

White Rabbit

Sub-nanosecond accuracy and picoseconds precision of synchronization for devices interconnected in a network.

Highlights

Sub-nanosecond Synchronisation

Provides sub-nanosecond accuracy and picoseconds of precision synchronization for devices connected to an ethernet network.

Deterministic Data Transfer

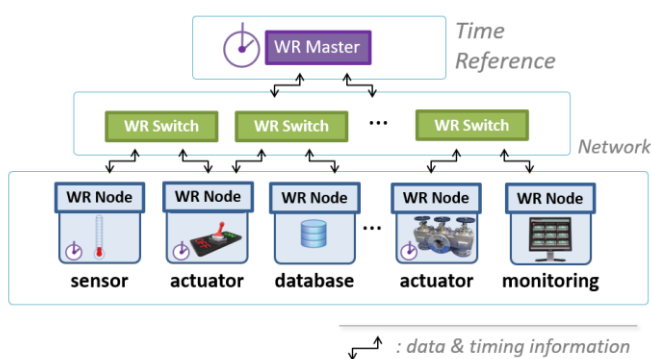
Sends data across the network with a known maximum latency to trigger synchronized events.

Large networks

Thousands of devices can be connected to the same network, which can span more than 1000km.

Keywords

Sub-nanosecond synchronization, deterministic data transfer, timestamping, trigger distribution, ethernet networks



Description

White Rabbit (WR) is a technology developed at CERN, in collaboration with institutes and companies, to synchronise devices in the accelerators down to sub-nanoseconds. At the scale of billionths of a second, the time light takes to travel through a fibre-optic cable and the time the electronics take to process the signal are no longer negligible. To avoid unknown potential delays, the co-inventors of White Rabbit designed a new ethernet switch.

White Rabbit (WR) Technology consists of a set of open-source basic blocks that can be used to implement WR Switches and WR Nodes. When interconnected, WR Switches and WR Nodes create a WR network. Such a network is a PTP-enabled Bridge Local Area Network compatible with IEEE 802.1Q, IEEE 802.3 and IEEE 1588 standards. The sub-nanosecond synchronization is provided only between WR Switches and WR Nodes.

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Advantages

Based on standards

White Rabbit distinguishes itself from other solutions in that it is fully based on industry standards. The concepts behind the White Rabbit Technology were incorporated in the IEEE1588-2019 High Accuracy Profile.

Open Source

White Rabbit can be adapted to your needs and incorporated in your products, modifying, when necessary, the core technology. This open-source technology benefits from a strong global community, centered around the White Rabbit Collaboration.

Commercially available

White Rabbit is a mature technology that can be bought off-the-shelf from a variety of vendors facilitating adoption and uptake.

For further information, please reach out to the CERN Venture Connect Program Manager or the White Rabbit Collaboration Bureau.

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Applications

Existing and emerging applications include:

- High Frequency Trading
- Quantum Networks and Computers
- Telecoms
- Indoor positioning
- Telescopes and other research infrastructure

The applications listed above are only some examples. The versatility of the technology encourages further exploration.

Publication

LIPINSKI, M ET AL. (2011). WHITE RABBIT: A PTP APPLICATION FOR ROBUST SUB-NANOSECOND SYNCHRONIZATION. [Link](#)

About the White Rabbit Collaboration

Launched by CERN in 2024, the Collaboration is a membership-based global community whose objective is to maintain a high-performance open-source technology and foster its uptake by industry. The WR Collaboration Bureau – a dedicated team composed of senior White Rabbit engineers and a community coordinator – was created to support members developing the technology further and incorporating it into their products.



www.white-rabbit.tech