International Telecommunication Union

ITU-T G.8271.2/Y.1366.2

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TELECOMMUNICATION
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Network limits for time synchronization in packet networks with partial timing support from the network

Recommendation ITU-T G.8271.2/Y.1366.2

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Recommendation ITU-T G.8271.2/Y.1366.2

Network limits for time synchronization in packet networks with partial timing support from the network

Summary

Recommendation ITU-T G.8271.2/Y.1366.2 specifies the maximum network limits of phase and time error that shall not be exceeded. It specifies the minimum equipment tolerance to phase and time error that shall be provided at the boundary of these packet networks at phase and time synchronization interfaces. It also outlines the minimum requirements for the synchronization function of network elements.

Recommendation ITU-T G.8271.2/Y.1366.2 addresses the case of time and phase distribution across a network with the packet-based method with partial timing support to the protocol level from the network.

History

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FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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Recommendation ITU-T G.8271.2/Y.1366.2

Network limits for time synchronization in packet networks with partial timing support from the network

1 Scope

This Recommendation specifies the maximum network limits of phase and time error that shall not be exceeded. It specifies the minimum equipment tolerance to phase and time error that shall be provided at the boundary of these packet networks at phase and time synchronization interfaces. It also outlines the minimum requirements for the synchronization function of network elements.

This Recommendation addresses the distribution of time and phase across a network, using the packet-based method with partial timing support (PTS) to the protocol level from the network. In particular, it applies to the assisted partial timing support (APTS) and PTS architectures described in [ITU-T G.8275] and the precision time protocol (PTP) profile defined in [ITU-T G.8275.2].

This Recommendation addresses the following cases.

1) APTS.

   In the APTS configuration, PTP is used as a backup timing source to a local time reference (e.g., primary reference time clock (PRTC) based on the global navigation satellite system (GNSS)) for durations up to 72 h. It is not intended to use PTP as the primary timing source.

   Network requirements take into consideration the dynamic time error (dTE) generated by the network.

2) PTS from the network.

   In the PTS configuration, PTP is used as the primary source of time to the end application. In this mode, a local time reference (e.g., GNSS) is not available.

   Network requirements take into consideration the combination of both the constant time error (cTE) and dTE components generated by the network.

A network that is based on the architecture defined in [ITU-T G.8265], and is designed to meet the network limits for frequency defined in [ITU-T G.8261.1], is not designed for the delivery of accurate time or phase, which requires much lower levels of packet delay variation (PDV) and asymmetry. The network limits specified in this Recommendation are for small, well-controlled networks (e.g., in-building or last-mile network segments), which can guarantee that the stringent PDV and asymmetry network limits are met. Further guidance can be found in Appendix II.

The main focus of this Recommendation is to meet the requirements of Class 4 in [ITU-T G.8271], Table 1, i.e., a maximum absolute time error of 1.5 µs. Other classes with less stringent requirements are for further study.

The necessary clock specifications are for further study.

The packet networks that are in the scope of this Recommendation are currently limited to the following types:

– Ethernet: [IEEE 802.3] and [IEEE 802.1Q]
– Multiprotocol label switching (MPLS): [IETF RFC 3031] and [ITU-T G.8110]
– Internet protocol (IP): [IETF RFC 791] and [IETF RFC 2460]

The use of other network types are for further study.

The physical layer that is relevant to this specification is the Ethernet media type as defined in [IEEE 802.3].

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2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a standalone document, the status of a Recommendation.

[ITU-T G.810] Recommendation ITU-T G.810 (1996), *Definitions and Terminology for Synchronization Networks*.

[ITU-T G.8110] Recommendation ITU-T G.8110/Y.1370 (2005), *MPLS Layer Network Architecture*.

[ITU-T G.8260] Recommendation ITU-T G.8260 (2020), *Definitions and Terminology for Synchronization in Packet Networks*.

[ITU-T G.8261.1] Recommendation ITU-T G.8261.1/Y.1361.1 (2012), *Packet Delay Variation Network Limits Applicable to Packet-based Methods (Frequency Synchronization).*

[ITU-T G.8265] Recommendation ITU-T G.8265/Y.1365 (2010), *Architecture and Requirements for Packet-based Frequency Delivery*.

[ITU-T G.8271] Recommendation ITU-T G.8271/Y.1366 (2020), *Time and Phase Synchronization Aspects of Telecommunication Networks*.

[ITU-T G.8271.1] Recommendation ITU-T G.8271.1/Y.1366.1 (2020), *Network Limits for Time Synchronization in Packet Networks with full timing support from the network.*

[ITU-T G.8272] Recommendation ITU-T G.8272/Y.1367 (2018), *Timing Characteristics of Primary Reference Time Clocks*.

[ITU-T G.8273.4] Recommendation ITU-T G.8273.4/Y.1368.4 (2020), *Timing Characteristics of Telecom Boundary Clocks and Telecom Time Slave Clocks for Use with Partial Timing Support from the Network.*

[ITU-T G.8275] Recommendation ITU-T G.8275/Y.1369 (2020), *Architecture and Requirements for Packet-based Time and Phase Distribution*.

[ITU-T G.8275.1] Recommendation ITU-T G.8275.1/Y.1369.1 (2020), *Precision Time Protocol Telecom Profile for Phase/Time Synchronization with Full Timing Support from the Network.*

[ITU-T G.8275.2] Recommendation ITU-T G.8275.2/Y.1369.2 (2020), *Precision Time Protocol Telecom Profile for Time/Phase Synchronization with Partial Timing Support from the Network*.

[IEEE 802.1Q] IEEE 802.1Q-2018, *IEEE Standard for Local and Metropolitan Area Network--Bridges and Bridged Networks*.

[IEEE 802.3] IEEE 802.3-2018, *IEEE Standard for Ethernet*.

[IEEE 1588-2008] IEEE 1588-2008, *IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems*.

[IEEE 1588-2019] IEEE 1588-2019, *IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems*.

[IETF RFC 791] IETF RFC 791 (1981), *Internet Protocol (IP)*.

[IETF RFC 2460] IETF RFC 2460 (1998), *Internet Protocol, Version 6 (IPv6) Specification*.

[IETF RFC 3031] IETF RFC 3031 (2001), *Multiprotocol Label Switching Architecture*.

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