Accurate Time distribution over fibre networks: present needs, opportunities, and results

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Many industries and academia need precise, reliable and traceable T/F measurements to advance capabilities and security, in particular in key sectors such as telecommunications, power grids, aerospace, calibration and finance. The adoption of new protocols such as Precision-Time-Protocol – White Rabbit (PTP-WR) triggers a new platform for T/F dissemination, allowing Europe companies to bolster their leadership and competitiveness.

For the cited sectors, international recommendations suggest to empower present capabilities of timing traced to UTC. For finance, there is also the new European regulation, known as ESMA-MiFiDII on time-stamping for the stock exchange transactions, requiring from 2018 improved traceability protocols.
Most industries today rely on GNNS for their timing needs, but GNSS cannot offer the resilience and security required in many applications because of severe problems such as spoofing and jamming. Moreover, the most used GNSS today, the GPS, is not formally traced to UTC, and high accuracy profile of PTP-WR will enable better performances.
On the other hand, GNSS Timing and fibre PTP-WR will be complementary, since a GNSS offers timing also in mobility and without the need of a terrestrial distributed infrastructure like the fibre network.

The industrial widespread adoption of PTP-WR needs the achievement of the best performances and robustness on existing telecommunication networks, for technical and economic reasons. The distribution of PTP-WR together with data traffic responds also to the telecom providers need for offering new, added value services over the fibre together with traditional digital services.
Moreover, concerning industrial security, a redundant solution also for timing is beneficial: GNSS and fibre dissemination could coexist for those applications in which security and integrity highly matter. Today such a redundancy of accurate time dissemination is not available or requires significative extracosts to set satellite techniques alternative to the cost-effective GNSS.

INRIM is the Italian Metorlogical Institute, realizes the unit of the time within the International System of units and disseminates the UTC timescale to the country.
Since 2008, INRIM developed new techniques to distribute ultra accurate time and frequency signals over optical fibre.
today, a backbone of 1700 km is under operation, connecting INRIM to seven different academic laboratories, in Bologna, Florence, Rome, Naple and Matera.
The most advanced results have been obtained by the distribution of INRIM's atomic clocks to Medicina (BO) at the INAF radioastronomical facility, at Sesto Fiorentino (FI) to the premises of the European Non-Linear Spectroscopy Laboratory (LENS) and CNR.
Presently, INRIM disseminate also PTP-WR to industrial costumers, in particular to the Financial District in Milano.

At the conference, the use of telecommunication fibre networks to disseminate accurate timing will be described, the obtained results will be analysed and the perspectives will be discussed, in particular in terms of scalability of the different techniques and in terms of convergence for new digital services.