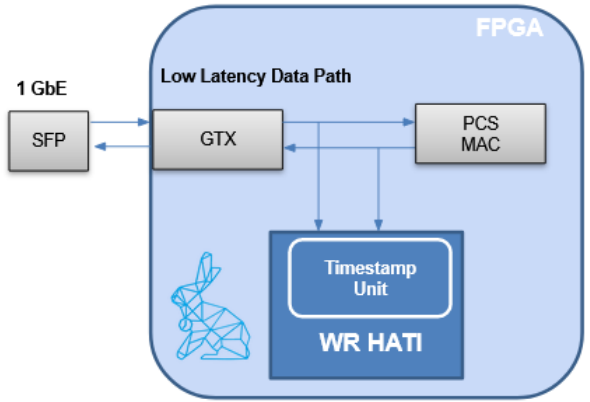
WR-Z16: The ultimate White Rabbit fanout

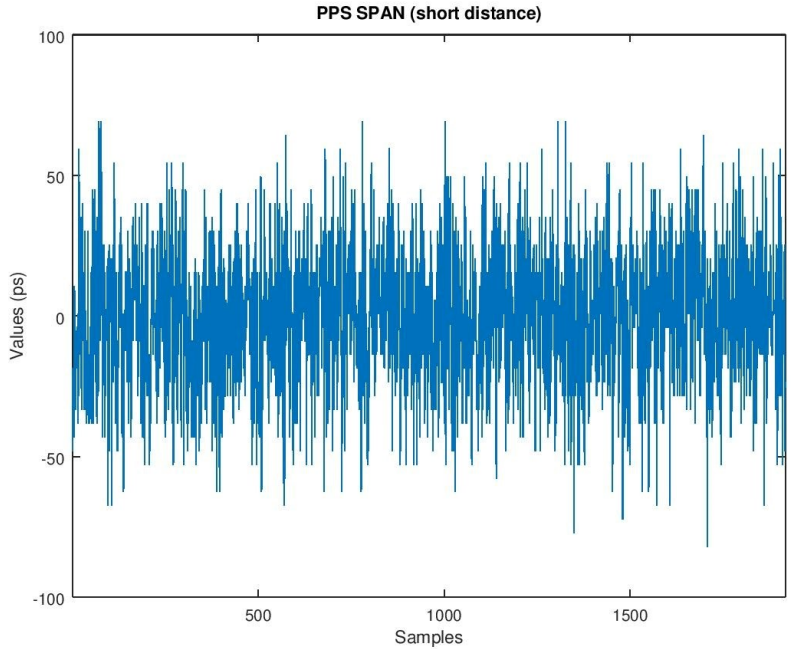
- **Multi-port synchronization** fan-out.
- WR, HATI, IEEE 1588 PTPv2 and NTP **interoperability** on all optical interfaces.
- **Multi-source** time references.
- **Failover** mechanisms.
  - Automatic switchover.
  - Holdover.
- Time **traceability** for regulatory purposes.
- **Extended monitoring** and management tools (Authentication, SNMP, security…).
- **Redundant power** supply and fans.
- Serial and Ethernet RJ45 ports.
- Additional features to come!

NEW!

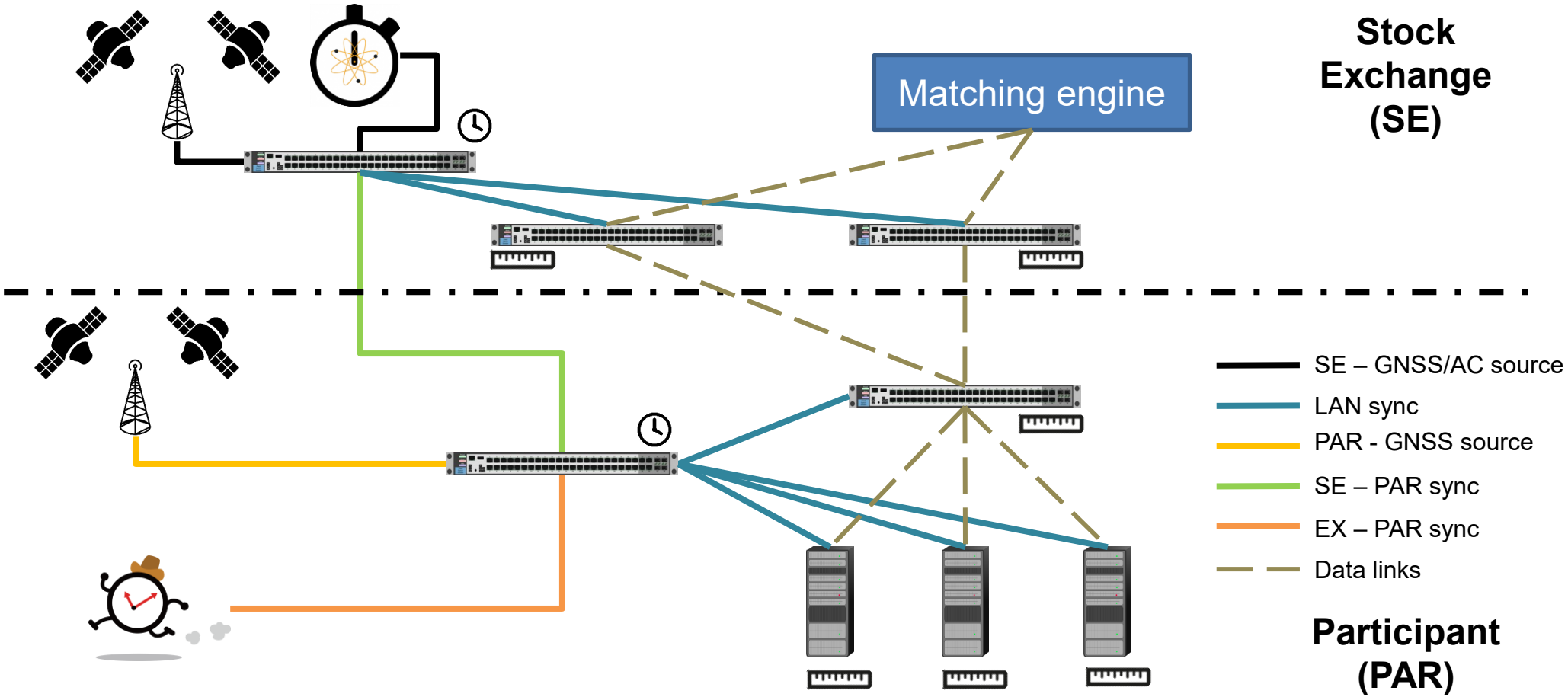
HATI: High Accuracy Timing IP core

- WR-PTP timing using **FPGA** (Xilinx) IP Core.
- **Sub-nanosecond** time accuracy on L1 switches and 3rd party NICs.





Time Synchronization in Trading

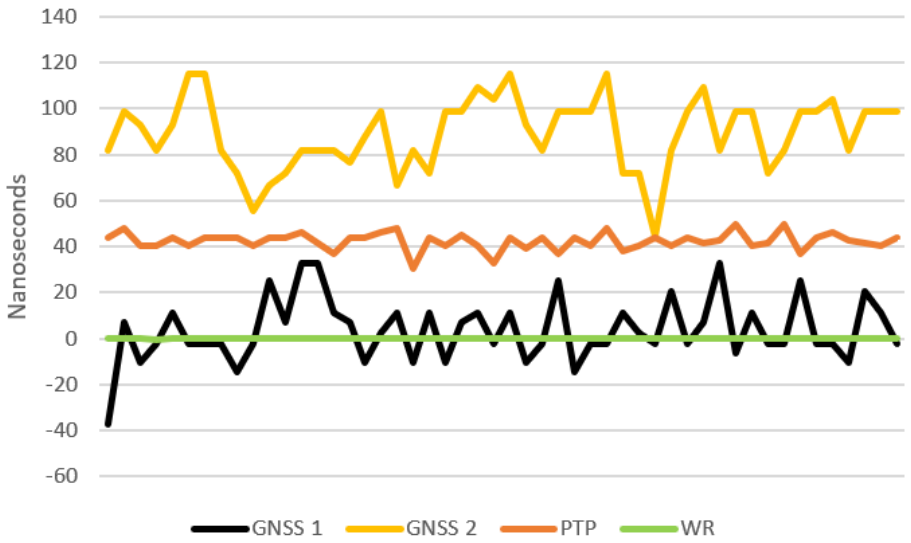


Ref: https://navisp.esa.int/opportunity/details/55/show
https://www.pinclipart.com/maxpin/xJmwRx/

Time Synchronization in Trading

- **Remote time distribution:** Primary timing **source** is a calibrated GNSS with <15 ns RMS jitter.
  - Monitoring timing **source** is an uncalibrated GNSS with <15 ns RMS jitter.
  - Monitoring timing **source** is a fiber IEEE 1588 PTPv2 with <10 ns RMS jitter.
  - Monitoring timing **source** is a fiber White Rabbit – PTP High Accuracy with < 1 ns RMS jitter.

Timing sources



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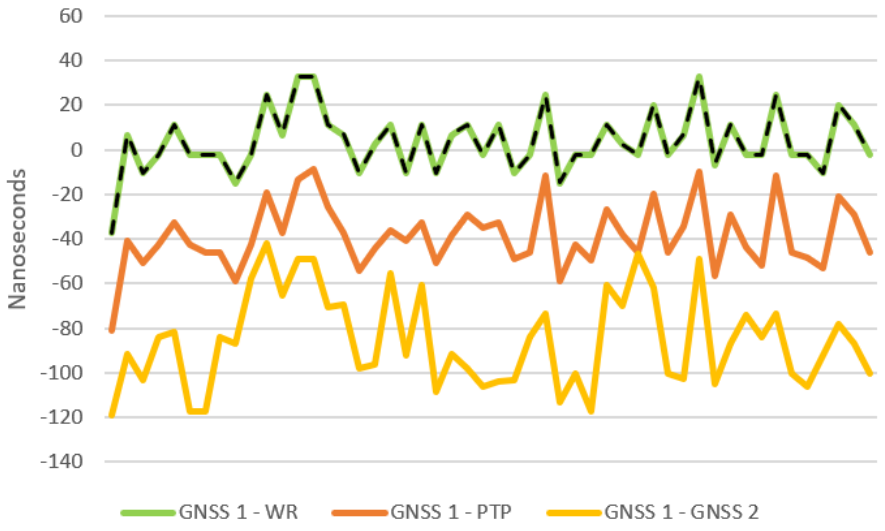
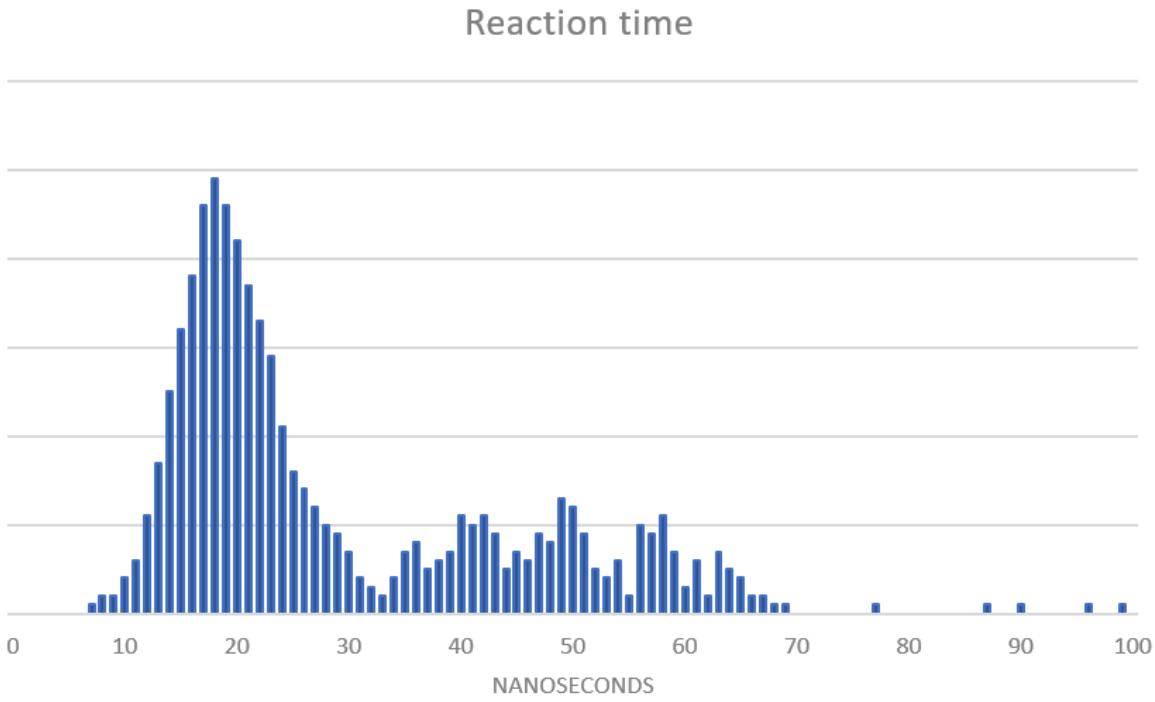


Not STAC benchmark

Time Synchronization in Trading

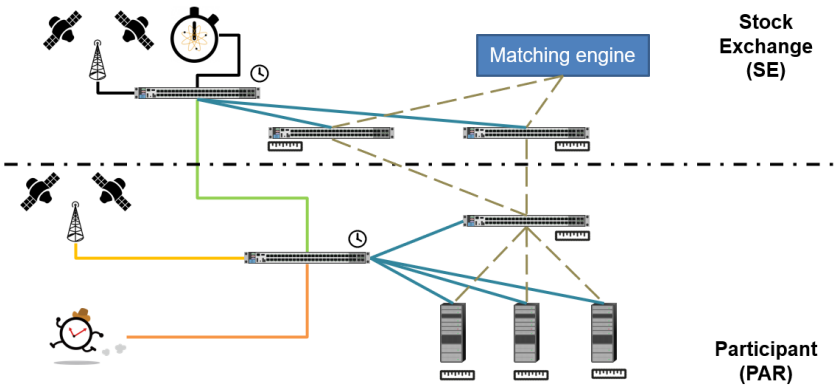
- **Latency measurement:** Absolute reaction times to market events oscillates between 15 and 70 nanoseconds. Main wave: 20 ± 10 ns.
  5 ns peak-to-peak time error means 50% uncertainty in the measurement.

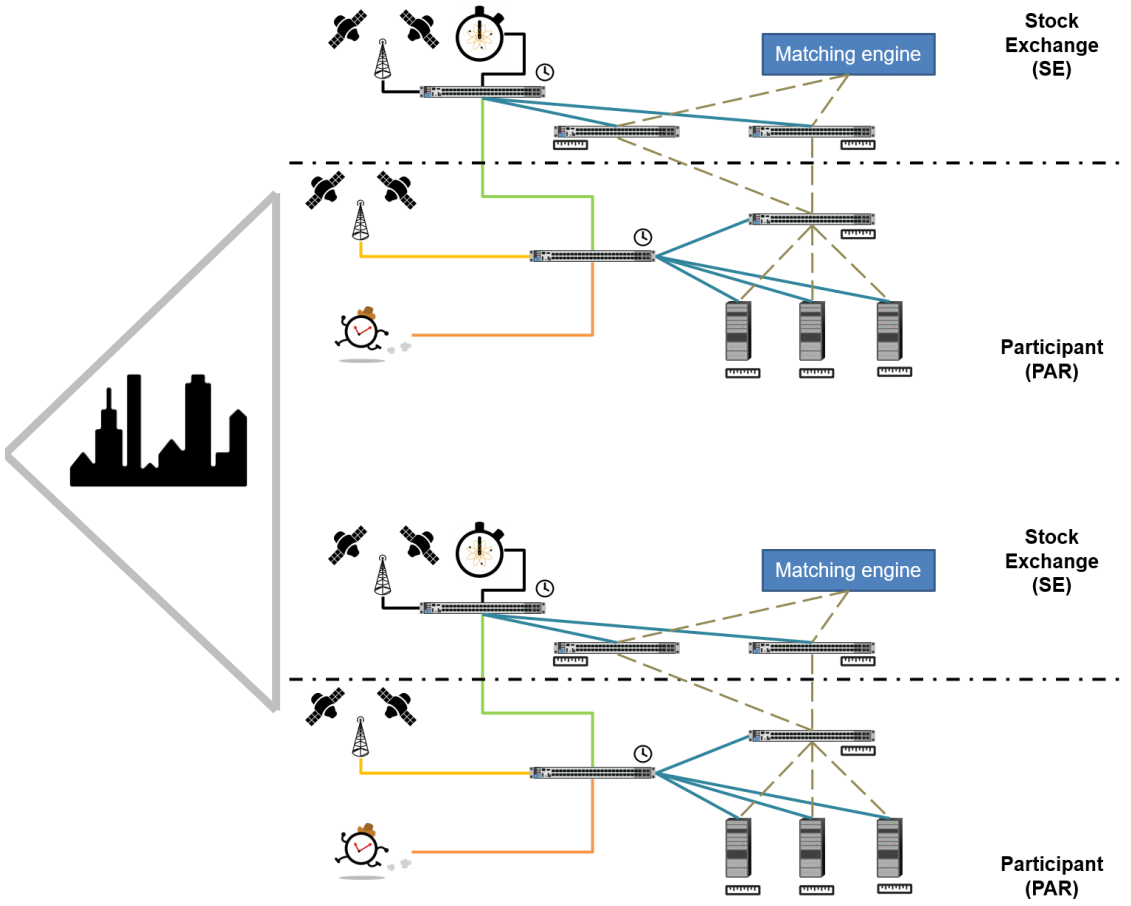
- **Data quality:** Training AI with incorrect latency values affects the fidelity of the outcome. Even when not interested on running the “low-latency” race, time sync and capturing are important tools to improve your profitability.



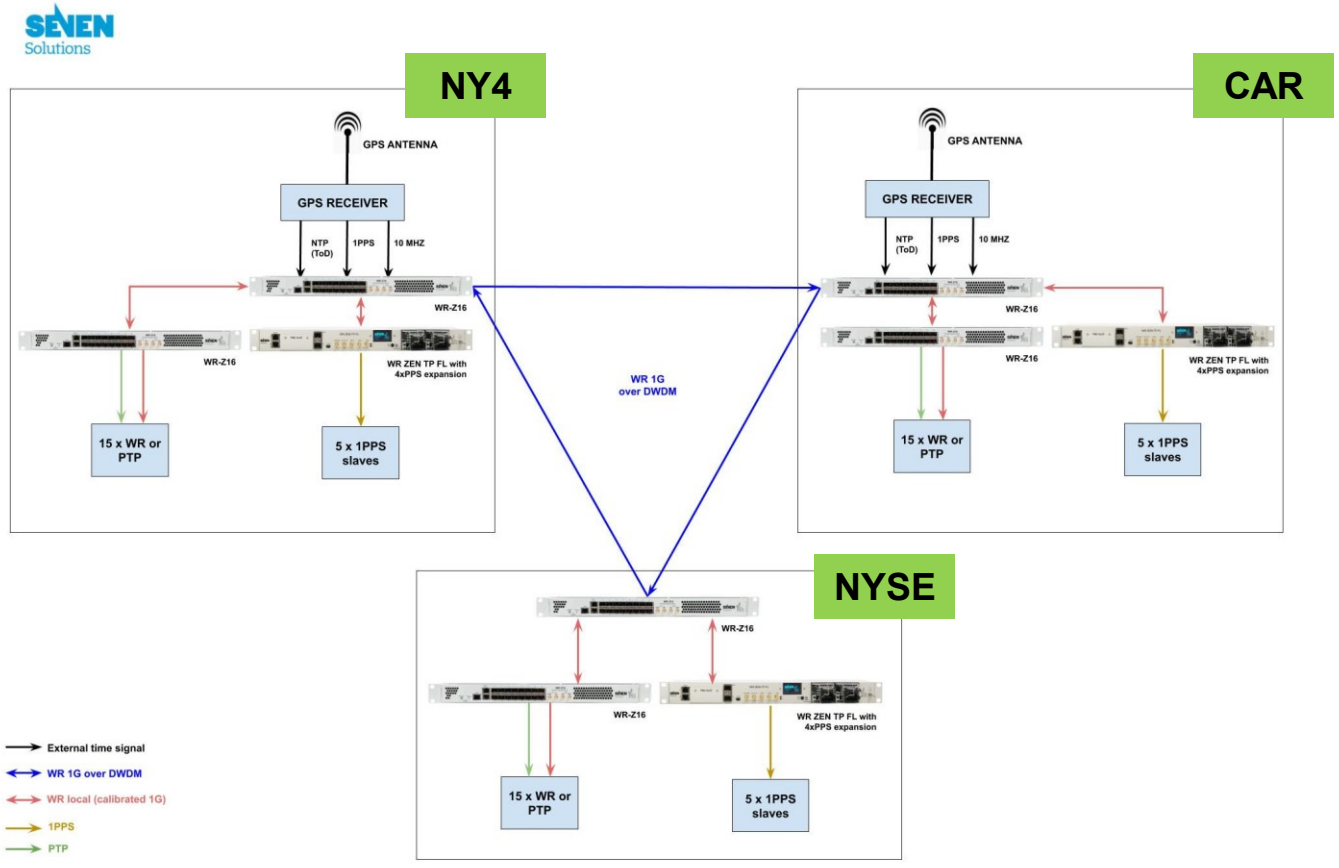
Time Synchronization in Trading

NYC / London / Chicago / APAC / EMEA



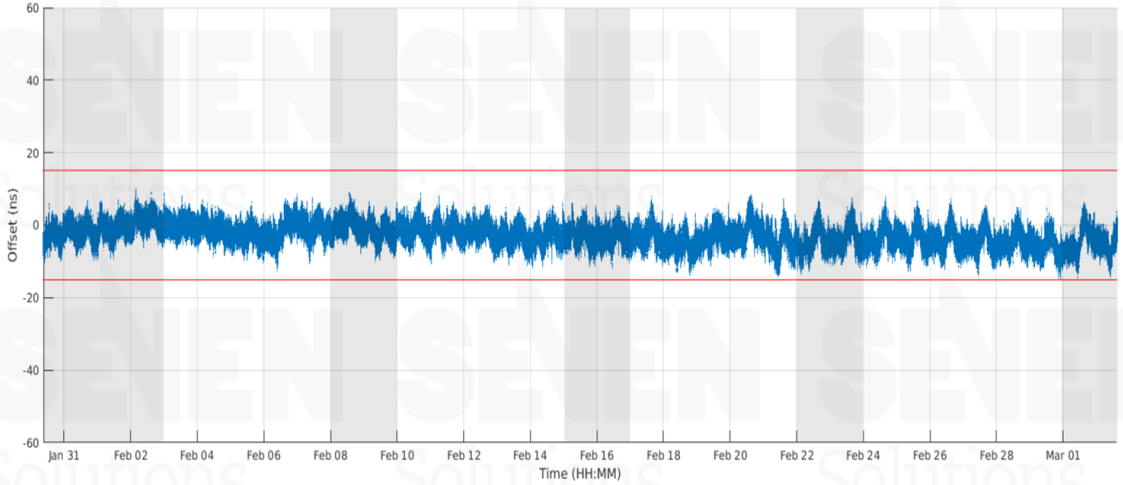


Time Synchronization in Trading



Spanish stock market use case

- **Sub-nanosecond synchronization** over a 44 km fiber link (27 miles).
- **± 15 nanoseconds traceability** to UTC using the DOWR.
- **Holdover capabilities** if the link is lost.



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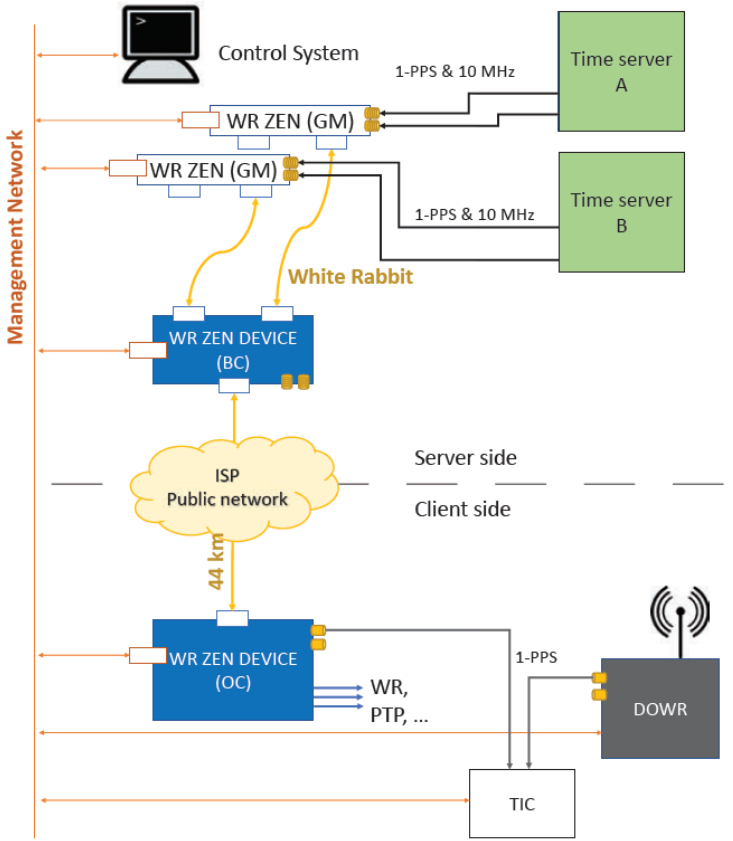

WRaaS: White Rabbit as a Service

- **Metro-area** time synchronization using White Rabbit protocol.
- **Sub-nanosecond** time accuracy with resilient time sources related to **official UTC** implementations.
- **Backup to GNSS-based** time synchronization in finance networks.

Stay connected for updates!

A present technology **designed for the future**

Best-in-class synchronization **accuracy** for the next electronic trading generation.

- Deutsche Börse: https://stacresearch.com/STAC-Summit-6-Jun-2019-deutsche-boerse
- Optiver: https://www.youtube.com/watch?v=pe6Gh_fi3Wc&t=2s
- Spanish stock market: https://ieeexplore.ieee.org/document/9071992

Basis for the Standard IEEE 1588-2019 **High Accuracy** profile.

Alternative to GNSS synchronization in several segments.

- USA Department of Transportation demonstration as Global Positioning GPS backup: https://insidegnss.com/seven-solutions-to-demo-alternate-precision-time-keeping-for-dot/
- European GNSS Agency: https://www.gsc-europa.eu/sites/default/files/sites/all/files/Report_on_User_Needs_and_Requirements_Timing_Synchronisation.pdf
- Leader technology in science.
- 5G telecom evaluations: Deutsche Telekom, Orange…

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  - Available during the whole show!

Thank you for your attention!