

A Synchronization Method for Timing the Network Using Single-TimeSync Frame*

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Abstract. Network synchronization is important to time-sensitive applications. Legacy NTP provides the base time to other network devices. Time accuracy gets lower as the stratum goes down, due to jitter/wander. To solve this problem, IEEE 1588 PTP and IEEE 802.1AS were developed. These technologies, however, have problems with too many messages being generated. Therefore, this paper proposes a synchronization method timing the LANs using Single-TimeSync frame. This method is able to reduce network overload caused by too many messages and the processing complexity of the network devices. This method also has the advantage that does not affect the time accuracy but provides a simple process in each network device. We provide some experimental results on the performance of this method using OPNET.

Key words: Timing and Synchronization, NTP, IEEE 1588 PTP, IEEE 802.1AS, Time-Sensitive Applications

1 Introduction

As multimedia services increase through a network, more service satisfaction can be provided for users. We can already experience Voice Over Internet Protocol (VoIP) and Internet Protocol Television (IPTV), which are various technologies of multimedia services [1][2]. However, current Internet technology has reached its uppermost limits in intercontinental and national services. The Institute of Electrical and Electronics Engineers (IEEE) 802.1 Audio/Video Bridging (AVB) Task Group (TG) has been assembled to overcome these limits [3]. IEEE 802.1 AVB provides new quality of service (QoS) guaranteed networks and supports consumer electronics, Digital Versatile (Video) Disk (DVD), High-Definition Television (HDTV), and High Fidelity (HiFi) Audio, in residential

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areas. Fig. 1 represents the communication between time-sensitive consumer electronics applications in a home network.

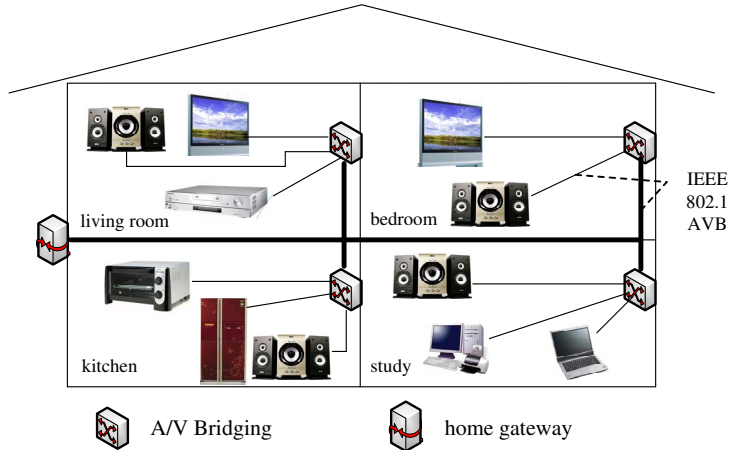


Fig. 1. Communication between time-sensitive consumer electronics applications in home network and the range of IEEE 802.1AVB

Network devices operate the service based on each local clock. Because a local clock of any device is different from another local clock, each time-sensitive application is not synthesize another one. Therefore, every local clock is synchronized with typical local clock (i.e., master clock) in bridged LANs. There are several approaches to network synchronization. Network Time Protocol (NTP) relies on sophisticated mechanisms to access national time, organize time-synchronization subnets, and adjust the local clock in each participating peer [4][5]. IEEE 1588 Precision Time Protocol (PTP) is based on one node transmitting a time synchronization message, followed by another time-synchronization message containing the precise time of the previous time message [6][7].

IEEE 802.1AS enables stations attached to bridged LANs to meet the respective jitter, wander, and time synchronization requirements for time-sensitive applications [8]. IEEE 1588 PTP and IEEE 802.1AS, however, have problems with a lot of unnecessary messages. Therefore, this paper proposes a method of time synchronization for time-sensitive applications using Single-TimeSync frame in bridged LANs. This method is able to reduce network overload by unnecessary messages and processing complexity of the network devices. It also has an advantage in that it does not affect the time accuracy but just provides the required simple process in each network device.

The rest of this paper is organized as follows. In section 2, we deal with a problem caused by the existing methods, NTP, IEEE 1588 PTP, and IEEE 802.1AS. Section 3 presents the proposed method of time synchronization us-

