



**5G;
5G System (5GS);
Device-Side Time Sensitive Networking (TSN)
Translator (DS-TT) to Network-Side TSN Translator (NW-TT)
protocol aspects;
Stage 3
(3GPP TS 24.535 version 16.1.0 Release 16)**



Reference

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Keywords

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Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

- | | |
|------------------|---|
| shall | indicates a mandatory requirement to do something |
| shall not | indicates an interdiction (prohibition) to do something |

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

- | | |
|-------------------|--|
| should | indicates a recommendation to do something |
| should not | indicates a recommendation not to do something |
| may | indicates permission to do something |
| need not | indicates permission not to do something |

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

- | | |
|---------------|--|
| can | indicates that something is possible |
| cannot | indicates that something is impossible |

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

- | | |
|-----------------|--|
| will | indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document |
| will not | indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document |
| might | indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document |

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the protocols of communication between a DS-TT and a NW-TT as specified in 3GPP TS 23.501 [2] for:

- a) gPTP message delivery.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".
- [3] IEEE 1588-2008: "IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control".
- [4] IEEE Std 802.1AS-Rev/D7.3, August 2018: "IEEE Standard for Local and metropolitan area networks--Timing and Synchronization for Time-Sensitive Applications".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

example: text used to clarify abstract rules by applying them literally.

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.501 [2] apply:

5G System
Time Sensitive Communication
TSN working domain

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

5GS	5G System
DS-TT	Device-Side TSN Translator
gPTP	Generalized Precision Time Protocol
NW-TT	Network-Side TSN Translator
OUI	Organizational Unique Identifier
TSC	Time Sensitive Communication

4 General

For time sensitive communication (TSC), a 5G system (5GS) can be integrated as a bridge in a time-sensitive networking (TSN) network (i.e. a TSN bridge). The device-side TSN translator (DS-TT) is deployed at the UE-side edge and the network-side TSN translator (NW-TT) is deployed at the network-side edge in order to interface with a TSN network while achieving transparency (see 3GPP TS 23.501 [2]).

The DS-TT and NW-TT fulfil all functions related to IEEE 802.1AS [4], which include delivery of generalized precision time protocol (gPTP) messages. Clause 5 describes details of the gPTP message delivery.

5 gPTP message delivery

5.1 Overview

For TSN time synchronization, a 5G system (5GS) can be considered as a time-aware system, which needs to support implementation of generalized precision time protocol (gPTP) requirements (see IEEE 802.1AS [4]).

Within a 5GS, a gPTP message is delivered over the user plane. While the generic mechanisms for the gPTP message delivery are according to IEEE 802.1AS [4], a specific requirement for the DS-TT and the NW-TT is available in terms of the signalling of ingress time. See clause 5.2 for further details.

5.2 Signalling of ingress time for time synchronization

Upon reception of a downlink gPTP message (Sync message for one-step operation or Follow_up message for two-step operation) for a given TSN working domain, the NW-TT shall create an ingress timestamping (TSi) for each gPTP event (Sync) message and add TSi in the Suffix field of the gPTP message encoded as specified in clause 5.3.1.

Upon reception of a gPTP message over the user plane, the UE shall forward the gPTP message to the DS-TT. The DS-TT shall create an egress timestamping (TSe) for every gPTP event (Sync) message. The DS-TT shall use TSi from the Suffix field of the gPTP message (Sync message for one-step operation or Follow_up message for two-step operation) to calculate the residence time spent within the 5G system for the gPTP event (Sync) message expressed in 5GS time as specified in 3GPP TS 23.501 [2] for the corresponding TSN working domain, then shall remove TSi from the Suffix field of the gPTP message before sending the gPTP message toward the downstream TSN node.

In case of multiple TSN working domains, the procedure above is repeated for each TSN working domain sending its own gPTP messages.

5.3 Encoding of organization specific TLV extensions

5.3.1 General

Organization specific TLV extensions are included the Suffix field of a gPTP message as specified in clause 14.3 of IEEE 1588-2008 [3]. The Suffix field is coded as shown in figure 5.3.1.1 and table 5.3.1.1.

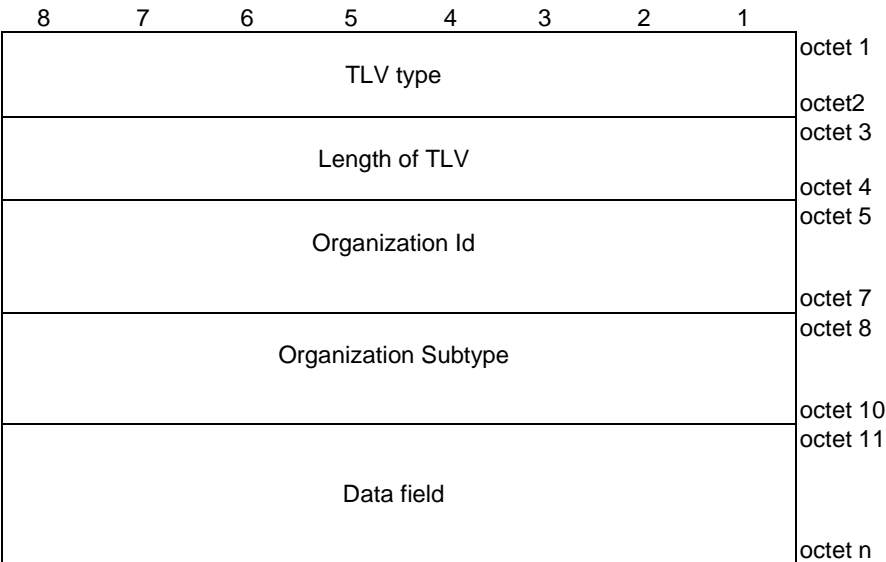


Figure 5.3.1.1: Suffix field

Table 5.3.1.1: Suffix field

TLV type (octets 1 to 2)
This field indicates the type of TLV extension and shall be coded as follows:
- 00003H ORGANIZATION_EXTENSION;
All other values are reserved.
Length of TLV (octets 3 to 4)
This field indicates the length of the value part of the TLV extension (i.e. octets 5 to n) coded in binary over 2 octets.
Organization Id (octets 5 to 7)
This field indicates the value of the Organizational Unique Identifier (OUI) assigned to 3GPP by the IEEE, coded in binary over 3 octets.
Organization Subtype (octets 8 to 10)
This field identifies the type of TLV extension included in the Data field and shall be coded as follows:
- 00000H Reserved;
- 00001H Ingress timestamp
All other values are spare.
Data field (octets 11 to n)
This field contains the contents of the specific TLV extension. Its encoding is specified in the corresponding clause.

Editor's note: The value of the OUI for 3GPP needs to be assigned by the IEEE.

5.3.2 Ingress timestamp

The Data field of a TLV extension carrying an Ingress timestamp is coded as shown in figure 5.3.2.1 and table 5.3.2.1.

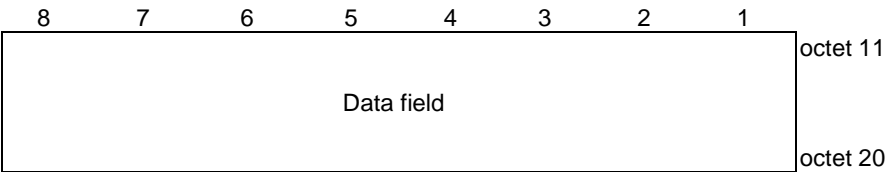


Figure 5.3.2.1: Data field for Ingress time stamp (Organization Subtype = 0001H)

Table 5.3.2.1: Data field for Ingress time stamp (Organization Subtype = 0001H)

Data field (octets 11 to 20)
For Organization Subtype = 0001H, the data field contains the ingress timestamp of the gPTP event (Sync) message, encoded over 10 octets as specified in clause 5.3.3. of IEEE 1588-2008 [3].

Annex A (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2019-08	CT1#119	C1-194647				Draft skeleton provided by the rapporteur	0.0.0
2019-09	CT1#119 CT#85	C1-194650 CP-192258				Implementation of an agreed pseudo CR (C1-194650) Addition of the TS number assigned in CT#85	0.1.0
2019-11	CT1#121					Implementation of the following pseudo CRs agreed by CT1: C1-198476, C1-198749, C1-198750, and C1-199023 Corrections made by the rapporteur	0.2.0
2019-12	CT#86	CP-193151				Presentation for information to TSG CT	1.0.0
2019-12	CT#86	CP-183288				A title corrected	1.0.1
2020-03	CT1#122					Implementation of the following pseudo CR agree by CT1: C1-200734 Corrections made by the rapporteur	1.1.0
2020-03	CT-87e	CP-200167				Presentation for approval to TSG CT	2.0.0
2020-03	CT-87e					Version 16.0.0 created after approval	16.0.0
2020-06	CT-88e	CP-201137	0002	1	F	TSN working domain	16.1.0

History

Document history		
V16.1.0	July 2020	Publication