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The NIST Special Calibration Service

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Extended Abstract

The Time and Frequency Division of NIST has established a Special Calibration Service to distribute time and frequency data that is directly traceable to UTC(NIST) and through UTC(NIST) to UTC. The service is in addition to the network and broadcast time and frequency services already provided [1]. This new service will have several important aspects, which I will describe in more detail in the presentation. (1) The service will distribute time and frequency information by means of dedicated circuits that will normally be realized with optical fibers, and other transmission media will be considered if they can satisfy the accuracy and stability requirements outlined below. (2) The real-time service data will be completely independent of signals from any satellite system such as GPS or Galileo. (3) The format of the data transmissions will be chosen to conform to the needs of users, and multiple distribution formats will be used if appropriate. The initial design will realize a time accuracy of 1 microsecond with respect to UTC(NIST) at the end-point of the user's equipment, and this accuracy will be improved during the first six months of operation. The ultimate accuracy is expected to be better than 100 nanoseconds, and will probably be limited by the accuracy and stability of the transmission medium and the end-point hardware.

NIST will support the service with ensembles of cesium clocks at its two locations in Boulder, Colorado and Gaithersburg, Maryland. The ensemble of clocks in Boulder provides the primary definition and realization of UTC(NIST), and UTC(NIST) is typically within a few nanoseconds of UTC as computed by the BIPM. The clock ensemble in Gaithersburg, Maryland is calibrated and monitored in real-time by using signals from the GPS satellites in common-view with respect to the clock ensemble in Boulder and by periodic clock trips as required. The uncertainty in the calibration is about 25 ns RMS. The fractional frequency stability of the clock ensemble in Gaithersburg is approximately 2×10^{-14}, which is adequate to support the time accuracy specified in the previous paragraph for several months without external calibration information. A failure in the common-view calibration would therefore not impact the service for several months, and the monitoring system is designed to ignore problems with the accuracy of the signals received from the satellites.

The interface hardware at the NIST end of the circuit will be chosen based on the requirements of the user, and multiple interface methods can be supported if needed. The clock hardware at both sites can provide the usual signals: 1 pps pulses and sine waves at 5MHz and 10 MHz. Other signals and frequencies could be supported, but will probably require additional hardware.

The service can support a direction connection from the NIST clock ensemble to an end-user, although we think it is more likely that a third party will act as the intermediary between NIST and the end users, who may have commercial, financial, or other applications.

The Time and Frequency Division can assist with calibrating and validating the accuracy of the time delivered to end-users or to intermediate distribution points, and the explicit NIST-certified traceability will be determined by these calibrations. The overall accuracy of the service will be monitored in real time and will also be validated by periodic calibrations as required.

The Special Calibration Service is identified as 78100S and the detailed formal announcement is at www.nist.gov/calibrations. Detailed questions about the service can be directed to the author at the address above.

References

[1] The NIST time and frequency services are described at www.nist.gov/pml/time-and-frequency-division/services.