Using ePRTC to Deliver a Deterministic Time Base across a Whole Network

In PDH/SDH networks that require a stable frequency to operate efficiently, independence of your timing can easily be achieved by tracing back to one or more Caesium Atomic Clocks (such as ePRTC). In fact, the current international definition of the second derives from the transitions of Caesium-133. A commercial Caesium Atomic Clock will maintain Stratum 1 timing (1E-11) for the lifetime of the Caesium Beam Tube.

Independence from the Sky

Time and phase requirements at the edge of new networks has changed this situation. For example, a standalone Caesium Atomic Clock can only maintain one microsecond for around a month. Not the five, eight or ten-year life of the Tube as before. It's important to remember that you are responsible for maintaining your network's performance and security in challenging circumstances. Jammed GNSS signals may seem relatively trivial, without correct mitigation it could lead to real network problems.

Enhanced Primary Reference Time Clock e(PRTC)

To meet these new challenges, with minimal reliance of GNSS signals from the sky requires the Enhanced Primary Reference Time Clock (ePRTC). When a sky signal is lost, ePRTC uses Caesium as a flywheel technology. Conditioned over several weeks, it is capable of delivering time to within 30ns of UTC and hold to 100ns for 14 days should sky signals be lost. Luckily if this signal is interrupted, the ePRTC should be able to recover in a shorter period that initial conditioning.

Building on the ePRTC, a network can be designed with several ePRTC instances, perhaps alongside PRTC-B GNSS only clocks. Utilising Optical Timing Channels, multiple Time Domains and Class D Boundary Clocks, an entire network (Microchip call this a Virtual Primary Reference Time Clock or vPRTC) can be rolled out. This can be done with all available ports to within 100ns of UTC, built on at least 14-day support of ePRTCs as required.

Summary

In essence, we can use packet-based timing protocols to deliver a deterministic time base across a whole network. Whether it be a city, a country, or several data centres across national boundaries. Except for a global loss of satellite signals, this network will deliver despite any localised issues with GNSS.

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Further reading: Enhanced Primary Reference Time Clock (ePRTC)