Towards ±1ms accuracy using FonOclock telephone time dissemination system

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Precise measurement of time, its dissemination and synchronization play a pivotal role in almost every aspect. In the era of modern technologies like global positioning systems, synchronization of telecommunication system, secure communications, radio telescopes, air traffic control, stock exchange, space navigation, and satellite systems etc., time synchronization is the utmost requirement [1].CSIR-NPL (NPLI) is the National Metrology Institute (NMI) and a premier R&D laboratory in India which has the mandate for generation and dissemination of Indian Standard Time (IST) and keeping it traceable to international standards. NPLI currently disseminates time through internet and satellites. A new system FonOclock has recently been developed to disseminate IST through telephone lines.

FonOclock is basically a time dissemination system over Public Switched Telephone Network (PSTN). It was designed and developed indigenously at NPLI for more precise time synchronization over telephone network. FonOclock broadly consists of three parts, namely, the transmitter (also known as time server), a transmission channel (PSTN), and a receiver. Both the transmitter and the receiver are embedded with a modem (v.92 56k USB) and a micro-controller (ATMEGA16). The complete time synchronization process is controlled and operated by the on-board microcontroller which is configured with 16MHz crystal oscillator. The clock of the transmitter is synchronized to IST using 1PPS signal from UTC(NPLI).

Time synchronization accuracy using FonOclock has been extensively evaluated using Time Interval Counter (TIC). An accuracy of ±10ms is routinely achieved with the system. From the entire process of evaluation of accuracy and various uncertainty aspects, it was concluded that the delay in synchronization is solely dependent on the instrumentation rather than on communication channel.

In 1992 N. Moriya et. al. from Japan have demonstrated and claimed that a synchronization accuracy within ±1ms was achieved [2-3]. In the present work our focus is to improve the performance of modem and study the various associated uncertainty aspects in order to achieve the synchronization accuracy of ±1ms. It is expected that switching to some other modem may reduce the data channel connection time and also data throughput. These factors are expected to improve the synchronization accuracy. At present, different kinds of USB and serial interface modems are being tested for reduction in buffer time, enhancement in the speed of data transfer and hence the accuracy in time synchronization. The detailed analysis and results will be presented in this paper.

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