**3GPP TSG- Meeting # *r12+changes***

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network | **X** |

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| ***Title:***  |  |
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| ***Source to WG:*** | , Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** |  |
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| ***Work item code:*** |  |  | ***Date:*** |  |
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| ***Category:*** |  |  | ***Release:*** |  |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | RAN WG2/3 discussed questions that SA2 had asked in LS (S2-2301463) and provided LS replies to SA2 (R2-2302106 and R3-230811). This CR aligns the description of timing synchronization status reporting based on the inputs from the RAN WGs. |
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| ***Summary of change:*** | The main changes are as follows:1) Adding ITU-T Rec. G.8275.1 among references in clause 2;2) Updating Table 5.27.1.12-1 with parameters and their descriptions based on inputs from RAN WG2/3 in their LS replies, and clarifying that it is up to gNB whether and what parameters it may use to report a time synchronization status (as per RAN WGs statement)3) Specifying which parameters in UMIC can be used to convey information about UPF/NW-TT time synchronization status event4) Clarify that a reference report ID is constructed from a Scope of time synchronization status (TSS) and an Event ID. A scope of TSS supports providing clock quality information for a group of cells within a single gNB.5) Correcting that in case of (g)PTP the TSCTSF determines whether or not the AF-requested Time synchronization error budget can/cannot be met (not clock quality acceptance criteria) as per the latest TR conclusions as specified in [S2-2301461](https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_154AHE_Electronic_2023-01/Docs/S2-2301461.zip). 6) Specify that AF may decline/confirm TSCTSF intentions or modify the service once received notification from the TSCTSF. |
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| ***Consequences if not approved:*** | The ENs remain in the spec although there are LS replies from RAN WGs to address them; incorrect and incomplete specification. |
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| ***Clauses affected:*** | 5.27.1.8, 5.27.1.11, 5.27.1.12, 5.28.3, 6.2.1, 6.2.29 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

>>>> Start of Changes <<<<

#### 5.27.1.8 Exposure of Time Synchronization

5G System supports time synchronization service that can be activated and deactivated by AF. Exposure of time synchronization comprises the following capabilities:

- The AF may learn 5GS and/or UE availability and capabilities for time synchronization service.

- The AF controls activation and deactivation of the time synchronization service for the target UE(s).

- The AF may subscribe to time synchronization service status for the target UE(s).

The AF may use the service-specific parameters to control the time synchronization service for targeted UE(s). These parameters are specified in clause 4.15.9.3 and 4.15.9.4 of TS 23.502 [3] for (g)PTP-based and 5G access stratum-based time synchronization services, respectively.

The AF may subscribe for 5GS and/or UE availability and capabilities for time synchronization service. The AF indicates in the request the DNN, S-NSSAI, and in addition the AF may indicate a list of UE identities or group identity to limit the subscription only to corresponding UEs. If the AF does not indicate DNN, S-NSSAI, the NEF determines the DNN, S-NSSAI based on the AF Identifier.

The TSCTSF (directly or via NEF) exposes the 5GS and/or UE availability and capabilities for synchronization service to the AF as described in clause 4.15.9.2 of TS 23.502 [3]. The exposed information includes the list of user plane node identities, the list of UE identities and may include the supported capabilities for (g)PTP time synchronization service per user plane node and UE.

The AF request to control the (g)PTP time synchronization service is sent to the TSCTSF (directly or via NEF). The request is targeted to a set of AF-sessions that are associated with the exposure of UE availability and capabilities for synchronization service.

The AF may request to use a specific PTP instance type when requesting the (g)PTP-based time synchronization distribution method (IEEE Std 1588 [126] or IEEE Std 802.1AS [104] operation (i.e. as a Boundary Clock, peer-to-peer Transparent Clock, or end-to-end Transparent Clock or as a PTP relay instance)). The request to control the (g)PTP time synchronization service may contain other service parameters as specified in Table 4.15.9.3-1 in clause 4.15.9.3 of TS 23.502 [3].

The AF may request to use the 5G access stratum as a time synchronization distribution method. In this case, the time source is provided by the 5GS. 5G-AN provides the 5GS time to the UE via 3GPP radio access; UE/DS-TT may provide 5G access stratum timing information to end stations using implementation specific means. The request to control the 5G access stratum time distribution (including the parameters such AF requests may contain) is described in clause 4.15.9.4 of TS 23.502 [3].

The AF or NEF selects the TSCTSF as specified in clause 6.3.24.

The AF request may include a time synchronization error budget (see also clause 5.27.1.9). The time synchronization error budget defines an upper bound for time synchronization errors introduced by 5GS.

The AF uses the procedure for configuring the (g)PTP instance in 5GS as described in clause 4.15.9.3 of TS 23.502 [3] and uses the procedure for providing the 5G access stratum time distribution as described in clause 4.15.9.4 of TS 23.502 [3] for the UEs.

The TSCTSF uses the Time Synchronization parameters (Table 4.15.9.3-1 of TS 23.502 [3]) as received from the AF (directly or via NEF) to control the (g)PTP time synchronization service. When IEEE Std 1588 [126] or IEEE Std 802.1AS [104] operation have been selected, the TSCTSF determines the necessary (g)PTP parameters to activate and control the service in DS-TT(s) and NW-TTs. For this purpose, the TSCTSF uses the PMIC or UMIC to manage the IEEE Std 1588 [126] or IEEE Std 802.1AS [104] operation in the DS-TT(s) or NW-TTs, respectively (see clause 5.27.1.4).

The TSCTSF may indicate whether it can support the service or not as per the requested acceptance criteria (e.g.,based on the known timing synchronization status attribute thresholds pre-configured at gNBs) and provide notification when there is a service status update if the AF subscribes to service status updates (see also clause 5.27.1.12).

The TSCTSF uses the Time Synchronization parameters (Table 4.15.9.4-1 of TS 23.502[3]) as received from the AF (directly or via NEF) to control the 5G access stratum time synchronization distribution as described in clause 4.15.9.4 of TS 23.502 [3].

For handling (g)PTP traffic, the PCF, according to PCC rule authorization, chooses a 5QI and dynamically set the PDB and/or MDBV according to requirements for (g)PTP protocol. The PCF provides the SMF with a PCC rule generated based on the AF request to control the (g)PTP time synchronization service. The SMF may take the information in the PCC rule to modify a PDU Session to create or modify or release a QoS Flow for transmitting the (g)PTP messages. The PCF acknowledges the policy request to the TSCTSF. The TSCTSF may report the result of the time synchronization request to the AF (directly or via NEF).

The AF may provide a temporal validity condition to the TSCTSF (directly or via NEF) when the AF activates or modifies the time synchronization service. Temporal validity condition contains the start-time and stop-time (in absolute time value) attributes that describe the time period when the time synchronization service is active for the targeted AF sessions. The TSCTSF manages the temporal validity condition as described in clauses 4.15.9.3 and 4.15.9.4 of TS 23.502 [3].

The AF may provide clock quality detail level and clock quality acceptance criteria to the TSCTSF (directly or via NEF) when the AF activates or modifies the time synchronization service. For ASTI based time synchronization services, the TSCTSF provides the clock quality reporting control information to AMF (see also clause 5.27.1.12).

The AF may provide a requested coverage area for the time synchronization service to the TSCTSF (directly or via NEF) when the AF activates or modifies the time synchronization service. The requested coverage area defines a spatial validity condition for the service using a geographical area (e.g. a civic address or shapes), or a list of Tracking Area Identities (TAIs).

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5.27.1.11 Controlling time synchronization service based on the Subscription

The distribution of timing information, 5G access stratum-based time distribution and (g)PTP-based time distribution, for a UE may be controlled based on subscription data stored in the UDM. The (g)PTP-based or 5G access stratum-based time synchronization service may be provided to a UE based on the UE's subscription which is specified in the TS 23.502 [3] clause 5.2.3.3.1.

The Access and Mobility Subscription data include for the control of 5G access stratum-based time distribution the following information:

- the Access Stratum Time Synchronization Service Authorization, which indicates whether the UE should be provisioned with 5G system internal clock timing information over access stratum as specified in TS 38.331 [28].

- optionally, the Uu time synchronization error budget.

- optionally, one or more periods of start and stop times defining the times when the UE should be provisioned with 5G system internal clock timing information.

- optionally, a Time Synchronization Coverage Area comprising a list of TAs where the UE shall be provisioned with 5G system internal clock timing information.

- optionally, a clock quality detail level indicating whether and which clock quality information to provide to the UE. It comprises one of the following values: clock quality metrics or acceptable/not acceptable indication.

- optionally, the clock quality acceptance criteria for the UE. It may be defined based on one or more attributes listed in Table 5.27.1.12-1 with the exception on PTP clockClass.

Editor's note: Whether PTP clockClass can be used to define acceptance criteria is FFS.

During the Registration procedure, the AMF retrieves the subscription from UDM. If the AMF receives 5G access stratum-based time synchronization service subscription for the given UE, the AMF controls the 5G access stratum-based time distribution:

- If the 5G access stratum-based time synchronization service is allowed for the UE, the AMF provides the 5G access stratum time distribution indication to the NG-RAN so that it can provide 5G timing information to the UE.

- The AMF may provide a Uu time synchronization error budget to the NG-RAN (as described in clause 5.27.1.9). If the UE's subscription contains a Uu time synchronization error budget, then AMF sends it to NG-RAN. Otherwise, the AMF uses the pre-configured Uu time synchronization error budget and sends it to NG-RAN.

- If the UE's subscription contains Coverage Area (defined as a list of TAs), the AMF configures the NG-RAN to provide the 5G timing information to UE only when the UE is in the Coverage Area as described in clause 5.27.1.10.

- If the AMF receives the start and stop times, then the AMF enables and disables the 5G access stratum time distribution indication to the NG-RAN according to the expiry of start and stop times if the UE is in CM\_Connected state. If the UE is in CM\_Idle state when a Start time condition is met, the AMF pages the UE and provides the 5G access stratum time distribution indication to NG-RAN as part of the subsequent service request procedure initiated by the UE in the response to the paging.

- If the AMF receives the clock quality detail level, then the AMF configures the NG-RAN to provide clock quality detail information reporting to UE as described in clause 5.27.1.12. The AMF may instruct the UE to reconnect to the network when the UE detects that the RAN timing synchronization status has changed while the UE is in RRC\_INACTIVE or RRC\_IDLE, as described in clause 5.27.1.12.

- If the AMF receives the same parameters both in the Access and Mobility Subscription data from UDM and in the AM Policy from PCF, the AMF shall use the value received from the AM policy

The Time Synchronization Subscription data is the subscription data for the control of (g)PTP-based time distribution and 5G access stratum-based time distribution and includes the following information:

- the "AF request Authorization", indicating whether the UE is authorized for an AF-requested 5G access stratum-based time distribution and (g)PTP-based time distribution services. The indication is provided separately for each service:

- "allowed" or "not allowed" for (g)PTP based time synchronization service (per DNN/S-NSSAI and UE identity),

- "allowed" or "not allowed" for ASTI based time synchronization services (per UE identity).

- optionally, a list of TA(s) which specifies an area (a so called Authorized Time Synchronization Coverage Area) in which an AF may request time synchronization services.

- optionally, one or more periods of authorized start and stop times, which indicates the allowed time period during which an AF may request time synchronization services.

- optionally, authorized Uu time synchronization error budget, which indicates the limit the AF may request. When this field exists, the indication on "allowed" or "not allowed" for ASTI based time synchronization services (per UE identity) is set to allowed.

- one or more Subscribed time synchronization service ID(s), each containing the DNN/S-NSSAI and a reference to a PTP instance configuration pre-configured at the TSCTSF (e.g. PTP profile, PTP domain, etc.):

- optionally, for each PTP instance configuration, one or more periods of start and stop times defining active times of time synchronization service for the PTP instance.

- optionally, for each PTP instance configuration, a Time Synchronization Coverage Area defining a list of TAs where the (g)PTP-based time synchronization is available for the UEs in the PTP instance.

- optionally, for each PTP instance configuration, Uu time synchronization error budget.

The TSCTSF retrieves the Time Synchronization Subscription data from UDM. If the TSCTSF receives the Time Synchronization Subscription data for a UE, the TSCTSF controls the Time Synchronization Service including (g)PTP-based time distribution and 5G access stratum-based time distribution:

- The TSCTSF retrieves the Time Synchronization Subscription data from the UDM when the TSCTSF receives an AF request for the time synchronization service (either ASTI or (g)PTP):

- According to the "AF request Authorization" in the UE's Time Synchronization Subscription data, the TSCTSF determines whether the UE is authorized for an AF-requested time synchronization service. If the UE's Time Synchronization Subscription data contains an Authorized Time Synchronization Coverage Area (i.e. a list of TA(s) defining the restricted area for AF request), whether the UE is in the authorized area. If the requested Coverage Area (see clause 5.27.1.10) is within the Authorized Time Synchronization Coverage Area, the TSCTSF uses the requested Coverage Area. If the Authorized Time Synchronization Coverage Area is inside of the requested Coverage Area, the TSCTSF uses the Authorized Time Synchronization Coverage Area. If the requested Coverage Area partly overlaps with the Authorized Time Synchronization Coverage Area, the TSCTSF uses the interclause of them. If there is no overlap between them, the TSCTSF shall reject the AF request. If the AF request is authorized, the TSCTSF proceeds as specified in clause 5.27.1.8 and TS 23.502 [3]. Otherwise, the TSCTSF rejects the AF request.

- If the UE's Time Synchronization Subscription data contains authorized Uu time synchronization error budget, the TSCTSF checks whether the Uu time synchronization error budget derived from AF request satisfies (i.e. equal or larger than) the authorized Uu time synchronization error budget.

- If the UE's Time Synchronization Subscription data contains an Authorized Time Synchronization Coverage Area (i.e. a list of TA(s) defining the restricted area for AF request), the TSCTSF checks whether the AF requested Coverage Area satisfies (i.e. within) the subscribed Time Synchronization Coverage Area.

- If the UE's Time Synchronization Subscription data contains periods of authorized start and stop times, the TSCTSF checks whether the AF requested temporal validity condition satisfies (i.e. within) any of the periods of authorized start and stop times.

- The TSCTSF retrieves the Time Synchronization Subscription data from the UDM when it receives notification from the PCF that a UE has established a PDU Session that is potentially impacted by (g)PTP-based time synchronization service:

- The TSCTSF retrieves the PTP instance configurations referenced from the "Subscribed time synchronization service ID(s)". The PTP instance configurations are stored locally in the TSCTSF. The TSCTSF determines if one or more of the PTP instance configurations match with the DNN/S-NSSAI of the given PDU Session. If no PTP instance exists for the given PTP instance configuration, the TSCTSF initializes the PTP instance in 5GS as described in clause K.2.2 of TS 23.501 [2].

- The TSCTSF configures a PTP port in DS-TT and adds it to the corresponding PTP instance in NW-TT as described in clause K.2.2 of TS 23.501 [2].

- If the PTP instance configuration referenced by UE's Time Synchronization Subscription data contains an Uu time synchronization error budget, then the TSCTSF uses it to derive an Uu time synchronization error budget available for the NG-RAN to provide the 5G access stratum time for the UE as specified in clause 5.27.1.9.

- If the PTP instance configuration referenced by the Time Synchronization Subscription data for the UE contains start and stop times, the TSCTSF, upon expiry of start time, creates the PTP instance and adds the PTP port in DS-TT to the PTP instance. Upon expiry of stop time, if this is the last period of start and stop times in the PTP instance configuration, the TSCTSF deletes the PTP instance, otherwise the TSCTSF temporarily disables the PTP instance.

- If the PTP instance configuration referenced by the Time Synchronization Subscription data for the UE contains a Time Synchronization Coverage Area, the TSCTSF subscribes to UE's Presence in Area(s) of Interest corresponding to the Time Synchronization Coverage Area at the discovered AMF(s). When the TSCTSF determines that the UE has moved inside or outside of the Time Synchronization Coverage Area, the TSCTSF adds or temporarily removes the PTP port in DS-TT from the corresponding PTP instance.

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#### 5.27.1.12 Support for network timing synchronization status monitoring

While the time synchronization service is offered by the 5GS, based on 5G access stratum-based time distribution or (g)PTP-based time distribution, the network timing synchronization status of the nodes involved in the operation (e.g. gNBs and/or UPF/NW-TTs) may change. gNBs and UPF/NW-TT can detect timing synchronization degradation or improvement locally. The support for network timing synchronization status monitoring enables the 5GS to modify time synchronization service for a UE or a group of UEs depending on the current synchronization status and notify service updates. There may be three consumers of this information:

- TSCTSF may receive node-level information about timing synchronization status from gNB and/or UPF/NW-TT directly from OAM or alternatively, if supported by a node, using control plane signalling at node level. Node level signalling uses UMIC for UPF/NW-TT case and an AMF service to report N2 node level information for gNB case. In the latter case, the AMF controls the gNB node level reporting and subscription using NGAP messages (see TS 38.413 [34]).

- AF may subscribe to time synchronization status notifications for a UE or group of UEs for which the AF requests or has requested time synchronization service (for 5G access stratum time distribution or (g)PTP services).

- For 5G access stratum time synchronization service, the UE may receive clock quality information from the gNB based on UE subscription data stored in the UDM (see clause 5.27.1.11) or AF request for clock quality reporting to the UE.

When activating time synchronization for a UE, TSCTSF requests the AMF (via PCF using AM policy) to instruct the UE to transition to the RRC\_CONNECTED state in the case when the UE later detects that the gNB timing synchronization status has changed while the UE is in the RRC\_INACTIVE or RRC\_IDLE state. When the UE wants to access the 5GS, the UE shall perform Unified Access Control as defined in TS 38.331 [28].

gNBs may be pre-configured with thresholds for each timing synchronization status attribute, if supported, that is described in Table 5.27.1.12-1. When the network timing synchronization status exceeds the thresholds (i.e. status degradation), or the network timing synchronization status meets the thresholds again (i.e. status improvement), the gNB notifies the TSCTSF (either using N2 node level signalling via AMF, or via OAM) with the gNB ID, the scope of the timing synchronization status (i.e., all cells or a list of Cell IDs within a single gNB) and the corresponding network timing synchronization status (TSS) attributes as described in this clause. The gNB indicates the status change to the UEs via SIB9:

- When the network timing synchronization status exceeds any of the pre-configured thresholds, the gNB includes in SIB9 a reference report ID. When the network timing synchronization status meets the thresholds again (i.e. status improvement), the gNB stops broadcasting the reference report ID in SIB9. Either event serves as a notification for the UEs reading the SIB9 that there is new TSS information available.

- If supported, the UE in the RRC\_INACTIVE or RRC\_IDLE state compares the reference report ID in SIB9 (or lack of reference report ID) with its locally stored reference report ID to determine whether it has the lastest available clock quality information already or it needs to transit to the RRC\_CONNECTED state to retrieve it. A reference report ID consists of a scope of the TSS and an Event ID. The Event ID is an integer indicating that the clock quality information change has been detected by a gNB. A scope of the TSS supports providing TSS information for a group of cells within a single gNB.

- If the UE is instructed by AMF (via the Registration procedure, the UE Configuration Update procedure, or via DL NAS TRANSPORT message) to reconnect to the network in the case when the UE determines that the reference report ID has changed or based on UE local configuration, the UE in the RRC\_INACTIVE or RRC\_IDLE state, if supported by the UE, reconnects to the network. RAN may delay or prioritize UE’s transition to the RRC\_CONNECTED state using the UAC framework [28], i.e., UEs are not expected to transition to the RRC\_CONNECTED state immediately after determining that the clock quality information has changed and receiving instructions from the AMF. After the UE has reconnected to the network, the gNB uses unicast RRC signaling to provision the clock quality information to the UEs.

The network timing synchronization status information from gNB or UPF/NW-TT to the TSCTSF may contain the following information as described in the Table 5.27.1.12-1. However, it is up to gNB to determine whether to provide its timing synchronization status reporting and which of the information elements to include in the TSS report to the TSCTSF, i.e., based on the implementation gNB may report all, some, or none of the information elements from Table 5.27.1.12-1.

Table 5.27.1.12-1: Information elements that gNB or UPF/NW-TT timing synchronization status information may contain (all optional)

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| Information Name | Description |
| Synchronization state | Indicates the state of the node synchronization, represented by the values "Locked", "Holdover", or "Freerun" (NOTE 1). |
| Clock quality |  |
| >> Traceable to GNSS | Indicates whether the current time source is traceable to the GNSS and represented by values “Yes” or “No”  |
| >> Traceable to UTC | Indicates whether the current time source is traceable to the UTC and represented by values “Yes” or “No” |
| >> Frequency stability | Describes the estimate of the variation of the local clock when it is not synchronized to another source (NOTE 2). |
| >> PTP clockClass | The attribute is defined in Table 5.28.3.1-2 and available under the assumption that the nodes is synchronized using (g)PTP. |
| >> Clock Accuracy | Describes the mean in ns over an ensemble of measurements of the time between the clock under test and a reference clock (NOTE 3). |
| Parent time source | Describes the primary source the node is currently using, represented by the values "PTP", "GNSS", "atomic clock", "terrestrial radio", "serial time code", "NTP", "hand\_set", "other". |
| NOTE 1: Clock is in the "Locked", "Holdover", or "Freerun" mode, as defined in ITU‑T G.810 [164].NOTE 2: Frequency stability is estimated in a similar manner as for offsetScaledLogVariance attribute defined in clause 7.6.3.5 of IEEE Std 1588 [126].NOTE 3: Clock accuracy measurement considers accuracy up to gNB antenna and RAN internal process. |

The TSCTSF determines the UEs impacted by gNB’s timing synchronization status change (i.e. degradation, failure or improvement) or UPF timing synchronization status change (only for the case when UPF/NW-TT is involved in providing time information to DS-TT).

- For gNB case, when the TSCTSF receives information about timing synchronization status change, the TSCTSF discovers the AMFs serving the impacted gNBs and subscribes to receive notifications for UE’s presence in Area of Interest information. The Area of Interest is set to the scope of the timing synchronization status (i.e., a gNB ID or a group of cells within the gNB specified with a list of Cell IDs that has reported status degradation (i.e. the pre-configured thresholds are exceeded in the gNB) from AMF as described in clause 5.3.4.4. The subscription is targeted to any UE in the AMF. When the AMF notifies the TSCTSF for the UE presence in Area of Interest, the TSCTSF correlates information about impacted gNBs and the UE location information received from the AMF. If the gNB notifies the TSCTSF for the status improvement (i.e. the pre-configured thresholds are met in the gNB), the TSCTSF modifies the subscription to remove the corresponding Area of Interest from the subscription.

- For UPF case, the TSCTSF determines the UEs for which the impacted UPF/NW-TT is configured to send (g)PTP messages on behalf of DS-TT (see clause 5.27.1.7).

If gNB’s or UPF’s timing synchronization status change, the TSCTSF may perform the following:

- For AFs that subscribe for 5G access stratum time synchronization service or (g)PTP time synchronization service status update (i.e. change in support status of the clock quality acceptance criteria provided by the AF and specified using TSS attributes from Table 5.27.1.12-1), the TSCTSF may provide notification towards the AF when there is a change in support status for a UE or group of UEs.

- Deactivating/reactivating/updating time synchronization services:

- (g)PTP time synchronization service case: For UEs that are part of a PTP instance and which are impacted by NG-RAN or UPF time synchronization status degradation or improvement:

- If TSCTSF determines that the clock quality acceptance criteria provided by AF can still be met, then TSCTSF may update the clockQuality information sent in Announce messages (see clause 7.6.2 of IEEE 1588 [8]) for the PTP instance using existing procedures and existing PMIC/UMIC information. The handling of Announce messages follows existing procedures as described in clause 5.27.1.6.

- If TSCTSF determines that the clock quality acceptance criteria provided by AF cannot be met, then TSCTSF informs the AF for the corresponding PTP port being inactive due to the result of fulfilling the clock quality acceptance criteria; and the TSCTSF temporarily removes the UE/DS-TT from the PTP instance using the procedure in clause K.2.2.1 and clause K.2.2.4. AF may send a service update or delete request (see clauses 4.15.9.3 of TS 23.502 [3]).

- If TSCTSF determines that the clock quality acceptance criteria provided by AF can be met again then TSCTSF informs the AF about the result, adds the DS-TT PTP port to the PTP instance again and re-activates the Grandmaster functionality.

For 5G access stratum time synchronization service, clock quality reporting control information manages the gNBs timing synchronization status reporting to the UE. When AMF provides the 5G access stratum time distribution indication and the Uu time synchronization error budget to gNB, the AMF also includes the clock quality reporting control information (CQRCI) provided by the TSCTSF or retrieved from UDM. CQRCI may be a part of Access and Mobility Subscription data at the UDM, and AF may include CQRCI in its request. CQRCI contains the following fields:

- Clock quality detail level. It indicates whether and which clock quality information to provide to the UE and can take one of the following values: clock quality metrics or acceptable/not acceptable indication.

- If the clock quality detail level equals "clock quality metrics", the NG-RAN provides clock quality metrics to the UE that reflect its current timing synchronization status. Clock quality metrics refers to one or more of the following information elements: clock accuracy, traceability to UTC and to GNSS, frequency stability, parent time source, synchronization state as defined in Table 5.27.1.12-1.

- If the clock quality detail level equals "acceptable/not acceptable indication", clock quality acceptance criteria for the UE. The gNB provides an acceptable indication to the UE if the gNB's timing synchronization status matches the acceptance criteria received from the AMF; otherwise, the gNB indicates "not acceptable" to the UE. Clock quality acceptance criteria can be defined based on one or more information elements listed in Table 5.27.1.12-1 with the exception on PTP clockClass. If AF includes clock quality acceptance criteria in its request towards TSCTSF, the AF shall be notified about the result once TSCTSF determines whether the clock quality acceptance criteria can be met or not. Based on the notification, the AF may decide to modify the service if preferred (e.g., disable the service upon degradation or enable it again upon recovery).

When determining the clock quality metrics for a UE and when determining whether clock quality is acceptable or not acceptable for a UE, gNB considers whether propagation delay compensation is performed.

NOTE X: In this release, UE capabilities and internal inaccuracies are assumed to be budgeted by the client network operator when agreeing the required clock accuracy with the 5G network operator.

To provision clock quality information to the UEs, a gNB uses unicast RRC signaling:

- For UEs in the RRC Connected state, the gNB uses unicast RRC signaling.

- UEs that are not in the RRC\_CONNECTED state first need to establish or resume the RRC connection to receive the TSS information from the gNB via unicast RRC signaling.

>>>> Next Change <<<<

### 5.28.3 Port and user plane node management information exchange in 5GS

#### 5.28.3.1 General

Port number for the PDU Session is assigned by the UPF during PDU session establishment. The port number for a PDU Session shall be reported to the SMF from the UPF and further stored at the SMF. The SMF provides the port number via PCF to the TSN AF or TSCTSF. TSN AF or TSCTSF maintains an association between the port number for the PDU Session and the DS-TT port MAC address (with Ethernet type PDU session) or IP address (applicable for TSCTSF only, with IP type PDU Session) of the UE. If a PDU session for which SMF has reported a port number to TSN AF or TSCTSF is released, then SMF informs TSN AF or TSCTSF accordingly. The port number for the PDU Session corresponds to the device side port of the 5GS bridge/router. When the device supports the DS-TT functionality, the port number represents the DS-TT port number corresponding to the given PDU Session.

NOTE 1: Port number can refer either to Ethernet port or PTP port. In Ethernet type PDU Sessions, it is assumed that the PTP port number is the same as the associated Ethernet port number.

When the DS-TT or the NW-TT functions are used, the 5GS shall support transfer of standardized and deployment-specific port management information transparently between TSN AF or TSCTSF and DS-TT or NW-TT, respectively inside a Port Management Information Container. NW-TT may support one or more ports. In this case, each port uses separate Port Management Information Container. 5GS shall also support transfer of standardized and deployment-specific user plane node management information transparently between TSN AF or TSCTSF and NW-TT, respectively inside a User Plane Node Management Information Container. Table 5.28.3.1-1 and Table 5.28.3.1-2 list standardized port management information and user plane node management information, respectively.

If TSN AF is deployed, i.e. if 5GS is integrated with an IEEE TSN network, the port and user plane node management information is exchanged between CNC and TSN AF. The port management information is related to ports located in DS-TT or NW-TT. The user plane node management information container is related to 5GS bridge management.

If TSN AF is not deployed, the port and user plane node management information is exchanged between TSCTSF and DS-TT/NW-TT.

NOTE 2: The time synchronization parameters used in Port Management Information Container and User Plane Node Management Information Container are from IEEE Std 1588 [126], Edition 2019, and from IEEE Std 802.1AS [104]. Since the IEEE time synchronization data sets are not exposed, care needs to be taken when interoperating with devices supporting Edition 2008, IEEE Std 1588-2008 [107] (which can be the case when operating under the SMPTE profile, ST 2059-2:2015 [127]) and using a common management.

Table 5.28.3.1-1: Standardized port management information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Port management information | Applicability (see NOTE 6) | Supported operations by TSN AF | Supported operations by TSCTSF | Reference |
|  | DS-TT | NW-TT | (see NOTE 1) | (see NOTE 1) |  |
| **General** |  |  |  |  |  |
| Port management capabilities (see NOTE 2) | X | X | R | R |  |
| **Bridge delay related information** |  |  |  |  |  |
| txPropagationDelay | X | X | R | - | IEEE Std 802.1Qcc [95] clause 12.32.2.1 |
| txPropagationDelayDeltaThreshold (see NOTE 23) | X | X | RW |  |  |
| **Traffic class related information** |  |  |  |  |  |
| Traffic class table | X | X | RW | - | IEEE Std 802.1Q [98] clause 12.6.3 and clause 8.6.6. |
| **Gate control information** |  |  |  |  |  |
| GateEnabled | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-29 |
| AdminBaseTime | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-29 |
| AdminControlList | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-29 |
| AdminCycleTime (see NOTE 3) | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-29 |
| AdminControlListLength (see NOTE 3) | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-29 |
| AdminCycleTimeExtension | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-29 |
| Tick granularity | X | X | R | - | IEEE Std 802.1Q [98] Table 12-29 |
| SupportedListMax | X | X | R | - | IEEE Std 802.1Q [98] Table 12-29 |
| **General Neighbor discovery configuration****(NOTE 4)** |  |  |  |  |  |
| adminStatus | D | X | RW | - | IEEE Std 802.1AB [97] clause 9.2.5.1 |
| lldpV2LocChassisIdSubtype | D | X | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2LocChassisId | D | X | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2MessageTxInterval | D | X | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2MessageTxHoldMultiplier | D | X | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| **NW-TT port neighbor discovery configuration** |  |  |  |  |  |
| lldpV2LocPortIdSubtype |  | X | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2LocPortId |  | X | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| **DS-TT port neighbor discovery configuration** |  |  |  |  |  |
| lldpV2LocPortIdSubtype | D |  | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2LocPortId | D |  | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| **Neighbor discovery information for each discovered neighbor of NW-TT (NOTE 26)** |  |  |  |  |  |
| lldpV2RemChassisIdSubtype |  | X | R | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2RemChassisId |  | X | R | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2RemPortIdSubtype |  | X | R | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2RemPortId |  | X | R | - | IEEE Std 802.1AB [97] Table 11-2 |
| TTL |  | X | R | - | IEEE Std 802.1AB [97] clause 8.5.4 |
| **Neighbor discovery information for each discovered neighbor of DS-TT****(NOTE 5)** |  |  |  |  |  |
| lldpV2RemChassisIdSubtype | D |  | R | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2RemChassisId | D |  | R | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2RemPortIdSubtype | D |  | R | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2RemPortId | D |  | R | - | IEEE Std 802.1AB [97] Table 11-2 |
| TTL | D |  | R | - | IEEE Std 802.1AB [97] clause 8.5.4.1 |
| Information for deterministic networking for each NW-TT port (NOTE 27) |  |  |  |  |  |
| Interface information |  |  |  |  |  |
| Interface type |  | X |  | R | IETF RFC 8343 [151] |
| Interface enabled status |  | X |  | R | IETF RFC 8343 [151] |
| phys-address |  | X |  | R | IETF RFC 8343 [151] |
| IPv4 information |  |  |  |  |  |
| IPv4 enabled status |  | X |  | R | IETF RFC 8344 [152] |
| IPv4 forwarding status |  | X |  | R | IETF RFC 8344 [152] |
| IPv4 MTU |  | X |  | R | IETF RFC 8344 [152] |
| Information for each IPv4 address |  |  |  |  |  |
| IPv4 address |  | X |  | R | IETF RFC 8344 [152] |
| prefix-length |  | X |  | R | IETF RFC 8344 [152] |
| netmask |  | X |  | R | IETF RFC 8344 [152] |
|  origin |  | X |  | R | IETF RFC 8344 [152] |
| Information for each IPv4 neighbor |  |  |  |  |  |
| IPv4 address |  | X |  | R | IETF RFC 8344 [152] |
| link-layer-address |  | X |  | R | IETF RFC 8344 [152] |
| origin |  | X |  | R | IETF RFC 8344 [152] |
| IPv6 information |  |  |  |  |  |
| IPv6 enabled status |  | X |  | R | IETF RFC 8344 [152] |
| IPv6 forwarding status |  | X |  | R | IETF RFC 8344 [152] |
| IPv6 MTU |  | X |  | R | IETF RFC 8344 [152] |
| Information for each IPv6 address |  |  |  |  |  |
| IPv6 address |  | X |  | R | IETF RFC 8344 [152] |
| prefix-length |  | X |  | R | IETF RFC 8344 [152] |
| origin |  | X |  | R | IETF RFC 8344 [152] |
| status |  | X |  | R | IETF RFC 8344 [152] |
| Information for each IPv6 neighbor |  |  |  |  |  |
| IPv6 address |  | X |  | R | IETF RFC 8344 [152] |
| link-layer-address |  | X |  | R | IETF RFC 8344 [152] |
| origin |  | X |  | R | IETF RFC 8344 [152] |
| is-router |  | X |  | R | IETF RFC 8344 [152] |
| state |  | X |  | R | IETF RFC 8344 [152] |
| **Stream Parameters****(NOTE 11)** |  |  |  |  |  |
| MaxStreamFilterInstances | X |  | R | - | IEEE Std 802.1Q [98] clause 12.31.1.1 |
| MaxStreamGateInstances | X |  | R | - | IEEE Std 802.1Q [98] clause 12.31.1.2 |
| MaxFlowMeterInstances | X |  | R | - | IEEE Std 802.1Q [98] clause 12.31.1.3 |
| SupportedListMax | X |  | R | - | IEEE Std 802.1Q [98] clause 12.31.1.4 |
| **Per-Stream Filtering and Policing information**(NOTE 10) |  |  |  |  |  |
| Stream Filter Instance Table(NOTE 8) |  |  |  | - | IEEE Std 802.1Q [98] Table 12-32 |
| > StreamFilterInstanceIndex | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-32 |
| > Stream Identification type | X | X | RW | - | IEEE 802.1CB [83] clause 9.1.1.6 |
| > Stream Identification Controlling Parameters | X | X | RW | - | IEEE 802.1CB [83] clauses 9.1.2, 9.1.3, 9.1.4(NOTE 12) |
| > PrioritySpec | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-32 |
| > StreamGateInstanceID | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-32 |
| Stream Gate Instance Table(NOTE 9) |  |  |  |  | IEEE Std 802.1Q [98] Table 12-33 |
| StreamGateInstanceIndex | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-33 |
| PSFPAdminBaseTime | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-33 |
| PSFPAdminControlList | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-33 |
| PSFPAdminCycleTime | X | X | RW | - | IEEE Std 802.1Q [98] Table 12-33 |
| PSFPTickGranularity | X | X | R | - | IEEE Std 802.1Q [98] Table 12-33 |
| PSFPAdminCycleTimeExtension | X | X | R | - | IEEE Std 802.1Q [98] Table 12-33 |
| **Time Synchronization Information** |  |  |  |  |  |
| TSN Time domain number (NOTE 24) | X | X | RW |  |  |
| Supported PTP instance types (NOTE 13) | X |  | R | R | IEEE Std 1588 [126] clause 8.2.1.5.5 |
| Supported transport types (NOTE 14) | X |  | R | R |  |
| Supported delay mechanisms (NOTE 15) | X |  | R | R | IEEE Std 1588 [126] clause 8.2.15.4.4 |
| PTP grandmaster capable (NOTE 16) | X |  | R | R |  |
| gPTP grandmaster capable (NOTE 17) | X |  | R | R |  |
| Supported PTP profiles (NOTE 18) | X |  | R | R |  |
| Number of supported PTP instances | X |  | R | R |  |
| **PTP instance specification** |  |  |  |  |  |
| PTP Instance ID (NOTE 25) | X | X | RW | RW |  |
| > PTP profile (NOTE 19) | X |  | RW | RW |  |
| > Transport type (NOTE 20) | X |  | RW | RW |  |
| > Grandmaster enabled (NOTE 21) | X |  | RW | RW |  |
| **IEEE Std 1588 [126] data sets (NOTE 22)** |  |  |  |  |  |
| > defaultDS.clockIdentity | X |  | RW | RW | IEEE Std 1588 [126] clause 8.2.1.2.2 |
| > defaultDS.clockQuality.clockClass | X |  | RW | RW | IEEE Std 1588 [126] clause 8.2.1.3.1.2 |
| > defaultDS.clockQuality.clockAccuracy | X |  | RW | RW | IEEE Std 1588 [126] clause 8.2.1.3.1.3 |
| > defaultDS.clockQuality.offsetScaledLogVariance | X |  | RW | RW | IEEE Std 1588 [126] clause 8.2.1.3.1.4 |
| > defaultDS.priority1 | X |  | RW | RW | IEEE Std 1588 [126] clause 8.2.1.4.1 |
| > defaultDS.priority2 | X |  | RW | RW | IEEE Std 1588 [126] clause 8.2.1.4.2 |
| > defaultDS.domainNumber | X |  | RW | RW | IEEE Std 1588 [126] clause 8.2.1.4.3 |
| > defaultDS.sdoId | X |  | RW | RW | IEEE Std 1588 [126] clause 8.2.1.4.5 |
| > defaultDS.instanceEnable | X |  | RW | RW | IEEE Std 1588 [126] clause 8.2.1.5.2 |
| > defaultDS.instanceType | X |  | RW | RW | IEEE Std 1588 [126] clause 8.2.1.5.5 |
| > portDS.portIdentity | X | X | RW | RW | IEEE Std 1588 [126] clause 8.2.15.2.1 |
| > portDS.portState | X | X | R | R | IEEE Std 1588 [126] clause 8.2.15.3.1 |
| > portDS.logMinDelayReqInterval | X | X | RW | RW | IEEE Std 1588 [126] clause 8.2.15.3.2 |
| > portDS.logAnnounceInterval | X | X | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.1 |
| > portDS.announceReceiptTimeout |  | X | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.2 |
| > portDS.logSyncInterval | X | X | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.3 |
| > portDS.delayMechanism | X | X | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.4 |
| > portDS.logMinPdelayReqInterval | X | X | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.5 |
| > portDS.versionNumber | X | X | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.6 |
| > portDS.minorVersionNumber | X | X | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.7 |
| > portDS.delayAsymmetry | X | X | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.8 |
| > portDS.portEnable | X | X | RW | RW | IEEE Std 1588 [126] clause 8.2.15.5.1 |
| > timePropertiesDS.currentUtcOffset | X |  | RW | RW | IEEE Std 1588 [126] clause 8.2.4.2 |
| > timePropertiesDS.timeSource | X |  | RW | RW | IEEE Std 1588 [126] clause 8.2.4.9 |
| > externalPortConfigurationPortDS.desiredState |  |  | RW | RW | IEEE Std 1588 [126] clause 15.5.3.7.15.1 |
| **IEEE Std 802.1AS [104] data sets (NOTE 22)** |  |  |  |  |  |
| > defaultDS.clockIdentity | X |  | RW | RW | IEEE Std 802.1AS [104] clause 14.2.2 |
| > defaultDS.clockQuality.clockClass | X |  | RW | RW | IEEE Std 802.1AS [104] clause 14.2.4.2 |
| > defaultDS.clockQuality.clockAccuracy | X |  | RW | RW | IEEE Std 802.1AS [104] clause 14.2.4.3 |
| > defaultDS.clockQuality.offsetScaledLogVariance | X |  | RW | RW | IEEE Std 802.1AS [104] clause 14.2.4.4 |
| > defaultDS.priority1 | X |  | RW | RW | IEEE Std 802.1AS [104] clause 14.2.5 |
| > defaultDS.priority2 | X |  | RW | RW | IEEE Std 802.1AS [104] clause 14.2.6 |
| > defaultDS.timeSource | X |  | RW | RW | IEEE Std 802.1AS [104] clause 14.2.15 |
| > defaultDS.domainNumber | X |  | RW | RW | IEEE Std 802.1AS [104] clause 14.2.16 |
| > defaultDS.sdoId | X |  | RW | RW | IEEE Std 802.1AS [104] clause 14.2.4.3 |
| > defaultDS.instanceEnable | X |  | RW | RW | IEEE Std 802.1AS [104] clause 14.2.19 |
| > portDS.portIdentity |  | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.2 |
| > portDS.portState |  | X | R | R | IEEE Std 802.1AS [104] clause 14.8.3 |
| > portDS.ptpPortEnabled | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.4 |
| > portDS.delayMechanism | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.5 |
| > portDS.isMeasuringDelay | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.6 |
| > portDS.asCapable | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.7 |
| > portDS.meanLinkDelay | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.8 |
| > portDS.meanLinkDelayThresh | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.9 |
| > portDS.delayAsymmetry | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.10 |
| > portDS.neighborRateRatio | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.11 |
| > portDS.initialLogAnnounceInterval | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.12 |
| > portDS.currentLogAnnounceInterval | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.13 |
| > portDS.useMgtSettableLogAnnounceInterval | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.14 |
| > portDS.mgtSettableLogAnnounceInterval | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.15 |
| > portDS.announceReceiptTimeout |  | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.16 |
| > portDS.initialLogSyncInterval | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.17 |
| > portDS.currentLogSyncInterval | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.18 |
| > portDS.useMgtSettableLogSyncInterval | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.19 |
| > portDS.mgtSettableLogSyncInterval | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.20 |
| > portDS.syncReceiptTimeout |  | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.21 |
| > portDS.syncReceiptTimeoutTimeInterval |  | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.22 |
| > portDS.initialLogPdelayReqInterval | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.23 |
| > portDS.currentLogPdelayReqInterval | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.24 |
| > portDS.useMgtSettableLogPdelayReqInterval | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.25 |
| > portDS.mgtSettableLogPdelayReqInterval | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.26 |
| > portDS.initialLogGptpCapableMessageInterval | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.27 |
| > portDS.currentLogGptpCapableMessageInterval | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.28 |
| > portDS.useMgtSettableLogGptpCapableMessageInterval | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.29 |
| > portDS.mgtSettableLogGptpCapableMessageInterval | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.30 |
| > portDS.initialComputeNeighborRateRatio | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.31 |
| > portDS.currentComputeNeighborRateRatio | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.32 |
| > portDS.useMgtSettableComputeNeighborRateRatio | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.33 |
| > portDS.mgtSettableComputeNeighborRateRatio | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.34 |
| > portDS.initialComputeMeanLinkDelay | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.35 |
| > portDS.currentComputeMeanLinkDelay | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.36 |
| > portDS.useMgtSettableComputeMeanLinkDelay | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.37 |
| > portDS.mgtSettableComputeMeanLinkDelay | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.38 |
| > portDS.allowedLostResponses | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.39 |
| > portDS.allowedFaults | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.40 |
| > portDS.gPtpCapableReceiptTimeout | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.41 |
| > portDS.versionNumber | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.42 |
| > portDS.nup | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.43 |
| > portDS.ndown | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.44 |
| > portDS.oneStepTxOper | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.45 |
| > portDS.oneStepReceive | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.46 |
| > portDS.oneStepTransmit | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.47 |
| > portDS.initialOneStepTxOper | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.48 |
| > portDS.currentOneStepTxOper | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.49 |
| > portDS.useMgtSettableOneStepTxOper | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.50 |
| > portDS.mgtSettableOneStepTxOper | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.51 |
| > portDS.syncLocked | X | X | R | R | IEEE Std 802.1AS [104] clause 14.8.52 |
| > portDS.pdelayTruncatedTimestampsArray | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.53 |
| > portDS.minorVersionNumber | X | X | RW | RW | IEEE Std 802.1AS [104] clause 14.8.54 |
| > timePropertiesDS.currentUtcOffset | X |  | RW | RW | IEEE Std 802.1AS [104] clause 14.5.2 |
| > externalPortConfigurationPortDS.desiredState |  | X | RW | RW | IEEE Std 802.1AS [104] clause 14.12.2 |
| NOTE 1: R = Read only access; RW = Read/Write access; ― = not supported.NOTE 2: Indicates which standardized and deployment-specific port management information is supported by DS-TT or NW-TT.NOTE 3: AdminCycleTime and AdminControlListLength are optional for gate control information.NOTE 4: If DS-TT supports neighbor discovery, then TSN AF sends the general neighbor discovery configuration for DS-TT Ethernet ports to DS-TT. If DS-TT does not support neighbor discovery, then TSN AF sends the general neighbor discovery configuration for DS-TT Ethernet ports to NW-TT using the User Plane Node Management Information Container (refer to Table 5.28.3.1-2) and NW-TT performs neighbor discovery on behalf on DS-TT. When a parameter in this group is changed, it is necessary to provide the change to every DS-TT and the NW-TT that belongs to the 5GS TSN bridge. It is mandatory that the general neighbor discovery configuration is identical for all DS-TTs and the NW-TTs that belongs to the bridge.NOTE 5: If DS-TT supports neighbor discovery, then TSN AF retrieves neighbor discovery information for DS-TT Ethernet ports from DS-TT. TSN AF indicates the neighbor discovery information for each discovered neighbor of DS-TT port to CNC. If DS-TT does not support neighbor discovery, then TSN AF retrieves neighbor discovery information for DS-TT Ethernet ports from NW-TT, using the User Plane Node Management Information Container (refer to Table 5.28.3.1-2), the NW-TT performing neighbor discovery on behalf on DS-TT.NOTE 6: X = applicable; D = applicable when validation and generation of LLDP frames is processed at the DS-TT.NOTE 7: Void.NOTE 8: There is a Stream Filter Instance Table per Stream.NOTE 9: There is a Stream Gate Instance Table per Gate.NOTE 10: TSN AF indicates the support for PSFP to the CNC only if each DS-TT and NW-TT of the 5GS bridge has indicated support of PSFP. DS-TT indicates support of PSFP using port management capabilities, i.e. by indicating support for the Per-Stream Filtering and Policing information and by setting higher than zero values for MaxStreamFilterInstances, MaxStreamGateInstances, MaxFlowMeterInstances, SupportedListMax parameters. When available, TSN AF uses the PSFP information for determination of the traffic pattern information as described in Annex I. The PSFP information can be used at the DS-TT (if supported) and at the NW-TT (if supported) for the purpose of per-stream filtering and policing as defined in clause 8.6.5.1 of IEEE Std 802.1Q [98].NOTE 11: TSN AF composes a Stream Parameter Table towards the CNC. It is up to TSN AF how it composes the Stream Parameter Table based on the numerical values as received from DS-TT and NW-TT port(s) and for the bridge for each individual parameter.NOTE 12: The set of Stream Identification Controlling Parameters depends on the Stream Identification type value as defined in IEEE Std 802.1CB [83] Table 9-1 and clauses 9.1.2, 9.1.3, 9.1.4.NOTE 13: Enumeration of supported PTP instance types. Allowed values as defined in clause 8.2.1.5.5 of IEEE Std 1588 [126].NOTE 14: Enumeration of supported transport types. Allowed values: IPv4 (as defined in Annex C of IEEE Std 1588 [126]), IPv6 (as defined in IEEE Std 1588 [126] Annex D), Ethernet (as defined in Annex E of IEEE Std 1588 [126]).NOTE 15: Enumeration of supported PTP delay mechanisms. Allowed values as defined in clause 8.2.15.4.4 of IEEE Std 1588 [126].NOTE 16: Indicates whether DS-TT supports acting as a PTP grandmaster.NOTE 17: Indicates whether DS-TT supports acting as a gPTP grandmaster.NOTE 18: Enumeration of supported PTP profiles, each identified by PTP profile ID, as defined in clause 20.3.3 of IEEE Std 1588 [126].NOTE 19: PTP profile to apply, identified by PTP profile ID, as defined in clause 20.3.3 of IEEE Std 1588 [126].NOTE 20: Transport type to use. Allowed values: IPv4 (as defined in Annex C of IEEE Std 1588 [126]), IPv6 (as defined in IEEE Std 1588 [126] Annex D), Ethernet (as defined in Annex E of IEEE Std 1588 [126]).NOTE 21: Indicates whether to act as grandmaster or not, i.e. whether to send Announce, Sync and optionally Follow\_Up messages.NOTE 22: The IEEE Std 802.1AS [104] data sets apply if the IEEE 802.1AS PTP profile is used; otherwise the IEEE Std 1588 [126] data sets apply.NOTE 23: Indicates how much the txPropagationDelay needs to change so that DS-TT/NW-TT report a change in txPropagationDelay to TSN AF. This is optional for NW-TT.NOTE 24: Indicates the gPTP domain (identified by a domain number) that is assumed by the CNC as the reference clock for time information in the scheduled traffic (gate control) information, PSFP information and bridge delay related information. This is optional for NW-TT.NOTE 25: PTP Instance ID uniquely identifies a PTP instance within the user plane node.NOTE 26: TSN AF indicates the neighbor discovery information for each discovered neighbor of NW-TT port to CNC.NOTE 27: Applicable in case of interworking with IETF Deterministic Networking. |

Table 5.28.3.1-2: Standardized user plane node management information

|  |  |  |  |
| --- | --- | --- | --- |
| User plane node management information | Supported operations by TSN AF | Supported operations by TSCTSF | Reference |
|  | (see NOTE 1) | (see NOTE 1) |  |
| **Information for 5GS Bridge/Router** |  |  |  |
| User plane node Address | R | R |  |
| User plane node ID | R | R |  |
| NW-TT port numbers | R | R |  |
| **Traffic forwarding information** |  |  |  |
| Static Filtering Entry (NOTE 3) | RW | - | IEEE Std 802.1Q [98] clause 8.8.1 |
| **General Neighbor discovery configuration****(NOTE 2)** |  |  |  |
| adminStatus | RW | - | IEEE Std 802.1AB [97] clause 9.2.5.1 |
| lldpV2LocChassisIdSubtype | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2LocChassisId | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2MessageTxInterval | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| lldpV2MessageTxHoldMultiplier | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| **DS-TT port neighbor discovery configuration for DS-TT ports (NOTE 4)** |  |  |  |
| **>DS-TT port neighbor discovery configuration for each DS-TT port** |  |  |  |
| >> DS-TT port number | RW | - |  |
| >> lldpV2LocPortIdSubtype | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| >> lldpV2LocPortId | RW | - | IEEE Std 802.1AB [97] Table 11-2 |
| **Discovered neighbor information for DS-TT ports****(NOTE 4)** |  |  |  |
| **>Discovered neighbor information for each DS-TT port****(NOTE 4)** |  |  |  |
| >> DS-TT port number | R | - |  |
| >> lldpV2RemChassisIdSubtype | R | - | IEEE Std 802.1AB [97] Table 11-2 |
| >> lldpV2RemChassisId | R | - | IEEE Std 802.1AB [97] Table 11-2 |
| >> lldpV2RemPortIdSubtype | R | - | IEEE Std 802.1AB [97] Table 11-2 |
| >> lldpV2RemPortId | R | - | IEEE Std 802.1AB [97] Table 11-2 |
| >> TTL | R | - | IEEE Std 802.1AB [97] clause 8.5.4.1 |
| **Stream Parameters (NOTE 5)** |  |  |  |
| MaxStreamFilterInstances | R | - | IEEE Std 802.1Q [98] |
| MaxStreamGateInstances | R | - | IEEE Std 802.1Q [98] |
| MaxFlowMeterInstances | R | - | IEEE Std 802.1Q [98] |
| SupportedListMax | R | - | IEEE Std 802.1Q [98] |
| **Time synchronization information** |  |  |  |
| Supported PTP instance types (NOTE 6) | R | R |  |
| Supported transport types (NOTE 7) | R | R |  |
| Supported delay mechanisms (NOTE 8) | R | R |  |
| PTP grandmaster capable (NOTE 9) | R | R |  |
| gPTP grandmaster capable (NOTE 10) | R | R |  |
| Supported PTP profiles (NOTE 11) | R | R |  |
| Number of supported PTP instances | R | R |  |
| **Time synchronization information for PTP instances (NOTE 16)** |  |  |  |
| **> PTP instance specification** |  |  |  |
| >> PTP Instance ID (NOTE 17)  | RW | RW |  |
| >> PTP profile (NOTE 12) | RW | RW |  |
| >> Transport type (NOTE 13) | RW | RW |  |
| >> Grandmaster candidate enabled | RW | RW |  |
| **IEEE Std 1588 [126] data sets (NOTE 15)** |  |  |  |
| >> defaultDS.clockIdentity | RW | RW | IEEE Std 1588 [126] clause 8.2.1.2.2 |
| >> defaultDS.clockQuality.clockClass | RW | RW | IEEE Std 1588 [126] clause 8.2.1.3.1.2 |
| >> defaultDS.clockQuality.clockAccuracy | RW | RW | IEEE Std 1588 [126] clause 8.2.1.3.1.3 |
| >> defaultDS.clockQuality.offsetScaledLogVariance | RW | RW | IEEE Std 1588 [126] clause 8.2.1.3.1.4 |
| >> defaultDS.priority1 | RW | RW | IEEE Std 1588 [126] clause 8.2.1.4.1 |
| >> defaultDS.priority2 | RW | RW | IEEE Std 1588 [126] clause 8.2.1.4.2 |
| >> defaultDS.domainNumber | RW | RW | IEEE Std 1588 [126] clause 8.2.1.4.3 |
| >> defaultDS.sdoId | RW | RW | IEEE Std 1588 [126] clause 8.2.1.4.5 |
| >> defaultDS.instanceEnable | RW | RW | IEEE Std 1588 [126] clause 8.2.1.5.2 |
| >> defaultDS.externalPortConfigurationEnabled | RW | RW | IEEE Std 1588 [126] clause 8.2.1.5.3 |
| >> defaultDS.instanceType | RW | RW | IEEE Std 1588 [126] clause 8.2.1.5.5 |
| >> timePropertiesDS.currentUtcOffset | RW | RW | IEEE Std 1588 [126] clause 8.2.4.2 |
| >> timePropertiesDS.timeSource | RW | RW | IEEE Std 1588 [126] clause 8.2.4.9 |
| **IEEE Std 802.1AS [104] data sets (NOTE 15)** |  |  |  |
| >> defaultDS.clockIdentity | RW | RW | IEEE Std 802.1AS [104] clause 14.2.2 |
| >> defaultDS.clockQuality.clockClass | RW | RW | IEEE Std 802.1AS [104] clause 14.2.4.2 |
| >> defaultDS.clockQuality.clockAccuracy | RW | RW | IEEE Std 802.1AS [104] clause 14.2.4.3 |
| >> defaultDS.clockQuality.offsetScaledLogVariance | RW | RW | IEEE Std 802.1AS [104] clause 14.2.4.4 |
| >> defaultDS.priority1 | RW | RW | IEEE Std 802.1AS [104] clause 14.2.5 |
| >> defaultDS.priority2 | RW | RW | IEEE Std 802.1AS [104] clause 14.2.6 |
| >> defaultDS.timeSource | RW | RW | IEEE Std 802.1AS [104] clause 14.2.15 |
| >> defaultDS.domainNumber | RW | RW | IEEE Std 802.1AS [104] clause 14.2.16 |
| >> defaultDS.sdoId | RW | RW | IEEE Std 802.1AS [104] clause 14.2.18 |
| >> defaultDS.externalPortConfigurationEnabled | RW | RW | IEEE Std 802.1AS [104] clause 14.2.4.3 |
| >> defaultDS.instanceEnable | RW | RW | IEEE Std 802.1AS [104] clause 14.2.19 |
| >> timePropertiesDS.currentUtcOffset | RW | RW | IEEE Std 802.1AS [104] clause 14.5.2 |
| **Time synchronization information for DS-TT ports** |  |  |  |
| **> Time synchronization information for each DS-TT port** |  |  |  |
| > DS-TT port number | RW | RW |  |
| **>> Time synchronization information for each PTP Instance** |  |  |  |
| >> PTP Instance ID (NOTE 17) | RW | RW |  |
| >> Grandmaster on behalf of DS-TT enabled (NOTE 14) | RW | RW |  |
| **IEEE Std 1588 [126] data sets (NOTE 15)** |  |  |  |
| >> portDS.portIdentity | RW | RW | IEEE Std 1588 [126] clause 8.2.15.2.1 |
| >> portDS.portState | R | R | IEEE Std 1588 [126] clause 8.2.15.3.1 |
| >> portDS.logMinDelayReqInterval | RW | RW | IEEE Std 1588 [126] clause 8.2.15.3.2 |
| >> portDS.logAnnounceInterval | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.1 |
| >> portDS.announceReceiptTimeout | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.2 |
| >> portDS.logSyncInterval | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.3 |
| >> portDS.delayMechanism | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.4 |
| >> portDS.logMinPdelayReqInterval | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.5 |
| >> portDS.versionNumber | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.6 |
| >> portDS.minorVersionNumber | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.7 |
| >> portDS.delayAsymmetry | RW | RW | IEEE Std 1588 [126] clause 8.2.15.4.8 |
| >> portDS.portEnable | RW | RW | IEEE Std 1588 [126] clause 8.2.15.5.1 |
| >> externalPortConfigurationPortDS.desiredState | RW | RW | IEEE Std 1588 [126] clause 15.5.3.7.15.1 |
| **IEEE Std 802.1AS [104] data sets (NOTE 15)** |  |  |  |
| >> portDS.portIdentity | RW | RW | IEEE Std 802.1AS [104] clause 14.8.2 |
| >> portDS.portState | R | R | IEEE Std 802.1AS [104] clause 14.8.3 |
| >> portDS.ptpPortEnabled | RW | RW | IEEE Std 802.1AS [104] clause 14.8.4 |
| >> portDS.delayMechanism | RW | RW | IEEE Std 802.1AS [104] clause 14.8.5 |
| >> portDS.isMeasuringDelay | R | R | IEEE Std 802.1AS [104] clause 14.8.6 |
| >> portDS.asCapable | R | R | IEEE Std 802.1AS [104] clause 14.8.7 |
| >> portDS.meanLinkDelay | R | R | IEEE Std 802.1AS [104] clause 14.8.8 |
| >> portDS.meanLinkDelayThresh | RW | RW | IEEE Std 802.1AS [104] clause 14.8.9 |
| >> portDS.delayAsymmetry | RW | RW | IEEE Std 802.1AS [104] clause 14.8.10 |
| >> portDS.neighborRateRatio | R | R | IEEE Std 802.1AS [104] clause 14.8.11 |
| >> portDS.initialLogAnnounceInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.12 |
| >> portDS.currentLogAnnounceInterval | R | R | IEEE Std 802.1AS [104] clause 14.8.13 |
| >> portDS.useMgtSettableLogAnnounceInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.14 |
| >> portDS.mgtSettableLogAnnounceInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.15 |
| >> portDS.announceReceiptTimeout | RW | RW | IEEE Std 802.1AS [104] clause 14.8.16 |
| >> portDS.initialLogSyncInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.17 |
| >> portDS.currentLogSyncInterval | R | R | IEEE Std 802.1AS [104] clause 14.8.18 |
| >> portDS.useMgtSettableLogSyncInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.19 |
| >> portDS.mgtSettableLogSyncInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.20 |
| >> portDS.syncReceiptTimeout | RW | RW | IEEE Std 802.1AS [104] clause 14.8.21 |
| >> portDS.syncReceiptTimeoutTimeInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.22 |
| >> portDS.initialLogPdelayReqInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.23 |
| >> portDS.currentLogPdelayReqInterval | R | R | IEEE Std 802.1AS [104] clause 14.8.24 |
| >> portDS.useMgtSettableLogPdelayReqInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.25 |
| >> portDS.mgtSettableLogPdelayReqInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.26 |
| >> portDS.initialLogGptpCapableMessageInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.27 |
| >> portDS.currentLogGptpCapableMessageInterval | R | R | IEEE Std 802.1AS [104] clause 14.8.28 |
| >> portDS.useMgtSettableLogGptpCapableMessageInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.29 |
| >> portDS.mgtSettableLogGptpCapableMessageInterval | RW | RW | IEEE Std 802.1AS [104] clause 14.8.30 |
| >> portDS.initialComputeNeighborRateRatio | RW | RW | IEEE Std 802.1AS [104] clause 14.8.31 |
| >> portDS.currentComputeNeighborRateRatio | R | R | IEEE Std 802.1AS [104] clause 14.8.32 |
| >> portDS.useMgtSettableComputeNeighborRateRatio | RW | RW | IEEE Std 802.1AS [104] clause 14.8.33 |
| >> portDS.mgtSettableComputeNeighborRateRatio | RW | RW | IEEE Std 802.1AS [104] clause 14.8.34 |
| >> portDS.initialComputeMeanLinkDelay | RW | RW | IEEE Std 802.1AS [104] clause 14.8.35 |
| >> portDS.currentComputeMeanLinkDelay | R | R | IEEE Std 802.1AS [104] clause 14.8.36 |
| >> portDS.useMgtSettableComputeMeanLinkDelay | RW | RW | IEEE Std 802.1AS [104] clause 14.8.37 |
| >> portDS.mgtSettableComputeMeanLinkDelay | RW | RW | IEEE Std 802.1AS [104] clause 14.8.38 |
| >> portDS.allowedLostResponses | RW | RW | IEEE Std 802.1AS [104] clause 14.8.39 |
| >> portDS.allowedFaults | RW | RW | IEEE Std 802.1AS [104] clause 14.8.40 |
| >> portDS.gPtpCapableReceiptTimeout | RW | RW | IEEE Std 802.1AS [104] clause 14.8.41 |
| >> portDS.versionNumber | RW | RW | IEEE Std 802.1AS [104] clause 14.8.42 |
| >> portDS.nup | RW | RW | IEEE Std 802.1AS [104] clause 14.8.43 |
| >> portDS.ndown | RW | RW | IEEE Std 802.1AS [104] clause 14.8.44 |
| >> portDS.oneStepTxOper | R | R | IEEE Std 802.1AS [104] clause 14.8.45 |
| >> portDS.oneStepReceive | R | R | IEEE Std 802.1AS [104] clause 14.8.46 |
| >> portDS.oneStepTransmit | R | R | IEEE Std 802.1AS [104] clause 14.8.47 |
| >> portDS.initialOneStepTxOper | RW | RW | IEEE Std 802.1AS [104] clause 14.8.48 |
| >> portDS.currentOneStepTxOper | RW | RW | IEEE Std 802.1AS [104] clause 14.8.49 |
| >> portDS.useMgtSettableOneStepTxOper | RW | RW | IEEE Std 802.1AS [104] clause 14.8.50 |
| >> portDS.mgtSettableOneStepTxOper | RW | RW | IEEE Std 802.1AS [104] clause 14.8.51 |
| >> portDS.syncLocked | R | R | IEEE Std 802.1AS [104] clause 14.8.52 |
| >> portDS.pdelayTruncatedTimestampsArray | RW | RW | IEEE Std 802.1AS [104] clause 14.8.53 |
| >> portDS.minorVersionNumber | RW | RW | IEEE Std 802.1AS [104] clause 14.8.54 |
| >> externalPortConfigurationPortDS.desiredState | RW | RW | IEEE Std 802.1AS [104] clause 14.12.2 |
| **Time synchronization status (TSS) information** |  |  |  |
| > Synchronization state | R | R | Table 5.27.1.12-1 |
| > Clock quality  | R | R | Table 5.27.1.12-1 |
| >> Traceable to UTC | R | R | Table 5.27.1.12-1 |
| >> Traceable to GNSS | R | R | Table 5.27.1.12-1 |
| >> Frequency stability | R | R | Table 5.27.1.12-1 |
| >> Clock accuracy | R | R | Table 5.27.1.12-1 |
| > Parent time source | R | R | Table 5.27.1.12-1 |
| NOTE 1: R = Read only access; RW = Read/Write access; ― = not supported.NOTE 2: General neighbor discovery information is included only when NW-TT performs neighbor discovery on behalf of DS-TT. When a parameter in this group is changed, it is necessary to provide the change to every DS-TT and the NW-TT that belongs to the 5GS TSN bridge.NOTE 3: If the Static Filtering Entry information is present, UPF/NW-TT can use Static Filtering Entry information for forwarding TSC traffic, as specified in clause 5.8.2.5.3.NOTE 4: DS-TT discovery configuration and DS-TT discovery information are used only when DS-TT does not support LLDP and NW-TT performs neighbor discovery on behalf of DS-TT. TSN AF indicates the discovered neighbor information for each DS-TT port to CNC.NOTE 5: TSN AF indicates the support for PSFP to the CNC only if each DS-TT and NW-TT of the 5GS bridge have indicated support of PSFP. The support of PSFP at the NW-TT ports is expressed by setting higher than zero values for MaxStreamFilterInstances, MaxStreamGateInstances, MaxFlowMeterInstances, SupportedListMax parameters.NOTE 6: Enumeration of supported PTP instance types. Allowed values as defined in clause 8.2.1.5.5 of IEEE Std 1588 [126].NOTE 7: Enumeration of supported transport types. Allowed values: IPv4 (as defined in IEEE Std 1588 [126] Annex C), IPv6 (as defined in IEEE Std 1588 [126] Annex D), Ethernet (as defined in Annex E of IEEE Std 1588 [126]).NOTE 8: Enumeration of supported PTP delay mechanisms. Allowed values as defined in clause 8.2.15.4.4 of IEEE Std 1588 [126].NOTE 9: Indicates whether NW-TT supports acting as a PTP grandmaster.NOTE 10: Indicates whether NW-TT supports acting as a gPTP grandmaster.NOTE 11: Enumeration of supported PTP profiles, each identified by PTP profile ID, as defined in clause 20.3.3 of IEEE Std 1588 [126].NOTE 12: PTP profile to apply, identified by PTP profile ID, as defined in clause 20.3.3 of IEEE Std 1588 [126].NOTE 13: Transport type to use. Allowed values: IPv4 (as defined in Annex C of IEEE Std 1588 [126]), IPv6 (as defined in IEEE Std 1588 [126] Annex D), Ethernet (as defined in Annex E of IEEE Std 1588 [126]).NOTE 14: Indicates whether to act as grandmaster on behalf of a DS-TT port or not if 5GS is determined to be the grandmaster clock, i.e. whether to send Announce, Sync and optionally Follow\_Up messages on behalf of DS-TT.NOTE 15: The IEEE Std 802.1AS [104] data sets apply if the IEEE 802.1AS PTP profile is used; otherwise, the IEEE Std 1588 [126] data sets apply.NOTE 16: Specifies the default data set for each PTP instance identified by PTP instance ID within the user plane node.NOTE 17: PTP Instance ID uniquely identifies a PTP instance within the user plane node. |

Exchange of port and user plane node management information between TSN AF or TSCTSF and NW-TT or between TSN AF or TSCTSF and DS-TT allows TSN AF or TSCTSF to:

1) retrieve port management information for a DS-TT or NW-TT port or user plane node management information;

2) send port management information for a DS-TT or NW-TT port or user plane node management information;

3) subscribe to and receive notifications if specific port management information for a DS-TT or NW-TT port changes or user plane node management information changes.

4) delete selected entries in the following data structures:

- "DS-TT port neighbour discovery configuration for DS-TT port" in UMIC using the DS-TT port number to reference the selected entry.

- "Stream Filter Instance Table" in PMIC using the Stream Filter Instance ID to reference the selected entry.

- "Stream Gate Instance Table" in PMIC using the Stream Gate Instance ID to reference the selected entry.

- "Static Filtering Entries table" in UMIC using the (MAC address, VLAN ID) pair to reference the selected entry.

5) delete PTP Instances in a DS-TT port or NW-TT port using the PTP Instance ID to reference the selected entry as described in clause K.2.2.1.

Exchange of port management information between TSN AF or TSCTSF and NW-TT or DS-TT is initiated by DS-TT or NW-TT to:

- notify TSN AF or TSCTSF if port management information has changed that TSN AF or TSCTSF has subscribed for.

Exchange of user plane node management information between TSN AF or TSCTSF and NW-TT is initiated by NW-TT to:

- notify TSN AF or TSCTSF if user plane node management information has changed that TSN AF or TSCTSF has subscribed for.

Exchange of port management information is initiated by DS-TT to:

- provide port management capabilities, i.e. provide information indicating which standardized and deployment-specific port management information is supported by DS-TT.

TSN AF or TSCTSF indicates inside the Port Management Information Container or user plane node Management Information Container whether it wants to retrieve or send port or user plane node management information or intends to (un-)subscribe for notifications. If the UPF supports direct reporting, the UPF may directly report TSC management information to the TSN AF or TSCTSF using Nupf\_EventExposure\_Notify.

>>>> Next Change <<<<

### 6.2.1 AMF

The Access and Mobility Management function (AMF) includes the following functionality. Some or all of the AMF functionalities may be supported in a single instance of an AMF:

- Termination of RAN CP interface (N2).

- Termination of NAS (N1), NAS ciphering and integrity protection.

- Registration management.

- Connection management.

- Reachability management.

- Mobility Management.

- Lawful intercept (for AMF events and interface to LI System).

- Provide transport for SM messages between UE and SMF.

- Transparent proxy for routing SM messages.

- Access Authentication.

- Access Authorization.

- Provide transport for SMS messages between UE and SMSF.

- Security Anchor Functionality (SEAF) as specified in TS 33.501 [29].

- Location Services management for regulatory services.

- Provide transport for Location Services messages between UE and LMF as well as between RAN and LMF.

- EPS Bearer ID allocation for interworking with EPS.

- UE mobility event notification.

- S-NSSAIs per TA mapping notification.

- Support for Control Plane CIoT 5GS Optimisation.

- Support for User Plane CIoT 5GS Optimisation.

- Support for restriction of use of Enhanced Coverage.

- Provisioning of external parameters (Expected UE Behaviour parameters or Network Configuration parameters).

- Support for Network Slice-Specific Authentication and Authorization.

- Support for charging.

- Controlling the 5G access stratum-based time distribution based on UE's subscription data.

- Controlling the gNB’s time synchronization status reporting and subscription.

NOTE 1: Regardless of the number of Network functions, there is only one NAS interface instance per access network between the UE and the CN, terminated at one of the Network functions that implements at least NAS security and Mobility Management.

In addition to the functionalities of the AMF described above, the AMF may include the following functionality to support non-3GPP access networks:

- Support of N2 interface with N3IWF/TNGF. Over this interface, some information (e.g. 3GPP Cell Identification) and procedures (e.g. Handover related) defined over 3GPP access may not apply, and non-3GPP access specific information may be applied that do not apply to 3GPP accesses.

- Support of NAS signalling with a UE over N3IWF/TNGF. Some procedures supported by NAS signalling over 3GPP access may be not applicable to untrusted non-3GPP (e.g. Paging) access.

- Support of authentication of UEs connected over N3IWF/TNGF.

- Management of mobility, authentication, and separate security context state(s) of a UE connected via a non-3GPP access or connected via a 3GPP access and a non-3GPP access simultaneously.

- Support as described in clause 5.3.2.3 a co-ordinated RM management context valid over a 3GPP access and a Non 3GPP access.

- Support as described in clause 5.3.3.4 dedicated CM management contexts for the UE for connectivity over non-3GPP access.

- Determine whether the serving N3IWF/TNGF is appropriate based on the slices supported by the N3IWFs/TNGFs as specified in clause 6.3.6 and clause 6.3.12 respectively.

NOTE 2: Not all of the functionalities are required to be supported in an instance of a Network Slice.

In addition to the functionalities of the AMF described above, the AMF may include policy related functionalities as described in clause 6.2.8 of TS 23.503 [45].

The AMF uses the N14 interface for AMF re-allocation and AMF to AMF information transfer. This interface may be either intra-PLMN or inter-PLMN (e.g. in the case of inter-PLMN mobility).

In addition to the functionality of the AMF described above, the AMF may include the following functionality to support monitoring in roaming scenarios:

- Normalization of reports according to roaming agreements between VPLMN and HPLMN (e.g. change the location granularity in a report from cell level to a level that is appropriate for the HPLMN); and

- Generation of charging/accounting information for Monitoring Event Reports that are sent to the HPLMN.

In addition to the functionality of the AMF described above, the AMF may provide support for Network Slice restriction and Network Slice instance restriction based on NWDAF analytics.

In addition to the functionalities of the AMF described above, the AMF may provide support for the Disaster Roaming as described in clause 5.40.

In addition to the functionalities of the AMF described above, the AMF may also include following functionalities to support Network Slice Admission Control:

- Support of NSAC for maximum number of UEs as defined in clauses 5.15.11.1 and 5.15.11.3.

In addition to the functionality of the AMF described above, the AMF may include the following functionality to support SNPNs:

- Support for Onboarding of UEs for SNPNs.

In addition to the functionalities of the AMF described above, the AMF may also include following functionalities to support satellite backhaul:

- Support for reporting satellite backhaul category (i.e. GEO, MEO, LEO or OTHERSAT) and its modification based on AMF local configuration to SMF as defined in clause 5.8.2.15.

In addition to the functionalities of the AMF described above, the AMF may provide support for Network Slice instance change for PDU sessions as defined in clause 5.15.5.3.

In addition to the functionalities of the AMF described above, the AMF may also support functionalities for Partial Network Slice support in a Registration Area as described in clause 5.15.17.

In addition to the functionalities of the AMF described above, the AMF may also include functionalities to support NS-AoS not matching deployed Tracking Areas as described in clause 5.15.18.

In addition to the functionalities of the AMF described above, the AMF may also include functionalities to support Network Slice Replacement as described in clause 5.15.19.

>>>> Next Change <<<<

### 6.2.29 TSCTSF

The Time Sensitive Communication and Time Synchronization Function (TSCTSF) supports the following functionality:

- Associating the time synchronization service request (see clause 5.27.1.8) from the NF consumer to the AF sessions with the PCF (the session between the PCF and TSCTSF).

- Controlling time synchronization service request from the NF consumer, (g)PTP-based time distribution and ASTI-based time distribution based on subscription data. The TSCTSF may be pre-configured with one or several PTP instance configurations. For each PTP instance configuration, it may contain:

- a reference to the PTP instance configuration.

- PTP profile.

- PTP domain.

- Detecting and reporting time synchronization service status based on NG-RAN and UPF/NW-TT timing synchronization status information and reporting status updates.

- Managing the DS-TT and NW-TT via exchange of PMIC and UMIC as described in Annex K.

- Detecting availability of 5GS Bridge/Router information (including user plane node ID that applies also for IP type PDU Sessions) as reported by PCF for both Ethernet and IP type PDU Sessions (including the need to (un)subscribe 5GS Bridge/Router information Notification from PCF).

- Creating the TSC Assistance Container based on individual traffic pattern parameters from the NEF/AF or DetNet controller and providing it to the PCF.

- Determining the Requested PDB by subtracting the UE-DS-TT Residence Time from the Requested 5GS Delay provided by the NEF/AF or DetNet controller and providing the determined Requested PDB to the PCF.

- Discovering the AMFs serving the list of TA(s) that comprise the spatial validity condition from the NRF and subscribing to the discovered AMF(s) to receive notifications about presence of the UE in an Area of Interest events determined by the list of TA(s) served by the AMF.

- Discovering the AMF(s) serving a UE or a list of TA(s) and subscribing to gNB’s node-level timing synchronization status.

- Obtaining gNB’s and UPF’s node-level timing synchronization status information as defined in clause 5.27.1.12.

- Determining the spatial validity condition from the requested coverage area by the NEF/AF and enforcing time synchronization service for the requested coverage area.

- Support for RAN feedback for BAT offset and adjusted periodicity as defined in clause 5.27.2.5.

- In the case of support of integration with IETF Deterministic Networking (as depicted in clauses 4.4.8.4 and 5.28.5), acting as a stateful translator function between a DetNet controller and 5G System Network Functions and Procedures, including the NW-TT. This includes exposing the information about the 5GS router to the DetNet controller and mapping 5GS router configuration parameters provided by the DetNet controller to 5G System parameters. The details are defined in clause 5.28.5.

>>>> End of Changes <<<<