



Development of Infrastructure for Precise Time Dissemination Across India

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CSIR – NPL is the National Metrology Institute (NMI) of India and has the responsibility to realize, maintain and disseminate the Indian Standard Time (IST) and keeping it traceable to International Time, i.e., Coordinated Universal Time (UTC) [1,2]. Precise time synchronization is a prerequisite for many of the modern and advanced technologies, ranging from satellite navigation to telecommunications and state of the art scientific research. Considering the critical importance of accurate timekeeping, CSIR-NPL in collaboration with Indian Space Research Organisation (ISRO) and Department of Consumer affairs (DoCA) working towards developing advanced national timing infrastructure at five different laboratories of the Regional Reference Standard laboratory (RRSL), Ministry of Consumer Affair.

Timing infrastructure at each RRSL centre has a redundant timescale, traceable to locally realized Coordinated Universal Time realized at CSIR-NPL, i.e., UTC(NPLI). The timescales consist of four Passive Hydrogen Maser (PHM) and its traceability to the National Time, i.e., UTC(NPLI) will be established through Indian Regional Satellite System (IRNSS) as well as through common view of common view of Global Navigational Satellite Systems (CVGNSS) [3]. The established timing structures at each RRSL centre will contribute for precise and accurate time dissemination across the country.

Furthermore, Network Time Protocol (NTP) and Precision Time Protocol (PTP) servers have been established to support national time dissemination across the country. At present the NTP servers are synchronized to the UTC(NPLI) with nanosecond accuracy and achieving stratum 1 status within the network hierarchy. The time dissemination services from those NTP server is accessible through pre-defined IP addresses and provide reliable and efficient time synchronization through continuous operation as shown in Fig. 1.

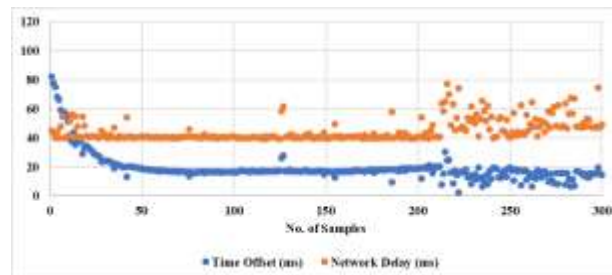


Fig. 1 NTP Service Performance

Following the above describe architecture, time dissemination services through network protocol will start at each of the timing centres of RRSLs and will cause significant enhancement in the national dissemination infrastructure. The current work presents our effort towards developing timing infrastructure for ensuring seamless, precise and accurate time dissemination across the country.

1. Vattikonda, B., Das, M., Bhardwaj, T., Panja, S., Arora, P., Gupta, A. and Aswal, D.K., 2020. Time and Frequency Metrology: Part I: Realization and Dissemination of Indian Standard Time. *Metrology for Inclusive Growth of India*, pp.145-195.
2. Vattikonda, B., Das, M., Bhardwaj, T., Panja, S., Arora, P., Gupta, A. and Aswal, D.K., 2020. Time and frequency metrology. *Metrology for Inclusive Growth of India*, pp.145-195.
3. Arora, A., Dakkumalla, S., Bhardwaj, A.A., Sadasivan, R., Maharana, S., Ganesh, T.S. and Ramakrishna, B.N., 2019, April. An in-house developed Timescale for NavIC PTF. In *2019 European Navigation Conference (ENC)* (pp. 1-6). IEEE.