# Timing System based on White Rabbit and Time Sensitive Network

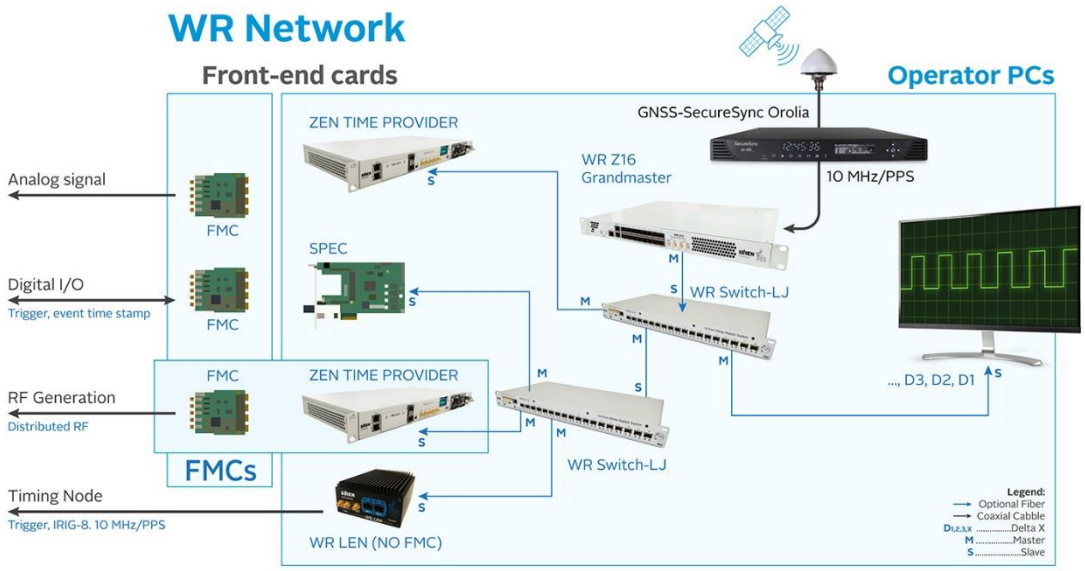
Seven Solutions and Orolia develop the White Rabbit System Network.

One of the crucial elements of any scientific installation, such as a particle accelerator, is the timing system. Timing systems are used to provide accurate timing and stable frequencies to all the elements composing the network as well as generation of discrete events and periodic signals that are shared by the different elements across the installation.

The goal of the White Rabbit timing system will be to provide resilience, time synchronization and frequency distribution while ensuring events and critical message delivery despite data load by using Time Sensitive Network (TSN) Protocols.

## About the White Rabbit Timing System

The graphic below illustrates the joint solution, combining Orolia's accurate timing and resilient technologies to implement a time-triggered control system paradigm and Seven Solutions' Ethernet-based White Rabbit (WR) technology for sub-nanosecond timing distribution, picosecond level frequency spread, timestamp, trigger generation, and control of distributed systems.




This solution includes the use of the Time Sensitive Network (TSN) protocol, enabling fully deterministic packet delivery over loaded Ethernet networks in order to share low latency control and timing packets with best effort data over the same link.

Based on the common time base provided by SecureSync and distributed through WR, with TSN as a deterministic network substrate for latency control, the time triggered control system will be able to provide reliable timing information, across the global network.

## White Rabbit System Network components

### *White Rabbit Technology*

- **Sub-nanosecond** Accuracy
- **Sync-E & PTP (IEE-1588v2)**
- Picosecond-level timestamps
- **Thousands of nodes**
- Distance range over **80 km**
- Robustness & redundancy
- **Self-calibration** over long distances
- **Sub-picosecond RMS Jitter**

### *Time Sensitive Network*

- **Deterministic time transfer accuracy** (<50 ns, based on IEEE 802.IAS gPTP)
- **Traffic prioritization** and shaping over single networking infrastructure
- **Bandwidth optimization** via Frame Preemption mechanism (IEEE 802.3br)
- **Seamless redundancy** for ultra-reliable data streams (based on IEEE 802.1CB)

### *SecureSync*

- **Multi-GNSS, multi reference** Time Server
- **High time-keeping** accuracy with internal TCXO, OCXO or Rubidium oscillators
- **Configuration flexibility** to support a wide variety of timing input/output signals.
- **GNSS and network cybersecurity**

## White Rabbit System Network benefits

The solution facilitates the propagation of secured events and data through a calibration-less timing system with a user-controlled latency and determinism level on advanced time triggered control systems.

## About Seven Solutions

Seven Solutions S.L. is a telecommunications company leader in accurate sub-nanosecond time transfer for reliable industrial and scientific applications. We have more than 15 years of expertise in embedded systems design and control (electronics, firmware, and embedded software), with a remarkable track-record in cutting-edge projects at different sectors such as fintech, avionics, telecommunications, Smart-Grid, space, defence and scientific facilities as particle accelerators and distributed radio-telescopes.

We are leaders in ultra-accurate time transfer and synchronization in the Fintech and Science segments. We were born in the framework of Large Scientific Infrastructures (Industry for Science). In this segment we are continuously growing and consolidating creating break-through solutions for timing and for advanced control systems and diagnosis in particle accelerators. https://sevensols.com/

## About Orolia

Orolia is the world leader in Resilient Positioning, Navigation and Timing (PNT) solutions that improve the reliability, performance and safety of critical, remote or high-risk operations, even in GPS denied environments. With a presence in more than 100 countries, Orolia provides virtually fail-safe GPS/GNSS and PNT solutions for military and commercial applications worldwide. www.orolia.com