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Event Reference Synchronization (ERS): Scalable Clock Synchronization for Large-Scale IoT Networks

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Abstract (150 words): This paper addresses clock synchronization in large-scale Internet of Things (IoT) and Industrial Internet of Things (IIoT) deployments. Networked sensor nodes in an industrial plant facilitate real-time optimization of plant operations, fine-grained monitoring, real-time fault detection and fault prediction. Synchronizing thousands of wirelessly connected sensor nodes in a factory environment poses some unique challenges. Though the Precision Time Protocol (PTP), defined in the IEEE 1588 standard, is becoming the dominant clock synchronization method, its requirements of transparent bridges and specialized NICs are at odds with the low-cost devices, whereas, low-cost limited-capability sensor nodes are practical necessity in large-scale deployments. This paper addresses this gap. It presents Event Reference Synchronization (ERS), an asynchronous clock synchronization method for large scale IoT and IIoT networks consisting of predominantly low-cost devices. ERS can provide secure time reference service. Evaluation of ERS on a proof-of-concept test-bed was carried out where all its components were implemented on a low-cost IoT platform. ERS achieved 85 microsecond accuracy despite using software timestamping.

Keywords: Clock Synchronization; Time-of-Day Transfer; Large-Scale Internet of Things; Industrial Internet of Things; Wireless Networks.