Certified Time Steering and Synchronization

Contact person: Bruno Bertrand, Pascale Defraigne
Observatoire royal de Belgique, bruno.bertrand@oma.be / 02 373 02 83

Introduction

Precise Time is more and more crucial to a great variety of economic activities around the world. Communication systems, electric power grids and financial networks all rely on accurate and reliable timing for synchronization and operational efficiency.

The Royal Observatory of Belgium (ORB) is maintaining the Belgian realization of the international time scale UTC (Universal Time Coordinated), named UTC(ORB). This time scale is built using atomic clocks. It is the most precise time that can be found in the country, with an accuracy of some nanosecond.

In the frame of a project named DEMETRA (www.demetratime.eu), and funded by the European GNSS Agency (GSA) under the European Union's Horizon 2020 program, the ORB developed a prototype of Certified Time Steering and Synchronization based on Galileo observations. The goal is to allow any user to have a precise (at some nanosecond) synchronization of a low cost oscillator on the UTC(ORB) in real time. The main developments and results have been achieved, we are now looking for a transfer of the technology to the industry for user-friendly development and commercialization.

We are making contact with industrial partner with a client portfolio to develop and promote the product.

Certified time steering

The certified time steering service aims to disseminate precise and accurate time using Global Navigation Satellite Systems (GNSS), especially GPS and Galileo.

.The goal is to make a **remote synchronization and steering of an oscillator on a precise time reference** based on an atomic clock aligned on the Universal Time Coordinate, i.e. the international time reference.

.The technique is based on satellite common view and a real-time internet link.

.In addition, a real-time monitoring and certification of the time offset between the user oscillator and the time reference is provided. The system is illustrated in Figure 1.

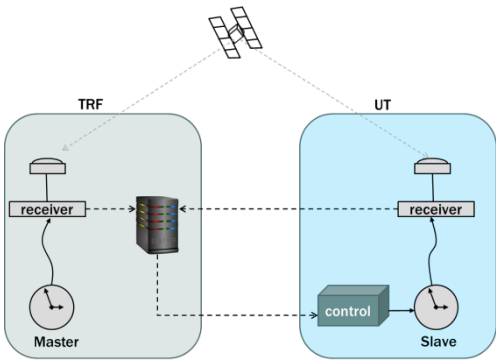

Figure 1. Description of the certified time steering service. The User Terminal (UT) is composed of a steerable oscillator , a GNSS receiver, and a computer with internet connection. The GNSS observations are sent continuously to the Time Reference Facility where the offset between the user oscillator and the time reference is computed from GNSS observations; from these data the TRF sends the correction to apply to the oscillator to stay aligned on the reference time. The computer of the UT receives this correction and sends it to the oscillator. It collects the real-time correction stream in order to discipline the steerable oscillator, and hence to improve its medium term stability.

The prototype build in the frame of the DEMETRA project proved the possibility for synchronization at the level of 5 ns. The frequency stabilities of the UT oscillator was good also, but limited by the performance of the oscillator in terms of frequency correction precision.

Objectives

The goal of the proposed study is

- the possible improvement of the prototype, solving the issues encountered, the service is still not ready and further research and development are required.
- Develop a lower-cost user-friendly equipment that could be consider for commercial distribution. This includes the production cost and break-even point as a function of the number of solutions sold, the study of available pieces in the market, the development of the product in itself as a coherent solution including the station (receiver, antenna, cables), the oscillator and the software easy to install on different platforms with a GUI interface, and the preparation of a user guide according to different configurations and installations specific to some categories of users.
- The performance tests will be realized in the precise time facilities at the Royal Observatory of Belgium (ORB)