From: pnt-eo@list.nist.gov on behalf of Francisco Girela
Sent: Monday, July 13, 2020 11:01 AM
To: pnt-eo@list.nist.gov
Subject: [pnt-eo] Profile of Responsible Use of PNT Services
Attachments: 7f025956.jpeg; DOT RFI v1 final 5-30-2019.pdf; BME_casestudy_V06.pdf

Categories: Red Category

To whom it may concern,

Please, find attached to this email the RFI from Seven Solutions covering the White Rabbit/IEEE 1588 High Accuracy technology as a timing alternative in case of GNSS disruption.

Identify and describe any approaches, practices, and/or technologies used by the public or private sector to recover or respond to PNT disruptions.

The default version of White Rabbit allows plug-and-play links up to 10 kilometers with sub-nanosecond accuracy. Due to that, this technology has been adopted by many datacenter-centric applications as finance, where clock synchronization accuracy is used for traceability reasons and for enhanced trading strategies.

For example, this technology has been adopted by Deutshe Börse stock exchange in Frankfurt to synchronize all their network capture and timestamping devices and offers this data to their customers as well as a clock reference aligned to the stock exchange reference. In this sector, several US companies already trust in this technology as their main network synchronization mechanism, distributing a time reference between the multiple locations where their trading systems are placed that allows to correlate timestamps, legally trace the events and to enable a back-up reference in case of GPS malfunctioning. The main goal of those companies is not fulfilling the FINRA or SEC regulations but improving their trading capabilities. It is noteworthy that the tick-to-trade time in this sector is tens of nanoseconds, so the accuracy levels required by regulations are not sufficient for many participants. However, high accuracy time synchronization services is actually used for bookkeeping.

Datacenter companies are also pursuing better synchronization performance in their networks as a result of the increasing demand of on-the-cloud services which are distributed in servers placed in several locations inside one datacenter or in different datacenters. Applications like distributed databases or the increasement of cloud-based financial services as cryptocurrencies are leading the adoption of better synchronization beyond the typical NTP accuracy.

In the framework of telecommunication or broadcasting networks, packet-based synchronization is used for timing dissemination to reduce the GNSS dependency, the associated costs and to improve timing performance. In example, Fifth Generation (5G) technologies demand more strict synchronization requirements between 110 and 12.5 nanoseconds and, at the same time, require advanced capabilities related to reliability and redundancy. In the broadcasting industry, a PTP adoption trend has arisen during the last years.

Another critical sector which requires accurate time information is electrical power grids. New smart grids include synchronophasor where data is time sensitive and requires very accurate synchronization mechanism for event timestamping. Additionally, timing information must be provided to the Power Management Unit (PMU) in a reliable way. On the other hand, there are initiatives to promote resiliency practices in timing for electric power grids, i.e. inter-substation timing comparison with GNSS dependency. These new conditions show that timing synchronization requirements are becoming more demanding for this kind of applications.

White Rabbit has been proved to be a resilient time backup to GNSS based sources and it is being used to distribute timing information through optical fibers using already deployed DWDM based networks. In this context, different European funded projects focus on pan-European White Rabbit based clock distribution for scientific and industrial applications as CLOck NETwork Services (CLONETS) or White Rabbit for Industrial Timing Enhancement (WRITE).

Another advantage of this innovative protocol is its capability to improve the reliability of the network. Reliability is defined as the probability of a device performing its intended function under given operating conditions and environments for a specified length of time, including abnormal circumstances. Then, a reliable distributed system should be able to make its functions even if the system is damaged. To do this, White Rabbit has well defined tolerance level that ensures the system reliability even in presence of complex interactions between the different nodes.

This technology is now part of the IEEE 1588-2019 (PTPv2.1) High Accuracy default profile. Thanks to its precision, this technology eases calibration procedures while benefiting from physical communication networks. Additional details about the technology status can be found here: https://ieeexplore.ieee.org/document/9023998

Although there are a lot of resources regarding White Rabbit and it has been adopted by many companies worldwide under confidentiality agreements, a remarkable public use case of White Rabbit is the inter-datacenter time synchronization in a metro area scenario for BME (Spanish Stock Exchange) that we have attached to this text. The technical article can be found here: https://ieeexplore.ieee.org/document/9071992

Additional information from Department Of Transportation RFI where Seven Solutions participated to demonstrate that White Rabbit is capable of providing backup timing services to critical infrastructure in the event of a temporary disruption to GPS is also attached to the document.

Kind regards,
Francisco

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Francisco Girela López - Americas Tech Responsible

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