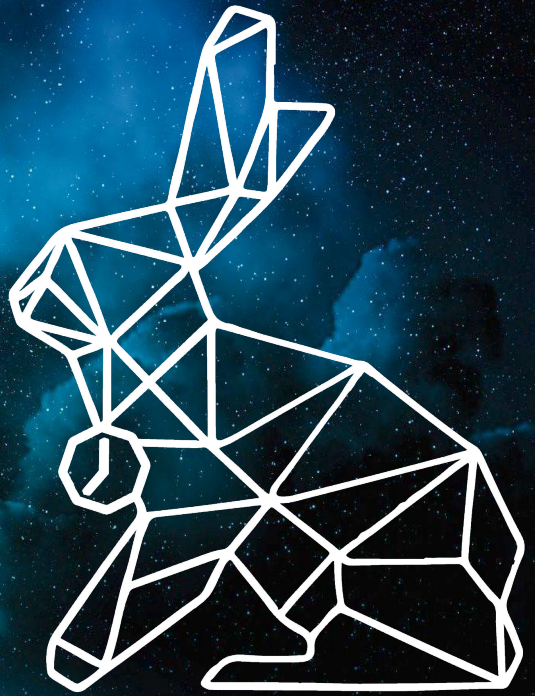
SEVEN Solutions

Down the White Rabbit hole

Sub-nanosecond long distance links and integrations in FPGA devices



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Background to White Rabbit
(New announcements in the following section!)
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What is White Rabbit?

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

White Rabbit?

White Rabbit

- Sub nanosecond accuracy and precision
- Inter- and intra- datacenter sync
- In-built failover
- Extremely scalable
- Pre-calibrated

+

- Dedicated infrastructure required

−

PTP

- Tens of nanosecond accuracy
- Can share existing network
- Susceptible to issues during high traffic patterns

+

- Susceptible to accuracy variations during high traffic patterns
- Many different implementations/tuning parameters
- Dedicated HW required

−

GNSS/GPS

- Highly available
- Tens of nanoseconds accuracy

+

- Limited distribution capabilities
- Susceptible to outages
- Custom cabling and infrastructure
- Not possible in all locations

−

NTP

- Globally available and free reference services over internet

+

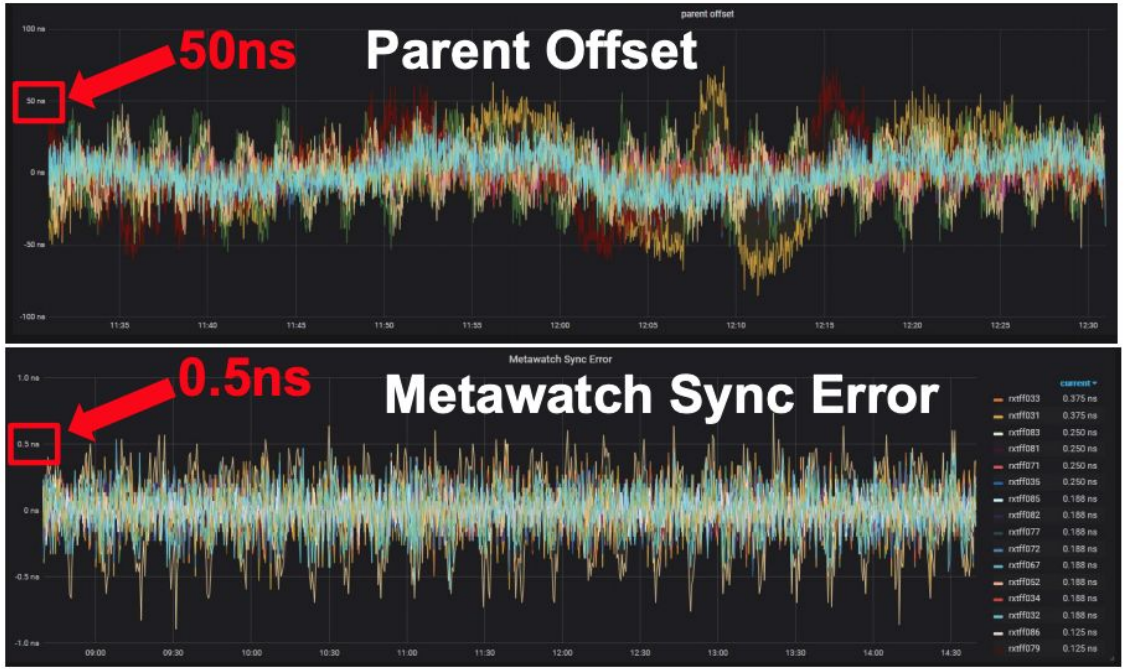
- Low levels of accuracy and precision (microseconds)

−

White Rabbit vs PTP

PTP

White Rabbit



Not STAC benchmark

https://stacresearch.com/system/files/resource/files/STAC-Summit-15-Nov-2018-White%20Rabbit.pdf


White Rabbit for electronic trading
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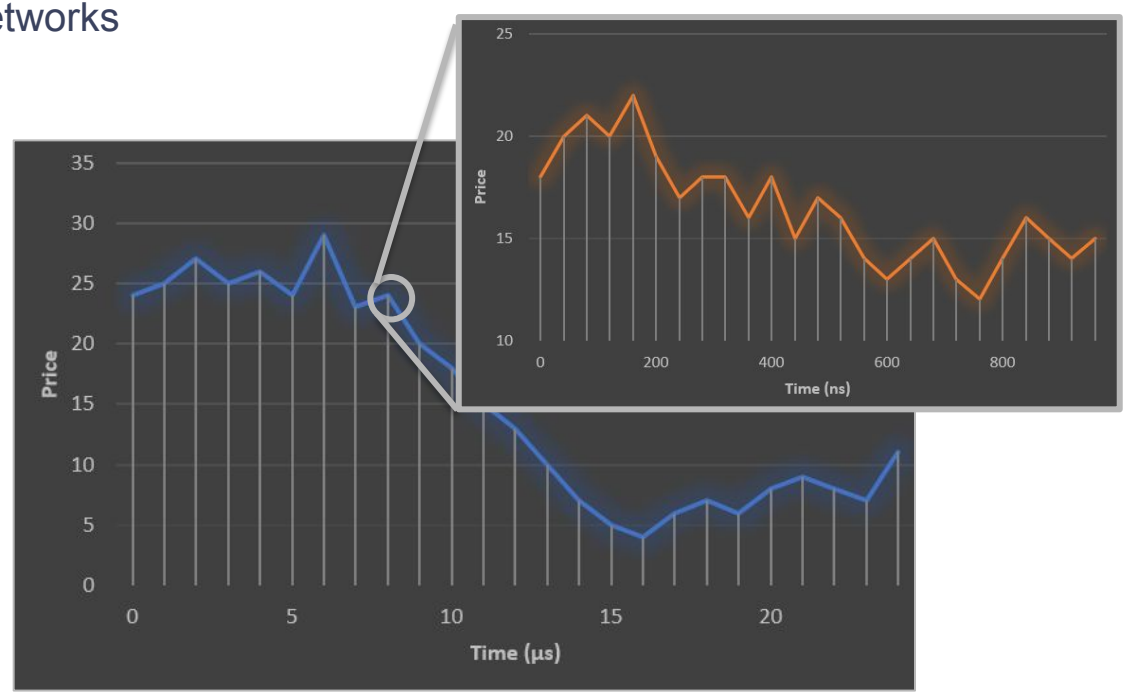
Electronic trading use-cases

At the **core of electronic trading** networks

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

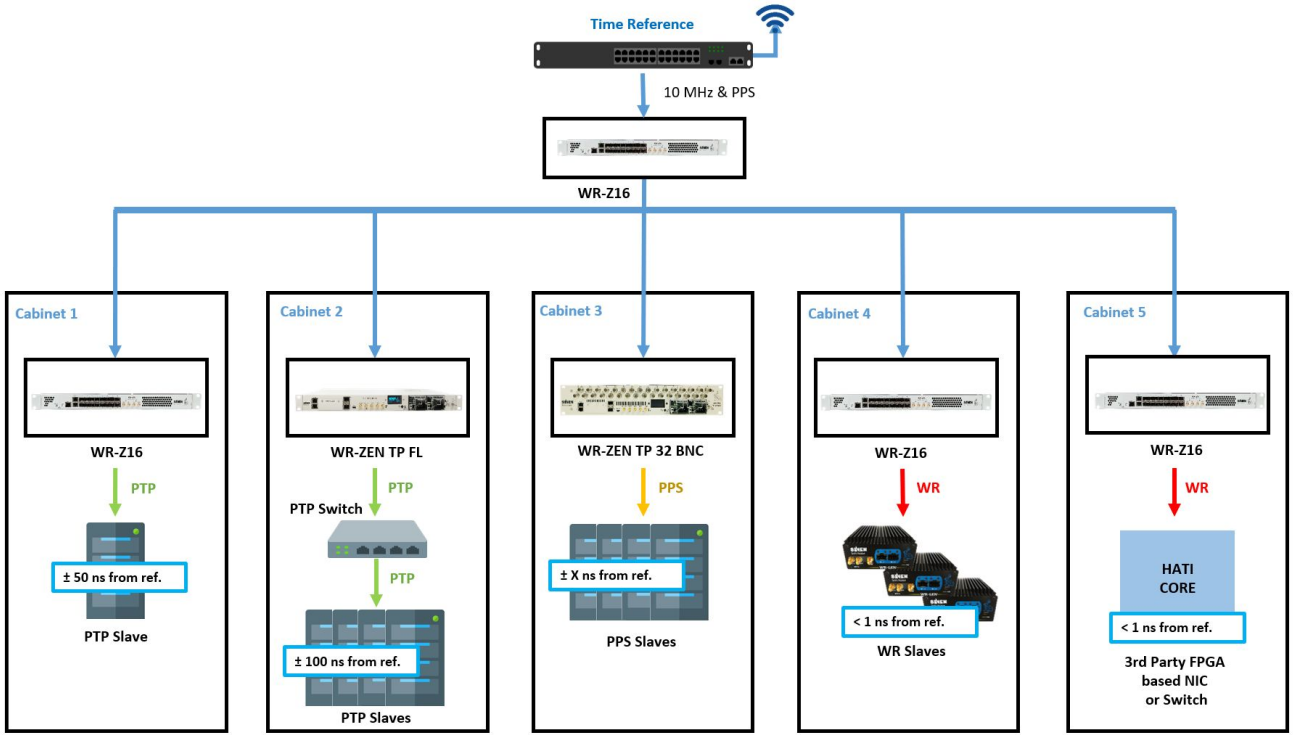


White Rabbit for trading firms

- Better **accuracy** and **precision** between trading sites
  - White Rabbit over DWDM
  - i.e. NJ triangle, Aurora & Cermak
- Auto **failover** between GPS at different sites
  - Ideal if not all sites have GPS capability
  - Holdover as a backup (< 1µs drift over 24 hours)
- **Simplifying** existing PTP/PPS distribution network design
  - White rabbit to existing PTP slaves or end clients
  - Better accuracy
  - <1ns between White rabbit devices
- Leveraging HATI IP core for **direct access** to White Rabbit from FPGA application

Not STAC benchmark

Sub nano data center time distribution

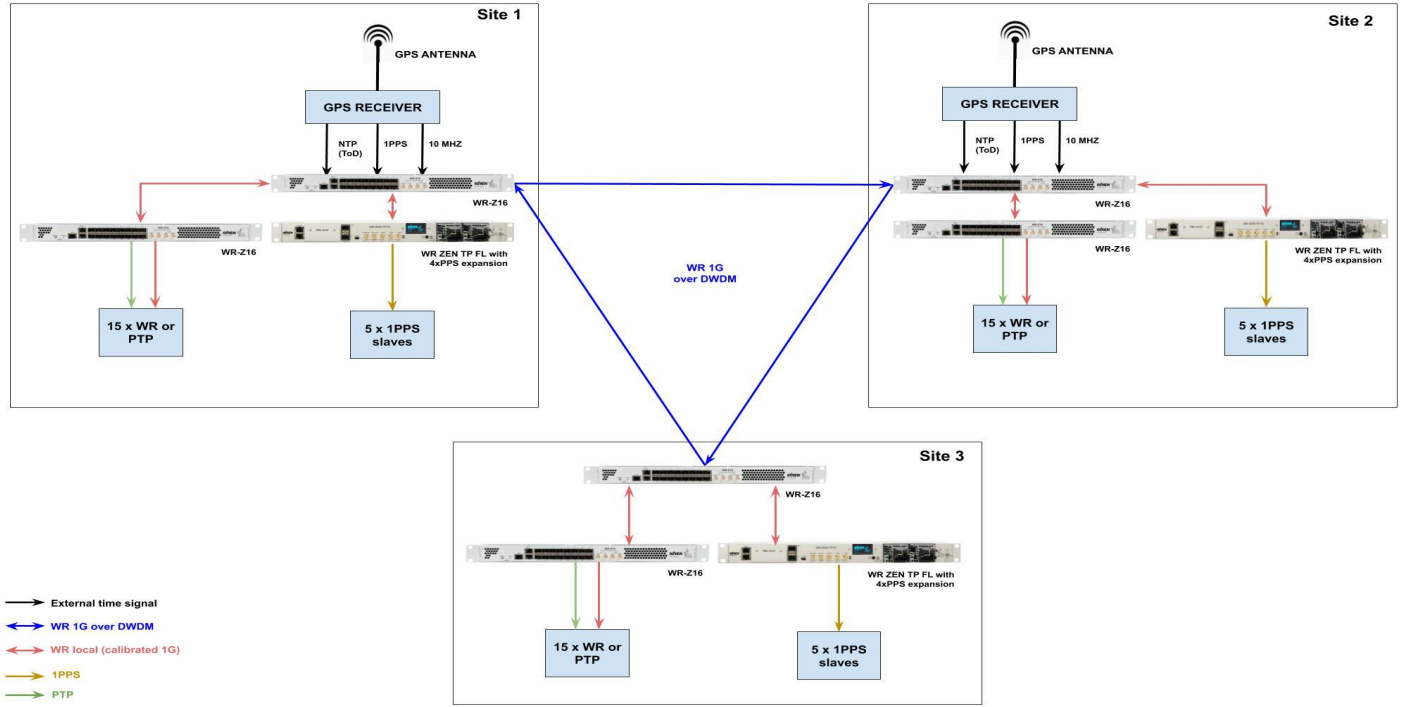


Case study: Proprietary trading firm

- Deployed White Rabbit to **improve accuracy and precision** for internal timestamping
- **Resilience** between sites and time sources a key requirement
  - Not all sites had GPS capability/accessibility
- Leveraging FPGA based timestamping switch to **accurately timestamp** at network points
  - PPS input to switches
- Desired **improvement** with existing PTP services without replacing existing network
  - PPS where high sub-nano accuracy needed <1ns
  - PTP to existing infrastructure with <30 ns accuracy

Not STAC benchmark

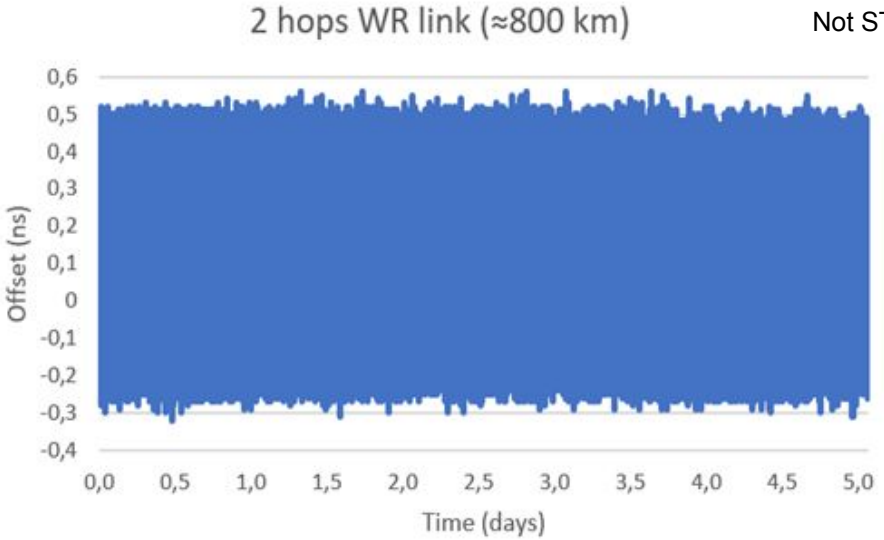
Case study: Proprietary trading firm



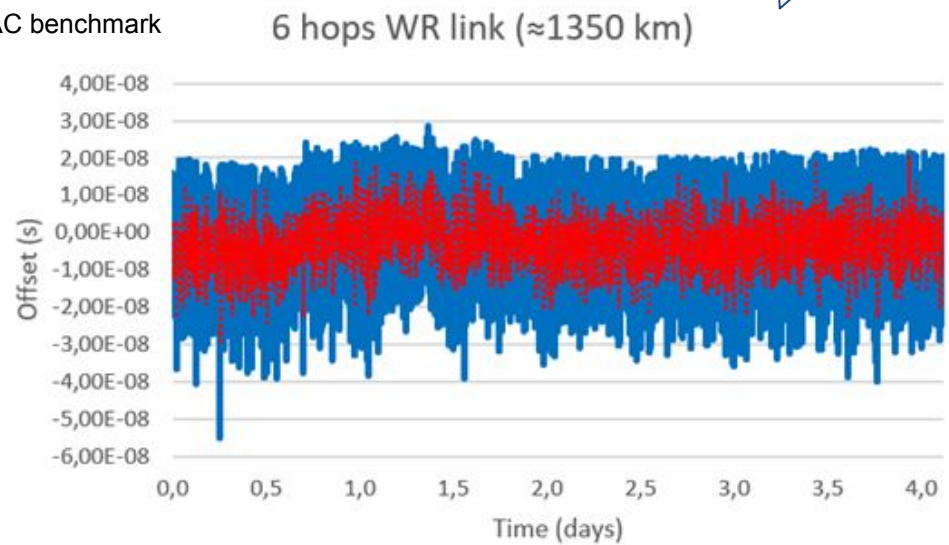
Case study: NJ <-> CHI link

NEW

Not STAC benchmark



Std. Dev. = 139 ps - Pk-pk = 880 ps Mean = 112 ps



Std. Dev. = 10.0 ns - Pk-pk = 83.3 ns Mean = -2.98 ns

https://www.gpsworld.com/white-rabbit-makes-leap-for-time-over-fiber/

Case study: Arista 7130 Metawatch + HATI

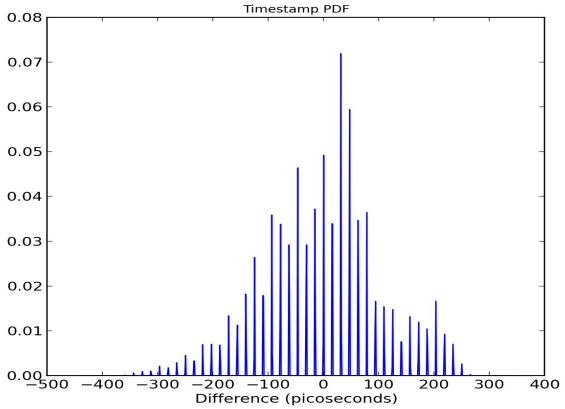
NEW

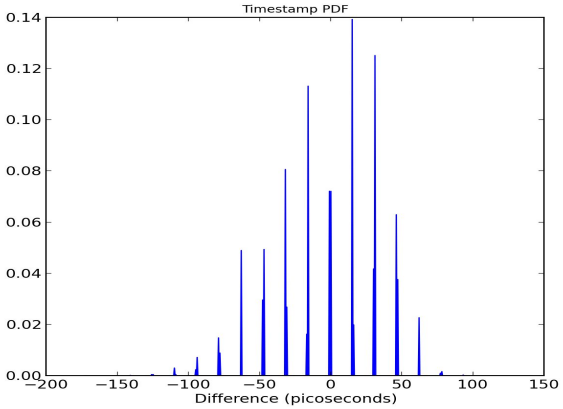
- More **accuracy & precision** for internal timestamping
  - Know when packets were received at gateways, matching engine, distribution points
  - Accurate visibility on how long each component takes
  - Advanced knowledge of client tick-to-trade times
  - Better monitoring, operational capability and management
- Increased time synchronization **scalability**
  - No need for PPS distribution
  - Intra-datacenter sub-nanosecond accuracy using regular fibers
- Timing **monitoring**
  - Available parameters to monitor the timing performance of the HATI core.

Case study: Arista 7130 Metawatch + HATI

NEW

Not STAC benchmark





MetaWatch with PPS

Median	Mid-range	Half-range	Std. dev	Mean
47.000	0.500	390.500	107.219	44.173

MetaWatch with White Rabbit

Median	Mid-range	Half-range	Std. dev	Mean
-62.000	78.000	157.000	36.391	-63.846

HATI Core: Arista 7130 use case

NEW

- **Sub-nanosecond** time accuracy on **Arista 7130.**
- Compatible with **7130L, LB and EH** models**.**
- Distribution over **fiber without calibration** from the WR-Z16**.**
- Working with Arista to integrate **HATI and 7130 applications.**
- **Available** to anyone who wants to develop a **custom application.**

ARISTA

Contact Details

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

- **Check** our webpage: https://sevensols.com/
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- **Meet** the speaker:
  - E-mail: francisco.girela@sevensols.com
  - Available during the whole show!

Don't forget to tick our box and visit our booth!

Thank you for your attention.