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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 stage 3 protocol and data model for the Ntsctsf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the TSCTSF.

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition are specified in 3GPP TS 29.500 [4] and 3GPP TS 29.501 [5].

# 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] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[4] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[5] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[6] OpenAPI: "OpenAPI Specification Version 3.0.0", <https://spec.openapis.org/oas/v3.0.0>.

[7] 3GPP TR 21.900: "Technical Specification Group working methods".

[8] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[9] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".

[10] 3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".

[11] IETF RFC 9113: "HTTP/2".

[12] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".

[13] IETF RFC 9457: "Problem Details for HTTP APIs".

[14] 3GPP TS 29.534: "5G System; Access and Mobility Policy Authorization Service; Stage 3".

[15] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces Stage 3".

[16] 3GPP TS 29.508: "5G System; Session Management Event Exposure Service; Stage 3".

[17] 3GPP TS 29.522: "5G System; Network Exposure Function Northbound APIs; Stage 3".

[18] IEEE Std 802.1Q-2018: "IEEE Standard for Local and metropolitan area networks--Bridges and Bridged Networks".

[19] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System".

[20] 3GPP TS 29.514: "5G System; Policy Authorization Service; Stage 3".

[21] 3GPP TS 29.122: "T8 reference point for northbound Application Programming Interfaces (APIs)".

[22] IETF RFC 7396: "JSON Merge Patch".

[23] 3GPP TS 29.521: "5G System; Binding Support Management Service; Stage 3".

[24] 3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

[25] IEEE Std 1588-2019: "IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control".

[26] IEEE Std 802.1AS-2020: "IEEE Standard for Local and metropolitan area networks--Timing and Synchronization for Time-Sensitive Applications".

[27] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".

[28] IETF draft-ietf-detnet-yang: "Deterministic Networking (DetNet) YANG Model".

Editor's note: The above document cannot be formally referenced until it is published as an RFC.

[29] IETF RFC 6241: "Network Configuration Protocol (NETCONF)".

[30] IETF RFC 8040: "RESTCONF Protocol".

[31] 3GPP TS 29.513: "5G System; Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3".

[32] IETF RFC 8939: "Deterministic Networking (DetNet) Data Plane: IP".

[33] IETF RFC 7950: "The YANG 1.1 Data Modeling Language".

[34] IETF RFC 8407: "Guidelines for Authors and Reviewers of Documents Containing YANG Data Models".

[35] IETF RFC 6020: "YANG – A Data Modeling Language for the Network Configuration Protocol (NETCONF)".

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions 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].

Void

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

Void

## 3.3 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].

ASTI Access Stratum Time distribution

BAT Burst Arrival Time

DetNet Deterministic Networking

DS-TT Device-side TSN translator

NW-TT Network-side TSN translator

PTP Precision Time Protocol

TA Tracking Area

TSC Time Sensitive Communication

TSCAI TSC Assistance Information

TSCTSF Time Sensitive Communication and Time Synchronization function

# 4 Overview

## 4.1 Introduction

The Ntsctsf services are offered by the TSCTSF to support the Time Sensitive Communications and Time Synchronization.

The following Ntsctsf services are specified:

- Ntsctsf\_TimeSynchronization service;

- Ntsctsf\_QoSandTSCAssistance service.

- Ntsctsf\_ASTI service.

To enable the reporting of 5GS DetNet node configuration and the provisioning and configuration data for DetNet flows, the TSCTSF offers RESTCONF (IETF RFC 8040 [30]) and/or NETCONF (IETF RFC 6241 [29]) interfaces to the DetNet controller to access the 3GPP extended Deterministic Networking (DetNet) YANG Model as specified in Annex B.

## 4.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2].

The known NF service consumers of the Ntsctsf services are the Application Function (AF) within the operator's trust domain and the Network Exposure Function (NEF).

The Ntsctsf services are provided by the TSCTSF and consumed by the NF service consumers (e.g. AF, NEF), as shown in figure 4.2-1 for the SBI representation model and in figure 4.2-2 for the reference point representation model.



Figure 4.2-1: Ntsctsf services architecture, SBI representation



Figure 4.2-2: Ntsctsf services architecture, reference point representation

The DetNet controller, as specified in clause 4.4.8.4 of 3GPP TS 23.501 [2], is the TSCTSF's consumer that accesses the 3GPP extended DetNet YANG model, as specified in Annex B, clause B.1.1.

# 5 Services offered by the TSCTSF

## 5.1 Introduction

Table 5.1-1 summarizes the corresponding APIs defined for this specification.

Table 5.1-1: API Descriptions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Service Name** | **Clause** | **Description** | **OpenAPI Specification File** | **apiName** | **Annex** |
| Ntsctsf\_TimeSynchronization | 6.1 | Provides the support to subscribe/unsubscribe to the notification about time synchronization capabilities or changes in time synchronization status information. Also allows to activate and deactivate the time synchronization configuration. | TS29565\_Ntsctsf\_TimeSynchronization.yaml | ntsctsf-time-sync | A.2 |
| Ntsctsf\_QoSandTSCAssistance | 6.2 | Provides the support to request specific QoS and provide assistance for handling traffic characterized by TSC QoS parameters. | TS29565\_Ntsctsf\_QoSandTSCAssistance.yaml | ntsctsf-qos-tscai | A.3 |
| Ntsctsf\_ASTI | 6.3 | Provides support for time synchronization service based on 5G access stratum time distribution method. Allows the NF consumer to configure the 5GC and RAN for 5G access stratum based time synchronization service for the UEs and subscribe to get informed about changes in time synchronization status information. | TS29565\_Ntsctsf\_ASTI.yaml | ntsctsf-asti | A.4 |

## 5.2 Ntsctsf\_TimeSynchronization Service

### 5.2.1 Service Description

#### 5.2.1.1 Overview

This service provides:

- Authorization of NF Service Consumer requests for the subscription to the notification of the capability of time synchronization service.

- Authorization of NF Service Consumer requests to create and update time synchronization configuration, and to activate and deactivate the time synchronization service as described in clause 5.27.1.8 of TS 23.501 [2].

NOTE: The AF can use either the procedure specified in bullet2) for configuring the (g)PTP instance in 5GS or the procedure specified in clause 5.4.2.2 for controlling the 5G access stratum time distribution for a particular UE. The procedures are not intended to be used in conjunction with each other by the AF. However, the (g)PTP instance activation, modification, and deactivation can influence the 5G access stratum time distribution for the UEs that are part of the impacted PTP instance.

- Detection and reporting of time synchronization service status based on gNB and/or UPF/NW-TT timing synchronization status information and reporting status updates.

- Notifications to the NF service consumer about the state and changes of state of time synchronization configuration due to evaluation of e.g. time synchronization coverage area conditions.

#### 5.2.1.2 Network Functions

##### 5.2.1.2.1 TSCTSF

The TSCTSF supports to:

- receive the request to create/update the subscription to the notification of the capability of time synchronization service from the NEF or AF and interact with the related PCF;

- receive the request to delete the subscription to the notification of the capability of time synchronization service from the NEF or AF and remove the information from the related PCF;

- receive the notification of the availability of the user plane node information from the PCF and subscribe the notification of user plane node related events at the PCF;

- makes a translation from External/Internal Group Identifier to a list of SUPI by querying UDM;

- retrieve the Time Synchronization Subscription data from UDM for the control of (g)PTP instance(s) and make decision based on received the Time Synchronization Subscription data;

- determine the capability of time synchronization service based on the capability information received from the DS-TT(s) and NW-TT and notify the NEF or AF of the capability;

- receive the request to create or modify the time synchronization configuration from the NEF or AF, configure and initialize the PTP instance(s) by constructing a PMIC to each DS-TT/UE to activate the time synchronization service in DS-TT and PMIC(s) and UMIC to NW-TT to activate the time synchronization service in NW-TT and provision them to the PCF;

- determine whether the UE is inside/outside the requested time synchronization coverage area and enforce the time synchronization service accordingly;

- notify the NEF or AF of the current state of the time synchronization service configuration;

- receive the request of time synchronization deactivation from the NEF or AF and disable the corresponding PTP instance(s) in the DS-TT(s) and NW-TT.

- indicate whether the service is supported or not as per the requested acceptance criteria (e.g., based on the known timing synchronization status attribute thresholds pre-configured at gNB); and

- based on gNB and/or UPF/NW-TT timing synchronization status (degradation/failure/improvement) information and reporting, provide a notification when there is a service status update if the NEF or AF subscribe to service status updates.

##### 5.2.1.2.2 NF Service Consumers

The NF service consumer supports to:

- send the request to create/update and delete the subscription to the notification of the capability of time synchronization service to TSCTSF;

- receive the notification of the capability of time synchronization service;

- send the request to create, modify and delete the time synchronization configuration to the TSCTSF;

- provide clock quality reporting control information, consisting of clock quality detail level and clock quality acceptance criteria during activation or modification of time synchronization service; and

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

### 5.2.2 Service Operations

#### 5.2.2.1 Introduction

Service operations defined for the Ntsctsf\_TimeSynchronization service are shown in table 5.2.2.1-1.

Table 5.2.2.1-1: Ntsctsf\_TimeSynchronization Service Operations

|  |  |  |
| --- | --- | --- |
| Service Operation Name | Description | Initiated by |
| Ntsctsf\_TimeSynchronization\_CapsSubscribe | Allows the NF service consumer to create or modify a subscription to the notification about the capability of time synchronization service for a list of UEs a group of UEs or any UE using a DNN/S-NSSAI combination. | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_TimeSynchronization\_CapsUnsubscribe | Allows the NF service consumer to delete the subscription to the notification about capability of time synchronization service for a list of UEs, a group of UEs or any UE using a DNN/S-NSSAI combination. | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_TimeSynchronization\_CapsNotify | Allows the TSCTSF to notify the NF service consumer of the capability of time synchronization service. | TSCTSF |
| Ntsctsf\_TimeSynchronization\_ConfigCreate | Allows the NF service consumer to create a time synchronization configuration. | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_TimeSynchronization\_ConfigUpdate | Allows the NF service consumers to update the time synchronization configuration. | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_TimeSynchronization\_ConfigDelete | Allows the NF service consumer to delete the time synchronization configuration. | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_TimeSynchronization\_ConfigUpdateNotify | Allows the TSCTSF to notify the NF service consumer of the state of time synchronization configuration. | TSCTSF |

NOTE: The NEF and the AF use the Ntsctsf\_TimeSynchronization service in the same way.

#### 5.2.2.2 Ntsctsf\_TimeSynchronization\_CapsSubscribe

##### 5.2.2.2.1 General

This service operation is used by an NF service consumer to subscribe to notification of capability of time synchronization service for a list of UEs, a group of UEs or any UE using a DNN/S-NSSAI combination.

The following procedures using the Ntsctsf\_TimeSynchronization\_CapsSubscribe service operation are supported:

- creating a new subscription;

- modifying an existing subscription.

##### 5.2.2.2.2 Creating a new subscription

Figure 5.2.2.2.2-1 illustrates the creation of a subscription.



Figure 5.2.2.2.2-1: Creation of a subscription

To subscribe the notification of the capability of time synchronization service, the NF service consumer shall send an HTTP POST message to the TSCTSF to the URI "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions". The HTTP POST message shall include the TimeSyncExposureSubsc data structure as request body. The TimeSyncExposureSubsc data structure shall include:

- the indication of the UEs to which the time synchronization capabilities is requested via:

- identification of a list of individual UEs within a "supis" attribute;

- identification of a list of individual UEs within a "gpsis" attribute;

- indication of any UE within the "anyUeInd" attribute; or

- identification of a group of UE(s) within the "interGroupId" attribute; or

- identification of a group of UE(s) within the "exterGroupId" attribute.

- subscription to event(s) notification as "subscribedEvents" attribute;

- notification URI within the "subsNotifUri" attribute;

- notification correlation Id within the "subsNotifId" attribute;

- DNN with the "dnn" attribute; and

- S-NSSAI with the "snssai" attribute;

and may include:

- the conditions to match for notifying the event within the "eventFilters" attribute;

- notification method within the "notifMethod" attribute

- maximum number of reports within the "maxReportNbr" attribute;

- expiry time within the "expiry" attribute; and

- report period within the "repPeriod" attribute.

Upon receipt of the HTTP request from the NF service consumer, if the request is authorized, the TSCTSF shall:

- create a new subscription;

- assign a subscription correlation ID;

- select an expiry time that is equal to or less than the expiry time potentially received in the request;

- store the subscription;

- if the "interGroupId" attribute or "exterGroupId" attribute is received from the NF service consumer, interact with the UDM to retrieve the SUPI list that belong to the group using the Nudm\_SDM service as defined in 3GPP TS 29.503 [24];

- if the "gpsis" attribute is received from the NF service consumer, interact with the UDM to retrieve the SUPI(s) that correspond to the GPSI(s) using the Nudm\_SDM service as defined in 3GPP TS 29.503 [24];

- use the parameters received from the NF service consumer (i.e. DNN, S-NSSAI and, if available, the list of UEs or UEs that belong to the group of UEs) and the time synchronization subscription data retrieved from UDM to determine the matching AF-session(s) that are authorized by subscription, and for any such AF-session for which the SUPI interact with the PCF by triggering Npcf\_PolicyAuthorization\_Create/Update request message as defined in 3GPP TS 29.514 [20].

NOTE 1: If the PCF determines an existing PDU Session is potentially impacted by time synchronization service (based on local configuration or SM Policy Association), the PCF invokes Npcf\_PolicyAuthorization\_Notify service operation to the TSCTSF as defined in clause 4.2.5.16 of 3GPP TS 29.514 [20] to send the received TSC User Plane Node information. At that time, the TSCTSF retrieves from the BSF the PCF binding information (including the UE Identities as SUPI and if available, GPSI for the notified PDU session), as specified in 3GPP TS 29.521 [23], and can create the AF-session by sending to the PCF the Npcf\_PolicyAuthorization\_Create service operation.

- send an HTTP "201 Created" response with TimeSyncExposureSubsc data structure as response body and a Location header field containing the URI of the created individual subscription resource, i.e. "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}".

The TSCTSF shall handle the AF session(s) associated with the "Individual Time Synchronization Exposure Subscription" resource as follows:

- For the association of AF sessions to "Individual Time Synchronization Exposure Subscription" resources:

- Upon PDU Session establishment, i.e. when the TSCTSF receives the Npcf\_PolicyAuthorization\_Notify service operation for the establishment of a new PDU session, the TSCTSF shall retrieve from the BSF, as specified in 3GPP TS 29.521 [23], the PCF binding information to complete the necessary AF-Session information and triggers the Npcf\_PolicyAuthorization\_Create request message to the PCF to create an AF-session to subscribe to TSC user plane node related events. The TSCTSF, shall use the parameters of existing "Individual Time Synchronization Exposure Subscription" resources to determine whether they shall be associated to this newly created AF sessionThe TSCTSF associates the new AF session to the "Individual Time Synchronization Exposure Subscription" resources for which these parameters match. The TSCTSF shall read time synchronization capabilities from the DS-TT and NW-TT, if not available in the AF session, from the PCF by triggering Npcf\_PolicyAuthorization\_Update request message as defined in 3GPP TS 29.514 [20] and determine the (g)PTP capabilities from the DS-TT and the NW-TT as described in clause K.2.1 of 3GPP TS 23.501 [2]. The TSCTSF shall update the time synchronization service capability for this new DS-TT as defined in clause 5.2.2.4.2.

- Upon AF sessions establishment, i.e. when the TSCTSF receives the AF request for the time synchronization service, the TSCTSF shall retrieve Time Synchronization Subscription data from UDM. The TSCTSF, shall use the parameters of existing "Individual Time Synchronization Exposure Subscription" resources to determine whether they shall be associated to this newly created AF session. The TSCTSF associates the new AF session to the "Individual Time Synchronization Exposure Subscription" resources for which these parameters match if the AF-session (i.e., the SUPI) is authorized by UDM subscription, otherwise the AF-session is excluded.

- Upon "Individual Time Synchronization Exposure Subscription" resource creation, the TSCTSF uses the parameters of the created resource to determine which existing and authorized AF sessions it matches. The TSCTSF associates the new "Individual Time Synchronization Exposure Subscription" resource to the authorized AF sessionsfor which these parameters match.

- To remove an AF session from the associated ones to the "Individual Time Synchronization Exposure Subscription" resource, when the TSCTSF receives the Npcf\_PolicyAuthorization\_Notify service operation indicating the termination of an existing PDU session, the TSCTSF triggers the Npcf\_PolicyAuthorization\_Delete request message to the PCF and determines if the corresponding AF session is associated with the "Individual Time Synchronization Exposure Subscription" resource. If it is so, the TSCTSF shall remove the AF session from the list of AF session(s) associated with the "Individual Time Synchronization Exposure Subscription" resource. The TSCTSF shall update the time synchronization service capability for this removed DS-TT as defined in clause 5.2.2.4.2.

NOTE 2: After the TSCTSF retrieves from the BSF the PCF binding information (including the UE Identities for the notified PDU session), as specified in 3GPP TS 29.521 [23], the TSCTSF can store internally the information required to invoke Npcf\_PolicyAuthorization\_Create service operation and delay the Npcf\_PolicyAuthorization\_Create service operation (the creation of the AF session) till the subscription to notification of the capability of time synchronization service is received for the concerned UE. In this case, when the TSCTSF receives the subscription request, the TSCTSF interacts with the PCF by triggering Npcf\_PolicyAuthorization\_Create message as defined in 3GPP TS 29.514 [20].

NOTE 3: When the TSCTSF receives the Npcf\_PolicyAuthorization\_Notify service operation indicating the termination of an existing PDU session associated to an AF session that it is not associated with any "Individual Time Synchronization Exposure Subscription" resource, the TSCTSF removes the AF-session and triggers the Npcf\_PolicyAuthorization\_Delete request message to the PCF.

If the TSCTSF cannot successfully fulfil the received HTTP POST request due to the internal TSCTSF error or due to the error in the HTTP POST request, the TSCTSF shall send the HTTP error response as specified in clause 6.1.7.

##### 5.2.2.2.3 Modifying an existing subscription

Figure 5.2.2.2.3-1 illustrates the modification of a subscription.



Figure 5.2.2.2.3-1: Modification of a subscription

To modify the subscription to the notification of the capability of time synchronization service, the NF service consumer shall send an HTTP PUT message to the TSCTSF to the URI "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}" representing an existing "Individual Time Synchronization Exposure Subscription" resource, as shown in figure 5.2.2.2.3-1, step 1. The HTTP PUT message shall include the TimeSyncExposureSubsc data structure as request body. The TimeSyncExposureSubsc data structure shall include the parameters as defined in clause 5.2.2.2.2.

Upon receipt of the HTTP request from the NF service consumer, if the request is authorized, the TSCTSF shall:

- update the existing "Individual Time Synchronization Exposure Subscription" resource;

- identify the affected AF session(s) based on the parameters received from the NF service consumer and interact with the PCF by triggering Npcf\_PolicyAuthorization\_Update request message as defined in 3GPP TS 29.514 [20] for the new added UE(s), by triggering Npcf\_PolicyAuthorization\_Delete request message as defined in 3GPP TS 29.514 [20] for the removed UE(s) or by triggering Npcf\_PolicyAuthorization\_Update request message as defined in 3GPP TS 29.514 [20] for the existing UE(s) if necessary.

NOTE 1: If the PCF determines an existing PDU Session is potentially impacted by time synchronization service (based on local configuration or SM Policy Association), the PCF invokes Npcf\_PolicyAuthorization\_Notify service operation to the TSCTSF as defined in clause 4.2.5.16 of 3GPP TS 29.514 [20] to send the received TSC User Plane Node information. At that time, the TSCTSF retrieves from the BSF the PCF binding information (including the UE Identities as SUPI and if available, GPSI for the notified PDU session), as specified in 3GPP TS 29.521 [23], and can create the AF-session by sending to the PCF the Npcf\_PolicyAuthorization\_Create service operation.

NOTE 2: After the TSCTSF retrieves from the BSF the PCF binding information (including the UE Identities for the notified PDU session), as specified in 3GPP TS 29.521 [23], the TSCTSF can store internally the information required to invoke Npcf\_PolicyAuthorization\_Create service operation and delay the Npcf\_PolicyAuthorization\_Create service operation (the creation of the AF-session) till the subscription to notification of the capability of time synchronization service is received for the concerned UE. In this case, when the TSCTSF receives the subscription request, the TSCTSF interacts with the PCF by triggering Npcf\_PolicyAuthorization\_Create message as defined in in 3GPP TS 29.514 [20].

- update the list of AF sessions that are associated to the "Individual Time Synchronization Exposure Subscription" resource (i.e. add or remove AF sessions as associated to this resource) based on if the parameters of the AF sessions match the updated parameters of the "Individual Time Synchronization Exposure Subscription" resource.

- send a HTTP response including "200 OK" status code with TimeSyncExposureSubsc data structure or "204 No Content" status code, as shown in figure 5.2.2.2.3-1, step 2.

If the HTTP PUT request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP PUT request the cause for the rejection as specified in clause 6.1.7.

If the TSCTSF determines the received HTTP PUT request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

#### 5.2.2.3 Ntsctsf\_TimeSynchronization\_CapsUnsubscribe

##### 5.2.2.3.1 General

This service operation is used by an NF service consumer to unsubscribe from the notifications.

The following procedure using the Ntsctsf\_TimeSynchronization\_CapsUnsubscribe service operation is supported:

- unsubscription from capability notifications.

##### 5.2.2.3.2 Unsubscription from capability notifications

Figure 5.2.2.3.2-1 illustrates the unsubscription from event notifications.



Figure 5.2.2.3.2-1: Unsubscription from capability notifications

To unsubscribe from event notifications, the NF service consumer shall send an HTTP DELETE request with: "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the subscription correlation ID of the existing subscription that is to be deleted.

Upon the reception of the HTTP DELETE request, if the received HTTP request is successfully processed and accepted, the TSCTSF shall:

- remove the corresponding subscription;

- identify the affected AF session(s) and, for each AF session, interact with the PCF by triggering Npcf\_PolicyAuthorization\_Delete request message as defined in 3GPP TS 29.514 [20]; and

- send an HTTP "204 No Content" response.

If the HTTP DELETE request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP DELETE request the cause for the rejection as specified in clause 6.1.7.

If the TSCTSF determines the received HTTP DELETE request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

#### 5.2.2.4 Ntsctsf\_TimeSynchronization\_CapsNotify

##### 5.2.2.4.1 General

This service operation is used by the TSCTSF to send notifications to NF service consumers upon the detection of the capability of the time synchronization service for a list of UEs.

The following procedure using the Ntsctsf\_TimeSynchronization\_CapsNotify service operation is supported:

- notification about the capability of time synchronization service.

##### 5.2.2.4.2 Notification about the capability of time synchronization service

Figure 5.2.2.4.2-1 illustrates the notification about the capability of time synchronization service.



Figure 5.2.2.4.2-1: Notification about the capability of time synchronization service

The TSCTSF maintains the association between the AF session(s) and the Individual Time Synchronization Exposure Subscription resource as defined in clause 5.2.2.2.2 and detects the capability of time synchronization service (for a list of UEs, a group of UEs or any UE in a DNN and S-NSSAI), by composing the time synchronization capabilities for the DS-TT/UE(s) connected to the NW-TT based on the capability information received from the DS-TT(s) and NW-TT via the PCF. If the NF service consumer includes an Event Filter with one or more of the requested PTP instance type, requested transport protocol for PTP, or requested PTP Profile, the TSCTSF considers only the DS-TT(s) and NW-TT(s) with these capabilities as part of the time synchronization capability set that is reported to the NF service consumer. If necessary, when the list of AF session(s) associated to the Individual Time Synchronization Exposure Subscription resource changes, e.g. upon PDU Session establishment or termination, the TSCTSF may notify the update of the capability of time synchronization service for the DS-TT/UE(s) connected to the NW-TT(s). In order to send the capability of time synchronization service to the NF service consumer, the TSCTSF shall send an HTTP POST request with "{subsNotifUri}", as previously provided by the NF service consumer within the corresponding subscription, as request URI and TimeSyncExposureSubsNotif data structure as request body that shall include:

- Notification correlation ID provided by the NF service consumer during the subscription within "subsNotifId" attribute; and

- information about the observed event(s) within the "eventNotifs" attribute that shall contain for each observed event an "SubsEventNotification" data structure that shall include:

1. the detected event within the "event" attribute;

2. when the event is "AVAILABILITY\_FOR\_TIME\_SYNC\_SERVICE", the capabilities of time synchronization service for one or more user plane nodes with the "timeSyncCapas" attribute. Within each instance of TimeSyncCapability data structure, the TSCTSF shall include the identifier of the applicable NW-TT within the "upNodeId" attribute, the "gmCapables" attribute indicating if the user plane node supports acting as a gPTP and/or PTP grandmaster, the supported 5G clock quality within the "asTimeRes" attribute, if applicable, and the PTP capabilities for each UE within the "ptpCapForUes" attribute, when the UEs are identified with a SUPI, or within "ptpCapForGpsis" attribute, when the UEs are identified with a GPSI.

Upon the reception of an HTTP POST, the NF service consumer shall send an HTTP "204 No Content" response for a successful processing.

If the HTTP POST request from the TSCTSF is not accepted, the NF service consumer shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.1.7.

If the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

#### 5.2.2.5 Ntsctsf\_TimeSynchronization\_ConfigCreate

##### 5.2.2.5.1 General

This service operation is used by an NF service consumer to create a time synchronization configuration and activate the time synchronization service with the configuration.

The following procedures using the Ntsctsf\_TimeSynchronization\_ConfigCreate service operation are supported:

- creating a new configuration; and

- creating a subscription for notification for the changes in the time synchronization service configuration.

##### 5.2.2.5.2 Creating a new configuration

Figure 5.2.2.5.2-1 illustrates the creation of a configuration.



Figure 5.2.2.5.2-1: Creation of a configuration

To create a configuration, the NF service consumer shall send an HTTP POST message to the TSCTSF to the URI "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}/configurations". The HTTP POST message shall include the TimeSyncExposureConfig data structure as request body, as shown in figure 5.2.2.5.2-1, step 1. The TimeSyncExposureConfig data structure shall include:

- the user plane node Id within the "upNodeId" attribute;

- the requested PTP instance within the "reqPtpIns" attribute;

- the time domain within the "timeDom" attribute;

- the notification URI within the "configNotifUri" attribute;

- the notification correlation Id within the "configNotifId" attribute;

and may include:

- the "gmEnable" attribute set to true if the AF requests 5GS to act as a grandmaster for PTP or gPTP;

- the time synchronization error budget within the "timeSyncErrBdgt" attribute;

- the gandmaster priority with the "gmPrio" attribute;

- the temporal validity condition within the "tempValidity" attribute;

- if the "CoverageAreaSupport" feature is supported, the time synchronization coverage area encoded as "covReq" attribute, that contains a list of Tracking Area codes per serving network where the requested PTP instance applies; and

- if the "NetTimeSyncStatus" feature is supported, the clock quality detail level in the "clkQltDetLvl" attribute and the clock quality acceptance criteria for the PTP instance in the "clkQltAcptCri" attribute if applicable, if the NF service consumer to subscribe to receiving network time synchronization status report(s).

NOTE 1: The AF request for PTP service activation, modification cannot indicate that the clock quality detail level to provide is "metrics", i.e. if the AF includes the clock quality detail level, its value needs to set to "acceptable/not acceptable indication" and accompanied with "clock quality acceptance criteria". The UE/DS-TT retrieves detailed information (timing synchronization metrics) from Announce messages sent for (g)PTP services.

Upon receipt of the HTTP request from the NF service consumer, if the request is authorized, the TSCTSF shall:

- create a new resource, which represents a new "Individual Time Synchronization Exposure Configuration" instance, addressed by a URI as defined in clause 6.1.3.5 and containing a TSCTSF created resource identifier;

- send an HTTP "201 Created" response with TimeSyncExposureConfig data structure as response body and a Location header field containing the URI of the created Individual Time Synchronization Exposure Configuration resource, i.e. "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subcriptionId}/configuration/{configurationId}", as shown in figure 5.2.2.5.2-1, step 2;

- use the {subscriptionId} within the requested URI and user plane node ID within the "upNodeId" attribute in the request to determine the target UEs and corresponding authorized AF sessions, then use the parameters (e.g. requested PTP instance type, transport protocol, and PTP profile) in the request to determine suitable DS-TT(s) and AF session(s) among all the AF session(s) and:

a. if the "CoverageAreaSupport" feature is supported and a time synchronization coverage area is provided within the "covReq" attribute, the TSCTSF perform the following operations:

1. if the UE's Time Synchronization Subscription data from the UDM contains the list of TA(s) that comprise the authorized time synchronization coverage area. If the requested time synchronization coverage area within the "covReq" attribute is within the subscribed time synchronization coverage area, the TSCTSF determines that the time synchronization coverage area is fulfilled, and the UE is authorized for the requested time synchronization service. 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 intersection of them. If there is no overlap between them, the TSCTSF shall reject the AF request as described in clause 5.27.1.11 of 3GPP TS 23.501 [2].

2. The TSCTSF discovers the list of AMF(s) serving the list of TA(s) that comprise the authorized time synchronization coverage area using the Nnrf\_NFDiscovery service operation as described in 3GPP TS 29.510 [10], if they are not available, and, for each UE with matched AF-sessions, subscribes with the discovered AMF(s) to receive notifications about presence of the UE in an Area of Interest events using the Namf\_EventExposure service as described in 3GPP TS 29.518 [27], where the Area of Interest is the provided time synchronization coverage area.

3. Based on the outcome provided by the AMF about the UE’s presence in the Area of Interest and the authorized time synchronization coverage area, the TSCTSF determines if the time synchronization service is activated or deactivated:

i. If the UE presence is within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the time synchronization coverage area condition is fulfilled, and the UE is authorized for the activation of the received PTP instance configuration.

ii. If the UE presence is not within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the time synchronization coverage area condition is not fulfilled, and the UE is not authorized for the activation of the received PTP instance configuration;

b If the UE's Time Synchronization Subscription data contains the authorized Uu time synchronization error budget, and the requested time synchronization error budget within the "timeSyncErrBdgt" attribute is within the authorized time synchronization coverage area, the TSCTSF determines that the UE is authorized for the requested time synchronization service.

c. If the UE's Time Synchronization Subscription data contains the periods of authorized start and stop times, and the requested temporal validity condition within the "tempValidity" attribute is within any of the subscribed periods of authorized start and stop times, the TSCTSF determines that the UE is authorized for the requested time synchronization service.

- for each authorized UE and matched AF-session, contact with the each corresponding PCF for the PDU session to configure and initialize the PTP instance in the DS-TT(s) and NW-TT as defined in 3GPP TS 23.502 [3], clause 4.15.9.3.2, step 5-6;

- for each authorized UE with matched AF-session(s), calculate the Uu time synchronization error budget as specified in clauses 5.27.1.9 and 5.27.1.11 of 3GPP TS 23.501 [2], subscribe to event notifications of newly registered PCF for the UE for the affected UEs by invoking Nbsf\_Management\_Subscribe Service Operation as defined in clause 4.2.6 of 3GPP TS 29.521 [23] if not yet done, and send a request to the PCF for the UE for AM policy authorization by invoking Npcf\_AMPolicyAuthorization\_Create service operation as defined in clause 4.2.2 of 3GPP TS 29.534 [14] providing the appropriate values in the "asTimeDisParam" attribute in order to activate the access stratum time distribution and provide the calculated Uu time synchronization error budget.

- if the "NetTimeSyncStatus" feature is supported and upon the reception of the clock quality acceptance criteria in the "clkQltAcptCri" attribute, then TSCTSF subscribes to UPF/NW-TT time synchronization status reports via UMIC as described in clause 4.2.2.31 of 3GPP TS 29.514 [20], if the UPF/NW-TT is involved in providing time synchronization information to DS-TT. In case NG-RAN is involved in providing time synchronization status information to DS-TT, then TSCTSF sends the time synchronization status reporting control information to the NG-RAN and then initiates the subscription to the NG-RAN time synchronization status via AMF using Namf\_Communication\_NonUeN2InfoSubscribe service operation, if not previously done for the involved NG-RAN node, as described in 3GPP TS 29.518 [27].

If the temporal validity condition is provided and if the start-time is in the future, the TSCTSF shall maintain the time synchronization configuration and then proceed as described above when the start-time is reached; otherwise, if the start-time is in the past, the TSCTSF shall proceed as described above immediately. When the stop-time is reached for active time synchronization service configuration, the TSCTSF shall proceed as Ntsctsf\_TimeSynchronization\_ConfigDelete was received as described in clause 5.2.2.7.2 without interacting with the AF.

The TSCTSF shall associate the affected UEs and matched AF sessions to the "Individual Time Synchronization Exposure Configuration". When the "CoverageAreaSupport" feature is supported, the TSCTSF also associates whether the UE fulfills the time synchronization coverage area condition, if provided. When receiving the Npcf\_PolicyAuthorization\_Notify service operation indicating the termination of an existing PDU session and the corresponding AF session is associated with the "Individual Time Synchronization Exposure Configuration" resource, the TSCTSF shall remove the AF session from the list of AF sessions associated with the "Individual Time Synchronization Exposure Configuration" resource and invoke Npcf\_AMPolicyAuthorization\_Delete service operation as defined in clause 4.2.4 of 3GPP TS 29.534 [14] to remove the access stratum time distribution parameters for the UE if they were provided.

If for all the affected UEs the provided parameters are not allowed by subscription, the TSCTSF shall indicate in an HTTP "403 Forbidden" response message the "cause" attribute set to "UE\_SERVICE\_NOT\_AUTHORIZED".

If the HTTP POST request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.1.7.

If the TSCTSF determines the received HTTP POST request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

#### 5.2.2.6 Ntsctsf\_TimeSynchronization\_ConfigUpdate

##### 5.2.2.6.1 General

This service operation is used by an NF service consumer to update a time synchronization configuration.

The following procedures using the Ntsctsf\_TimeSynchronization\_ConfigUpdate service operation are supported:

- Updating an existing configuration;

- Creating the subscription for notification for the changes in the time synchronization service configuration in case the subscription was not created before.

##### 5.2.2.6.2 Updating an existing configuration

Figure 5.2.2.6.2-1 illustrates the updating of an existing configuration.



Figure 5.2.2.6.2-1: Update of a configuration

To update a configuration, the NF service consumer shall send an HTTP PUT request to the resource "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}/configurations/{configurationId}" representing an existing "Individual Time Synchronization Exposure Configuration" resource, as shown in figure 5.2.2.6.2-1, step 1, to modify the configuration.

The TimeSyncExposureConfig data structure provided in the request body shall include:

- the user plane node Id within the "upNodeId" attribute;

NOTE 1: The user plane node Id cannot be changed during the modification.

- the requested PTP instance within the "reqPtpIns" attribute;

- the time domain within the "timeDom" attribute;

NOTE 2: The user plane node Id, the requested PTP instance and the time domain cannot be changed during the modification.

- the notification URI within the "configNotifUri" attribute;

- the notification correlation Id within the "configNotifId" attribute;

NOTE 3: If the notification URI or notification correlation Id is not changed the previously value is included.

and may include:

- the "gmEnable" attribute set to true if the AF requests 5GS to act as a grandmaster for PTP or gPTP;

- the time synchronization error budget within the "timeSyncErrBdgt" attribute;

- the gandmaster priority with the "gmPrio" attribute;

- the temporal validity condition within the "tempValidity" attribute;

- if the "CoverageAreaSupport" feature is supported, the spatial validity condition encoded as "covReq" attribute, that contains a list of Tracking Area codes per serving network where the requested PTP instance applies; and

- if the "NetTimeSyncStatus" feature is supported, the clock quality detail level in the "clkQltDetLvl" attribute and the clock quality acceptance criteria for the PTP instance in the "clkQltAcptCri" attribute if applicable.

Upon receipt of the corresponding HTTP PUT message, if the request is authorized, theTSCTSF shall:

- update the existing "Individual Time Synchronization Exposure Configuration" resource;

- send a HTTP response including "200 OK" status code with TimeSyncExposureConfig data structure or "204 No Content" status code, as shown in figure 5.2.2.6.2-1, step 2;

- use the {subscriptionId} within the requested URI and user plane node ID within the "upNodeId" attribute in the request to determine the target UEs and corresponding AF-sessions, then use the updated parameters (e.g. requested PTP instance type, transport protocol, and PTP profile) in the request to determine suitable DS-TT(s) and AF session(s) among all AF session:

a. If the "CoverageAreaSupport" feature is supported and a requested coveragea area is provided or updated within the "covReq" attribute, the TSCTSF perform the following operations:

1. the TSCTSF, based on the time synchronization coverage area retrieved from UDM determines whether the UE is authorized for the request again as described in clause 5.2.2.5.2.

2. The TSCTSF discovers the list of AMF(s) serving the list of TA(s) that comprise the authorized time synchronization coverage area using the Nnrf\_NFDiscovery service operation as described in 3GPP TS 29.510 [10], if they are not available, and for each UE with matched AF-sessions, subscribes/updates the subscription, if applicable, with the discovered AMF(s) to receive notifications about presence of the UE in an Area of Interest events using the Namf\_EventExposure service as described in 3GPP TS 29.518 [27], where the Area of Interest is the requested/applicable spatial validity condition.

3. Based on the outcome provided by the AMF or available in the TSCTSF about the UE’s presence in the Area of Interest, the TSCTSF determines if the time synchronization service is activated or deactivated:

i. If the UE presence is within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the spatial validity condition is fulfilled, and the UE is authorized for the activation of the received PTP instance configuration.

- If the UE presence is within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the spatial validity condition is not fulfilled, and the UE is not authorized for the activation of the received PTP instance configuration;

b. If the "CoverageAreaSupport" feature is supported and a requested coverage area previously provided is removed, the TSCTSF perform the following operations:

1. For each UE with matched AF-sessions, the TSCTSF terminates the subscriptions to notifications about presence of the UE in an Area of Interest events using the Namf\_EventExposure service as described in 3GPP TS 29.518 [27].

2. For each UE with matched AF-sessions that did not fulfil the removed spatial validity condition, the TSCTSF determines the UE is authorized for the activation of the received PTP instance configuration

c. If the time synchronization error budget within the "timeSyncErrBdgt" attribute and/or the temporal validity condition within the "tempValidity" attribute from the NF service consumer is provided, updated, or removed, the TSCTSF based on the Time Synchronization Subscription data retrieved from the UDM determines whether the UE is authorized for the request again as described in clause 5.2.2.5.2

- for each authorized UE and matched AF-session, and contact with each correspondingPCF for the PDU session to configure and initialize the PTP instance in the DS-TT(s) and NW-TT as defined in 3GPP TS 23.502 [3], clause 4.15.9.3.3, step 5-6. The TSCTSF associates the new affected AF session(s) with the "Individual Time Synchronization Exposure Configuration" resource.

- for each authorized UE with matched AF-session(s), if the time synchronization error budget is provided, updated, or removed, calculate the Uu time synchronization error budget as specified in clause 5.27.1.9 of 3GPP TS 23.501 [2]and send a request to the PCF for the UE for AM policy authorization by invoking Npcf\_AMPolicyAuthorization\_Update service operation as defined in clause 4.2.3 of 3GPP TS 29.534 [14] in order to update the Uu time synchronization error budget.

- if the "NetTimeSyncStatus" feature is supported and upon the reception of the updated clock quality acceptance criteria within the "clkQltAcptCri" attribute, then TSCTSF determines the clock acceptance criteria results as specified in clause 5.2.2.8.2. In case the updated clock quality acceptance criteria within the "clkQltAcptCri" attribute is received and the clock acceptance criteria results is not available, then TSCTSF subscribes to UPF/NW-TT time synchronization status reports via UMIC as described in clause 4.2.3.34 of 3GPP TS 29.514 [20], if the UPF/NW-TT is involved in provoding time information to DS-TT. In case NG-RAN is involved in providing time synchronization status information to DS-TT, then TSCTSF sends the updated confiugration of time synchronization status reporting to the NG-RAN and then initiates the subscription to the NG-RAN time synchronization status via AMF using Namf\_Communication\_NonUeN2InfoSubscribe service operation, as described in 3GPP TS 29.518 [27]

If the temporal validity condition was provided but it is removed during the update of time synchronization configuration, the TSCTSF shall perform the time synchronization configuration as described above without considering the temporal validity condition.

If the temporal validity condition was not provided and the temporal validity condition is provided during the update of configuration, the TSCTSF shall perform as follows:

- if the start-time is in the future, the TSCTSF shall maintain the time synchronization configuration and then proceeds as described above when the start-time is reached; otherwise, if the start-time is in the past, the TSCTSF shall proceed as described above immediately;

- When the stop-time is reached for active time synchronization service configuration, the TSCTSF shall proceed as Ntsctsf\_TimeSynchronization\_ConfigDelete was received as described in clause 5.2.2.7.2 without interacting with the AF.

If the temporal validity condition was provided and the temporal validity condition is updated during the update of configuration, the TSCTSF shall perform as follows:

- if the previously provided time configuration is being applied but the new start-time is in the future, the TSCTSF shall proceed as Ntsctsf\_TimeSynchronization\_ConfigDelete was received as described in clause 5.2.2.7.2 without interacting with the AF firstly and then proceeds as described above when the new start-time is reached; otherwise if the time synchronization configuration has been created but the new start-time is in the past, the TSCTSF keep the existing configuration;

- when the new stop-time is reached for active time synchronization service configuration, the TSCTSF shall proceed as Ntsctsf\_TimeSynchronization\_ConfigDelete was received as described in clause 5.2.2.7.2 without interacting with the AF;

- if the previously provided time configuration is not being applied because the previously provided start-time is in the future, the TSCTSF shall perform as the case that the temporal validity condition was not provided previously.

The TSCTSF shall associate the affected UEs and matched AF session to the "Individual Time Synchronization Exposure Configuration". When the "CoverageAreaSupport" feature is supported, the TSCTSF also associates whether the UE fulfills the spatial validity condition, if provided. When receiving the Npcf\_PolicyAuthorization\_Notify service operation indicating the termination of an existing PDU session and the corresponding AF session is associated with the "Individual Time Synchronization Exposure Configuration" resource, the TSCTSF shall remove the AF session from the list of AF sessions associated with the "Individual Time Synchronization Exposure Configuration" resource and invoke Npcf\_AMPolicyAuthorization\_Delete service operation as defined in clause 4.2.4 of 3GPP TS 29.534 [14] to remove the access stratum time distribution parameters for the UE if they were provided.

If for all the affected UEs the provided parameters are not allowed by subscription, the TSCTSF shall indicate in an HTTP "403 Forbidden" response message the "cause" attribute set to "UE\_SERVICE\_NOT\_AUTHORIZED".

If the HTTP PUT request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP PUT request the cause for the rejection as specified in clause 6.1.7.

If the TSCTSF determines the received HTTP PUT request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

#### 5.2.2.7 Ntsctsf\_TimeSynchronization\_ConfigDelete

##### 5.2.2.7.1 General

This service operation is used by an NF service consumer to delete a time synchronization configuration.

The following procedures using the Ntsctsf\_TimeSynchronization\_ConfigDelete service operation are supported:

- Deleting an existing configuration.

##### 5.2.2.7.2 Deleting an existing configuration

Figure 5.2.2.7.2-1 illustrates the deleting of an existing configuration.



Figure 5.2.2.7.2-1: Deletion of a configuration

To delete a configuration, the NF service consumer shall send an HTTP DELETE request to the resource "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}/configurations/{configurationId}" representing an existing "Individual Time Synchronization Exposure Configuration" resource, as shown in figure 5.2.2.7.2-1, step 1, to delete the configuration.

Upon the reception of an HTTP DELETE request and if the HTTP DELETE request is accepted by the TSCTSF, the TSCTSF shall:

- remove the corresponding configuration and respond with "204 No Content" as shown in figure 5.2.2.7.2-1, step 2;

- use the {configurationId} within the requested URI to identify the time synchronization service configuration and the corresponding AF sessions, and then interact with:

- the PCF(s) for the PDU Session to disable the corresponding PTP instance(s) in the DS-TT(s) and NW-TT as defined in 3GPP TS 23.502 [3], clause 4.15.9.3.4, step 5-6.

- the PCF(s) for the UE to remove the time synchronization error budget by invoking the Npcf\_AMPolicyAuthorization\_Delete service operation as defined in clause 4.2.4 of 3GPP TS 29.534 [14].

If the HTTP DELETE request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP DELETE request the cause for the rejection as specified in clause 6.1.7.

If the TSCTSF determines the received HTTP DELETE request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

#### 5.2.2.8 Ntsctsf\_TimeSynchronization\_ConfigUpdateNotify

##### 5.2.2.8.1 General

This service operation is used by an TSCTSF to notify the NF Service Consumer of the current state of the time synchronization configuration.

The following procedures using the Ntsctsf\_TimeSynchronization\_ConfigUpdateNotify service operation are supported:

- notification about the current state of the time synchronization configuration.

##### 5.2.2.8.2 Notifying the current state of an existing configuration

Figure 5.2.2.8.2-1 illustrates the notification about the current state of the time synchronization configuration.



Figure 5.2.2.8.2-1: Notification about the current state of the time synchronization configuration

When the TSCTSF receives the notification of the change in the PTP instance for each DS-TT and/or NW-TT from the PCF as defined in clause 4.2.5.13 of 3GPP TS 29.514 [20] or when the TSCTSF receives the NG-RAN time synchronization status update related to clock quality acceptance criteria via AMF as described in clause 5.2.2.4.2 of 3GPP TS 29.518 [27] and determines the affected PTP instance(s), the TSCTSF shall determine the current state of the time synchronization configuration and sends an HTTP POST request with "{configNotifUri}", as previously provided by the NF service consumer within the corresponding configuration, as URI and the TimeSyncExposureConfigNotif data structure as request body, as shown in figure 5.2.2.8.2-1, step 1.

The TimeSyncExposureConfigNotif data structure as request body that shall include:

- Notification correlation ID provided by the NF service consumer during the configuration within the "configNotifId" attribute;

- current states of the time synchronization configuration for the DS-TT port(s) and/or NW-TT port within the "stateOfConfig" attribute;

and may include:

- if "NetTimeSyncStatus" feature is supported, the report of whether the time synchronization service status according to the clock quality acceptance criteria result is acceptable or not acceptable within the "stateOfConfig" attribute.

If the "CoverageAreaSupport" feature is supported and the TSCTSF received time synchronization coverage area as part of the Ntsctsf\_TimeSynchronization\_ConfigCreate/Update service operation as described in clauses 5.2.2.5.2 and 5.2.2.6.2, when the TSCTSF receives a change in the UE presence in Area of Interest notification as described in 3GPP TS 29.518 [27], the TSCTSF checks the activation or deactivation of the time synchronization service and adds/removes the UE/DS-TT port to/from the PTP instance and configures the Grandmaster functionality, as applicable, as specified in clause K.2.1 of 3GPP TS 23.501 [2]. For the added/removed UE/DS-TT port to/from the PTP instance, the TSCTSF triggers the notification to the NF service consumer where the "stateOfDstts" attribute within the "stateOfConfig" attribute shall include the state of the added/removed UE/DS-TT port.

If the "NetTimeSyncStatus" feature is supported and the TSCTSF received the clock quality detail level and the clock quality acceptance criteria as part of the Ntsctsf\_TimeSynchronization\_ConfigCreate/Update service operation as described in clauses 5.2.2.5.2 and 5.2.2.6.2, when the TSCTSF receives a change corresponding to the time synchronization status as described in clause 5.27.1.12 of 3GPP TS 23.501 [2], the TSCTSF provides the notification for the clock quality acceptance criteria result by including the "clkQltAcptCriResInd" attribute within the "stateOfConfig" attribute (for the result related to the NW-TT port(s)) and/or within the entries of the "stateOfDstts" attribute of the "stateOfConfig" attribute (for the results related to every DS-TT port).

Editor’s note: Whether it is required the report of the clock quality acceptance criteria for the NW-TTP ports (i.e., whether the clkQltIndOfNwtt attribute is needed) is FFS and requires SA2 clarifications.

If the HTTP POST request from the TSCTSF is not accepted, the NF service consumer shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.1.7.

If the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

## 5.3 Ntsctsf\_QoSandTSCAssistance Service

### 5.3.1 Service Description

#### 5.3.1.1 Overview

This service provides:

- Authorization of NF Service Consumer requests for the resource reservation for TSC.

- NF Service Consumer request to reserve or update resources for handling traffic characterized by TSC QoS parameters as described in clause 6.1.3.22 of TS 23.503 [19].

#### 5.3.1.2 Network Functions

##### 5.3.1.2.1 TSCTSF

The TSCTSF supports to:

- receive the request to reserve or update a specific QoS or a specific QoS with additional Alternative QoS for an AF session;

- receive the request to delete the AF session with requested QoS or the AF session with requested QoS including Alternative Service Requirements

- receive the request to subscribe or unsubscribe to the event(s) about the AF session with requested QoS or the AF session with requested QoS including Alternative Service Requirements;

- determine the requested PDB and construct the TSC Assistance Container; and

- Notify the NF service consumer of the event(s).

##### 5.3.1.2.2 NF Service Consumers.

The NF service consumer supports to:

- send the request to reserve or update a specific QoS or a specific QoS with additional Alternative QoS for an AF session;

- send the request to delete the AF session with requested QoS or the AF session with requested QoS including Alternative Service Requirements

- send the request to subscribe or unsubscribe to the event(s); and

- receive the notification of the event(s).

### 5.3.2 Service Operations

#### 5.3.2.1 Introduction

Service operations defined for the Ntsctsf\_QoSandTSCAssistance service are shown in table 6.3.2.1-1.

Table 5.3.2.1-1: Ntsctsf\_TimeSynchronization Service Operations

|  |  |  |
| --- | --- | --- |
| Service Operation Name | Description | Initiated by |
| Ntsctsf\_QoSandTSCAssistance\_Create | Allows the NF service consumer to request the network to provide a specific QoS or a specific QoS with additional Alternative QoS for an AF session. | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_QoSandTSCAssistance\_Update | Allows the NF service consumer to request the network to update the QoS or the QoS with additional Alternative QoS for an AF session | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_QoSandTSCAssistance\_Delete | Allows the NF service consumer to request the network to delete the AF session with requested QoS or the AF session with requested QoS including Alternative Service Requirements. | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_QoSandTSCAssistance\_Notify | Allows the TSCTSF to report the QoS Flow level event(s) to the NF service consumer. | TSCTSF |
| Ntsctsf\_QoSandTSCAssistance\_Subscribe | Allows the NF service consumer to subscribe to the event(s). | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_QoSandTSCAssistance\_Unsubscribe | Allows the NF service consumer to unsubscribe to the event(s). | NF service consumer (e.g. AF, NEF) |

NOTE: The NEF and the AF use the Ntsctsf\_QoSandTSCAssistance service in the same way.

#### 5.3.2.2 Ntsctsf\_QoSandTSCAssistance\_Create

##### 5.3.2.2.1 General

This service operation is used by an NF service consumer to request the network to provide a specific QoS for an AF session.

The following procedures using the Ntsctsf\_QoSandTSCAssistance\_Create service operation are supported:

- Initial provisioning of TSC related service information.

- Subscriptions to Service Data Flow QoS notification control.

- Subscription to Service Data Flow Deactivation

- Subscription to resources allocation outcome

- Subscriptions to Service Data Flow QoS Monitoring Information.

- Initial provisioning of sponsored connectivity information.

- Initial provisioning of AF requested QoS for a UE or a group of UE(s) not identified by UE address.

- Subscription to BAT offset notification.

##### 5.3.2.2.2 Initial provisioning of TSC related service information

This procedure is used to set up a TSC AF application session context for the service as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.3.2.2.2-1 illustrates the initial provisioning of TSC related service information.



Figure 5.3.2.2.2-1: Initial provisioning of TSC related service information

When a new TSC AF application session context needs to be established, the NF service consumer shall invoke the Ntsctsf\_QoSandTSCAssistance\_Create service operation by sending the HTTP POST request to the resource URI representing the "TSC Application Sessions" collection resource of the TSCTSF, as shown in figure 5.3.2.2.2-1, step 1.

The NF service consumer shall include the "TscAppSessionContextData" data type in the content of the HTTP POST request in order to request the creation of the "Individual TSC Application Session Context" resource. The "Individual TSC Application Session Context" resource and the "Events Subscription" sub-resource are created as described below.

The NF service consumer shall include in the "TscAppSessionContextData" data structure:

- the AF identifier within the "afId" attribute;

- when the "GMEC" feature is not supported, either the IP address (IPv4 or IPv6) of the PDU session within the "ueIpAddr" attribute for IP type PDU session or the MAC address of the DS-TT port within the "ueMac" attribute for Ethernet type PDU sessions;

- when the "GMEC" feature is supported, either the targeted UE within the "ueId" attribute or the targeted group of UE(s) within the "externalGroupId" attribute as defined in clause 5.3.2.2.8;

- either the Application Id within the "appId" attribute or the flow information within:

a. for IP flows, the "flowInfo" attribute; or

b. for Ethernet flows, either the "ethFlowInfo" attribute or, if the Ethernet\_UL/DL\_Flows feature is supported, the "enEthFlowInfo" attribute;

- the QoS reference within the "qosReference" attribute or the individual QoS parameter set (i.e. requested GBR, requested MBR, requested maximum burst size, requested priority if received and requested 5GS delay if received, and requested packet error rate if received) within the "tscQosReq" attribute;

- the input information to construct the TSC Assistance Container within the "tscaiInputUl" attribute and/or "tscaiInputDl" attribute of the "tscQosReq" attribute and the (g)PTP domain that the AF is located in within the "tscaiTimeDom" attribute of the "tscQosReq" attribute, if available; and

- the URI where the TSCTSF can request to the NF service consumer to delete the "Individual TSC Application Session Context" resource within the "notifUri" attribute;

and may include:

- the DNN within the "dnn" attribute;

- the S-NSSAI within the "snssai" attribute;

- the domain identity in the "ipDomain" attribute;

- if the "EnTSCAC" feature is supported, the capability for BAT adaptation in the "capBatAdaptation" attribute;

- an ordered list of alternative QoS references within the "altQosReferences" attribute if the QoS reference is provided or an ordered list of requested alternative QoS parameters set(s) within the "altQosReqs" attribute if the individual QoS parameter set is provided. When the NF service consumer provides the "altQosReferences" attribute or the "altQosReqs" attribute, the NF service consumer shall also subscribe to receive notifications from the TSCTSF when the resources associated to the corresponding service information have been allocated as described in clause 5.3.2.2.5 and when the GBR QoS targets for one or more service data flows can no longer (or can again) be guaranteed, as described in clause 5.3.2.2.3;

and

- the request of the notification of certain user plane events within the "evSubsc" attribute. Within the EventsSubscReqData data structure, the NF service consumer shall include:

a) the URI where the TSCTSF sends the event notification to the NF service consumer within the "notifUri" attribute;

b) a Notification Correlation Identifier for the requested notifications within the "notifCorreId" attribute;

c) the subscribed events within the "events" attribute;

d) the usage threshold within the "usgThres" attribute if the "USAGE\_REPORT" event is subscribed; and

e) QoS monitoring information within the "qosMon" attribute if the "QOS\_MONITORING" event is subscribed.

Upon the reception of this HTTP POST request, the TSCTSF shall:

- construct the TSC Assistance Container based on information provided by the NF service consumer;

- if the Requested 5GS delay including the requested 5GS delay within the individual QoS parameter set or within the requested alternative QoS parameters set(s) is received from NF service consumer, calculate a Requested PDB by subtracting the UE-DS-TT residence time either provided by the PCF or pre-configured at TSCTSF from the Requested 5GS delay;

- if the time domain information is not received with the Burst Arrival Time or Periodicity within the "tscQosReq" attribute from the NF service consumer, the TSCTSF may indicate Time Domain = "5GS" within the "tscaiTimeDom" attribute within the "tscQosReq" attribute to indicate that the NF service consumer does not provide the time domain information;

NOTE 1: The Time Domain value corresponding to "5GS" is locally configured in the SMF and in the TSCTSF, and indicates that the AF does not provide a Time Domain and the provided TSCAI input information will be used without adjustments.

- if the feature EnTSCAC is supported and if the NF service consumer includes the capability for BAT adaptation within the "capBatAdaptation" attribute or a BAT window within the "burstArrivalTimeWnd" attribute within the "tscaiInputUl" attribute and/or "tscaiInputDl" attribute of the "tscQosReq" attribute or the periodicity range in the "periodicityRange" attribute in the request, then the TSCTSF shall subscribe to the notification on BAT offset by using the "EventsSubscReqData" data type including an event within the "events" attribute with the "event" attribute set to "BAT\_OFFSET\_INFO;

- interact with the PCF for the received UE address:

a) if the TSCTSF has an AF-session with the PCF for the received UE address, the TSCTSF shall interact with the PCF by triggering a Npcf\_PolicyAuthorization\_Update request to provision the related parameters to the PCF as defined in 3GPP TS 29.514 [20]; or

b) if the TSCTSF does not have an AF-Session with the PCF for the received UE address, the TSCTSF shall discover the PCF for the PDU session as specified in 3GPP TS 29.521 [23], and shall interact with the PCF by triggering a Npcf\_PolicyAuthorization\_Create to provision the related parameters to the PCF as defined in 3GPP TS 29.514 [20]; and

NOTE 2: If the PCF determines an existing PDU Session is related with TSC traffic (based on local configuration or SM Policy Association), the PCF invokes Npcf\_PolicyAuthorization\_Notify service operation to the TSCTSF as defined in clause 4.2.5.16 of 3GPP TS 29.514 [20] to send the received TSC User Plane Node information. At that time, the TSCTSF retrieves from the BSF the PCF binding information, as specified in 3GPP TS 29.521 [23], and can create the AF-session by sending to the PCF the Npcf\_PolicyAuthorization\_Create service operation, if TSC related information, as e.g. QoS requirements, and/or subscription to PMIC(s)/UMIC updates need to be provided to the PCF.

NOTE 3: After the TSCTSF retrieves from the BSF the PCF binding information (including the UE Identities for the notified PDU session), as specified in 3GPP TS 29.521 [23], the TSCTSF can store internally the received information and delay the Npcf\_PolicyAuthorization\_Create service operation (the creation of the AF-session). In this case, when the TSCTSF receives the QoS request, the TSCTSF interacts with the PCF by triggering a Npcf\_PolicyAuthorization\_Create request to provision the related parameters to the PCF as defined in 3GPP TS 29.514 [20].

- if receiving a successful response from the PCF, the TSCSTF shall create an "Individual TSC Application Session Context" resource and send to the NF service consumer a "201 Created" response to the HTTP POST request, as shown in figure 5.3.2.2.2-1, step 2. If the "evSubsc" attribute is received, the "Events Subscription" sub-resource shall be created within the "Individual TSC Application Session Context" resource. The TSCTSF shall include in the "201 Created" response:

a) a Location header field; and

b) a "TscAppSessionContextData" data type in the content.

The Location header field shall contain the URI of the created "Individual TSC Application Session Context" i.e. "{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}".

When "Events Subscription" sub-resource is created in this procedure, the NF service consumer shall build the sub-resource URI by adding the path segment "/events-subscription" at the end of the URI path received in the Location header field.

If the TSCTSF cannot successfully fulfil the received HTTP POST request due to the internal TSCTSF error or due to the error in the HTTP POST request, the TSCTSF shall send the HTTP error response as specified in clause 6.2.7.

The TSCTSF may send the following error responses based on failed AF-session creation/update request responses received from the PCF as specified in 3GPP TS 29.514 [20]:

a. If the TSCSTSF receives the indication that the PCF failed in executing session binding, the TSCTSF shall reject the HTTP POST request with an HTTP "500 Internal Server Error" response including the "cause" attribute set to "PDU\_SESSION\_NOT\_AVAILABLE".

b. If the service information provided in the body of the HTTP POST request is rejected by the PCF (e.g. the subscribed guaranteed bandwidth for a particular user is exceeded or the authorized data rate in that slice for a UE is exceeded), the TSCTSF shall indicate in an HTTP "403 Forbidden" response message the cause for the rejection including the "cause" attribute set to "REQUESTED\_SERVICE\_NOT\_AUTHORIZED", as received.

c. If the service information provided in the body of the HTTP POST request is rejected due to a temporary condition in the network, the TSCTSF may include in the "403 Forbidden" response the "cause" attribute set to "REQUESTED\_SERVICE\_TEMPORARILY\_NOT\_AUTHORIZED". The TSCTSF may also provide a received retry interval within the "Retry-After" HTTP header field. When the NF service consumer receives the retry interval within the "Retry-After" HTTP header field, the NF service consumer shall not send the same service information to the TSCTSF again (for the same application session context) until the retry interval has elapsed. The "Retry-After" HTTP header is described in 3GPP TS 29.500 [4] clause 5.2.2.2.

The TSCTSF may additionally provide the received acceptable bandwidth within the attribute "acceptableServInfo" included in the "ProblemDetailsTsctsfQosTscac" data structure returned in the rejection response message.

##### 5.3.2.2.3 Subscriptions to Service Data Flow QoS notification control

The NF service consumer shall use the "EventsSubscReqData" data type as described in clause 5.3.2.2.2 and shall include in the HTTP POST request message an event within the "evSubsc" attribute with the "event" attribute set to "QOS\_GUARANTEED" and an event within the "evSubsc" attribute with the "event" attribute set to "QOS\_NOT\_GUARANTEED".

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2.

As result of this action, the TSCTSF shall set the appropriate subscription to QoS notification control as described in in 3GPP TS 29.514 [20].

##### 5.3.2.2.4 Subscription to Service Data Flow Deactivation

The NF service consumer shall use the "EventsSubscReqData" data type as described in clause 5.3.2.2.2 and shall include in the HTTP POST request message an event entry within the "evSubsc" attribute with the "event" attribute set to "FAILED\_RESOURCES\_ALLOCATION".

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2.

As result of this action, the TSCTSF shall set the appropriate subscription to service data flow deactivation as described in in 3GPP TS 29.514 [20].

##### 5.3.2.2.5 Subscription to resources allocation outcome

The NF service consumer shall use the "EventsSubscReqData" data type as described in clause 5.3.2.2.2 and shall include in the HTTP POST request message:

- if the NF service consumer requests the TSCTSF to provide a notification when the resources associated to the service information have been allocated, an event entry within the "events" attribute with the "event" attribute set to "SUCCESSFUL\_RESOURCES\_ALLOCATION"; and/or

- if the NF service consumer requests the TSCTSF to provide a notification when the resources associated to the service information cannot be allocated, an event entry within the "events" attribute with the "event" attribute set to "FAILED\_RESOURCES\_ALLOCATION".

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2.

As result of this action, the TSCTSF shall set the appropriate subscription to notification of resources allocation outcome as described in in 3GPP TS 29.514 [20].

##### 5.3.2.2.6 Subscriptions to Service Data Flow QoS Monitoring Information

The NF service consumer shall use the "EventsSubscReqData" data type as described in clause 5.3.2.2.2 and shall include in the HTTP POST request message an event within the "evSubsc" attribute with the "event" attribute set to "QOS\_MONITORING" and include the QoS monitoring information with the "qosMon" attribute. Within the QosMonitoringInformation data structure, the AF shall include:

- one or more requested QoS Monitoring Parameter(s) within the "reqQosMonParams"; and

- one or more report frequency within the "repFreqs" attribute; and

- when the "repFreqs" attribute includes the value "PERIODIC", the periodic time for reporting and, if the feature "PacketDelayFailureReport" is supported, the maximum period with no QoS measurement results reported within the "repPeriod" attribute; and

- when the "repFreqs" attribute includes the value "EVENT\_TRIGGERED", the AF shall include:

- the minimum waiting time between subsequent reports within the "waitTime" attribute; and

for QoS monitoring for packet delay:

- the delay threshold for downlink with the "repThreshDl" attribute;

- the delay threshold for uplink with the "repThreshUl" attribute; and/or

- the delay threshold for round trip with the "repThreshRp" attribute; and

- if the feature "PacketDelayFailureReport" is supported, the maximum period with no QoS measurement results reported within the"repPeriod" attribute.

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2.

As result of this action, the TSCTSF shall set the appropriate subscription to service data flow QoS monitoring information as described in in 3GPP TS 29.514 [20].

##### 5.3.2.2.7 Initial provisioning of sponsored connectivity information

The NF service consumer may include in the HTTP POST request message described in clause 5.3.2.2.2 an application service provider identity and a sponsor identity within the "aspId" attribute and "sponId" attribute. Additionally, the NF service consumer may provide an indication to the TSCTSF of sponsored data connectivity not enabled by including the "sponStatus" attribute set to "SPONSOR\_DISABLED".

To support the usage monitoring of sponsored data connectivity, the NF service consumer may subscribe with the TSCTSF to the notification of usage threshold reached. The NF service consumer may also include the "evSubsc" attribute with:

- the usage thresholds to apply in the "usgThres" attribute; and

- an entry of the "events" attribute set to "USAGE\_REPORT".

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2.

As result of this action, the TSCTSF shall provision the sponsored data connectivity information to the PCF as described in 3GPP TS 29.514 [20].

The TSCTSF may send the following error responses based on the response to the provisioning of sponsored data connectivity information received from the PCF, as described in 3GPP TS 29.514 [20], as follows:

- HTTP "403 Forbidden" response message with the "cause" attribute set to "UNAUTHORIZED\_SPONSORED\_DATA\_CONNECTIVITY", when received from the PCF.

- HTTP "403 Forbidden" response message the "cause" attribute set to "REQUESTED\_SERVICE\_NOT\_AUTHORIZED", when received from the PCF.

5.3.2.2.8 Initial provisioning of AF requested QoS for a UE or group of UE(s) not identified by UE address

When the "GMEC" feature is supported, if the NF service consumer includes in the HTTP POST request message described in clause 5.3.2.2.2 the targeted UE identified by its GPSI, within the "ueId" attribute, or the targeted group of UE(s) identified by its External Group ID, within the "externalGroupId" attribute, the provisions of clause 5.3.2.2.2 shall apply with the following differences:

- the AF request information may include:

a. the Temporal invalidity conditions, within the "tempInValidity" attribute;

b. the traffic characteristics information, within the "evSubsc" attribute;

c. the QoS parameters for monitoring, within the "tscQosReq" attribute;

d. the QoS parameters, within either the "qosReference" attribute, the "altQosReferences" attribute or the "altQosReqs" attribute; and/or

e. the flow description, within either the "flowInfo" attribute or the "enEthFlowInfo" attribute.

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2 with the following differences:

- upon reception of the HTTP request from the NF service consumer, and if the request is authorized, the TSCTSF shall:

- create a new "Individual TSC Application Session Context" resource;

- if the "externalGroupId" attribute is received from the NF service consumer, interact with the UDM to retrieve the list of SUPI(s) identifying the UE(s) constituting the targeted group of UE(s) using the Nudm\_SDM service as defined in 3GPP TS 29.503 [24];

- if the "ueId" attribute is received from the NF service consumer, interact with the UDM to retrieve the SUPI that corresponds to the targeted GPSI using the Nudm\_SDM service as defined in 3GPP TS 29.503 [24];

- use the parameters received from the NF service consumer (i.e., DNN, S-NSSAI and, if available, the identifier of the targeted UE or group of UE(s) to determine the corresponding AF-session(s) (i.e., to which they macth); and

- for each matching AF-session interact with the PCF by invoking the Npcf\_PolicyAuthorization\_Create/Update service operation as defined in 3GPP TS 29.514 [20] to create/update the AF session based on the provided requested QoS parameters; and

NOTE 1: If the PCF determines that an existing PDU Session is potentially impacted by the time synchronization service (based on local configuration or SM Policy Association), the PCF invokes Npcf\_PolicyAuthorization\_Notify service operation towards the TSCTSF as defined in clause 4.2.5.16 of 3GPP TS 29.514 [20] to send the received TSC User Plane Node information. The TSCTSF then retrieves from the BSF the PCF binding information (including the UE Identities for the notified PDU session), as specified in 3GPP TS 29.521 [23], and can create the AF-session by invoking the Npcf\_PolicyAuthorization\_Create service operation towards the PCF.

- the TSCTSF shall handle the AF session(s) associated with a given "Individual TSC Application Session Context" resource as follows:

- For the association of the AF session(s) at the PCF to the "Individual TSC Application Session Context" resource:

a. Upon PDU Session establishment, i.e. when the TSCTSF receives a Npcf\_PolicyAuthorization\_Notify service operation following the establishment of a new PDU session, the TSCTSF shall retrieve from the BSF, as specified in 3GPP TS 29.521 [23], the PCF binding information to complete the necessary AF-Session information. The TSCTSF shall then trigger the Npcf\_PolicyAuthorization\_Create service operation towards the PCF to create an AF-session to subscribe to TSC user plane node related events. The TSCTSF shall use the parameters of the existing "Individual TSC Application Session Context" resources to determine whether they shall be associated to this newly created AF session. The TSCTSF associates the new AF session to the "Individual TSC Application Session Context" resource to which these parameters match.

b. Upon "Individual TSC Application Session Context" resource creation, the TSCTSF uses the parameters of the created resource to determine which existing AF session(s) it matches. The TSCTSF then associates the new "Individual TSC Application Session Context" resource to the corresponding AF session(s).

- To remove an AF session from the list of AF session(s) associated to an "Individual TSC Application Session Context" resource, when the TSCTSF receives the Npcf\_PolicyAuthorization\_Notify service operation from the PCF indicating the termination of the corresponding existing PDU session, the TSCTSF triggers the Npcf\_PolicyAuthorization\_Delete service operation towards the PCF and determines if the corresponding AF session is associated with the "Individual TSC Application Session Context" resource. If it is so, the TSCTSF shall remove the AF session from the list of AF session(s) associated with the "Individual TSC Application Session Context" resource.

NOTE 2: After the TSCTSF retrieves from the BSF the PCF binding information (including the UE Identities for the notified PDU session), as specified in 3GPP TS 29.521 [23], the TSCTSF can store internally the information required to invoke Npcf\_PolicyAuthorization\_Create service operation and delay the Npcf\_PolicyAuthorization\_Create service operation (the creation of the AF session) till a request is received for the concerned UE (time synchronization capability exposure or QoS provisioning request). In this case, when the TSCTSF receives the request, the TSCTSF interacts with the PCF by triggering Npcf\_PolicyAuthorization\_Create service operation as defined in 3GPP TS 29.514 [20].

NOTE 3: When the TSCTSF receives the Npcf\_PolicyAuthorization\_Notify service operation indicating the termination of an existing PDU session associated to an AF session that it is not associated with any "Individual Time Synchronization Exposure Subscription" resource and "Individual TSC Application Session Context resource" resource, the TSCTSF removes the AF-session and triggers the Npcf\_PolicyAuthorization\_Delete service operation towards the PCF.

5.3.2.2.9 Subscription to BAT offset notification

When the "EnTSCAC" feature is supported, The NF service consumer shall use the "EventsSubscReqData" data type and shall include in the HTTP POST request message an event entry within the "evSubsc" attribute with the "event" attribute set to "BAT\_OFFSET\_INFO" to subscribe to receive a notification when AF provides the Capability for BAT adaptation or BAT Window as defined in clause 5.3.2.2.2.

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2.

As result of this action, the TSCTSF shall set the appropriate subscription to BAT offset notification as described in 3GPP TS 29.514 [20].

#### 5.3.2.3 Ntsctsf\_QoSandTSCAssistance\_Update

##### 5.3.2.3.1 General

This service operation is used by an NF service consumer to request the network to update the QoS and/or additional Alternative QoS for an AF session.

The following procedures using the Ntsctsf\_QoSandTSCAssistance\_Update service operation are supported:

- Modification of TSC related service information.

- Modification of Subscription to Service Data Flow QoS notification control.

- Modification of Subscription to Service Data Flow Deactivation.

- Modification of subscription to resources allocation outcome.

- Modification of Subscription to Service Data Flow QoS Monitoring Information.

- Modification of sponsored connectivity information.

- Modification of AF the requested QoS for a UE or a group of UE(s) not identified by UE address.

- Modification of subscription to BAT offset notification.

##### 5.3.2.3.2 Modification of TSC related service information

This procedure is used to modify an existing TSC application session context as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.3.2.3.2-1 illustrates the modification of TSC related service information using HTTP PATCH method.



Figure 5.3.2.3.2-1: Modification of TSC related service information using HTTP PATCH

The NF service consumer may modify the TSC application session context information at any time and invoke the Ntsctsf\_QoSandTSCAssistance\_Update service operation by sending the HTTP PATCH request message to the resource URI representing the "Individual TSC Application Session Context" resource, as shown in figure 5.3.2.3.2-1, step 1, with the modifications to apply.

The JSON body within the PATCH request shall include the "TscAppSessionContextUpdateData" data type and shall be encoded according to "JSON Merge Patch", as defined in IETF RFC 7396 [22].

The NF service consumer may include in the "TscAppSessionContextUpdateData" data structure:

- the updated flow information within the "flowInfo" attribute for IP flows or, either the "ethFlowInfo" or, if the Ethernet\_UL/DL\_Flows feature is supported, the "enEthFlowInfo" attribute for Ethernet flows;

- the updated application Id within the "appId" attribute;

- the updated QoS reference within the "qosReference" attribute or the updated individual QoS parameter set within the "tscQosReq" attribute;

- the updated input information to construct the TSC Assistance Container within the "tscaiInputUl" attribute and/or "tscaiInputDl" attribute of the "tscQosReq" attribute, and/or the updated (g)PTP domain that the AF is located in within the "tscaiTimeDom" attribute of the "tscQosReq" attribute;

- if the "EnTSCAC" feature is supported, the capability for BAT adaptation in the "capBatAdaptation" attribute;

- the updated URI where the TSCTSF can request to the NF service consumer to delete the "Individual TSC Application Session Context" resource within the "notifUri".

- the updated ordered list of alternative QoS references within the "altQosReferences" attribute or updated ordered list of requested alternative QoS parameters set(s) within the "altQosReqs" attribute; and

- the updated event subscription information within the "evSubsc" attribute. Within the EventsSubscReqDataRm data structure, the NF service consumer shall include:

- the new complete list of subscribed events within the "events" attribute;

- when the NF service consumer requests to update the additional information related to an event (e.g. the NF service consumer needs to provide new thresholds to the TSCTSF in the "usgThres" attribute related to the "USAGE\_REPORT" event), the additional information within the corresponding attribute(s).

NOTE 2: Note that when the NF service consumer requests to remove an event, this event is not included in the "events" attribute.

NOTE 3: When an event is included in the "events" attribute and its related additional information is set to null, the TSCTSF considers the subscription to this event is active, but the related procedures stop applying.

NOTE 4: When an event is removed from the "events" attribute but its related information is not set to null, the TSCTSF considers the subscription to this event is terminated, the related additional information is removed, and the related procedures stop applying.

The NF service consumer shall remove existing event subscription information by setting to null the "evSubsc" attribute included in "TscAppSessionContextUpdateData".

NOTE 5: The "notifUri" attribute within the EventsSubscReqData data structure can be modified to request that subsequent notifications are sent to a new NF service consumer.

Upon the reception of this HTTP PATCH request, the TSCTSF shall

- if the updated Requested 5GS delay including the requested 5GS delay within the individual QoS parameter set or within the requested alternative QoS parameters set(s) is received from NF service consumer, re-calculate a Requested PDB by subtracting the UE-DS-TT residence time provided by the PCF or pre-configured in the TSCTSF from the Requested 5GS delay;

- update the TSC Assistance Container based on updated information provided by the NF service consumer;

- if the time domain information is not received with the Burst Arrival Time or Periodicity within the "tscQosReq" attribute from the NF service consumer, the TSCTSF may indicate Time Domain = "5GS" within the "tscaiTimeDom" attribute within the "tscQosReq" attribute to indicate that the NF service consumer does not provide the time domain information;

NOTE 6: The Time Domain value corresponding to "5GS" is locally configured in the SMF and in the TSCTSF, and indicates that the AF does not provide a Time Domain and the provided TSCAI input information will be used without adjustments.

- if the feature EnTSCAC is supported and if the NF service consumer during the modification includes the capability for BAT adaptation within the "capBatAdaptation" attribute or a BAT window within the "burstArrivalTimeWnd" attribute within the "tscaiInputUl" attribute and/or "tscaiInputDl" attribute of the "tscQosReq" attribute or the periodicity range in the "periodicityRange" attribute in the update request, then the TSCTSF shall subscribe to the notification on BAT offset by using the "EventsSubscReqDataRm" data type including an event within the "events" attribute with the "event" attribute set to "BAT\_OFFSET\_INFO;

- interact with the PCF by triggering a Npcf\_PolicyAuthorization\_Update request to provision the related parameters to the PCF as defined in 3GPP TS 29.514 [20];

- if receiving a successful response from the PCF, the TSCSTF shall update the "Individual TSC Application Session Context" resource and send a "200 OK" or "204 No Content" response to the HTTP POST request to the NF service consumer, as shown in figure 5.3.2.3.2-1, step 2.

If the TSCTSF cannot successfully fulfil the received HTTP PATCH request due to the internal TSCTSF error or due to the error in the HTTP PATCH request, the TSCTSF shall send the HTTP error response as specified in clause 6.2.7.

The TSCTSF may send the following error responses based on failed AF-session update responses received from the PCF as specified in 3GPP TS 29.514 [20]:

a. If the updated service information is not acceptable for the PCF (e.g. the subscribed guaranteed bandwidth for a particular user is exceeded or the authorized data rate in that slice for the UE is exceeded), the TSCTSF shall indicate in an HTTP "403 Forbidden" response message the received cause for the rejection including the "cause" attribute set to "REQUESTED\_SERVICE\_NOT\_AUTHORIZED".

b. If the service information provided in the body of the HTTP POST request is rejected due to a temporary condition in the network, the TSCTSF may include in the "403 Forbidden" response the "cause" attribute set to "REQUESTED\_SERVICE\_TEMPORARILY\_NOT\_AUTHORIZED". The TSCTSF may also provide a received retry interval within the "Retry-After" HTTP header field. When the NF service consumer receives the retry interval within the "Retry-After" HTTP header field, the NF service consumer shall not send the same service information to the TSCTSF again (for the same application session context) until the retry interval has elapsed. The "Retry-After" HTTP header is described in 3GPP TS 29.500 [4] clause 5.2.2.2.

The TSCTSF may additionally provide the acceptable bandwidth within the attribute "acceptableServInfo" included in the "ProblemDetailsTsctsfQosTscac" data structure returned in the rejection response message.

If the TSCTSF determines the received HTTP PATCH request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

##### 5.3.2.3.3 Modification of Subscription to Service Data Flow QoS notification control

The NF service consumer shall use the HTTP PATCH method to update the "Events Subscription" sub-resource together with the modifications to the "Individual TSC Application Sessions" resource.

The NF service consumer shall include in the HTTP PATCH request message described in clause 5.3.2.3.2, the updated event subscription information within the "evSubsc" attribute. Within the EventsSubscReqDataRm data type, the NF service consumer shall include the "events" attribute with the "QOS\_GUARANTEED" and "QOS\_NOT\_GUARANTEED" values to indicate the subscription to QoS notification control or include the "events" but without the "QOS\_GUARANTEED" and "QOS\_NOT\_GUARANTEED" values to indicate the termination of the subscription to QoS notification control.

As result of this action, the TSCTSF shall set the appropriate subscription to QoS notification control as described in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2.

The TSCTSF may send the following error responses based on the response to the provisioning of sponsored data connectivity information received from the PCF, as described in 3GPP TS 29.514 [20], as follows:

- HTTP "403 Forbidden" response message with the "cause" attribute set to "UNAUTHORIZED\_SPONSORED\_DATA\_CONNECTIVITY", when received from the PCF.

- HTTP "403 Forbidden" response message the "cause" attribute set to "REQUESTED\_SERVICE\_NOT\_AUTHORIZED", when received from the PCF.

##### 5.3.2.3.4 Modification of Subscription to Service Data Flow Deactivation

The NF service consumer shall use the HTTP PATCH method to update the "Events Subscription" sub-resource together with the modifications to the "Individual TSC Application Sessions" resource.

The NF service consumer shall include in the HTTP PATCH request message described in clause 5.3.2.3.2, the updated event subscription information within the "evSubsc" attribute. Within the EventsSubscReqDataRm data type, the NF service consumer shall include the "events" attribute with the "FAILED\_RESOURCES\_ALLOCATION" values to the subscription to service data flow deactivation or include the "events" but without "FAILED\_RESOURCES\_ALLOCATION" value to indicate the termination of the subscription to Service Data Flow Deactivation.

As result of this action, the TSCTSF shall set the appropriate subscription to QoS notification control as described in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2.

##### 5.3.2.3.5 Modification of subscription to resources allocation outcome

The NF service consumer shall use the HTTP PATCH method to modify the "Events Subscription" sub-resource together with the modifications to the "Individual TSC Application Sessions" resource.

The NF service consumer shall include in the HTTP PATCH request message described in clause 5.3.2.3.2, the updated event subscription information within the "evSubsc" attribute. Within the EventsSubscReqDataRm data type, the NF service consumer shall include the "events" attribute with the "SUCCESSFUL\_RESOURCES\_ALLOCATION" value for the successful resource allocation and/or "FAILED\_RESOURCES\_ALLOCATION" value for the unsuccessful resource allocation to the subscription to resources allocation outcome or include the "events" but without "SUCCESSFUL\_RESOURCES\_ALLOCATION" and/or "FAILED\_RESOURCES\_ALLOCATION" value to indicate the termination of the subscription to resources allocation outcome.

As result of this action, the TSCTSF shall set the appropriate subscription to resources allocation outcome as described in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2.

##### 5.3.2.3.6 Modification of Subscription to Service Data Flow QoS Monitoring Information

The NF service consumer shall use the HTTP PATCH method to update the "Events Subscription" sub-resource together with the modifications to the "Individual TSC Application Sessions" resource.

The NF service consumer shall include in the HTTP PATCH request message described in clause 5.3.2.3.2, the updated event subscription information within the "evSubsc" attribute. Within the EventsSubscReqDataRm data type, the NF service consumer shall perform as follows:

- to create a subscription to QoS monitoring information:

a) include the "events" attribute with the "QOS\_MONITORING" value; and

b) include the updated QoS monitoring information within the "qosMon" attribute as defined in clause 5.3.2.2.6;

- to remove a subscription to QoS monitoring information:

a) include the "events" attribute without "QOS\_MONITORING".

As result of this action, the TSCTSF shall set the appropriate subscription to Service Data Flow QoS Monitoring Information as described in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2.

##### 5.3.2.3.7 Modification of sponsored connectivity information

The NF service consumer shall use the HTTP PATCH method to modify the sponsored connectivity information.

The NF service consumer shall include in the HTTP PATCH request message described in clause 5.3.2.3.2, an application service provider identity and a sponsor identity within the "aspId" attribute and "sponId" attribute, and optionally an indication of whether to enable or disable sponsored data connectivity within the "sponStatus" attribute set to the applicable value to provide sponsored connectivity information or to update existing sponsored connectivity information.

If the NF service consumer requests to enable sponsored data connectivity the NF service consumer shall change the "sponStatus" attribute value to "SPONSOR\_ENABLED".

If the NF service consumer requests to disable sponsored data connectivity the NF service consumer shall provide an indication to disable sponsored data connectivity to the TSCTSF by setting the "sponStatus" attribute to "SPONSOR\_DISABLED".

To support the usage monitoring of sponsored data connectivity, the NF service consumer may also include in the HTTP PATCH a new or modified "evSubsc" attribute with:

- the usage thresholds to apply in the "usgThres" attribute; and

- an entry of the "events" attribute set to "USAGE\_REPORT".

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2.

As result of this action, the TSCTSF shall provision the updated sponsored data connectivity information to the PCF as described in in 3GPP TS 29.514 [20].

5.3.2.3.8 Modification of AF requested QoS for a UE or group of UE(s) not identified by UE address

When the "GMEC" feature is supported, the NF service consumer shall use the HTTP PATCH method to modify the requested QoS, traffic characteristics information and/or QoS Monitoring information for a UE or a group of UE(s).

The NF service consumer shall include in the HTTP PATCH request message the parameters to modify as described in clause 5.3.2.3.2, with the following differences:

- To support the request the modification of requested QoS, the traffic characteristics and monitoring of performance characteristics for a group, the NF service consumer may modify:

- the traffic characteristics information, within the "evSubsc" attribute;

- the QoS parameters for monitoring, within the "tscQosReq" attribute;

- the QoS parameters, within either the "qosReference" attribute, the "altQosReferences" attribute or the "altQosReqs" attribute;

- the temporal invalidity conditions, within the "tempInValidity" attribute; and

- the flow description, within either the "flowInfo" attribute or the "enEthFlowInfo" attribute.

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2.

As result of this action, the TSCTSF shall, for the list of matching AF-session(s) associated to the "Individual TSC Application Session Context" resource, provision to the PCF the updated requested QoS, traffic characteristics and/or QoS Monitoring information by the triggering Npcf\_PolicyAuthorization\_Update service operation as defined in 3GPP TS 29.514 [20].

##### 5.3.2.3.9 Modification of Subscription to BAT offset notification

When the "EnTSCAC" feature is supported, this procedure is used to modify in the TSCTSF the subscription to the BAT offset information notification.

The NF service consumer shall use the HTTP PATCH method to update the "Events Subscription" sub-resource together with the modifications to the " Individual TSC Application Session" resource.

The NF service consumer shall include in the HTTP PATCH request message described in clause 5.3.2.3.2, the updated event subscription information within the "evSubsc" attribute. Within the EventsSubscReqDataRm data type, the NF service consumer shall include the "events" attribute with the "BAT\_OFFSET\_INFO" to indicate the subscription to changes of the BAT offset and the optionally adjusted periodicity.

As result of this action, the TSCTSF shall set the appropriate subscription to resources allocation outcome as described in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2. The TSCTSF shall include the "evsNotif" attribute with an entry in the "evNotifs" array with the "event" attribute set to "BAT\_OFFSET\_INFO" and the "batOffsetInfo" attribute including the offset of the BAT and optionally an adjusted periodicity if the TSCTSF has previously subscribed with the PCF to changes in this information.

#### 5.3.2.4 Ntsctsf\_QoSandTSCAssistance\_Delete

##### 5.3.2.4.1 General

This service operation is used by an NF service consumer to request the network to delete the AF session with requested QoS or the AF session with requested QoS including Alternative Service Requirements.

The following procedures using the Ntsctsf\_QoSandTSCAssistance\_Delete service operation are supported:

- TSC AF application session context termination.

- Reporting usage for sponsored data connectivity.

- TSC AF application session context termination for a UE or group of UE(s) not identified by UE address.

##### 5.3.2.4.2 TSC AF application session context termination

This procedure is used to terminate an AF application session context for the service as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.3.2.4.2-1 illustrates the application session context termination.



Figure 5.3.2.4.2-1: Application session context termination

When a TSC AF session is terminated, and if the TSC AF application session context was created as described in clause 5.3.2.2, the NF service consumer shall invoke the Ntsctsf\_QoSandTSCAssistance\_Delete service operation to the TSCTSF using an HTTP POST request, as shown in figure 5.3.2.4.2-1, step 1.

The NF service consumer shall set the request URI to "{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}/delete".

The NF service consumer may include in the body of the HTTP POST the "EventsSubscReqData" data type with the "evSubsc" attribute indicating the corresponding list of events to subscribe to.

When the TSCTSF receives the HTTP POST request from the NF service consumer, indicating the termination of the TSC AF application session context information, the TSCTSF shall acknowledge that request by sending an HTTP response message with the corresponding status code.

If the HTTP POST request from the NF service consumer is accepted, the TSCTSF shall send to the NF service consumer:

a) if event information is reported, TSCTSF shall defer sending the response to the NF service consumer and shall immediately interact with the PCF to terminate the AF session with the event report, as specified in 3GPP TS 29.514 [20]. After receiving the event information from the PCF, the TSCTSF shall send a "200 OK" response to HTTP POST request, as shown in figure 5.3.2.4.2-1, step 2a, including in the "EventsNotification" to report to the NF service consumer;

b) otherwise, the TSCTSF shall send to the NF service consumer a "204 No Content".

If the TSCTSF cannot successfully fulfil the received HTTP POST request due to the internal TSCTSF error or due to the error in the HTTP POST request, the TSCTSF shall send the HTTP error response as specified in clause 6.2.7.

If the TSCTSF determines the received HTTP POST request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

##### 5.3.2.4.3 Reporting usage for sponsored data connectivity

When The NF service consumer indicated to enable sponsored data connectivity and the NF service consumer provided usage thresholds for such sponsor to the TSCTSF, the TSCTSF shall report accumulated usage to the NF service consumer using the response of the Ntsctsf\_QoSandTSCAssistance\_Delete service operation.

This procedure is initiated when:

- the "Individual TSC Application Session" is deleted by the NF service consumer; or

- the TSCTSF requests the deletion of the "Individual TSC Application Session" to the NF service consumer, as described in clause 5.2.2.5.3, due to PDU session termination, the termination of all the service data flows of the Individual TSC Application Session.

To report the accumulated usage, the TSCTSF shall immediately configure the PCF to retrieve the accumulated usage as specified in 3GPP TS 29.514 [20]. When the TSCTSF receives the usage information from the PCF, the TSCTSF shall notify the NF service consumer by including the "EventsNotification" data type in the response of the HTTP POST request as described in clause 5.3.2.4.2.

The TSCTSF shall within an instance of "events" attribute include:

- "USAGE\_REPORT" within the "event" attribute;

- accumulated usage within the "usgRep" attribute.

5.3.2.4.4 TSC AF application session context termination for a UE or group of UE(s) not identified by UE address

When the "GMEC" feature is supported, the NF service consumer shall use the HTTP POST method to terminate the requested QoS, traffic characteristics information and/or QoS Monitoring information for a UE or a group of UE(s) as described in clause 5.3.2.4.2 with the following differences:

- the TSCTSF shall identify the affected AF session(s) and, for each AF session, interact with the PCF by triggering the Npcf\_PolicyAuthorization\_Delete service operation as defined in 3GPP TS 29.514 [20], if the AF session is not associated with an "Individual Time Synchronization Exposure Subscription" resource.

#### 5.3.2.5 Ntsctsf\_QoSandTSCAssistance\_Notify

##### 5.3.2.5.1 General

The Ntsctsf\_QoSandTSCAssistance\_Notify service operation enables notification to NF service consumers that the previously subscribed event for the existing TSC application session context occurred or that the TSC application session context is no longer valid.

The following procedures using the Ntsctsf\_QoSandTSCAssistance\_Notify service operation are supported:

- Notification about TSC application session context event.

- Notification about TSC application session context termination.

- Notification about Service Data Flow QoS notification control.

- Notification about Service Data Flow Deactivation

- Notification about resources allocation outcome.

- Notification about Service Data Flow QoS Monitoring control.

- Reporting usage for sponsored data connectivity.

- Notification about AF requested QoS for a UE or group of UE(s) not identified by UE address.

- Notification about BAT offset.

##### 5.3.2.5.2 Notification about TSC application session context event

This procedure is invoked by the TSCTSF to notify the NF service consumer when a certain, previously subscribed, application session context event occurs, as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.3.2.5.2-1 illustrates the notification about TSC application session context event.



Figure 5.3.2.5.2-1: Notification about application session context event

When the TSCTSF determines that the event for the existing TSC AF application session context, to which the NF service consumer has subscribed to, occurred e.g. upon reception of an event notification for a PDU session from the PCF as described in 3GPP TS 29.514 [20], the TSCTSF shall invoke the Ntsctsf\_QoSandTSCAssistance\_Notify service operation by sending the HTTP POST request (as shown in figure 5.3.2.5.2-1, step 1) to the NF service consumer using the notification URI received in the subscription creation (or modification), as specified in clause 5.3.2.2.2, 5.3.2.3.2, and 5.3.2.6, and appending the "notify" segment path at the end of the URI. The TSCTSF shall provide in the body of the HTTP POST request the "EventsNotification" data type including:

- the notification correlation Id within the "notifCorreId"; and

- the list of the reported events in the "events" attribute.

The NF service consumer notification of other specific events using the Ntsctsf\_QoSandTSCAssistance\_Notify request is described in the related clauses.

Upon the reception of the HTTP POST request from the TSCTSF indicating that the PDU session and/or service related event occurred, the NF service consumer shall acknowledge that request by sending an HTTP response message with the corresponding status code.

If the HTTP POST request from the TSCTSF is accepted, the NF service consumer shall acknowledge the receipt of the event notification with a "204 No Content" response to HTTP POST request, as shown in figure 5.3.2.5.2-1, step 2.

If the HTTP POST request from the TSCTSF is not accepted, the NF service consumer shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.2.7.

If the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [5].

##### 5.2.2.5.3 Notification about TSC application session context termination

This procedure is invoked by the TSCTSF to notify the NF service consumer that the TSC application session context is no longer valid, as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.2.2.5.3-1 illustrates the notification about application session context termination.



Figure 5.2.2.5.3-1: Notification about TSC application session context termination

When the TSCTSF determines that the TSC application session context is no longer valid, the TSCTSF shall invoke the Ntsctsf\_QoSandTSCAssistance\_Notify service operation by sending the HTTP POST request (as shown in figure 5.2.2.5.3-1, step 1) using the notification URI received in the "Individual TSC Application Session Context" context creation, as specified in clause 5.3.2.2, and appending the "terminate" segment path at the end of the URI, to trigger the NF service consumer to request the TSC application session context termination (see clause 5.3.2.4.2). The TSCTSF shall provide in the body of the HTTP POST request the "TerminationInfo" data type including:

- the Individual TSC Application Session Context resource identifier related to the termination notification in the "resUri" attribute; and

- the TSC application session context termination cause in the "termCause" attribute.

Upon the reception of the HTTP POST request from the TSCTSF requesting the TSC application session context termination, the NF service consumer shall acknowledge that request by sending an HTTP response message with the corresponding status code.

If the HTTP POST request from the TSCTSF is accepted, the NF service consumer shall acknowledge the receipt of the TSC application session context termination request with a "204 No Content" response to HTTP POST request (as shown in figure 5.2.2.5.3-1, step 2) and shall invoke the Ntsctsf\_QoSandTSCAssistance\_Delete service operation to the TSCTSF as described in clause 5.3.2.4.

If the HTTP POST request from the TSCTSF is not accepted, the NF service consumer shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.2.7.

If the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [5].

##### 5.3.2.5.4 Notification about Service Data Flow QoS notification control

When the TSCTSF receives the notification about Service Data Flow QoS notification control from the PCF as described in 3GPP TS 29.514 [20], the TSCTSF shall inform the NF service consumer accordingly if the NF service consumer has previously subscribed as described in clauses 5.3.2.2.3 and 5.3.2.3.3.

The TSCTSF shall notify the NF service consumer by including the "EventsNotification" data type in the body of the HTTP POST request as described in clause 5.3.2.5.2.

The TSCTSF shall within an instance of "events" attribute include:

- "QOS\_GUARANTEED" or "QOS\_NOT\_GUARANTEED" within the "event" attribute;

- the identification of the affected service flows (if not all the flows are affected) encoded in the "flowIds" attribute if applicable; and

- the reference to the Alternative Service Requirement corresponding alternative QoS parameter set if received from the PCF within the "appliedQosRef" attribute. When the "appliedQosRef" attribute is omitted and the "event" attribute is QOS\_NOT\_GUARANTEED, it indicates that the lowest priority alternative QoS profile could not be fulfilled.

When the "AltQoSProfilesSupportReport" feature as defined in clause 6.2.8 is supported, and the NF service consumer included the "altQosReferences" attribute for the provided QoS reference, or the "AltQosReqs" attribute for the provided individual QoS parameter set, if the TSCTSF receives from the PCF the indication that the GBR QoS targets cannot be guaranteed and the indication that alternative QoS profiles are not supported in the NG-RAN where the UE is currently located as specified in 3GPP TS 29.514 [20], the TSCTSF may include within the EventNotification data structure the "altQosNotSuppInd" attribute set to true. When the Alternative QoS profiles are supported by the NG-RAN where the UE is currently located, the TSCTSF may omit or set the "altSerReqNotSuppInd" attribute to false, as indicated by the PCF.

##### 5.3.2.5.5 Notification about Service Data Flow Deactivation

When the TSCTSF receives the notification about service data flow deactivation from the PCF as described in 3GPP TS 29.514 [20], the TSCTSF shall inform the NF service consumer accordingly if the NF service consumer has previously subscribed as described in clauses 5.3.2.2.4 and 5.3.2.3.4.

The TSCTSF shall notify the NF service consumer by including the "EventsNotification" data type in the body of the HTTP POST request as described in clause 5.3.2.5.2.

The TSCTSF shall within an instance of "events" attribute include:

- "FAILED\_RESOURCES\_ALLOCATION" within the "event" attribute;

- the identification of the affected service flows (if not all the flows are affected) encoded in the "flowIds" attribute if applicable.

##### 5.3.2.5.6 Notification about resources allocation outcome

When the TSCTSF receives the notification about resources allocation outcome from the PCF as described in 3GPP TS 29.514 [20], the TSCTSF shall inform the NF service consumer accordingly if the NF service consumer has previously subscribed as described in clauses 5.3.2.2.5 and 5.3.2.3.5.

The TSCTSF shall notify the NF service consumer by including the "EventsNotification" data type in the body of the HTTP POST request as described in clause 5.3.2.5.2.

The TSCTSF shall within an instance of "events" attribute include:

- "SUCCESSFUL\_RESOURCES\_ALLOCATION" within the "event" attribute if the "SUCCESSFUL\_RESOURCES\_ALLOCATION" event is received from the PCF or "FAILED\_RESOURCES\_ALLOCATION" within the "event" attribute if the "FAILED\_RESOURCES\_ALLOCATION" event is received from the PCF;

- the identification of the affected service flows (if not all the flows are affected) encoded in the "flowIds" attribute if applicable.

- when the event is "SUCCESSFUL\_RESOURCES\_ALLOCATION", the reference to the Alternative Service Requirement corresponding alternative QoS parameter set if received from the PCF within the "appliedQosRef" attribute.

##### 5.3.2.5.7 Notification about Service Data Flow QoS Monitoring control

When the TSCTSF receives the notification about Service Data Flow QoS Monitoring control from the PCF as described in 3GPP TS 29.514 [20], the TSCTSF shall inform the NF service consumer accordingly if the NF service consumer has previously subscribed as described in clauses 5.3.2.2.6 and 5.3.2.3.6.

The PCF shall notify the NF service consumer by including the "EventsNotification" data type in the body of the HTTP POST request as described in clause 5.3.2.5.2.

The TSCTSF shall within an instance of "events" attribute include:

- "QOS\_MONITORING" within the "event" attribute;

- the identification of the affected service flows (if not all the flows are affected) encoded in the "flowIds" attribute if applicable; and

- the "qosMonReports" array with the monitored QoS information. For QoS monitoring for packet delay:

a) one or two uplink packet delays within the "ulDelays" attribute;

b) one or two downlink packet delays within the "dlDelays" attribute; and/or

c) one or two round trip packet delays within the "rtDelays" attribute; and

d) if the feature "PacketDelayFailureReport" is supported, the packet delay measurement failure indicator within "pdmf" attribute.

##### 5.3.2.5.8 Reporting usage for sponsored data connectivity

When the NF service consumer enabled sponsored data connectivity and the NF service consumer provided usage thresholds for such sponsor to the TSCTSF, the TSCTSF shall report accumulated usage to the NF service consumer using the Npcf\_PolicyAuthorization\_Notify service operation when:

- the TSCTSF detects that the usage threshold provided by the NF service consumer has been reached; or

- the NF service consumer disables the sponsored data connectivity.

The TSCTSF shall notify the NF service consumer of the accumulated usage by including the "EventsNotification" data type in the body of the HTTP POST request as described in clause 5.3.2.5.2.

The TSCTSF shall within an instance of "events" attribute include:

- "USAGE\_REPORT" within the "event" attribute;

- accumulated usage within the "usgRep" attribute.

When the NF service consumer receives the HTTP POST request, it shall acknowledge the request by sending a "204 No Content" response to the TSCTSF. The NF service consumer may terminate the Individual Application Session Context sending an HTTP POST as described in clause 5.3.2.4.2 or update the Individual Application Session Context information by providing a new usage threshold sending an HTTP PATCH request to the TSCTSF as described in clause 5.3.2.3.2 or an HTTP PUT request to the TSCTSF as described in clause 5.3.2.6.2.

5.3.2.5.9 Notification about AF requested QoS for a UE or group of UE(s) not identified by UE address.

When the TSCTSF receives a notification about the requested QoS, traffic characteristics information and/or QoS Monitoring information from the PCF as described in 3GPP TS 29.514 [20] for an AF-session associated with an existing "Individual TSC Application Session Context" resource, the TSCTSF shall inform the NF service consumer accordingly if the NF service consumer has previously subscribed as described in clauses 5.3.2.2.8 and 5.3.2.3.8.

The TSCTSF shall notify the NF service consumer by including the EventsNotification data type in the body of the HTTP POST request as described in clause 5.3.2.5.2. The TSCTSF notification of the specific events is described in the related clauses of the current specification (e.g. notification about service data flow QoS monitoring when the AF requested QoS for a UE or group of UE(s) as described in clause 5.3.2.5.7).

##### 5.3.2.5.10 Notification about BAT offset

When the TSCTSF receives the notification about network provided BAT offset from the PCF as described in 3GPP TS 29.514 [20], the TSCTSF shall inform the NF service consumer accordingly if the NF service consumer included the capability for BAT adaptation or a BAT window or the periodicity range as described in the clauses 5.3.2.2.8 and 5.3.2.3.8.

The PCF shall notify the NF service consumer by including the "EventsNotification" data type in the body of the HTTP POST request as described in clause 5.3.2.5.2.

The TSCTSF shall include:

- in the "events" attribute an entry with the "event" attribute set to "BAT\_OFFSET\_INFO"; and

- the "batOffsetInfo" attribute containing the offset of the BAT and the optionally adjusted periodicity. The "BatOffsetInfo" data type shall contain the BAT offset of the arrival time in the "ranBatOffsetNotif" attribute, and the optionally adjusted periodicity of the data bursts encoded in the "adjPeriod" attribute.

#### 5.3.2.6 Ntsctsf\_QoSandTSCAssistance\_Subscribe

##### 5.3.2.6.1 General

The Ntsctsf\_QoSandTSCAssistance\_Subscribe service operation enables NF service consumers handling of subscription to events for the existing TSC application session context. Subscription to events shall be created:

- within the application session context establishment procedure by invoking the Ntsctsf\_QoSandTSCAssistance\_Subscribe service operation, as described in clause 5.3.2.2; or

- within the TSC application session context modification procedure by invoking the Ntsctsf\_QoSandTSCAssistance\_Subscribe service operation, as described in clause 5.3.2.3; or

- by invoking the Ntsctsf\_QoSandTSCAssistance\_Subscribe service operation for the existing TSC application session context, as described in clause 5.3.2.6.2.

The following procedures using the Ntsctsf\_QoSandTSCAssistance\_Subscribe service operation is supported:

- Handling of subscription to events for the existing TSC application session context.

- Subscription to Service Data Flow QoS Monitoring Information.

- Subscription to Usage Monitoring of Sponsored Data Connectivity.

##### 5.3.2.6.2 Handling of subscription to events for the existing TSC application session context

This procedure is used to create a subscription to events for the existing TSC AF application session context bound to the corresponding PDU session or to modify an existing subscription, as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.3.2.6.2-1 illustrates the creation of events subscription information using HTTP PUT method.



Figure 5.3.2.6.2-1: Creation of events subscription information using HTTP PUT

Figure 5.3.2.6.2-2 illustrates the modification of events subscription information using HTTP PUT method.



Figure 5.3.2.6.2-2: Modification of events subscription information using HTTP PUT

When the NF service consumer decides to create a subscription to one or more events for the existing TSC application session context or to modify an existing subscription previously created by itself at the TSCTSF, the NF service consumer shall invoke the Ntsctsf\_QoSandTSCAssistance\_Subscribe service operation by sending the HTTP PUT request to the resource URI representing the "Events Subscription" sub-resource in the TSCTSF, as shown in figure 5.3.2.6.2-1, step 1 and figure 5.3.2.6.2-2, step 1. The NF service consumer shall provide in the "EventsSubscReqData" data type of the body of the HTTP PUT request:

- the "events" attribute with the list of events to be subscribed;

- the "notifUri" attribute that includes the Notification URI to indicate to the TSCTSF where to send the notification of the subscribed events;

- the notification correlation Id within the "notifCorreId" attribute; and

- the specific event information related to the subscribed event, e.g. QoS monitoring information within the "qosMon" attribute if the "QOS\_MONITORING" event is subscribed.

NOTE: The "notifUri" attribute within the EventsSubscReqData data structure can be modified to request that subsequent notifications are sent to a new NF service consumer.

Upon the reception of the HTTP PUT request from the NF service consumer, the TSCTSF shall decide whether the received HTTP PUT request is accepted.

If the TSCTSF accepted the HTTP PUT request to create a subscription to events, the TSCTSF shall create the "Events Subscription" sub-resource and shall send the HTTP response message to the NF service consumer as shown in figure 5.3.2.6.2-1, step 2. The TSCTSF shall include in the "201 Created" response:

- a Location header field that shall contain the URI of the created "Events Subscription" sub-resource i.e. "{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}/events-subscription"; and

- a response body with the "EventsSubscReqData" data type representing the created "Events Subscription" sub-resource.

If the TSCTSF accepted the HTTP PUT request to modify the events subscription, the TSCTSF shall modify the "Events Subscription" sub-resource and shall send to the NF service consumer:

- the HTTP "204 No Content" response (as shown in figure 5.3.2.6.2-2, step 2a); or

- the HTTP "200 OK" response (as shown in figure 5.3.2.6.2-2, step 2b) including in the "EventsSubscReqData" data type the updated representation of the "Events Subscription" sub-resource.

If the HTTP PUT request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.2.7.

If the TSCTSF determines the received HTTP PUT request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

##### 5.3.2.6.3 Subscription to Service Data Flow QoS Monitoring Information

This procedure is used by NF service consumer to subscribe and/or modify the subscription for notification about service data flow QoS monitoring information.

The NF service consumer shall include in the HTTP PUT request message the "EventsSubscReqData" data type, which shall contain:

- to create a subscription to QoS monitoring information:

- the "events" attribute with an entry containing the value "QOS\_MONITORING" to create a subscription to notification about service data flow QoS monitoring information;

- include the updated QoS monitoring information within the "qosMon" attribute as defined in clause 5.3.2.2.6

- to remove a subscription to QoS monitoring information:

- the "events" attribute containing an array that omits the values "QOS\_MONITORING".

The NF service consumer shall include other events related information as described in clause 5.3.2.6.1.

As result of this action, the TSCTSF shall set the appropriate subscription to service data flow QoS monitoring information as described in in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.6.1.

##### 5.3.2.6.4 Subscription to Usage Monitoring of Sponsored Data Connectivity

This procedure is used by NF service consumer to subscribe and/or modify the subscription for notification about usage monitoring of sponsored data connectivity.

The NF service consumer shall include in the HTTP PUT request message the "EventsSubscReqData" data type, which shall contain:

- to create a subscription to usage monitoring of sponsored data connectivity:

- the "events" attribute with an entry containing the value "USAGE\_REPORT" to create a subscription to notification about usage monitoring of sponsored data connectivity;

- include the usage thresholds to apply in the "usgThres" attribute.

- to remove a subscription to usage monitoring of sponsored data connectivity:

- the "events" attribute containing an array that omits the values "USAGE\_REPORT".

The NF service consumer shall include other events related information as described in clause 5.3.2.6.1.

As result of this action, the TSCTSF shall set the appropriate subscription to usage monitoring of sponsored data connectivity as described in in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.6.1.

#### 5.3.2.7 Ntsctsf\_QoSandTSCAssistance\_Unsubscribe

##### 5.3.2.7.1 General

The Ntsctsf\_QoSandTSCAssistance\_Unsubscribe service operation enables NF service consumers to remove subscription to all subscribed events for the existing TSC application session context. Subscription to events shall be removed:

- by invoking the Ntsctsf\_QoSandTSCAssistance\_Unsubscribe service operation for the existing application session context, as described in clause 5.3.2.7.2; or

- within the application session context modification procedure by invoking the Ntsctsf\_QoSandTSCAssistance\_Update service operation, as described in clause 5.3.2.3; or

- within the TSC application session context termination procedure by invoking the Ntsctsf\_QoSandTSCAssistance\_Delete service operation, as described in clause 5.3.2.4.

The following procedure using the Ntsctsf\_QoSandTSCAssistance\_Unsubscribe service operation is supported:

- Unsubscription to events.

##### 5.3.2.7.2 Unsubscription to events

This procedure is used to unsubscribe to all subscribed events for the existing TSC AF application session context, as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.3.2.7.2-1 illustrates the unsubscription to events using the HTTP DELETE method.



Figure 5.3.2.7.2-1: Removal of events subscription information using HTTP DELETE

When the NF service consumer decides to unsubscribe to all subscribed events for the existing TSC application session context, the NF service consumer shall invoke the Ntsctsf\_QoSandTSCAssistance\_Unsubscribe service operation by sending the HTTP DELETE request message to the resource URI representing the "Events Subscription" sub-resource in the TSCTSF, as shown in figure 5.3.2.7.2-1, step 1.

Upon the reception of the HTTP DELETE request message from the NF service consumer, the TSCTSF shall decide whether the received HTTP request message is accepted.

If the HTTP DELETE request message from the NF service consumer is accepted, the TSCTSF shall delete "Events Subscription" sub-resource and shall send to the NF service consumer a HTTP "204 No Content" response message. The TSCTSF may delete the existing subscription to event notifications for the related PDU session from the PCF as described in 3GPP TS 29.514 [20].

If the HTTP DELETE request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP DELETE request the cause for the rejection as specified in clause 6.2.7.

If the TSCTSF determines the received HTTP DELETE request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

## 5.4 Ntsctsf\_ASTI Service

### 5.4.1 Service Description

#### 5.4.1.1 Overview

This service provides:

- Authorization of NF Service Consumer requests for the activation, update, and deactivation of the 5G access stratum time distribution.

NOTE: The AF can use either the procedure specified in bullet 1) and 2) of clause 5.2.1.1 for configuring the (g)PTP instance in 5GS or the procedure specified in Ntsctsf\_ASTI service for controlling the 5G access stratum time distribution for a particular UE. The procedures are not intended to be used in conjunction.

- Detection and reporting of time synchronization service status based on gNB and/or UPF/NW-TT timing synchronization status information and reporting status updates.

- Detection and reporting of changes of the state of 5G access time distribution configuration based e.g. on evaluation of the time synchronization coverage area conditions.

#### 5.4.1.2 Network Functions

##### 5.4.1.2.1 TSCTSF

The TSCTSF supports to:

- receive the request to activate or update the 5G access stratum time distribution configuration from the NEF or AF and provide it for the target UE(s) to the PCF;

- receive the request to delete the 5G access stratum time distribution configuration from the NEF or AF and provide it for the target UE(s) to the PCF;

- receive the request to query the status of the access stratum time distribution from the NEF or AF and respond to the NEF or AF with the status of the access stratum time distribution;

- make a translation from External/Internal Group Identifier to a list of SUPI by querying UDM;

- retrieve the Time Synchronization Subscription data from UDM for the control of 5G access stratum-based time distribution and make decision based on received the Time Synchronization Subscription data;

- determine whether the UE is inside/outside the requested time synchronization coverage area and enforce the 5G access stratum time distribution service accordingly;

- indicate whether the service is supported or not as per the requested acceptance criteria (e.g., based on the known timing synchronization status attribute thresholds pre-configured at gNB); and

- based on gNB and/or UPF/NW-TT timing synchronization status (degradation/failure/improvement) information and reporting, provide a notification when there is a service status update if the NEF or AF subscribe to service status updates.

##### 5.4.1.2.2 NF Service Consumers

The NF service consumer supports to:

- send the request to create, modify and delete the 5G access stratum time distribution configuration to the TSCTSF;

- query the status of the access stratum time distribution configuration;

- provide clock quality reporting control information, consisting of clock quality detail level and clock quality acceptance criteria, during activation or modification of time synchronization service;

- subscribe to time synchronization service status for the target UE(s); and

- receive notifications about the state and changes of state of 5G access stratum time distribution configuration.

### 5.4.2 Service Operations

#### 5.4.2.1 Introduction

Service operations defined for the Ntsctsf\_ASTI service are shown in table 5.4.2.1-1.

Table 5.4.2.1-1: Ntsctsf\_ASTI Service Operations

|  |  |  |
| --- | --- | --- |
| Service Operation Name | Description | Initiated by |
| Ntsctsf\_ASTI\_Create | Allows the NF service consumer to create a 5G access stratum time distribution configuration. | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_ASTI\_Update | Allows the NF service consumer to update a 5G access stratum time distribution configuration. | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_ASTI\_Delete | Allows the NF service consumer to delete a 5G access stratum time distribution configuration. | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_ASTI\_Get | Allows the NF service consumer to query the status of the 5G access stratum time distribution configuration. | NF service consumer (e.g. AF, NEF) |
| Ntsctsf\_ASTI\_UpdateNotify | Allows the TSCTSF to notify about the status of the 5G access stratum time distribution and/or changes on the state of 5G access stratum time distribution configuration. | TSCTSF |

NOTE: The NEF and the AF use the Ntsctsf\_ASTI service in the same way.

#### 5.4.2.2 Ntsctsf\_ASTI\_Create

##### 5.4.2.2.1 General

This service operation is used by an NF service consumer to create a 5G access stratum time distribution configuration.

The following procedures using the Ntsctsf\_ASTI\_Create service operation are supported:

- creating a new configuration.

##### 5.4.2.2.2 Creating a new configuration

Figure 5.4.2.2.2-1 illustrates the creation of a configuration.



Figure 5.4.2.2.2-1: Creation of a configuration

To create a configuration, the NF service consumer shall send an HTTP POST message to the TSCTSF to the URI "{apiRoot}/ntsctsf-asti/<apiVersion>/configurations". The HTTP POST message shall include the AccessTimeDistributionData data structure as request body, as shown in figure 5.4.2.2.2-1, step 1. The AccessTimeDistributionData data structure shall include:

- one of the indication of the UEs to which the 5G access stratum time distribution configuration is requested via:

- identification of a list of individual UEs within the "supis" attribute; or

- identification of a group of UE(s) within the "interGrpId" attribute;

- identification of a list of individual UEs within the "gpsis" attribute;

- identification of a group of UE(s) within the "exterGrpId" attribute; and

- 5G access stratum time distribution parameters within the "asTimeDisParam" attribute.

Within the "asTimeDisParam" attribute inside the AccessTimeDistributionData data structure, the NF service consumer:

- shall include the "asTimeDisEnabled" attribute set to true if the access stratum time distribution via Uu reference point should be activated. Otherwise, if the access stratum time distribution via Uu reference point should be inactive, the "asTimeDisEnabled" attribute may either be omitted or included and set to "false";

- may include the time synchronization error budget within the "timeSyncErrBdgt" attribute;

- may include the temporal validity condition within the "tempValidity" attribute; and

- may indicate whether and which clock quality information to provide to the UE by including the clock quality detail level in the "clkQltDetLvl" attribute and optionally the clock quality acceptance criteria in the "clkQltAcptCri" attribute, if applicable.

When the "CoverageAreaSupport" feature is supported, the AccessTimeDistributionData data structure may include the time synchorinization coverage area encoded as "covReq" attribute, that contains a list of Tracking Area codes per serving network where the provided access stratum time distribution data applies.

When the "ASTIConfigReport" feature is supported, to receive notifications about changes in the 5G access stratum time distribution configuration, the NF service consumer shall also provide the notification URI within the "astiNotifUri" attribute and the notification correlation Id within the "astiNotifId" attribute. When the "NetTimeSyncStatus" feature is supported, the NF service consumer may also include the clock quality detail level in the "clkQltDetLvl" attribute and the clock quality acceptance criteria in the "clkQltAcptCri" attribute to indicate the subscription to notification of the status of the access stratum time distribution service.

Upon receipt of the HTTP request from the NF service consumer, if the request is authorized, the TSCTSF shall:

- if the 5G access stratum time distribution configuration applies to an internal group of UEs indicated in the "interGrpId" attribute or to an external group of UEs indicated in the "exterGrpId" attribute, interact with the UDM to retrieve the list of individual UEs that belong to the group using the Nudm\_SDM service as defined in 3GPP TS 29.503 [24];

- if the 5G access stratum time distribution configuration applies to a list of individual UEs within the "gpsis" attribute, interact with the UDM to retrieve the SUPI(s) that corresponds to each of the GPSI(s) using the Nudm\_SDM service as defined in 3GPP TS 29.503 [24];

- The TSCTSF retrieves the UE's Time Synchronization Subscription data from the UDM for each individual UE. If the UE's Time Synchronization Subscription data contains the authorized Uu time synchronization error budget, and the requested time synchronization error budget within the "timeSyncErrBdgt" attribute is within the authorized time synchronization error budget, the TSCTSF determines that the UE is authorized for the requested time synchronization service.

- if the "CoverageAreaSupport" feature is supported and a time synchronization coverage area is provided within the "covReq" attribute, perform the following operations:

a. 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 intersection of them. If there is no overlap between them, the TSCTSF shall reject the AF request as described in clause 5.27.1.11 of 3GPP TS 23.501 [2].

b. the TSCTSF shall discover the list of AMF(s) serving the list of TA(s) that comprise the time synchronization coverage area using the Nnrf\_NFDiscovery service operation as described in 3GPP TS 29.510 [10], if they were not previously retrieved, and:

c. subscribe with the discovered AMF(s):

1. for each UE, e.g. when the 5G access stratum time distribution configuration applies to a list of individual UEs, and the UE time synchronization coverage area within the "covReq" attribute is within the authorized time synchronization coverage area; or

2. for the group of UEs, when the 5G access stratum time distribution configuration applies to a group of UEs.

To receive notifications about presence of the UE in an Area of Interest events using the Namf\_EventExposure service as described in 3GPP TS 29.518 [27], where the Area of Interest is the provided time synchronization coverage area.

d. Based on the outcome provided by the AMF about the UE’s presence in the Area of Interest and the authorized time synchronization coverage area, the TSCTSF shall determine if the 5G access stratum time distribution configuration is enabled for the UE:

i. If the UE presence is within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the time synchronization coverage area condition is fulfilled, and the provided 5G access stratum time distribution configuration is enabled for the UE.

ii. If the UE presence is not within any of the TAs from the time synchronization coverage area, the TSCTSF determines that the time synchronization coveragae area condition is not fulfilled, and the provided 5G access stratum time distribution configuration is not enabled for the UE.

- The TSCTSF retrieves the UE's Time Synchronization Subscription data from the UDM for each individual UE. If the UE's Time Synchronization Subscription data contains the periods of authorized start and stop times, and the requested temporal validity condition within the "tempValidity" attribute is within any of the authorized periods of authorized start and stop times, the TSCTSF determines that the UE is authorized for the requested time synchronization service.

- for each authorized UE, subscribe to event notifications of newly registered PCF for the UE by invoking Nbsf\_Management\_Subscribe Service Operation as defined in 3GPP TS 29.521 [23], if not yet subscribed;

- for each authorized UE, if the access stratum time distribution via Uu reference point is being activated (i.e. the "asTimeDisEnabled" attribute within the "asTimeDisParam" attribute was received and set to true), calculate the Uu time synchronization error budget as specified in clauses 5.27.1.9 and 5.27.1.11 of 3GPP TS 23.501 [2];

- for each authorized UE, if clock quality information was provided, the authorized clock quality detail level within the "clkQltDetLvl" attribute and optionally the clock quality acceptance criteria in the "clkQltAcptCri" attribute, if applicable;

- for each authorized UE, interact with the PCF for a UE to provide the configuration information for each target UE using the Npcf\_AMPolicyAuthorization\_Create service operation as defined in 3GPP TS 29.534 [14];

- create a new resource, which represents a new "Individual ASTI Configuration" resource, addressed by a URI as defined in clause 6.1.3.7 and containing a TSCTSF created resource identifier; and

- send an HTTP "201 Created" response with AccessTimeDistributionData data structure as response body and a Location header field containing the URI of the created Individual ASTI Configuration resource, i.e. "{apiRoot}/ntsctsf-asti/<apiVersion>/configurations/{configId}", as shown in figure 5.4.2.2.2-1, step 2.

If for all the affected UEs the provided parameters are not allowed by subscription, the TSCTSF shall indicate in an HTTP "403 Forbidden" response message the "cause" attribute set to "UE\_SERVICE\_NOT\_AUTHORIZED".

If the TSCTSF cannot successfully fulfil the received HTTP POST request due to the internal TSCTSF error or due to the error in the HTTP POST request, the TSCTSF shall send the HTTP error response as specified in clause 6.3.7.

#### 5.4.2.3 Ntsctsf\_ASTI\_Update

##### 5.4.2.3.1 General

This service operation is used by an NF service consumer to update a 5G access stratum time distribution configuration.

The following procedures using the Ntsctsf\_ASTI\_Update service operation are supported:

- Updating an existing configuration.

##### 5.4.2.3.2 Updating an existing configuration

Figure 5.4.2.3.2-1 illustrates the updating of an existing configuration.



Figure 5.4.2.3.2-1: Update of a configuration

To update a configuration, the NF service consumer shall send an HTTP PUT request to the resource "{apiRoot}/ntsctsf-asti/<apiVersion>/configurations/{configId}" representing an existing "Individual ASTI Configuration" resource, as shown in figure 5.4.2.3.2-1, step 1, to modify the configuration.

The AccessTimeDistributionData data structure provided in the request body shall include an updated representation of the "Individual ASTI Configuration" resource with the updated 5G access stratum time distribution configuration information as defined in clause 5.4.2.2.2.

When the "CoverageAreaSupport" feature is supported, the AccessTimeDistributionData data structure may include the time synchronization coverage area encoded as "covReq" attribute, that may contain an updated list of Tracking Area codes per serving network where the provided access stratum time distribution data applies.

When the "ASTIConfigReport" feature is supported, to receive notifications about changes in the 5G access stratum time distribution configuration, the NF service consumer shall also provide the notification URI within the "astiNotifUri" attribute and the notification correlation Id within the "astiNotifId" attribute; and/or, when the "NetTimeSyncStatus" feature is supported, the update of the clock quality detail level in the "clkQltDetLvl" attribute and optionally the clock quality accpetance criteria in the "clkQltAcptCri" attribute indicates an update in the subscription to notification of status of the access stratum time distribution service.

Upon receipt of the corresponding HTTP PUT message, if the request is authorized, theTSCTSF shall:

- If the "CoverageAreaSupport" feature is supported and an updated time synchronization coverage area is provided within the "covReq" attribute:

i. discover the list of AMF(s) serving the list of TA(s) that comprise the time synchronization coverage area using the Nnrf\_NFDiscovery service operation as described in 3GPP TS 29.510 [10], if they were not previously retrieved, and:

ii. update the subscription with the discovered AMF(s), if applicable:

a. for each affected UE, e.g. when the 5G access stratum time distribution configuration applies to a list of individual UEs and the UE time synchronization coverage area within the "covReq" attribute is within the subscribed time synchronization coverage area; or

b. for the group of UEs, when the 5G access stratum time distribution configuration applies to a group of UEs.

to receive notifications about presence of the UE in an Area of Interest events using the Namf\_EventExposure service as described in 3GPP TS 29.518 [27], where the Area of Interest is the provided time synchronization coverage area.

iii. Based on the outcome provided by the AMF or the local available information about the UE’s presence in the Area of Interest and the authorized time synchronization coverage area, the TSCTSF shall determine if the 5G access stratum time distribution configuration is enabled for the UE:

i. If the UE presence is within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the time synchronization coverage area condition is fulfilled, and the provided 5G access stratum time distribution configuration is enabled for the UE.

ii. If the UE presence is not within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the time synchronization coverage area condition is not fulfilled, and the provided 5G access stratum time distribution configuration is not enabled for the UE.

- if the "CoverageAreaSupport" feature is supported and a time synchronization coverage area previously provided is removed:

1. terminate the related subscriptions to notifications about presence of the UE in an Area of Interest events using the Namf\_EventExposure service as described in 3GPP TS 29.518 [27].

2. for each UE that did not fulfil the removed time synchronization coverage area, authorize the UE for the 5GS access stratum time distribution configuration.

- if the time synchronization error budget within the "timeSyncErrBdgt" attribute and/or the temporal validity condition within the "tempValidity" attribute from the NF service consumer is provided, updated, or removed, the TSCTSF based on the Time Synchronization Subscription data retrieved from the UDM determines whether the UE is authorized for the request again as described in clause 5.4.2.2.2.

- for each authorized UE, if the access stratum time distribution via Uu reference point is being activated (i.e. the "asTimeDisEnabled" attribute within the "asTimeDisParam" attribute was received and set to true) or a time synchronization error budget for an active access stratum time distribution is provided or updated by the AF, calculate the Uu time synchronization error budget as specified in clause 5.27.1.9 of 3GPP TS 23.501 [2];

- for each authorized UE, interact with the PCF for a UE to provide the updated configuration information using the Npcf\_AMPolicyAuthorization\_Update service operation as defined in 3GPP TS 29.534 [14]; and

- update the existing "Individual ASTI Configuration" resource. Then the TSCTSF shall send a HTTP response including "200 OK" status code with AccessTimeDistributionData data structure or "204 No Content" status code, as shown in figure 5.4.2.3.2-1, step 2.

If for all the affected UEs the provided parameters are not allowed by subscription, the TSCTSF shall indicate in an HTTP "403 Forbidden" response message the "cause" attribute set to "UE\_SERIVCE\_NOT\_AUTHORIZED".

If the TSCTSF cannot successfully fulfil the received HTTP PUT request due to the internal TSCTSF error or due to the error in the HTTP PUT request, the TSCTSF shall send the HTTP error response as specified in clause 6.3.7.

If the TSCTSF determines the received HTTP PUT request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

#### 5.4.2.4 Ntsctsf\_ASTI\_Delete

##### 5.4.2.4.1 General

This service operation is used by an NF service consumer to delete a 5G access stratum time distribution configuration.

The following procedures using the Ntsctsf\_ASTI\_Delete service operation are supported:

- Delete an existing configuration.

##### 5.4.2.4.2 Delete an existing configuration

Figure 5.4.2.4.2-1 illustrates the deleting of an existing configuration.



Figure 5.4.2.4.2-1: Deletion of a configuration

To delete a configuration, the NF service consumer shall send an HTTP DELETE request to the resource "{apiRoot}/ntsctsf-asti/<apiVersion>/configurations/{configId}" representing an existing "Individual ASTI Configuration" resource, as shown in figure 5.4.2.4.2-1, step 1, to delete the configuration.

Upon the reception of an HTTP DELETE request from the NF service consumer, if the HTTP DELETE request is authorized, the TSCTSF shall:

- interact with the PCF for a UE to remove the configuration information in the PCF by using the Npcf\_AMPolicyAuthorization\_Delete service operation as defined in 3GPP TS 29.534 [14].

- remove the corresponding configuration and respond with "204 No Content" as shown in figure 5.4.2.4.2-1, step 2.

If the TSCTSF cannot successfully fulfil the received HTTP DELETE request due to the internal TSCTSF error or due to the error in the HTTP DELETE request, the TSCTSF shall send the HTTP error response as specified in clause 6.3.7.

If the TSCTSF determines the received HTTP DELETE request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

#### 5.4.2.5 Ntsctsf\_ASTI\_Get

##### 5.4.2.5.1 General

This service operation is used by an NF service consumer to retrieve ths status of the access stratum time distribution for a list of UEs.

The following procedures using the Ntsctsf\_ASTI\_Get service operation are supported:

- Retrieve the status of access stratum time distribution.

##### 5.4.2.5.2 Retrieve the status of access stratum time distribution

Figure 5.4.2.5.2-1 illustrates the retrieval of the status of access stratum time distribution.



Figure 5.4.2.5.2-1: Retrieval of the status of access stratum time distribution

To retrieve the status of access stratum time distribution, the NF service consumer shall send an HTTP POST request to the resource "{apiRoot}/ntsctsf-asti/<apiVersion>/configurations/retrieve". The HTTP POST message shall include the StatusRequestData data structure as request body, as shown in figure 5.4.2.5.2-1, step 1. The StatusRequestData data structure shall include:

- identification of a list of individual UEs within the "supis" attribute; or

- identification of a list of individual UEs within the "gpsis" attribute;

Upon the reception of an HTTP POST request and if the HTTP POST request is accepted by the TSCTSF, the TSCTSF determines the status of the access stratum time distribution is active for a UE if there is a 5G access stratum time distribution configuration applicable to the UE, i.e., it applies according to the temporal validity, if present, and the access time distribution via Uu reference point is activated; otherwise, the status of the access stratum time distribution is inactive for the UE.

The TSCTSF shall send an HTTP "200 OK" response with the StatusResponseData data structure as response body, as shown in figure 5.4.2.5.2-1, step 2 to notify of the status.

Within the StatusResponseData data structure, TSCTSF may include:

- a list of SUPI(s) whose status of the access stratum time distribution is inactive within the "inactiveUes" attribute or a list of GPSI(s) whose status of the access stratum time distribution is inactive within the "inactiveGpsis" attribute;

- the "activeUes" attribute containing one or more the ActiveUe instances which includes the UE identifier whose status of the access stratum time distribution is active within the "supi" attribute or "gpsi" attribute and the requested time synchronization error budget, if available, within the "timeSyncErrBdgt" attribute.

If the TSCTSF cannot successfully fulfil the received HTTP POST request due to the internal TSCTSF error or due to the error in the HTTP POST request, the TSCTSF shall send the HTTP error response as specified in clause 6.3.7.

#### 5.4.2.6 Ntsctsf\_ASTI\_UpdateNotify

##### 5.4.2.6.1 General

This service operation is used by the TSCTSF to report about the change of state of the 5G access stratum time distribution configuration and the 5G access stratum time distribution status information.

The following procedures using the Ntsctsf\_ASTI\_UpdateNotify service operation are supported:

- Notification about the 5G Access Stratum Time Distribution events

- Notification about ASTI configuration changes due to UE presence in time synchronization coverage area.

- Notification about the 5G access stratum time distribution status information.

##### 5.4.2.6.2 Notification about the 5G access stratum time distribution events

Figure 5.4.2.6.2-1 illustrates the notification about the 5G access stratum time distribution events.



Figure 5.4.2.6.2-1: Notification about the 5G access stratum time distribution event

The TSCTSF shall invoke the Ntsctsf\_ASTI\_UpdateNotify to report a 5G access stratum time distribution event by sending an HTTP POST request (as shown in figure 5.4.2.6.2-1, step 1) to the NF service consumer using as request URI the notification URI received in the creation (as specified in clause  5.4.2.2.2) or modification (as specified in clause  5.4.2.3.2) of the Individual ASTI Configuration resource, and the AstiConfigNotification data structure as request body.

The AstiConfigNotification data structure shall include:

- the notification correlation ID provided by the NF service consumer during the provisioning of 5G access stratum time distribution configuration within the "astiNotifId" attribute;

- the update of the 5G access stratum configuration for the indicated UE(s) within the "stateConfigs" attribute. Within each entry of the "stateConfigs" attribute, the TSCTSF shall include:

a. the identification of the individual UE within either the "supi" or the "gpsi" attribute;

b. information about the observed event within the "event" attribute. For each reported event, the additional event information, if applicable.

The notification of specific events using the Ntsctsf\_ASTI\_UpdateNotify service operation is described in the related clauses.

If the HTTP POST request from the TSCTSF is not accepted, the NF service consumer shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.3.7.

If the HTTP POST request from the TSCTSF is accepted, the NF service consumer shall acknowledge the receipt of the event notification with a "204 No Content" response, as shown in figure 5.4.2.6.2-1, step 2.

If the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

##### 5.4.2.6.3 Notification about ASTI configuration changes due to UE presence in time synchronization coverage area

If the feature "CoverageAreaSupport" is supported and the TSCTSF received time synchronization coverage area as part of the Ntsctsf\_ASTI\_Create/Update service operation as described in clauses 5.4.2.2.2 and 5.4.2.3.2, when the TSCTSF receives a change in the UE presence in Area of Interest notification as described in 3GPP TS 29.518 [27], the TSCTSF shall determine if the re-evaluation of the time synchronization coverage area shall trigger an activation or deactivation of the access stratum time distribution:

- If the notification of change of UE presence in Area of Interest indicates that the UE is within any TAs from the time synchronization coverage area, then the TSCTSF shall enable access stratum time distribution for the UE. The TSCTSF shall provide the 5G access stratum time distribution configuration to the UE using the Npcf\_AMPolicyAuthorization\_Create service operation as defined in 3GPP TS 29.534 [14].

- If the notification of change of UE presence in Area of Interest indicates that the UE is not within any TAs from the time synchronization coverage area, then the TSCTSF shall disable access stratum time distribution for the UE. The TSCTSF shall disable the 5G access stratum time distribution to the UE using the Npcf\_AMPolicyAuthorization\_Update service operation as defined in 3GPP TS 29.534 [14].

If the feature "ASTIConfigReport" is supported, the TSCTSF shall invoke the Ntsctsf\_ASTI\_UpdateNotify to report the change of 5G access stratum time distribution configuration as specified in clause 5.4.2.6.2. The "stateConfigs" attribute shall include:

a. the "event" attribute set to "ASTI\_ENABLED" to indicate the 5G access stratum time distribution configuration for the UE is active; or

b. the "event" attribute set to "ASTI\_DISABLED" to indicate the 5G access stratum time distribution configuration for the UE is inactive.

The NF service consumer shall acknowledge or redirect the request as described in clause 5.4.2.6.2.

##### 5.4.2.6.4 Notification about the 5G access stratum time distribution status information

If the "NetTimeSyncStatus" feature is supported and the TSCTSF received clock quality acceptance criteria as part of the Ntsctsf\_ASTI\_Create/Update service operation as described in clauses 5.4.2.2.2 and 5.4.2.3.2, when the TSCTSF is aware of 5G access stratum time distribution status information, the TSCTSF shall determine if the UE is impacted or not based on the UE presence in Area of Interest notification as described in clause 4.15.9.5.1 of 3GPP TS 23.502 [3].

If the "NetTimeSyncStatus" feature is supported and for the affected UEs, the TSCTSF shall invoke the Ntsctsf\_ASTI\_UpdateNotify to report about the 5G access stratum time distribution status as specified in clause 5.4.2.6.2 and shall include the status of the access stratum time distribution for the targeted UE(s) within the "stateConfigs" attribute as follows:

a. the "event" attribute set to "CLOCK\_QUAL\_ACCEPTABLE" to indicate the clock quality for the ASTI service is fulfilling the clock quality acceptance criteria for the UE; or

b. the "event" attribute set to "CLOCK\_QUAL\_NON\_ACCEPTABLE" to indicate the clock quality for the ASTI service is not fulfilling the clock quality acceptance criteria for the UE. Based on this notification, the AF decides whether to modify the ASTI service configured for the UE using the Ntsctsf\_ASTI\_Update service as described in clause 5.4.2.3.

The NF service consumer shall acknowledge or redirect the request as described in clause 5.4.2.6.2.

# 6 API Definitions

## 6.1 Ntsctsf\_TimeSynchronization Service API

### 6.1.1 Introduction

The Ntsctsf\_TimeSynchronization service shall use the Ntsctsf\_TimeSynchronization API.

The API URI of the Ntsctsf\_TimeSynchronization API shall be:

**{apiRoot}/<apiName>/<apiVersion>**

The request URIs used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

**{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>**

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].

- The <apiName>shall be "ntsctsf-time-sync".

- The <apiVersion> shall be "v1".

- The <apiSpecificResourceUriPart> shall be set as described in clause 6.1.3.

### 6.1.2 Usage of HTTP

#### 6.1.2.1 General

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

The OpenAPI [6] specification of HTTP messages and content bodies for the Ntsctsf\_TimeSynchronization API is contained in Annex A.

#### 6.1.2.2 HTTP standard headers

##### 6.1.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [4] for the usage of HTTP standard headers.

##### 6.1.2.2.2 Content type

JSON, IETF RFC 8259 [12], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [4]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 9457 [13].

#### 6.1.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4] may be supported.

In this Release of the specification, no specific custom headers are defined for the Ntsctsf\_TimeSynchronization API.

### 6.1.3 Resources

#### 6.1.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 6.1.3.1-1 depicts the resource URIs structure for the Ntsctsf\_TimeSynchronization API.



Figure 6.1.3.1-1: Resource URI structure of the Ntsctsf\_TimeSynchronization API

Table 6.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.1.3.1-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method or custom operation | Description |
| Time Synchronization Exposure | /subscriptions | POST | Create a new subscription to notification of capability of time synchronization service. |
| Individual Time Synchronization Exposure Subscription | /subscriptions/{subscriptionId} | GET | Read a subscription to notification of capability of time synchronization service. |
| PUT | Modify a subscription to notification of capability of time synchronization service. |
| DELETE | Delete a subscription to notification of capability of time synchronization service. |
| Time Synchronization Exposure Configurations | /subscriptions/{subscriptionId}/configurations | POST | Create a new configuration to time synchronization exposure. |
| Individual Time Synchronization Exposure Configuration | /subscriptions/{subscriptionId}/configurations/{configurationId} | GET | Read a configuration to time synchronization exposure. |
| PUT | Modify all of the properties of an existing configuration to time synchronization exposure. |
| DELETE | Delete a configuration to time synchronization exposure. |

#### 6.1.3.2 Resource: Time Synchronization Exposure Subscriptions

##### 6.1.3.2.1 Description

This resource allows a NF service consumer to create a new subscription to notification of the capability for time synchronization service.

##### 6.1.3.2.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions**

This resource shall support the resource URI variables defined in table 6.1.3.2.2-1.

Table 6.1.3.2.2-1: Resource URI variables for this resource

|  |  |  |
| --- | --- | --- |
| Name | Data type | Definition |
| apiRoot | string | See clause 6.1.1 |

##### 6.1.3.2.3 Resource Standard Methods

###### 6.1.3.2.3.1 POST

The POST method creates a new subscription resource to time synchronization exposure subscription. The NF service consumer shall initiate the HTTP POST request message and the TSCTSF shall respond to the message. The TSCTSF shall construct the URI of the created resource.

This method shall support the URI query parameters specified in table 6.1.3.2.3.1-1.

Table 6.1.3.2.3.1-1: URI query parameters supported by the POST method on this resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description | Applicability |
| n/a |  |  |  |  |  |

This method shall support the request data structures specified in table 6.1.3.2.3.1-2 and the response data structures and response codes specified in table 6.1.3.2.3.1-3.

Table 6.1.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| TimeSyncExposureSubsc | M | 1 | Parameters to request a subscription to notification of the capability for time synchronization service. |

Table 6.1.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| TimeSyncExposureSubsc | M | 1 | 201 Created | The subscription was created successfully.  The URI of the created resource shall be returned in the "Location" HTTP header. |
| NOTE: The manadatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. | | | | |

Table 6.1.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains the URI of the newly created resource, according to the structure: {apiRoot}/ntsctsf-time-sync/{apiVersion}/ subscriptions/{subscriptionId} |

##### 6.1.3.2.4 Resource Custom Operations

None.

#### 6.1.3.3 Resource: Individual Time Synchronization Exposure Subscription

##### 6.1.3.3.1 Description

This resource allows a NF service consumer to read, modify or delete an existing subscription to notification of the capability for time synchronization service.

##### 6.1.3.3.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}**

This resource shall support the resource URI variables defined in table 6.1.3.3.2-1.

Table 6.1.3.3.2-1: Resource URI variables for this resource

|  |  |  |
| --- | --- | --- |
| Name | Data type | Definition |
| apiRoot | string | See clause 6.1.1 |
| subscriptionId | string | Represents a specific subscription. It is the identifier of the Individual Time Synchronization Exposure Subscription resource. |

##### 6.1.3.3.3 Resource Standard Methods

###### 6.1.3.3.3.1 GET

This method shall support the URI query parameters specified in table 6.1.3.3.3.1-1.

Table 6.1.3.3.3.1-1: URI query parameters supported by the GET method on this resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description | Applicability |
| n/a |  |  |  |  |  |

This method shall support the request data structures specified in table 6.1.3.3.3.1-2 and the response data structures and response codes specified in table 6.1.3.3.3.1-3.

Table 6.1.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| n/a |  |  |  |

Table 6.1.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| TimeSyncExposureSubsc | M | 1 | 200 OK | An Individual Time Synchronization Exposure Subscription resource is returned successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during an Individual Time Synchronization Exposure Subscription resource retrieval.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during an Individual Time Synchronization Exposure Subscription resource retrieval.  (NOTE 2) |
| NOTE 1: The manadatory HTTP error status code for the GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.1.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.1.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

###### 6.1.3.3.3.2 DELETE

This method shall support the URI query parameters specified in table 6.1.3.3.3.2-1.

Table 6.1.3.3.3.2-1: URI query parameters supported by the DELETE method on this resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description | Applicability |
| n/a |  |  |  |  |  |

This method shall support the request data structures specified in table 6.1.3.3.3.2-2 and the response data structures and response codes specified in table 6.1.3.3.3.2-3.

Table 6.1.3.3.3.2-2: Data structures supported by the DELETE Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| n/a |  |  |  |

Table 6.1.3.3.3.2-3: Data structures supported by the DELETE Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| n/a |  |  | 204 No Content | The subscription was deleted successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during Individual Time Synchronization Exposure Subscription resource deletion.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during Individual Time Synchronization Exposure Subscription resource deletion.  (NOTE 2) |
| NOTE 1: The manadatory HTTP error status code for the DELETE method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.1.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.1.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

###### 6.1.3.3.3.3 PUT

This method shall support the URI query parameters specified in table 6.1.3.3.3.3-1.

Table 6.1.3.3.3.3-1: URI query parameters supported by the PUT method on this resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description | Applicability |
| n/a |  |  |  |  |  |

This method shall support the request data structures specified in table 6.1.3.3.3.3-2 and the response data structures and response codes specified in table 6.1.3.3.3.3-3.

Table 6.1.3.3.3.3-2: Data structures supported by the PUT Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| TimeSyncExposureSubsc | M | 1 | Modify an existing Time Synchronization Exposure Subscription. |

Table 6.1.3.3.3.3-3: Data structures supported by the PUT Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| TimeSyncExposureSubsc | M | 1 | 200 OK | The subscription was updated successfully. |
| n/a |  |  | 204 No Content | The subscription was updated successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during Individual Time Synchronization Exposure Subscription resource modification.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during Individual Time Synchronization Exposure Subscription resource modification.  (NOTE 2) |
| NOTE 1: The manadatory HTTP error status code for the PUT method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.1.3.3.3.3-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.1.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

##### 6.1.3.3.4 Resource Custom Operations

None.

#### 6.1.3.4 Resource: Time Synchronization Exposure Configurations

##### 6.1.3.4.1 Description

This resource allows a NF service consumer to create a new subscription to notification of the capability for time synchronization service.

##### 6.1.3.4.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}/configurations**

This resource shall support the resource URI variables defined in table 6.1.3.4.2-1.

Table 6.1.3.4.2-1: Resource URI variables for this resource

|  |  |  |
| --- | --- | --- |
| Name | Data type | Definition |
| apiRoot | string | See clause 6.1.1 |
| subscriptionId | string | Represents a specific subscription. It is the identifier of the Individual Time Synchronization Exposure Subscription resource. |

##### 6.1.3.4.3 Resource Standard Methods

###### 6.1.3.4.3.1 POST

The POST method creates a new configuration resource to activate time synchronization service. The NF service consumer shall initiate the HTTP POST request message and the TSCTSF shall respond to the message. The TSCTSF shall construct the URI of the created resource.

This method shall support the URI query parameters specified in table 6.1.3.4.3.1-1.

Table 6.1.3.4.3.1-1: URI query parameters supported by the POST method on this resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description | Applicability |
| n/a |  |  |  |  |  |

This method shall support the request data structures specified in table 6.1.3.4.3.1-2 and the response data structures and response codes specified in table 6.1.3.4.3.1-3.

Table 6.1.3.4.3.1-2: Data structures supported by the POST Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| TimeSyncExposureConfig | M | 1 | Parameters to create a configuration to activate time synchronization service. |

Table 6.1.3.4.3.1-3: Data structures supported by the POST Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| TimeSyncExposureConfig | M | 1 | 201 Created | The configuration was created successfully.  The URI of the created resource shall be returned in the "Location" HTTP header. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during Individual Time Synchronization Exposure Configuration resource creation.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during Individual Time Synchronization Exposure Configuration resource creation.  (NOTE 2) |
| ProblemDetails | O | 0..1 | 403 Forbidden | (NOTE 3) |
| NOTE 1: The manadatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).  NOTE 3: Failure cases are described in clause 6.1.7. | | | | |

Table 6.1.3.4.3.1-4: Headers supported by the 201 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains the URI of the newly created resource, according to the structure: {apiRoot}/ntsctsf-time-sync/{apiVersion}/ subscriptions/{subscriptionId}/configuration/{configurationId} |

Table 6.1.3.4.3.1-5: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.1.3.4.3.1-6: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

##### 6.1.3.4.4 Resource Custom Operations

None.

#### 6.1.3.5 Resource: Individual Time Synchronization Exposure Configuration

##### 6.1.3.5.1 Description

This resource allows a NF service consumer to modify/cancel a configuration to modify/deactivate Time Synchronization service with the TSCTSF

##### 6.1.3.5.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}/configurations/{configurationId}**

This resource shall support the resource URI variables defined in table 6.1.3.5.2-1.

Table 6.1.3.5.2-1: Resource URI variables for this resource

|  |  |  |
| --- | --- | --- |
| Name | Data type | Definition |
| apiRoot | string | See clause 6.1.1 |
| subscriptionId | string | Represents a specific subscription. It is the identifier of the Individual Time Synchronization Exposure Subscription resource. |
| configurationId | string | Represents a specific configuration. It is the identifier of the Individual Time Synchronization Exposure Configuration resource. |

##### 6.1.3.5.3 Resource Standard Methods

###### 6.1.3.5.3.1 GET

This method shall support the URI query parameters specified in table 6.1.3.5.3.1-1.

Table 6.1.3.5.3.1-1: URI query parameters supported by the GET method on this resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description | Applicability |
| n/a |  |  |  |  |  |

This method shall support the request data structures specified in table 6.1.3.5.3.1-2 and the response data structures and response codes specified in table 6.1.3.5.3.1-3.

Table 6.1.3.5.3.1-2: Data structures supported by the GET Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| n/a |  |  |  |

Table 6.1.3.5.3.1-3: Data structures supported by the GET Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| TimeSyncExposureConfig | M | 1 | 200 OK | The configuration information in the request URI are returned. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during Individual Time Synchronization Exposure Configuration resource retrieval.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during Individual Time Synchronization Exposure Configuration resource retrieval.  (NOTE 2) |
| NOTE 1: The manadatory HTTP error status code for the GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.1.3.4.3.1-5: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.1.3.4.3.1-6: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

###### 6.1.3.5.3.2 PUT

This method shall support the URI query parameters specified in table 6.1.3.5.3.2-1.

Table 6.1.3.5.3.2-1: URI query parameters supported by the PUT method on this resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description | Applicability |
| n/a |  |  |  |  |  |

This method shall support the request data structures specified in table 6.1.3.5.3.2-2 and the response data structures and response codes specified in table 6.1.3.5.3.2-3.

Table 6.1.3.5.3.2-2: Data structures supported by the PUT Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| TimeSyncExposureConfig | M | 1 | Modify an existing Time Synchronization Exposure Configuration. |

Table 6.1.3.5.3.2-3: Data structures supported by the PUT Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| TimeSyncExposureConfig | M | 1 | 200 OK | The subscription was updated successfully. |
| n/a |  |  | 204 No Content | The subscription was updated successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during Individual Time Synchronization Exposure Configuration resource update.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during Individual Time Synchronization Exposure Configuration resource update.  (NOTE 2) |
| ProblemDetails | O | 0..1 | 403 Forbidden | (NOTE 3) |
| NOTE 1: The manadatory HTTP error status code for the GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).  NOTE 3: Failure cases are described in clause 6.1.7. | | | | |

Table 6.1.3.5.3.2-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.1.3.5.3.2-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

###### 6.1.3.5.3.3 DELETE

This method shall support the URI query parameters specified in table 6.1.3.5.3.3-1.

Table 6.1.3.5.3.3-1: URI query parameters supported by the DELETE method on this resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description | Applicability |
| n/a |  |  |  |  |  |

This method shall support the request data structures specified in table 6.1.3.5.3.3-2 and the response data structures and response codes specified in table 6.1.3.5.3.3-3.

Table 6.1.3.5.3.3-2: Data structures supported by the DELETE Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| n/a |  |  |  |

Table 6.1.3.5.3.3-3: Data structures supported by the DELETE Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| n/a |  |  | 204 No Content | The configuration was deleted successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during Individual Time Synchronization Exposure Configuration resource deletion.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during Individual Time Synchronization Exposure Configuration resource deletion  (NOTE 2) |
| NOTE 1: The manadatory HTTP error status code for the GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.1.3.5.3.3-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.1.3.5.3.3-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

##### 6.1.3.5.4 Resource Custom Operations

None.

### 6.1.4 Custom Operations without associated resources

Void

### 6.1.5 Notifications

#### 6.1.5.1 General

Notifications shall comply to clause 6.2 of 3GPP TS 29.500 [4] and clause 4.6.2.3 of 3GPP TS 29.501 [5].

Table 6.1.5.1-1: Notifications overview

|  |  |  |  |
| --- | --- | --- | --- |
| Notification | Callback URI | HTTP method or custom operation | Description  (service operation) |
| Time Synchronization Capability Notification | {subsNotifUri} | POST | Time Synchronization Capability Notification for a list of UEs. |
| Time Synchronization Configuration Notification | {configNotifUri} | POST | Current state of Time Synchronization Service configuration Notification. |

#### 6.1.5.2 Time Synchronization Capability Notification

##### 6.1.5.2.1 Description

The Time Synchronization Capability Notification is used by the NF service producer to report the capability of the time synchronization service for a list of UEs to a NF service consumer that has subscribed to such Notifications.

##### 6.1.5.2.2 Target URI

The Callback URI **"{subsNotifUri}"** shall be used with the callback URI variables defined in table 6.1.5.2.2-1.

Table 6.1.5.2.2-1: Callback URI variables

|  |  |
| --- | --- |
| Name | Definition |
| subsNotifUri | String formatted as URI with the Callback Uri.  The Callback Uri is assigned within the Time Synchronization Capability Notification and described within the TimeSyncExposureSubsc type (see table 6.1.6.2.2-1). |

##### 6.1.5.2.3 Standard Methods

6.1.5.2.3.1 POST

This method shall support the request data structures specified in table 6.1.5.2.3.1-1 and the response data structures and response codes specified in table 6.1.5.2.3.1-2

Table 6.1.5.2.3.1-1: Data structures supported by the POST Request Body

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| TimeSyncExposureSubsNotif | M | 1 | Provides the time synchronization capabilities of a list of UEs by the TSCTSF to the NF service consumer. |

Table 6.1.5.2.3.1-2: Data structures supported by the POST Response Body

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| n/a |  |  | 204 No Content | The event notification is received successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during event notification.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during event notification.  (NOTE 2) |
| NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.1.5.2.3.1-3: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the notification request is redirected |

Table 6.1.5.2.3.1-4: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the notification request is redirected |

#### 6.1.5.3 Time Synchronization Configuration Notification

##### 6.1.5.3.1 Description

The Time Synchronization Configuration Notification is used by the NF service producer to report the current state of configuration of the time synchronization service.

##### 6.1.5.3.2 Target URI

The Callback URI **"{configNotifUri}"** shall be used with the callback URI variables defined in table 6.1.5.3.2-1.

Table 6.1.5.3.2-1: Callback URI variables

|  |  |
| --- | --- |
| Name | Definition |
| configNotifUri | String formatted as URI with the Callback Uri.  The Callback Uri is assigned within the Time Synchronization Configuration Notification and described within the TimeSyncExposureConfig type (see table 6.1.6.2.9-1). |

##### 6.1.5.3.3 Standard Methods

###### 6.1.5.3.3.1 POST

This method shall support the request data structures specified in table 6.1.5.3.3.1-1 and the response data structures and response codes specified in table 6.1.5.3.3.1-2.

Table 6.1.5.3.3.1-1: Data structures supported by the POST Request Body

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| TimeSyncExposureConfigNotif | M | 1 | Provides the current state of time synchronization configuration by the TSCTSF to the NF service consumer. |

Table 6.1.5.3.3.1-2: Data structures supported by the POST Response Body

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| n/a |  |  | 204 No Content | The event notification is received successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during event notification.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during event notification.  (NOTE 2) |
| NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.1.5.3.3.1-3: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the notification request is redirected. |

Table 6.1.5.3.3.1-4: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the notification request is redirected. |

### 6.1.6 Data Model

#### 6.1.6.1 General

This clause specifies the application data model supported by the API.

Table 6.1.6.1-1 specifies the data types defined for the Ntsctsf\_TimeSynchronization service based interface protocol.

Table 6.1.6.1-1: Ntsctsf\_TimeSynchronization specific Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Clause defined | Description | Applicability |
| ConfigForPort | 6.1.6.2.11 | Contains the configuration for a port. |  |
| PtpCapabilitiesPerUe | 6.1.6.2.6 | Contains the PTP capabilities supported by a UE. |  |
| PtpInstance | 6.1.6.2.10 | Contains the PTP Instance. |  |
| TimeSyncExposureSubsc | 6.1.6.2.2 | Contains the parameters for the subscription to notification of capability of time synchronization service |  |
| TimeSyncCapability | 6.1.6.2.5 | Contains the capability of time synchronization service |  |
| TimeSyncExposureConfig | 6.1.6.2.9 | Contains the configuration of time synchronization service |  |
| TimeSyncExposureConfigNotif | 6.1.6.2.7 | Contains the notification of configuration of time synchronization service. |  |
| TimeSyncExposureSubsNotif | 6.1.6.2.3 | Contains the notification of time synchronization service. |  |
| StateOfConfiguration | 6.1.6.2.8 | Indicates the PTP port states for a NW-TT and DS-TTs. |  |
| StateOfDstt | 6.1.6.2.12 | Contains the PTP port state of a DS-TT |  |
| SubsEventNotification | 6.1.6.2.4 | Contains the notification of capability of time synchronization for a list of UEs. |  |

Table 6.1.6.1-2 specifies data types re-used by the Ntsctsf\_TimeSynchronization service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Ntsctsf\_TimeSynchronization service based interface.

Table 6.1.6.1-2: Ntsctsf\_TimeSynchronization re-used Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Reference | Comments | Applicability |
| AcceptanceCriteriaResultIndication | 3GPP TS 29.522 [17] | Contains the acceptable/not acceptable indication of the clock quality acceptance criteria result information. | NetTimeSyncStatus |
| AsTimeResource | 3GPP TS 29.522 [17] | Indicates the supported 5G clock quality. |  |
| ClockQualityAcceptanceCriterion | 3GPP TS 29.571 [15] | Identifies clock quality acceptance criteria information. | NetTimeSyncStatus |
| ClockQualityDetailLevel | 3GPP TS 29.571 [15] | Identifies clock quality detail level information. | NetTimeSyncStatus |
| DateTime | 3GPP TS 29.571 [15] | String with format "date-time" as defined in OpenAPI Specification [6]. |  |
| DistributionMethod | 3GPP TS 29.522 [17] | Identifies the time synchronization distribution methods supported by 5GS. |  |
| Dnn | 3GPP TS 29.571 [15] | The DNN the user is connected to. |  |
| DurationSec | 3GPP TS 29.571 [15] | Identifies a period of time in units of seconds. |  |
| EventFilter | 3GPP TS 29.522 [17] | Contains the conditions to match for notifying the event. |  |
| ExternalGroupId | 3GPP TS 29.571 [15] | Identifies a External Group. |  |
| GmCapable | 3GPP TS 29.522 [17] | Indicates separately whether 5GS supports acting as a gPTP or PTP grandmaster. |  |
| Gpsi | 3GPP TS 29.571 [15] | The external identification of the user (i.e., an External Id or an MSISDN). |  |
| GroupId | 3GPP TS 29.571 [15] | Identifies a group of internal globally unique ID. |  |
| ProblemDetails | 3GPP TS 29.571 [15] | Problem Details when returning an error response. |  |
| RedirectResponse | 3GPP TS 29.571 [15] | Contains redirection related information. |  |
| ServiceAreaCoverageInfo | 3GPP TS 29.534 [14] | It represents a list of Tracking Areas within a serving network. | CoverageAreaSupport |
| Snssai | 3GPP TS 29.571 [15] | Identifies the S-NSSAI. |  |
| SubscribedEvent | 3GPP TS 29.522 [17] | Indicates the subscribed event. |  |
| Supi | 3GPP TS 29.571 [15] | The identification of the user (i.e. IMSI, NAI). |  |
| SupportedFeatures | 3GPP TS 29.571 [15] | Used to negotiate the applicability of the optional features defined in table 5.8-1. |  |
| TimeSyncExposureConfig | 3GPP TS 29.522 [17] | Contains the parameters of time synchronization configuration. |  |
| Uinteger | 3GPP TS 29.571 [15] | Unsigned integer. |  |
| Uint64 | 3GPP TS 29.571 [15] |  |  |
| Uri | 3GPP TS 29.571 [15] | Identifies a referenced resource. |  |

#### 6.1.6.2 Structured data types

##### 6.1.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

##### 6.1.6.2.2 Type: TimeSyncExposureSubsc

Table 6.1.6.2.2-1: Definition of type TimeSyncExposureSubsc

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| supis | array(Supi) | C | 1..N | Subscription Permanent Identifier. (NOTE) |  |
| gpsis | array(Gpsi) | C | 1..N | Public user identifier.  (NOTE) |  |
| interGrpId | GroupId | C | 0..1 | The internal Group Id(s).  (NOTE) |  |
| exterGrpId | ExternalGroupId | C | 0..1 | The external Group Id.  (NOTE) |  |
| anyUeInd | boolean | C | 0..1 | Identifies whether the AF request applies to any UE (i.e. all UEs). This attribute shall set to "true" if applicable for any UE, otherwise, set to "false".  (NOTE) |  |
| notifMethod | NotificationMethod | O | 0..1 | If "notifMethod" is not supplied, the default value "ON\_EVENT\_DETECTION" applies. |  |
| dnn | Dnn | M | 1 | Identifies a DNN, a full DNN with both the Network Identifier and Operator Identifier, or a DNN with the Network Identifier only. |  |
| snssai | Snssai | M | 1 | Identifies an S-NSSAI. |  |
| subscribedEvents | array(SubscribedEvent) | M | 1..N | Identifies the requirement to be notified of the event(s). |  |
| eventFilters | array(EventFilter) | O | 1..N | Contains the filter conditions to match for notifying the event(s) of time synchronization capabilities for a list of UE(s). |  |
| subsNotifUri | Uri | M | 1 | Notification URI for time sensitive capability reporting. |  |
| subsNotifId | string | M | 1 | Notification Correlation ID assigned by the NF service consumer. |  |
| maxReportNbr | Uinteger | O | 0..1 | If omitted, there is no limit. |  |
| expiry | DateTime | C | 0..1 | This attribute indicates the expiry time of the subscription, after which the NEF shall not send any event notifications and the subscription becomes invalid. It may be included in an event subscription request and may be included in an event subscription response based on operator policies. If an expiry time was included in the request, then the expiry time returned in the response should be less than or equal to that value. If the expiry time is not included in the response, the NF service consumer shall not associate an expiry time for the subscription. |  |
| repPeriod | DurationSec | C | 0..1 | Is supplied for notification Method "periodic". |  |
| suppFeat | SupportedFeatures | C | 0..1 | Represents the features supported by the NF service consumer. This parameter shall be supplied by the NF service consumer in the POST request and the response that requested the creation of an Individual Time Synchronization Subscription resource. |  |
| NOTE: Only one of the properties "supis", "gpsis", "anyUeInd", "exterGrpId" or "interGrpId" shall be included. | | | | | |

##### 6.1.6.2.3 Type: TimeSyncExposureSubsNotif

Table 6.1.6.2.3-1: Definition of type TimeSyncExposureSubsNotify

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| subsNotifId | string | M | 1 | Notification Correlation ID assigned by the NF service consumer. |  |
| eventNotifs | array(SubsEventNotification) | M | 1..N | Notifications about Individual Events |  |

##### 6.1.6.2.4 Type SubsEventNotification

Table 6.1.6.2.4-1: Definition of type SubsEventNotification

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| event | SubscribedEvent | M | 1 | Subscribed events |  |
| timeSyncCapas | array(TimeSyncCapability) | C | 1..N | Contains a list of time syncroniziation capabilities for the List of User-Plane Node IDs. It shall be provided if the reported event is "AVAILABILITY\_FOR\_TIME\_SYNC\_SERVICE". |  |

##### 6.1.6.2.5 Type: TimeSyncCapability

Table 6.1.6.2.5-1: Definition of type TimeSyncCapability

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| upNodeId | Uint64 | M | 1 | Identifies the applicable NW-TT. Contains a TSC user plane node Id. If integrated with TSN, the user plane node Id is a bridge Id defined in IEEE Std 802.1Q-2018 [18] clause 14.2.5. |  |
| gmCapables | array(GmCapable) | C | 1..N | Indicates whether user plane node supports acting as a gPTP and/or PTP grandmaster.  (NOTE) |  |
| asTimeRes | AsTimeResource | C | 0..1 | Indicates the supported 5G clock quality (i.e. the source of time used by the 5GS). (NOTE) |  |
| ptpCapForUes | map(PtpCapabilitiesPerUe) | C | 1..N | Contains the PTP capabilities supported by the list of UE(s). The key of the map is the SUPI.  Shall be present if the "gmCapables" attribute is included and the PTP Capabilities are reported per SUPI. |  |
| ptpCapForGpsis | map(PtpCapabilitiesPerUe) | C | 1..N | Contains the PTP capabilities supported by the list of UE(s). The key of the map is the GPSI.  Shall be present if the "gmCapables" attribute is included and the PTP Capabilities are reported per GPSI. |  |
| NOTE: At least one of the "gmCapables" attribute and "asTimeRes" attribute shall be included. | | | | | |

##### 6.1.6.2.6 Type: PtpCapabilitiesPerUe

Table 6.1.6.2.6: Definition of type PtpCapabilitiesPerUe

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| supi | Supi | C | 0..1 | Identifies the UE to which the reported PTP instance below apply.  (NOTE) |  |
| gpsi | Gpsi | C | 0..1 | Identifies the UE to which the reported PTP instance below apply.  (NOTE) |  |
| ptpCaps | array(EventFilter) | M | 1..N | Contains the reported PTP capabilities for the UE. |  |
| NOTE: Either the "supi" or the "gpsi" attribute is included, based on whether the request contained an internal or an external identifier. | | | | | |

##### 6.1.6.2.7 Type: TimeSyncExposureConfigNotif

Table 6.1.6.2.7-1: Definition of type TimeSyncExposureConfigNotif

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| configNotifId | string | M | 1 | Notification Correlation ID assigned by the NF service consumer. |  |
| stateOfConfig | StateOfConfiguration | M | 1 | Indicates the current state of time synchroniztion service configuration |  |

##### 6.1.6.2.8 Type: StateOfConfiguration

Table 6.1.6.2.8-1: Definition of type StateOfConfiguration

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| stateOfNwtt | boolean | O | 0..1 | When any of the PTP port state(s) in NW-TT is Leader, Follower or Passive, it is included and set to true to indicate the current state of the time synchronization configuration for the NW-TT port(s) of the PTP instance is active; when PTP port state is in any other case, it is included and set to false to indicate the state of configuration for the NW-TT port(s) of the PTP instance is inactive. Default value is false. |  |
| stateOfDstts | array(StateOfDstt) | O | 1..N | Contains the PTP port states and the clock quality acceptance criteria result of the DS-TT(s). |  |

Editor’s note: Whether it is required the report of the clock quality acceptance criteria for the NW-TTP ports (i.e., whether the clkQltIndOfNwtt attribute is needed) is FFS and requires SA2 clarifications.

##### 6.1.6.2.9 Type: TimeSyncExposureConfig

Table 6.1.6.2.9-1: Definition of type TimeSyncExposureConfig

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| upNodeId | Uint64 | M | 1 | Identifies the applicable NW-TT. Contains a TSC user plane node Id. If integrated with TSN, the user plane node Id is a bridge Id defined in IEEE 802.1Q [41] clause 14.2.5. |  |
| reqPtpIns | PtpInstance | M | 1 | Identifies the PtP instance configuration and activation requested by the AF. |  |
| gmEnable | boolean | O | 0..1 | Indicates that the AF requests 5GS to act as a grandmaster for PTP or gPTP if it is included and set to true. The default value "false" shall apply, if the attribute is not present. |  |
| gmPrio | Uinteger | O | 0..1 | Indicates a priority used as defaultDS.priority1 when generating Announce message when 5GS acts as (g)PTP GM. It may be present if the "gmEnable" is set to true. |  |
| timeDom | Uinteger | M | 1 | Indicate the (g)PTP domain that the (TSN)AF is located in. |  |
| timeSyncErrBdgt | Uinteger | O | 0..1 | Indicates the time synchronization budget for the time synchronization service in units of nanoseconds.  Minimum = 1. |  |
| tempValidity | TemporalValidity | O | 0..1 | Indicates the time period when the time synchronization service for a PTP instance is active. |  |
| configNotifUri | Uri | M | 1 | Notification URI for configuration state reporting. |  |
| configNotifId | string | M | 1 | Notification Correlation ID assigned by the NF service consumer. |  |
| covReq | array(ServiceAreaCoverageInfo) | O | 1..N | Identifies a list of Tracking Areas per serving network where the time synchronization service configuration is allowed. | CoverageAreaSupport |
| clkQltDetLvl | ClockQualityDetailLevel | O | 0..1 | Indicates the clock quality detail level.  For (g)PTP services, its value, if provided, shall be set to "ACCEPT\_INDICATION". | NetTimeSyncStatus |
| clkQltAcptCri | ClockQualityAcceptanceCriterion | C | 0..1 | Indicates the clock quality acceptance criteria, and it is used to determine whether the time synchronization status for the (g)PTP service is acceptable/not acceptable.  It shall be present when the "clkQltDetLvl" attribute is present. | NetTimeSyncStatus |

##### 6.1.6.2.10 Type: PtpInstance

Table 6.1.6.2.10-1: Definition of type PtpInstance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| instanceType | InstanceType | M | 1 | Indicates the PTP instance type. |  |
| protocol | Protocol | M | 1 | Indicates the protocol type. |  |
| ptpProfile | string | M | 1 | Identifies the PTP profile. |  |
| portConfigs | array(ConfigForPort) | O | 1..N | Contains the configurations for the PTP port(s) in the PTP instance. |  |

##### 6.1.6.2.11 Type: ConfigForPort

Table 6.1.6.2.11-1: Definition of type ConfigForPort

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| supi | Supi | C | 0..1 | Identifies the UE/DS-TT which the parameters below apply.  (NOTE) |  |
| gpsi | Gpsi | C | 0..1 | Identifies the UE/ DS-TT which the parameters below apply (NOTE) |  |
| n6Ind | boolean | C | 0..1 | Indicates the N6 termination which the parameters below apply.  (NOTE) |  |
| ptpEnable | boolean | O | 0..1 | This is used to set the portDS.portEnable. If omitted, the default value as described in the PTP Profile is used |  |
| logSyncInter | integer | O | 0..1 | Specifies the mean time interval between successive Sync messages. This is applicable for IEEE Std 1588-2019 [25] Boundary Clock or IEEE Std 802.1AS-2020 [26] operation. If omitted, the default value as described in the PTP Profile is used. |  |
| logSyncInterInd | boolean | O | 0..1 | When set to FALSE, the value of "logSyncInter" attribute is used to set the initialLogSyncInterval as described in IEEE Std 802.1AS-2020 [26]. When set to TRUE, the value of "logSyncInter" attribute is used to set the mgtSettableLogSyncInterval as described in IEEE Std 802.1AS-2020 [26].  If omitted, the default value as described in the IEEE Std 802.1AS-2020 [26] is used. |  |
| logAnnouInter | integer | O | 0..1 | Specifies the mean time interval between successive Announce messages. This is applicable for IEEE Std 1588-2019 [25] Boundary Clock or IEEE Std 802.1AS-2020 [26] operation. If omitted, the default value as described in the PTP Profile is used. |  |
| logAnnouInterInd | boolean | O | 0..1 | When set to FALSE, the value of "logAnnouInter" attribute is used to set the initialLogAnnounceInterval as described in IEEE 802.1AS-2020 [26]. When set to TRUE, the value of "logAnnouInter" attribute is used to set the mgtSettableLogAnnounceInterval as described in IEEE Std 802.1AS-2020 [26].  If omitted, the default value as described in the IEEE Std 802.1AS-2020 [26] is used. |  |
| NOTE: Only one of "supi", "gpsi" or "n6Ind" attribute shall be included. | | | | | |

##### 6.1.6.2.12 Type: StateOfDstt

Table 6.1.6.2.12-1: Definition of type StateOfDstt

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| supi | Supi | C | 0..1 | Identifies the UE/DS-TT which the parameters below apply.  (NOTE) |  |
| gpsi | Gpsi | C | 0..1 | Identifies the UE/DS-TT which the parameters below apply.  (NOTE) |  |
| state | boolean | M | 1 | When the PTP port state is Leader, Follower or Passive, it is included and set to true  to indicate the current state of the time synchronization configuration for DS-TT port is active; when PTP port state is  in any other case, it is included and set to false to indicate the state of configuration for DS-TT port is inactive. Default value is false. |  |
| clkQltIndOfDstts | AcceptanceCriteriaResultIndication | O | 0..1 | Indicates the clock quality acceptance criteria changes ("ACCEPTABLE", "NOT\_ACCEPTABLE") for the indicated DS-TT port of the PTP instance. | NetTimeSyncStatus |
| NOTE: Either the "supi" or the "gpsi" attribute is included, based on whether the request contained an internal or an external identifier | | | | | |

#### 6.1.6.3 Simple data types and enumerations

##### 6.1.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

##### 6.1.6.3.2 Simple data types

The simple data types defined in table 6.1.6.3.2-1 shall be supported.

Table 6.1.6.3.2-1: Simple data types

|  |  |  |  |
| --- | --- | --- | --- |
| Type Name | Type Definition | Description | Applicability |
|  |  |  |  |

### 6.1.7 Error Handling

#### 6.1.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [5].

For the Ntsctsf\_TimeSynchronization API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [4].

In addition, the requirements in the following clauses are applicable for the Ntsctsf\_TimeSynchronization API.

#### 6.1.7.2 Protocol Errors

No specific procedures for the Ntsctsf\_TimeSynchronization service are specified.

#### 6.1.7.3 Application Errors

The application errors defined for the Ntsctsf\_TimeSynchronization service are listed in Table 6.1.7.3-1.

Table 6.1.7.3-1: Application errors

|  |  |  |
| --- | --- | --- |
| Application Error | HTTP status code | Description |
| UE\_SERVICE\_NOT\_AUTHORIZED | 403 Forbidden | The requested service for the target UE is not authorized. |

### 6.1.8 Feature negotiation

The optional features in table 6.1.8-1 are defined for the Ntsctsf\_TimeSynchronization API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.1.8-1: Supported Features

|  |  |  |
| --- | --- | --- |
| Feature number | Feature Name | Description |
| 1 | CoverageAreaSupport | Indicates the support of spatial validity conditions for the activation/deactivation of the time synchronization service. |
| 2 | NetTimeSyncStatus | Indicates the time synchronization service status. |

### 6.1.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Ntsctsf\_TimeSynchronization API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Ntsctsf\_TimeSynchronization API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Ntsctsf\_TimeSynchronization service.

The Ntsctsf\_TimeSynchronization API defines a single scope "ntsctsf-time-sync" for the entire service, and it does not define any additional scopes at resource or operation level.

## 6.2 Ntsctsf\_QoSandTSCAssistance Service API

### 6.2.1 Introduction

The Ntsctsf\_QoSandTSCAssistance service shall use the Ntsctsf\_QoSandTSCAssistance API.

The API URI of the Ntsctsf\_QoSandTSCAssistance API shall be:

**{apiRoot}/<apiName>/<apiVersion>**

The request URIs used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [4], i.e.:

**{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>**

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].

- The <apiName>shall be "ntsctsf-qos-tscai".

- The <apiVersion> shall be "v1".

- The <apiSpecificResourceUriPart> shall be set as described in clause 6.2.3.

### 6.2.2 Usage of HTTP

#### 6.2.2.1 General

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

The OpenAPI [6] specification of HTTP messages and content bodies for the Ntsctsf\_QoSandTSCAssistance API is contained in Annex A.

#### 6.2.2.2 HTTP standard headers

##### 6.2.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [4] for the usage of HTTP standard headers.

##### 6.2.2.2.2 Content type

JSON, IETF RFC 8259 [12], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [4]. The use of the JSON format shall be signalled by the content type "application/json".

JSON object used in the HTTP PATCH request shall be encoded according to "JSON Merge Patch" and shall be signalled by the content type "application/merge-patch+json", as defined in IETF RFC 7396 [22].

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 9457 [13].

#### 6.2.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4] may be supported.

In this Release of the specification, no specific custom headers are defined for the Ntsctsf\_QoSandTSCAssistance API.

### 6.2.3 Resources

#### 6.2.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 6.2.3.1-1 depicts the resource URIs structure for the Ntsctsf\_QoSandTSCAssistance API.



Figure 6.2.3.1-1: Resource URI structure of the Ntsctsf\_QoSandTSCAssistance API

Table 6.2.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.2.3.1-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method or custom operation | Description |
| TSC Application Sessions | /tsc-app-sessions | POST | Ntsctsf\_QoSandTSCAssistance\_Create. Creates a new Individual TSC Application Session Context resource and may create the child Events Subscription sub-resource. |
| Individual TSC Application Session Context | /tsc-app-sessions/{appSessionId} | PATCH | Ntsctsf\_QoSandTSCAssistance\_Update. Updates an existing Individual TSC Application Session Context resource. It can also update an Events Subscription sub-resource. |
| GET | Reads an existing Individual TSC Application Session Context resource. |
| /tsc-app-sessions/{appSessionId}/delete | delete  (POST) | Ntsctsf\_QoSandTSCAssistance\_Delete. Deletes an existing Individual TSC Application Session Context resource and the child Events Subscription sub-resource. |
| Events Subscription | /tsc-app-sessions/{appSessionId} /events-subscription | PUT | Ntsctsf\_QoSandTSCAssistance\_Subscribe. Creates a new Events Subscription sub-resource or modifies an existing Events Subscription sub-resource. |
| DELETE | Ntsctsf\_QoSandTSCAssistance\_Unsubscribe.  Deletes an Events Subscription sub-resource. |

#### 6.2.3.2 Resource: TSC Application Sessions

##### 6.2.3.2.1 Description

This resource allows a NF service consumer to create a new Individual TSC Application Session Context resource and may create the child Events Subscription sub-resource.

##### 6.2.3.2.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions**

This resource shall support the resource URI variables defined in table 6.2.3.2.2-1.

Table 6.2.3.2.2-1: Resource URI variables for this resource

|  |  |  |
| --- | --- | --- |
| Name | Data type | Definition |
| apiRoot | string | See clause 6.2.1 |

##### 6.2.3.2.3 Resource Standard Methods

###### 6.2.3.2.3.1 POST

This method shall support the URI query parameters specified in table 6.2.3.2.3.1-1.

Table 6.2.3.2.3.1-1: URI query parameters supported by the POST method on this resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description | Applicability |
| n/a |  |  |  |  |  |

This method shall support the request data structures specified in table 6.2.3.2.3.1-2 and the response data structures and response codes specified in table 6.2.3.2.3.1-3.

Table 6.2.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| TscAppSessionContextData | M | 1 | Contains the information for the creation of a new Individual TSC Application Session Context resource. |

Table 6.2.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| TscAppSessionContextData | M | 1 | 201 Created | The subscription was created successfully.  The URI of the created resource shall be returned in the "Location" HTTP header. |
| ProblemDetailsTsctsfQosTscac | O | 0..1 | 403 Forbidden | (NOTE 2) |
| ProblemDetails | O | 0..1 | 500 Internal Server Error | (NOTE 2) |
| NOTE 1: The manadatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: Failure cases are described in clause 6.2.7. | | | | |

Table 6.2.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains the URI of the newly created resource, according to the structure: {apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions /{appSessionId} |

Table 6.2.3.2.3.1-5: Headers supported by the 403 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Retry-After | string | M | 1 | Indicates the time the NF service consumer has to wait before making a new request. |

##### 6.2.3.2.4 Resource Custom Operations

None.

#### 6.2.3.3 Resource: Individual TSC Application Session Context

##### 6.2.3.3.1 Description

This resource allows a NF service consumer to read, modify or delete an existing Individual TSC Application Session Context resource.

##### 6.2.3.3.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}**

This resource shall support the resource URI variables defined in table 6.2.3.3.2-1.

Table 6.2.3.3.2-1: Resource URI variables for this resource

|  |  |  |
| --- | --- | --- |
| Name | Data type | Definition |
| apiRoot | string | See clause 6.2.1 |
| appSessionId | string | Identifier of an Individual TSC Application Session Context resource |

##### 6.2.3.3.3 Resource Standard Methods

###### 6.2.3.3.3.1 GET

This method shall support the URI query parameters specified in table 6.2.3.3.3.1-1.

Table 6.2.3.3.3.1-1: URI query parameters supported by the GET method on this resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description | Applicability |
| n/a |  |  |  |  |  |

This method shall support the request data structures specified in table 6.2.3.3.3.1-2 and the response data structures and response codes specified in table 6.2.3.3.3.1-3.

Table 6.2.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| n/a |  |  |  |

Table 6.2.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| TscAppSessionContextData | M | 1 | 200 OK | An Individual TSC Application Session Context resource is returned successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during an Individual TSC Application Session Context resource retrieval.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during an Individual TSC Application Session Context resource retrieval.  (NOTE 2) |
| NOTE 1: The manadatory HTTP error status code for the GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.2.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.2.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

###### 6.2.3.3.3.2 PATCH

This method shall support the URI query parameters specified in table 6.2.3.3.3.2-1.

Table 6.2.3.3.3.2-1: URI query parameters supported by the PATCH method on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| n/a |  |  |  |  |

This method shall support the request data structures specified in table 6.2.3.3.3.2-2 and the response data structures and response codes specified in table 6.2.3.3.3.2-3.

Table 6.2.3.3.3.2-2: Data structures supported by the PATCH Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| TscAppSessionContextUpdateData | M | 1 | Contains the modification(s) to apply to the Individual TSC Application Session Context resource. |

Table 6.2.3.3.3.2-3: Data structures supported by the PATCH Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| TscAppSessionContextData | M | 1 | 200 OK | Successful case.  The Individual TSC Application Session Context resource was modified and a representation of that resource is returned. |
| n/a |  |  | 204 No Content | Successful case.  The Individual TSC Application Session Context resource was modified. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during an Individual TSC Application Session Context resource modification.  (NOTE 3) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during an Individual TSC Application Session Context resource modification.  (NOTE 3) |
| ProblemDetailsTsctsfQosTscac | O | 0..1 | 403 Forbidden | (NOTE 2) |
| NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [4] for the PATCH method shall also apply.  NOTE 2: Failure cases are described in clause 6.2.7.  NOTE 3: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.2.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.2.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.2.3.3.3.2-6: Headers supported by the 403 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Retry-After | string | M | 1 | Indicates the time the NF service consumer has to wait before making a new request. |

##### 6.2.3.3.4 Resource Custom Operations

###### 6.2.3.3.4.1 Overview

Table 6.2.3.3.4.1-1: Custom operations

|  |  |  |  |
| --- | --- | --- | --- |
| Operation name | Custom operation URI | Mapped HTTP method | Description |
| delete | /tsc-app-sessions/{appSessionId}/delete | POST | Ntsctsf\_QoSandTSCAssistance\_Delete. Deletes an existing Individual TSC Application Session Context resource and the child Events Subscription sub-resource. |

###### 6.2.3.3.4.2 Operation: delete

6.2.3.3.4.2.1 Description

6.2.3.3.4.2.2 Operation Definition

This custom operation deletes an existing Individual TSC Application Session Context resource and the child Events Subscription sub-resource in the TSCTSF.

This operation shall support the request data structures specified in table 6.2.3.3.4.2.2-1 and the response data structure and response codes specified in table 6.2.3.3.4.2.2-2.

Table 6.2.3.3.4.2.2-1: Data structures supported by the POST Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| EventsSubscReqData | O | 0..1 | Events subscription information to be sent by the NF service consumer to request event notification when the Individual TSC Application Session Context resource is deleted. |

Table 6.2.3.3.4.2.2-2: Data structures supported by the POST Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| n/a |  |  | 204 No Content | Successful case.  The Individual TSC Application Session Context resource was deleted. |
| EventsNotification | M | 1 | 200 OK | Successful case.  Describes information related to the notification of events. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during an Individual TSC Application Session Context resource deletion.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during an Individual TSC Application Session Context resource deletion.  (NOTE 2) |
| NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [4] for the POST method shall also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.2.3.3.4.2.2-3: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.2.3.3.4.2.2-4: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

#### 6.2.3.4 Resource: Events Subscription (Document)

##### 6.2.3.4.1 Description

The Events Subscription sub-resource represents a subscription to events for a TSC application session context that exists in the Ntsctsf\_QoSandTSCAssistance service.

##### 6.2.3.4.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}/events-subscription**

This resource shall support the resource URI variables defined in table 6.2.3.4.2-1.

Table 6.2.3.4.2-1: Resource URI variables for this resource

|  |  |  |
| --- | --- | --- |
| Name | Data type | Definition |
| apiRoot | string | See clause 6.2.1 |
| appSessionId | string | Identifier of an Individual TSC Application Session Context resource. |

##### 6.2.3.4.3 Resource Standard Methods

###### 6.2.3.4.3.1 PUT

This method shall support the URI query parameters specified in table 6.2.3.4.3.1-1.

Table 6.2.3.4.3.1-1: URI query parameters supported by the PUT method on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| n/a |  |  |  |  |

This method shall support the request data structures specified in table 6.2.3.4.3.1-2 and the response data structures and response codes specified in table 6.2.3.4.3.1-3.

Table 6.2.3.4.3.1-2: Data structures supported by the PUT Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| EventsSubscReqData | M | 1 | Contains information for the modification of the Events Subscription sub-resource. |

Table 6.2.3.4.3.1-3: Data structures supported by the PUT Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| EventsSubscReqData | M | 1 | 201 Created | Successful case.  The Events Subscription sub-resource was created. |
| EventsSubscReqData | M | 1 | 200 OK | Successful case.  The Events Subscription sub-resource was modified. |
| n/a |  |  | 204 No Content | Successful case.  The Events Subscription sub-resource was modified. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during an Events Subscription sub-resource creation.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during an Events Subscription sub-resource creation.  (NOTE 2) |
| NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [4] for the PUT method shall also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.2.3.4.3.1-4: Headers supported by the 201 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains the URI of the newly created resource, according to the structure: {apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}/events-subscription |

Table 6.2.3.4.3.1-5: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.2.3.4.3.1-6: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

###### 6.2.3.4.3.2 DELETE

This method shall support the URI query parameters specified in table 6.2.3.4.3.2-1.

Table 6.2.3.4.3.2-1: URI query parameters supported by the DELETE method on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| n/a |  |  |  |  |

This method shall support the request data structures specified in table 6.2.3.4.3.2-2 and the response data structures and response codes specified in table 6.2.3.4.3.2-3.

Table 6.2.3.4.3.2-2: Data structures supported by the DELETE Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| n/a |  |  |  |

Table 6.2.3.4.3.2-3: Data structures supported by the DELETE Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| n/a |  |  | 204 No Content | Successful case.  The Events Subscription sub-resource was deleted. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during an Events Subscription sub-resource deletion.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during an Events Subscription sub-resource deletion.  (NOTE 2) |
| NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [4] for the DELETE method shall also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.2.3.4.3.2-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.2.3.4.3.2-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

##### 6.2.3.4.4 Resource Custom Operations

None.

### 6.2.4 Custom Operations without associated resources

None.

### 6.2.5 Notifications

#### 6.2.5.1 General

Notifications shall comply to clause 6.2 of 3GPP TS 29.500 [4] and clause 4.6.2.3 of 3GPP TS 29.501 [5].

Table 6.2.5.1-1: Notifications overview

|  |  |  |  |
| --- | --- | --- | --- |
| Notification | Callback URI | HTTP method or custom operation | Description  (service operation) |
| Event Notification | {notifUri}/notify | notify (POST) | TSCTSF event notification. |
| Termination Request | {notifUri}/terminate | terminate (POST) | Request for termination of an Individual TSC Application Session Context. |

#### 6.2.5.2 Event Notification

##### 6.2.5.2.1 Description

The Event Notification is used by the TSCTSF to report one or several observed application session context events to the NF service consumer that has subscribed to such notifications via the Events Subscription sub-resource.

##### 6.2.5.2.2 Target URI

The Callback URI **"{notifUri}/notify "** shall be used with the callback URI variables defined in table 6.2.5.2.2-1.

Table 6.2.5.2.2-1: Callback URI variables

|  |  |
| --- | --- |
| Name | Definition |
| notifUri | The Notification Uri as assigned within the Events Subscription sub-resource and described within the EventsSubscReqData type (see table 6.2.6.2.3-1) or EventsSubscReqDataRm (see table 6.2.6.2.5-1). |

##### 6.2.5.2.3 Standard Methods

###### 6.2.5.2.3.1 POST

This method shall support the request data structures specified in table 6.2.5.2.3.1-1 and the response data structures and response codes specified in table 6.2.5.2.3.1-2.

Table 6.2.5.2.3.1-1: Data structures supported by the POST Request Body

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| EventsNotification | M | 1 | Provides Information about observed events. |

Table 6.2.5.2.3.1-2: Data structures supported by the POST Response Body

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| n/a |  |  | 204 No Content | The event notification is received successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during event notification.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during event notification.  (NOTE 2) |
| NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.2.5.2.3.1-3: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the notification request is redirected |

Table 6.2.5.2.3.1-4: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the notification request is redirected |

#### 6.2.5.3 Termination Request

##### 6.2.5.3.1 Description

The Termination Request is used by the TSCTSF to request the NF service consumer the deletion of the Individual TSC Application Session Context resource.

##### 6.2.5.3.2 Target URI

The Callback URI **"{notifUri}/terminate "** shall be used with the callback URI variables defined in table 6.2.5.3.2-1.

Table 6.2.5.3.2-1: Callback URI variables

|  |  |
| --- | --- |
| Name | Definition |
| notifUri | The Notification Uri as assigned within the Individual TSC Application Session Context resource and described within the TscAppSessionContextData Data type (see table 6.2.6.2.2-1) or TscAppSessionContextUpdateData (see table 6.2.6.2.4-1). |

##### 6.2.5.3.3 Standard Methods

###### 6.2.5.3.3.1 POST

This method shall support the request data structures specified in table 6.2.5.3.3.1-1 and the response data structures and response codes specified in table 6.2.5.3.3.1-2.

Table 6.2.5.3.3.1-1: Data structures supported by the POST Request Body

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| TerminationInfo | M | 1 | Provides information about the deletion of the resource. |

Table 6.2.5.3.3.1-2: Data structures supported by the POST Response Body

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| n/a |  |  | 204 No Content | The receipt of the Notification is acknowledged. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during event notification.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during event notification.  (NOTE 2) |
| NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.2.5.3.3.1-3: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the notification request is redirected |

Table 6.2.5.3.3.1-4: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the notification request is redirected |

### 6.2.6 Data Model

#### 6.2.6.1 General

This clause specifies the application data model supported by the API.

Table 6.2.6.1-1 specifies the data types defined for the Ntsctsf\_QoSandTSCAssistance service based interface protocol.

Table 6.2.6.1-1: Ntsctsf\_QoSandTSCAssistance specific Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Clause defined | Description | Applicability |
| AdditionalInfoTsctsfQosTscac | 6.2.6.2.8 | Describes additional error information specific for this API. |  |
| EventsNotification | 6.2.6.2.6 | Describes the notification(s) about the event(s) occurred within an Individual TSC Application Session Context resource. |  |
| EventNotification | 6.2.6.2.7 | Describes the notification for an Event. |  |
| EventsSubscReqData | 6.2.6.2.3 | Identifies the events the application subscribes to within an Individual TSC Application Session Context resource |  |
| EventsSubscReqDataRm | 6.2.6.2.5 | This data type is defined in the same way as the "EventsSubscReqData" data type, but with the OpenAPI "nullable: true" property. |  |
| ProblemDetailsTsctsfQosTscac | 6.2.6.4.1 | Problem details as defined in 3GPP TS 29.571 [15] extended with specific error information for this API, as described in AdditionalInfoTsctsfQosTscac data type. |  |
| TemporalInValidity | 6.2.6.2.9 | Indicates the time interval during which the NF service consumer request shall not to be applied. | GMEC |
| TscAppSessionContextData | 6.2.6.2.2 | Represents the Individual TSC Application Session Context resource data. |  |
| TscAppSessionContextUpdateData | 6.2.6.2.4 | Describes the modifications to an Individual TSC Application Session Context resource. |  |
| TscEvent | 6.2.6.3.3 | Indicates the subscribed event(s). |  |

Table 6.2.6.1-2 specifies data types re-used by the Ntsctsf\_QoSandTSCAssistance service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Ntsctsf\_QoSandTSCAssistance service based interface.

Table 6.2.6.1-2: Ntsctsf\_QoSandTSCAssistance re-used Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Reference | Comments | Applicability |
| AcceptableServiceInfo | 3GPP TS 29.514 [20] | Acceptable maximum requested bandwidth. |  |
| AccumulatedUsage | 3GPP TS 29.122 [21] | Accumulated Usage. |  |
| AspId | 3GPP TS 29.514 [20] | Contains an identity of an application service provider. |  |
| BatOffsetInfo | 3GPP TS 29.514 [20] | Contains the offset of the BAT and the optionally adjusted periodicity. | EnTSCAC |
| DateTime | 3GPP TS 29.571 [15] | Represents a date and a time. | GMEC |
| Dnn | 3GPP TS 29.571 [15] | The DNN the user is connected to. |  |
| ExternalGroupId | 3GPP TS 29.571 [15] | Identifies an External Group. | GMEC |
| EthFlowDescription | 3GPP TS 29.514 [20] | Defines a packet filter for an Ethernet flow. |  |
| EthFlowInfo | 3GPP TS 29.122 [21] | Contains an UL and/or DL Flow information. | Ethernet\_UL/DL\_Flows |
| FlowInfo | 3GPP TS 29.122 [21] | Contains the IP data flow information. |  |
| Gpsi | 3GPP TS 29.571 [15] | Represents a GPSI. | GMEC |
| IpAddr | 3GPP TS 29.571 [15] | Contains the IP address. |  |
| MacAddr48 | 3GPP TS 29.571 [15] | MAC Address. |  |
| ProblemDetails | 3GPP TS 29.571 [15] | Problem Details when returning an error response. |  |
| QosMonitoringInformation | 3GPP TS 29.122 [21] | Contains Qos Monitoring information. |  |
| QosMonitoringInformationRm | 3GPP TS 29.122 [21] | This data type is defined in the same way as the "QosMonitoringInformation" data type, but with the OpenAPI "nullable: true" property. |  |
| QosMonitoringReport | 3GPP TS 29.122 [21] | Contains Qos Monitoring Report information. |  |
| RedirectResponse | 3GPP TS 29.571 [15] | Contains redirection related information. |  |
| Snssai | 3GPP TS 29.571 [15] | Identifies the S-NSSAI. |  |
| SponId | 3GPP TS 29.514 [20] | Contains an Identity of a sponsor. |  |
| SponsoringStatus | 3GPP TS 29.514 [20] | Represents whether sponsored data connectivity is enabled or disabled/not enabled. |  |
| SubscribedEvent | 3GPP TS 29.522 [17] | Indicates the subscribed event. |  |
| SupportedFeatures | 3GPP TS 29.571 [15] | Used to negotiate the applicability of the optional features defined in table 5.8-1. |  |
| TerminationInfo | 3GPP TS 29.514 [20] | Includes information related to the termination of the Individual TSC Application Session Context resource. |  |
| TscQosRequirement | 3GPP TS 29.122 [21] | Contains the QoS requirements for time sensitive communication. |  |
| TscQosRequirementRm | 3GPP TS 29.122 [21] | This data type is defined in the same way as the "TscQosRequirement" data type, but with removable attributes. |  |
| UsageThreshold | 3GPP TS 29.122 [21] | Time period and/or traffic volume in which the QoS is to be applied. |  |
| UsageThresholdRm | 3GPP TS 29.122 [21] | This data type is defined in the same way as the "UsageThreshold" data type, but with the OpenAPI "nullable: true" property. |  |
| Uri | 3GPP TS 29.571 [15] | Identifies a referenced resource. |  |

#### 6.2.6.2 Structured data types

##### 6.2.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

##### 6.2.6.2.2 Type TscAppSessionContextData

Table 6.2.6.2.2-1: Definition of type TscAppSessionContextData

| Attribute name | Data type | P | Cardinality | Description | Applicability |
| --- | --- | --- | --- | --- | --- |
| ueIpAddr | IpAddr | C | 0..1 | The address of the UE.  (NOTE 1) (NOTE 5) |  |
| ipDomain | string | C | 0..1 | The IPv4 address domain identifier.  The attribute may only be provided if the ueIpAddr attribute is present and contains an IPv4 address. |  |
| ueMac | MacAddr48 | C | 0..1 | Identifies the MAC address.  (NOTE 1) (NOTE 5) |  |
| ueId | Gpsi | C | 0..1 | The identity of the targeted UE.  (NOTE 5) | GMEC |
| externalGroupId | ExternalGroupId | C | 0..1 | Identifies the targeted group of UE(s).  (NOTE 5) | GMEC |
| dnn | Dnn | O | 0..1 | Data Network Name, a full DNN with both the Network Identifier and Operator Identifier, or a DNN with the Network Identifier only. |  |
| snssai | Snssai | O | 0..1 | Identifies the S-NSSAI. |  |
| notifUri | Uri | M | 1 | Notification URI for Individual TSC Application Session Context termination requests. |  |
| appId | string | C | 0..1 | Contains the Application Identifier. (NOTE 1) |  |
| flowInfo | array(FlowInfo) | C | 1..N | Describe the IP data flow which requires QoS.  (NOTE 1) (NOTE 4) |  |
| enEthFlowInfo | array(EthFlowInfo) | C | 1..N | Identifies the Ethernet flows which require QoS. Each Ethernet flow consists of a flow identifier and the corresponding UL and/or DL flows.  (NOTE 1) (NOTE 4) | Ethernet\_UL/DL\_Flows |
| ethFlowInfo | array(EthFlowDescription) | C | 1..N | Identifies Ethernet packet flows.  (NOTE 1) |  |
| afId | string | M | 1 | Identifies the AF identifier. |  |
| tscQosReq | TscQosRequirement | C | 0..1 | Contains the QoS requirements for time sensitive communication. (NOTE 2) |  |
| qosReference | string | C | 0..1 | Identifies a pre-defined QoS information. (NOTE 2) (NOTE 3) |  |
| altQosReferences | array(string) | C | 1..N | Identifies an ordered list of pre-defined QoS information. The lower the index of the array for a given entry, the higher the priority. (NOTE 3) |  |
| altQosReqs | array(AlternativeServiceRequirementsData) | C | 1..N | Identifies an ordered list of alternative service requirements that include individual QoS parameter set(s). The lower the index of the array for a given entry, the higher the priority. (NOTE 3) |  |
| sponId | SponId | O | 0..1 | Sponsor identity. |  |
| aspId | AspId | O | 0..1 | Contains the Application service provider identity. It shall be included if sponsored connectivity is applicable. |  |
| sponStatus | SponsoringStatus | O | 0..1 | Indication of whether sponsored connectivity is enabled or disabled/not enabled.  The absence of the attribute indicates that the sponsored connectivity is enabled. |  |
| evSubsc | EventsSubscReqData | O | 0..1 | Identifies the events the application subscribes to at creation of an Individual TSC Application Session Context resource. |  |
| tempInValidity | TemporalInValidity | O | 0..1 | Indicates the time interval during which the AF request is not to be applied. | GMEC |
| suppFeat | SupportedFeatures | C | 0..1 | This IE represents a list of Supported features used as described in clause 6.2.8.  It shall be supplied by the NF service consumer in the POST request and response of requests a creation of an Individual TSC Application Session Context resource. |  |
| NOTE 1: When the "GMEC" feature is not supported, eirther the "ueIpAddr" attribute or the "ueMac" attribute shall be included. If IP address is provided, IP flow information shall be provided. If ipv4, the domain identifier may be provided. If mac address is provided, Ethernet flow information shall be provided. One of IP flow information, Ethernet flow information or Application Identifier shall be provided.  NOTE 2: The attributes "reqGbrDl", "reqGbrUl", "reqMbrDl", "reqMbrUl", "maxTscBurstSize", "req5Gsdelay", "reqPer" (if the ExtQoS feature is supported), and "priority" within the "tscQosReq" attribute may be provided only if the "qosReference" attribute is not provided. At least one of the "tscQosReq" attribute or the "qosReference" attribute shall be included.  NOTE 3: The attributes "altQoSReferences" and "altQosReqs" are mutually exclusive. The attributes "qosReference" and "altQosReqs" are also mutually exclusive.  NOTE 4: When the Ethernet flow information is provided and the Ethernet\_UL/DL\_Flows feature is supported, either the "ethFlowInfo" or the "enEthFlowInfo" shall be provided, but not both simultaneously.  NOTE 5: When the "GMEC" feature is supported, the "ueId" attribute and the "externalGroupId" attribute are mutually exclusive. If either the "ueId" attribute or the "externalGroupId" attribute are present, then neither the "ueIpAddr" attribute nor the "ueMac" attribute shall be present. | | | | | |

##### 6.2.6.2.3 Type EventsSubscReqData

Table 6.2.6.2.3-1: Definition of type EventsSubscReqData

| Attribute name | Data type | P | Cardinality | Description | Applicability |
| --- | --- | --- | --- | --- | --- |
| events | array(TscEvent) | M | 1..N | Subscribed Events. |  |
| notifUri | Uri | M | 1 | Notification URI for event notification. |  |
| qosMon | QosMonitoringInformation | C | 0..1 | Qos Monitoring information. It can be present when the event "QOS\_MONITORING" is subscribed. |  |
| usgThres | UsageThreshold | C | 0..1 | Includes the volume and/or time thresholds for sponsored data connectivity. It can be present when the event "USAGE\_REPORT" is subscribed. |  |
| notifCorreId | string | M | 1 | It is used to set the value of Notification Correlation ID in the corresponding notification. |  |

##### 6.2.6.2.4 Type TscAppSessionContextUpdateData

Table 6.2.6.2.4-1: Definition of type TscAppSessionContextUpdateData

| Attribute name | Data type | P | Cardinality | Description | Applicability |
| --- | --- | --- | --- | --- | --- |
| notifUri | Uri | O | 0..1 | Notification URI for Individual TSC Application Session Context termination requests. |  |
| appId | string | O | 0..1 | Identifies the external Application Identifier. (NOTE 1) |  |
| flowInfo | array(FlowInfo) | O | 1..N | Describe the IP data flow which requires QoS.  (NOTE 1) |  |
| ethFlowInfo | array(EthFlowDescription) | O | 1..N | Identifies Ethernet packet flows.  (NOTE 1) (NOTE 4) |  |
| enEthFlowInfo | array(EthFlowInfo) | C | 1..N | Identifies the Ethernet flows which require QoS. Each Ethernet flow consists of a flow identifier and the corresponding UL and/or DL flows.  (NOTE 1) (NOTE 4) | Ethernet\_UL/DL\_Flows |
| tscQosReq | TscQosRequirementRm | C | 0..1 | Contains the QoS requirements for time sensitive communication. (NOTE 2) |  |
| qosReference | string | C | 0..1 | Identifies a pre-defined QoS information. (NOTE 2) (NOTE 3) |  |
| altQosReferences | array(string) | C | 1..N | Identifies an ordered list of pre-defined QoS information. The lower the index of the array for a given entry, the higher the priority. (NOTE 3) |  |
| altQosReqs | array(AlternativeServiceRequirementsData) | C | 1..N | Identifies an ordered list of alternative service requirements that include individual QoS parameter set(s). The lower the index of the array for a given entry, the higher the priority. (NOTE 3) |  |
| evSubsc | EventsSubscReqDataRm | O | 0..1 | Identifies the events the application subscribes to at modification of an Individual TSC Application Session Context resource. |  |
| sponId | SponId | O | 0..1 | Sponsor identity. |  |
| aspId | AspId | O | 0..1 | Application service provider identity. It may be included if sponsored connectivity is applicable. |  |
| sponStatus | SponsoringStatus | O | 0..1 | Indication of whether sponsored connectivity is enabled or disabled/not enabled.  The absence of the attribute indicates that the sponsored connectivity is enabled. |  |
| tempInValidity | TemporalInValidity | O | 0..1 | Indicates the time interval during which the AF request is not to be applied. | GMEC |
| NOTE 1: One of IP flow information, Ethernet flow information or Application Identifier may be provided.  NOTE 2: Either "tscQosReq" attribute or "qosReference" attribute may be provided.  NOTE 3: The attributes "altQoSReferences" and "altQosReqs" are mutually exclusive. The attributes "qosReference" and "altQosReqs" are also mutually exclusive.  NOTE 4: When the Ethernet flow information is provided and the Ethernet\_UL/DL\_Flows feature is supported, either the "ethFlowInfo" or the "enEthFlowInfo" may be provided, but not both simultaneously. | | | | | |

##### 6.2.6.2.5 Type EventsSubscReqDataRm

This data type is defined in the same way as the "EventsSubscReqData" data type, but:

- with the OpenAPI "nullable: true" property; and

- the removable attribute "usgThres" is defined with the removable data type "UsageThresholdRm"; and removable attribute "qosMon" is defined with the removable data type "QosMonitoringInformationRm".

Table 6.2.6.2.5-1: Definition of type EventsSubscReqDataRm

| Attribute name | Data type | P | Cardinality | Description | Applicability |
| --- | --- | --- | --- | --- | --- |
| events | array(TscEvent) | M | 1..N | Subscribed Events. |  |
| notifUri | Uri | O | 0..1 | Notification URI for event notification. |  |
| qosMon | QosMonitoringInformationRm | O | 0..1 | Qos Monitoring information. It can be present when the event "QOS\_MONITORING" is subscribed. |  |
| usgThres | UsageThresholdRm | C | 0..1 | Includes the volume and/or time thresholds for sponsored data connectivity. It can be present when the notified event is "USAGE\_REPORT". |  |
| notifCorreId | string | O | 0..1 | It is used to set the value of Notification Correlation ID in the corresponding notification. |  |

##### 6.2.6.2.6 Type EventsNotification

Table 6.2.6.2.6-1: Definition of type EventsNotification

| Attribute name | Data type | P | Cardinality | Description | Applicability |
| --- | --- | --- | --- | --- | --- |
| notifCorreId | string | M | 1 | It is used to set the value of Notification Correlation ID in the corresponding notification. |  |
| events | array(EventNotification) | M | 1..N | Contains the reported event(s). |  |

##### 6.2.6.2.7 Type EventNotification

Table 6.2.6.2.7-1: Definition of type EventNotification

| Attribute name | Data type | P | Cardinality | Description | Applicability |
| --- | --- | --- | --- | --- | --- |
| event | TscEvent | M | 1 | Indicates the event reported by the TSCTSF. |  |
| flowIds | array(integer) | O | 1..N | Identifies the flows that were sent during event subscription |  |
| qosMonReports | array(QosMonitoringReport) | C | 1..N | QoS Monitoring reporting information. It shall be present when the notified event is "QOS\_MONITORING". |  |
| appliedQosRef | string | C | 0..1 | The currently applied alternative QoS requirement referring to an alternative QoS reference or a requested alternative QoS parameter set. Applicable for event QOS\_NOT\_GUARANTEED or SUCCESSFUL\_RESOURCES\_ALLOCATION.  When it is omitted and the "event" attribute is QOS\_NOT\_GUARANTEED, the event report indicates that the lowest priority alternative QoS profile could not be fulfilled either. |  |
| usgRep | AccumulatedUsage | C | 0..1 | Indicates the measured volume and/or time for sponsored data connectivity. Applicable for event USAGE\_REPORT. |  |
| altQosNotSuppInd | boolean | O | 0..1 | It may be set to true when the "event" attribute is QOS\_NOT\_GUARANTEED to indicate that alternative service requirements are not supported by NG-RAN. The default value false shall apply if the attribute is not present. | AltQoSProfilesSupportReport |
| batOffsetInfo | BatOffsetInfo | C | 0..1 | The offset of the BAT and the optionally adjusted periodicity.  It shall be present if available when the notified event is "BAT\_OFFSET\_INFO". | EnTSCAC |

##### 6.2.6.2.8 Type AdditionalInfoTsctsfQosTscac

Table 6.2.6.2.8-1: Definition of type AdditionalInfoTsctsfQosTscac

| Attribute name | Data type | P | Cardinality | Description | Applicability |
| --- | --- | --- | --- | --- | --- |
| acceptableServInfo | AcceptableServiceInfo | O | 0..1 | Describes information related to the acceptable service information, i.e., the maximum acceptable bandwidth for an AF session and/or for specific media components. |  |

6.2.6.2.9 Type TemporalInValidity

Table 6.2.6.2.9-1: Definition of type TemporalnValidity

| **Attribute name** | **Data type** | **P** | **Cardinality** | **Description** | **Applicability** |
| --- | --- | --- | --- | --- | --- |
| startTime | DateTime | M | 1 | Indicates the time from which the traffic routing requirements cease to apply.  The absence of this attribute indicates that the traffic routing requirements do not end at any time. |  |
| stopTime | DateTime | M | 1 | Indicates the time starting from which the traffic routing requirements start to apply.  The absence of this attribute indicates the traffic routing requirements apply immediately. |  |

#### 6.2.6.3 Simple data types and enumerations

##### 6.2.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

##### 6.2.6.3.2 Simple data types

The simple data types defined in table 6.2.6.3.2-1 shall be supported.

Table 6.2.6.3.2-1: Simple data types

|  |  |  |  |
| --- | --- | --- | --- |
| Type Name | Type Definition | Description | Applicability |
|  | <one simple data type, i.e. boolean, integer, number, or string> |  |  |

##### 6.2.6.3.3 Enumeration: TscEvent

The enumeration TscEvent represents event for TSC. It shall comply with the provisions defined in table 6.2.6.3.3-1.

Table 6.2.6.3.3-1: Enumeration TscEvent

|  |  |  |
| --- | --- | --- |
| Enumeration value | Description | Applicability |
| FAILED\_RESOURCES\_ALLOCATION | Indicates that one or more of the SDFs of an Individual TSC Application Session Context are deactivated. It also indicates that the resources requested for a particular service information cannot be successfully allocated. |  |
| SUCCESSFUL\_RESOURCES\_ALLOCATION | Indicates that the resources requested for particular service information have been successfully allocated. |  |
| QOS\_GUARANTEED | The QoS targets of one or more SDFs are guaranteed again. |  |
| QOS\_NOT\_GUARANTEED | The QoS targets of one or more SDFs are not being guaranteed. |  |
| QOS\_MONITORING | Indicates a QoS monitoring event. |  |
| USAGE\_REPORT | Volume and/or time usage for sponsored data connectivity. |  |
| BAT\_OFFSET\_INFO | Indicates the BAT offset and the optionally adjusted periodicity. | EnTSCAC |

#### 6.2.6.4 Data types describing alternative data types or combinations of data types

##### 6.2.6.4.1 Type: ProblemDetailsTsctsfQosTscac

Table 6.2.6.4.1-1: Definition of type ProblemDetailsTsctsfQosTscac as a list of to be combined data types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Cardinality | Description | Applicability |
| ProblemDetails | 1 | Problem details when returning an error response as specified in 3GPP TS 29.571 [15]. |  |
| AdditionalInfoTsctsfQosTscac | 1 | Describes additional error information specific for this API. |  |

### 6.2.7 Error Handling

#### 6.2.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [4].

For the Ntsctsf\_QoSandTSCAssistance API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [4].

In addition, the requirements in the following clauses are applicable for the Ntsctsf\_QoSandTSCAssistance API.

#### 6.2.7.2 Protocol Errors

No specific procedures for the Ntsctsf\_QoSandTSCAssistance service are specified.

#### 6.2.7.3 Application Errors

The application errors defined for the Ntsctsf\_QoSandTSCAssistance service are listed in Table 6.2.7.3-1.

Table 6.2.7.3-1: Application errors

|  |  |  |
| --- | --- | --- |
| Application Error | HTTP status code | Description |
| REQUESTED\_SERVICE\_NOT\_AUTHORIZED | 403 Forbidden | The service information provided in the request is rejected. |
| REQUESTED\_SERVICE\_TEMPORARILY\_NOT\_AUTHORIZED | 403 Forbidden | The service information provided in the request is temporarily rejected. |
| UNAUTHORIZED\_SPONSORED\_DATA\_CONNECTIVITY | 403 Forbidden | The request for sponsored data connectivity is not authorized. |
| PDU\_SESSION\_NOT\_AVAILABLE | 500 Internal Server Error | The PDU session is not found for the provided UE address. |

### 6.2.8 Feature negotiation

The optional features in table 6.2.8-1 are defined for the Ntsctsf\_QoSandTSCAssistance API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.2.8-1: Supported Features

|  |  |  |
| --- | --- | --- |
| Feature number | Feature Name | Description |
| 1 | Ethernet\_UL/DL\_Flows | Indicates the support of the description of the Ethernet flows as the combination of Flow Identifier, and UL and/or DL Ethernet flows. |
| 2 | PacketDelayFailureReport | Indicates the support of packet delay failure report as part of QoS Monitoring procedures. |
| 3 | ExtQoS | Indicates the support of extended QoS parameters. |
| 4 | EnTSCAC | Indicates the support of extensions to TSCAC, e.g. burst arrival time window adaptation, periodicity adjustment, and subsequent BAT offset report. |
| 5 | AltQoSProfilesSupportReport | This feature indicates the support of the report of whether Alternative QoS parameters are supported by NG-RAN. |
| 6 | GMEC | This feature indicates the support of Generic Group Management, Exposure and Communication Enhancements.  The following functionalities are supported:  - AF requested QoS for a UE or a group of UE(s) not identified by UE address. |

### 6.2.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Ntsctsf\_QoSandTSCAssistance API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Ntsctsf\_QoSandTSCAssistance API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Ntsctsf\_QoSandTSCAssistance service.

The Ntsctsf\_QoSandTSCAssistance API defines a single scope "ntsctsf-qos-tscai" for the entire service, and it does not define any additional scopes at resource or operation level.

## 6.3 Ntsctsf\_ASTI Service API

### 6.3.1 Introduction

The Ntsctsf\_ASTI service shall use the Ntsctsf\_ASTI API.

The API URI of the Ntsctsf\_ASTI API shall be:

**{apiRoot}/<apiName>/<apiVersion>**

The request URIs used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

**{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>**

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].

- The <apiName>shall be "ntsctsf-asti".

- The <apiVersion> shall be "v1".

- The <apiSpecificResourceUriPart> shall be set as described in clause 6.3.3.

### 6.3.2 Usage of HTTP

#### 6.3.2.1 General

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

The OpenAPI [6] specification of HTTP messages and content bodies for the Ntsctsf\_ASTI API is contained in Annex A.

#### 6.3.2.2 HTTP standard headers

##### 6.3.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [4] for the usage of HTTP standard headers.

##### 6.3.2.2.2 Content type

JSON, IETF RFC 8259 [12], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [4]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 9457 [13].

#### 6.3.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4] may be supported.

In this Release of the specification, no specific custom headers are defined for the Ntsctsf\_ASTI API.

### 6.3.3 Resources

#### 6.3.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 6.2.3.1-1 depicts the resource URIs structure for the Ntsctsf\_ASTI API.



Figure 6.3.3.1-1: Resource URI structure of the Ntsctsf\_ASTI API

Table 6.3.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.3.3.1-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method or custom operation | Description |
| ASTI Configurations | /configurations | POST | Create a new configuration of the 5G access stratum time distribution. |
| retrieve  (POST) | Request the status of the access stratum time distribution for a list of UEs. |
| Individual ASTI Configuration | /configurations/{configId} | PUT | Request to update the 5G access stratum time distribution configuration. |
| DELETE | Request to delete the 5G access stratum time distribution configuration. |

Editor’s note: It is FFS wether a new resource and applicable methods are required to support the subscription to notification of the status of the ASTI time synchronization service.

#### 6.3.3.2 Resource: ASTI Configurations

##### 6.3.3.2.1 Description

This resource allows a NF service consumer to create a new Individual ASTI Configuration resource.

##### 6.3.3.2.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-asti/<apiVersion>/configurations**

This resource shall support the resource URI variables defined in table 6.3.3.2.2-1.

Table 6.3.3.2.2-1: Resource URI variables for this resource

|  |  |  |
| --- | --- | --- |
| Name | Data type | Definition |
| apiRoot | string | See clause 6.3.1 |

##### 6.3.3.2.3 Resource Standard Methods

###### 6.3.3.2.3.1 POST

This method shall support the URI query parameters specified in table 6.3.3.2.3.1-1.

Table 6.3.3.2.3.1-1: URI query parameters supported by the POST method on this resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description | Applicability |
| n/a |  |  |  |  |  |

This method shall support the request data structures specified in table 6.3.3.2.3.1-2 and the response data structures and response codes specified in table 6.3.3.2.3.1-3.

Table 6.3.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| AccessTimeDistributionData | M | 1 | Contains the information for the creation of a new Individual ASTI Configuration resource. |

Table 6.3.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| AccessTimeDistributionData | M | 1 | 201 Created | The resource was created successfully and a representation of the created resource is returned.  The URI of the created resource shall be returned in the "Location" HTTP header. |
| ProblemDetails | O | 0..1 | 403 Forbidden | (NOTE 2) |
| NOTE 1: The manadatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: Failure cases are described in clause 6.3.7. | | | | |

Table 6.3.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains the URI of the newly created resource, according to the structure: {apiRoot}/ntsctsf-asti/<apiVersion>/configurations/{configId} |

##### 6.3.3.2.4 Resource Custom Operations

###### 6.3.3.2.4.1 Overview

Table 6.3.3.2.4.1-1: Custom operations

|  |  |  |  |
| --- | --- | --- | --- |
| Operation Name | Custom operation URI | Mapped HTTP method | Description |
| retrieve | /configurations/retrieve | retrieve (POST) | Request the status of the 5G access stratum time distribution for a list of UEs. |

###### 6.3.3.2.4.2 Operation: retrieve

6.3.3.2.4.2.1 Description

6.3.3.2.4.2.2 Operation Definition

This custom operation retrieves the status of the access stratum time distribution for a list of UEs.

This operation shall support the request data structures specified in table 6.3.3.2.4.2.2-1 and the response data structure and response codes specified in table 6.3.3.24.2.2-2.

Table 6.3.3.2.4.2.2-1: Data structures supported by the POST Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| StatusRequestData | M | 1 | Parameters to be sent by the NF service consumer when the status of the 5G access stratum time distribution for a list of UEs is requested. |

Table 6.3.3.2.4.2.2-2: Data structures supported by the POST Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| StatusResponseData | M | 1 | 200 OK | Status of the 5G access stratum time distribution for a list of UEs is returned. |
| NOTE: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. | | | | |

#### 6.3.3.3 Resource: Individual ASTI Configuration

##### 6.3.3.3.1 Description

This resource allows a NF service consumer to read, modify or delete an existing Individual ASTI Configuration resource.

##### 6.3.3.3.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-asti/<apiVersion>/configurations/{configId}**

This resource shall support the resource URI variables defined in table 6.3.3.3.2-1.

Table 6.3.3.3.2-1: Resource URI variables for this resource

|  |  |  |
| --- | --- | --- |
| Name | Data type | Definition |
| apiRoot | string | See clause 6.3.1 |
| configId | string | Identifier of an Individual ASTI Configuration resource. |

##### 6.3.3.3.3 Resource Standard Methods

###### 6.3.3.3.3.2 PUT

This method shall support the URI query parameters specified in table 6.3.3.3.3.2-1.

Table 6.3.3.3.3.2-1: URI query parameters supported by the PUT method on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| n/a |  |  |  |  |

This method shall support the request data structures specified in table 6.3.3.3.3.2-2 and the response data structures and response codes specified in table 6.3.3.3.3.2-3.

Table 6.3.3.3.3.2-2: Data structures supported by the PUT Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| AccessTimeDistributionData | M | 1 | Contains the modification(s) to apply to the Individual ASTI Configuration resource. |

Table 6.3.3.3.3.2-3: Data structures supported by the PUT Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| AccessTimeDistributionData | M | 1 | 200 OK | Successful case. The Individual ASTI Configuration resource was modified and a representation of that resource is returned. |
| n/a |  |  | 204 No Content | Successful case.  The Individual ASTI Configuration resource was modified. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during an Individual ASTI Configuration resource modification.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during an Individual ASTI Configuration resource modification.  (NOTE 2) |
| ProblemDetails | O | 0..1 | 403 Forbidden | (NOTE 3) |
| NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [4] for the PUT method shall also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).  NOTE 3: Failure cases are described in clause 6.3.7. | | | | |

Table 6.3.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.3.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

###### 6.3.3.3.3.3 DELETE

This method shall support the URI query parameters specified in table 6.3.3.3.3.3-1.

Table 6.3.3.3.3.3-1: URI query parameters supported by the DELETE method on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| n/a |  |  |  |  |

This method shall support the request data structures specified in table 6.3.3.3.3.3-2 and the response data structures and response codes specified in table 6.3.3.3.3.3-3.

Table 6.3.3.3.3.3-2: Data structures supported by the DELETE Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| n/a |  |  |  |

Table 6.3.3.3.3.3-3: Data structures supported by the DELETE Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| n/a |  |  | 204 No Content | The configuration was terminated successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during an Individual ASTI Configuration resource modification deletion.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during an Individual ASTI Configuration resource modification deletion.  (NOTE 2) |
| NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [4] for the DELETE method shall also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.3.3.3.3.3-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

Table 6.3.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target TSCTSF (service) instance towards which the request is redirected. |

##### 6.3.3.3.4 Resource Custom Operations

None.

### 6.3.4 Custom Operations without associated resources

None.

### 6.3.5 Notifications

#### 6.3.5.1 General

Notifications shall comply to clause 6.2 of 3GPP TS 29.500 [4] and clause 4.6.2.3 of 3GPP TS 29.501 [5].

Table 6.3.5.1-1: Notifications overview

|  |  |  |  |
| --- | --- | --- | --- |
| Notification | Callback URI | HTTP method or custom operation | Description  (service operation) |
| ASTI Notification | {astiNotifUri} | POST | ASTI notification. |

#### 6.3.5.2 ASTI Notification

##### 6.3.5.2.1 Description

The ASTI Notification is used by the NF service producer to report the changes on the ASTI service.

##### 6.3.5.2.2 Target URI

The Callback URI **"{astiNotifUri}"** shall be used with the callback URI variables defined in table 6.3.5.2.2-1.

Table 6.3.5.2.2-1: Callback URI variables

|  |  |
| --- | --- |
| Name | Definition |
| astiNotifUri | String formatted as URI with the Callback Uri.  The Callback Uri is assigned within the Individual ASTI Configuration resource and described within the AccessTimeDistributionData data type (see table 6.3.6.2.2-1). |

##### 6.3.5.2.3 Standard Methods

###### 6.3.5.2.3.1 POST

This method shall support the request data structures specified in table 6.3.5.2.3.1-1 and the response data structures and response codes specified in table 6.3.5.2.3.1-1.

Table 6.3.5.2.3.1-1: Data structures supported by the POST Request Body

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| AstiConfigNotification | M | 1 | Provides the change in the 5G Access Stratum Time Distribution configuration. |

Table 6.3.5.2.3.1-2: Data structures supported by the POST Response Body

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| n/a |  |  | 204 No Content | The event notification is received successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during event notification.  (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during event notification.  (NOTE 2) |
| NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.  NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). | | | | |

Table 6.3.5.2.3.1-3: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the notification request is redirected |

Table 6.3.5.2.3.1-4: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.  For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the notification request is redirected |

### 6.3.6 Data Model

#### 6.3.6.1 General

This clause specifies the application data model supported by the API.

Table 6.3.6.1-1 specifies the data types defined for the Ntsctsf\_ASTI service based interface protocol.

Table 6.3.6.1-1: Ntsctsf\_ASTI specific Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Clause defined | Description | Applicability |
| AccessTimeDistributionData | 6.3.6.2.2 | Contains the parameters for the creation of 5G access stratum time distribution configuration. |  |
| ActiveUe | 6.3.6.2.6 | Contains the UE identifier whose status of the access stratum time distribution is active and the optional requested time synchronization error budget. |  |
| AstiConfigNotification | 6.3.6.2.7 | Contains the report of a change in the 5G Access Stratum Time Distribution parameters applied to the UE(s). | ASTIConfigReport |
| AstiConfigStateNotification | 6.3.6.2.8 | Contains the report about a change in the 5G Access Stratum Time Distribution parameters for a UE. | ASTIConfigReport  NetTimeSyncStatus |
| AstiEvent | 6.3.6.3.3 | ASTI Event. | ASTIConfigReport  NetTimeSyncStatus |
| AsTimeDistributionParam | 6.3.6.2.3 | Contains the 5G access stratum time distribution parameters. |  |
| StatusRequestData | 6.3.6.2.4 | Contains the parameters for retrieval of the status of the access stratum time distribution for a list of UEs. |  |
| StatusResponseData | 6.3.6.2.5 | Contains the parameters for the status of the access stratum time distribution for a list of UEs. |  |

Table 6.3.6.1-2 specifies data types re-used by the Ntsctsf\_ASTI service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Ntsctsf\_ASTI service based interface.

Table 6.3.6.1-2: Ntsctsf\_ASTI re-used Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Reference | Comments | Applicability |
| ClockQualityAcceptanceCriterion | 3GPP TS 29.571 [15] | Identifies clock quality acceptance criteria information. | NetTimeSyncStatus |
| ClockQualityDetailLevel | 3GPP TS 29.571 [15] | Indicates the clock quality detail level information. | NetTimeSyncStatus |
| ExternalGroupId | 3GPP TS 29.571 [15] | Identifies an External Group. |  |
| Gpsi | 3GPP TS 29.571 [15] | The external identification of the user (i.e., an External Id or an MSISDN). |  |
| GroupId | 3GPP TS 29.571 [15] | Identifies a group of internal globally unique ID. |  |
| ProblemDetails | 3GPP TS 29.571 [15] | Problem Details when returning an error response. |  |
| RedirectResponse | 3GPP TS 29.571 [15] | Contains redirection related information. |  |
| ServiceAreaCoverageInfo | 3GPP TS 29.534 [14] | It represents a list of Tracking Areas within a serving network. | CoverageAreaSupport |
| Supi | 3GPP TS 29.571 [15] | The identification of the user (i.e. IMSI, NAI). |  |
| SupportedFeatures | 3GPP TS 29.571 [15] | Used to negotiate the applicability of the optional features defined in table 6.3.8-1. |  |
| TemporalValidity | 3GPP TS 29.514 [20] | TemporalValidity |  |
| Uinteger | 3GPP TS 29.571 [15] | Unsigned integer. |  |
| Uri | 3GPP TS 29.571 [15] | Identifies a referenced resource. | ASTIConfigReport  NetTimeSyncStatus |

#### 6.3.6.2 Structured data types

##### 6.3.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

##### 6.3.6.2.2 Type: AccessTimeDistributionData

Table 6.3.6.2.2-1: Definition of type AccessTimeDistributionData

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| supis | array(Supi) | C | 1..N | Subscription Permanent Identifier(s). (NOTE 1) |  |
| gpsis | array(Gpsi) | C | 1..N | Public user Identifier(s). (NOTE 1) |  |
| interGrpId | GroupId | C | 0..1 | The internal Group Id(s). (NOTE 1) |  |
| exterGrpId | ExternalGroupId | C | 0..1 | The external Group Id(s). (NOTE 1) |  |
| asTimeDisParam | AsTimeDistributionParam | M | 1 | 5G access stratum time distribution parameters.  (NOTE 2) |  |
| covReq | array(ServiceAreaCoverageInfo) | O | 1..N | Identifies a list of Tracking Areas per serving network where the 5GS access stratum time distribution service is allowed. | CoverageAreaSupport |
| astiNotifUri | Uri | C | 0..1 | Notification URI for reporting changes in 5G access stratum time distribution status, and/or reporting the 5G access stratum time distribution information.  It shall be provided if the ASTIConfigReport feature is supported and/or the NetTimeSyncStatus feature is supported. | ASTIConfigReport |
| astiNotifId | string | C | 0..1 | Notification Correlation ID assigned by the NF service consumer.  It shall be provided if the ASTIConfigReport feature is supported. | ASTIConfigReport |
| suppFeat | SupportedFeatures | C | 0..1 | Represents the features supported by the NF service consumer. This parameter shall be supplied by the NF service consumer in the POST request and the response that requested the creation of an Individual ASTI Configuration resource. |  |
| NOTE 1: One of "supis", "gpsis", "exterGroupId" or "interGrpId" attributes shall be provided.  NOTE 2: If the feature "NetTimeSyncStatus" is supported, the "clkQltDetLvl" and "clkQltAcptCri" attributes within the AsTimeDistributionParam data type shall be present together with the "astiNotifUri" attribute. | | | | | |

##### 6.3.6.2.3 Type: AsTimeDistributionParam

Table 6.3.6.2.3-1: Definition of type AsTimeDistributionParam

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| asTimeDisEnabled | boolean | O | 0..1 | When this attribute is included and set to true, it indicates that the access stratum time distribution via Uu reference point is activated.  When present it shall be set as follows:  - true: activated.  - false (default): deactivated. |  |
| timeSyncErrBdgt | Uinteger | O | 0..1 | Indicates the time synchronization error budget in terms of time units of nanoseconds. |  |
| tempValidity | TemporalValidity | O | 0..1 | Indicates the time interval during which the AF request is to be applied. |  |
| clkQltDetLvl | ClockQualityDetailLevel | O | 0..1 | For ASTI services, its value, if provided, shall be set to "ACCEPT\_INDICATION" | NetTimeSyncStatus |
| clkQltAcptCri | ClockQualityAcceptanceCriterion | C | 0..1 | It indicates the acceptable clock quality acceptance criteria for the UE, and it is used to determine whether the time synchronization status for the ASTI service is acceptable/not acceptable. It shall be present when the "clkQltDetLvl" attribute is present. | NetTimeSyncStatus |

##### 6.3.6.2.4 Type: StatusRequestData

Table 6.3.6.2.4-1: Definition of type StatusRequestData

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| supis | array(Supi) | C | 1..N | Subscription Permanent Identifier(s). |  |
| gpsis | array(Gpsi) | C | 1..N | Public User Identifier(s). |  |
| NOTE: Either the "supis" or the "gpsis" attribute is included. | | | | | |

##### 6.3.6.2.5 Type: StatusResponseData

Table 6.3.6.2.5-1: Definition of type StatusResponseData

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| inactiveUes | array(Supi) | O | 1..N | Indicate the SUPI(s) whose status of the access stratum time distribution is inactive.  (NOTE) |  |
| inactiveGpsis | array(Gpsi) | O | 1..N | Indicate the GPSI(s) whose status of the access stratum time distribution is inactive.  (NOTE) |  |
| activeUes | array(ActiveUe) | O | 1..N | Contains the UE identifier(s) whose status of the access stratum time distribution is active and the optional requested time synchronization error budget. |  |
| NOTE: Either the "inactiveUes" or the "inactiveGpsis" attribute is included, based on whether the request contained an internal or an external identifier. | | | | | |

##### 6.3.6.2.6 Type: ActiveUe

Table 6.3.6.2.6-1: Definition of type ActiveUe

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| supi | Supi | C | 0..1 | Indicate the SUPI whose status of the access stratum time distribution is active.  (NOTE) |  |
| gpsi | Gpsi | C | 0..1 | Indicate the GPSI whose status of the access stratum time distribution is active.  (NOTE) |  |
| timeSyncErrBdgt | Uinteger | O | 0..1 | Indicates the time synchronization error budget in terms of time units of nanoseconds. |  |
| NOTE: Either the "supi" or the "gpsi" attribute is included, based on whether the request contained an internal or an external identifier. | | | | | |

##### 6.3.6.2.7 Type AstiConfigNotification

Table 6.3.6.2.7-1: Definition of type AstiConfigNotification

| Attribute name | Data type | P | Cardinality | Description | Applicability |
| --- | --- | --- | --- | --- | --- |
| astiNotifId | string | M | 1 | It is used to set the value of Notification Correlation ID in the corresponding notification. |  |
| stateConfigs | array(AstiConfigEventNotification) | O | 1..N | Contains change of state of 5G access stratum time distribution configuration. | ASTIConfigReport |

##### 6.3.6.2.8 Type AstiConfigStateNotification

Table 6.3.6.2.8-1: Definition of type AstiConfigStateNotification

| Attribute name | Data type | P | Cardinality | Description | Applicability |
| --- | --- | --- | --- | --- | --- |
| supi | Supi | C | 0..1 | Identifies the UE to which the status below apply. |  |
| gpsi | Gpsi | C | 0..1 | Identifies the UE to which the status below apply. |  |
| event | AstiEvent | M | 1 | Indicates the reported event. |  |
| NOTE: Only one of the properties "supi" or "gpsi" shall be included. | | | | | |

#### 6.3.6.3 Simple data types and enumerations

##### 6.3.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

##### 6.3.6.3.2 Simple data types

The simple data types defined in table 6.3.6.3.2-1 shall be supported.

Table 6.3.6.3.2-1: Simple data types

|  |  |  |  |
| --- | --- | --- | --- |
| Type Name | Type Definition | Description | Applicability |
|  |  |  |  |

##### 6.3.6.3.3 Enumeration: AstiEvent

The enumeration AstiEvent represents event for ASTI service. It shall comply with the provisions defined in table 6.3.6.3.3-1.

Table 6.3.6.3.3-1: Enumeration AstiEvent

|  |  |  |
| --- | --- | --- |
| Enumeration value | Description | Applicability |
| ASTI\_ENABLED | Indicates that the access stratum time distribution via Uu reference point is activated. |  |
| ASTI\_DISABLED | Indicates that the access stratum time distribution via Uu reference point is deactivated. |  |
| CLOCK\_QUAL\_ACCEPTABLE | Indicates the UE meets the clock quality acceptance criteria. |  |
| CLOCK\_QUAL\_NON\_ACCEPTABLE | Indicates the UE does not meet the clock quality acceptance criteria |  |

### 6.3.7 Error Handling

#### 6.3.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [5].

For the Ntsctsf\_ASTI API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [4].

In addition, the requirements in the following clauses are applicable for the Ntsctsf\_ASTI API.

#### 6.3.7.2 Protocol Errors

No specific procedures for the Ntsctsf\_ASTI service are specified.

#### 6.3.7.3 Application Errors

The application errors defined for the Ntsctsf\_ASTI service are listed in Table 6.3.7.3-1.

Table 6.3.7.3-1: Application errors

|  |  |  |
| --- | --- | --- |
| Application Error | HTTP status code | Description |
| UE\_SERVICE\_NOT\_AUTHORIZED | 403 Forbidden | The request service for the target UE is not authorized. |

### 6.3.8 Feature negotiation

The optional features in table 6.3.8-1 are defined for the Ntsctsf\_ASTI API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.3.8-1: Supported Features

|  |  |  |
| --- | --- | --- |
| Feature number | Feature Name | Description |
| 1 | CoverageAreaSupport | Indicates the support of time synchronization coverage area conditions for the activation/deactivation of the time synchronization service.  It requires the support of ASTIConfigReport feature. |
| 2 | ASTIConfigReport | Indicates the support of the report of ASTI service status information and/or ASTI configuration changes. |
| 3 | NetTimeSyncStatus | Indicates the time synchronization service status |

### 6.3.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Ntsctsf\_ASTI API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Ntsctsf\_ASTI API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Ntsctsf\_ASTI service.

The Ntsctsf\_ASTI API defines a single scope "ntsctsf-asti" for the entire service, and it does not define any additional scopes at resource or operation level.

Annex A (normative):  
OpenAPI specification

# A.1 General

This Annex specifies the formal definition of the API(s) defined in the present specification. It consists of OpenAPI specifications in YAML format.

This Annex takes precedence when being discrepant to other parts of the specification with respect to the encoding of information elements and methods within the API(s).

NOTE 1: The semantics and procedures, as well as conditions, e.g. for the applicability and allowed combinations of attributes or values, not expressed in the OpenAPI definitions but defined in other parts of the specification also apply.

Informative copies of the OpenAPI specification files contained in this 3GPP Technical Specification are available on a Git-based repository that uses the GitLab software version control system (see 3GPP TS 29.501 [5] clause 5.3.1 and 3GPP TR 21.900 [7] clause 5B).

# A.2 Ntsctsf\_TimeSynchronization API

openapi: 3.0.0

info:

title: Ntsctsf\_TimeSynchronization Service API

version: 1.1.0-alpha.5

description: |

TSCTSF Time Synchronization Service.

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externalDocs:

description: >

3GPP TS 29.565 V18.4.0; 5G System; Time Sensitive Communication and Time Synchronization Function

Services; Stage 3.

url: 'https://www.3gpp.org/ftp/Specs/archive/29\_series/29.565/'

servers:

- url: '{apiRoot}/ntsctsf-time-sync/v1'

variables:

apiRoot:

default: https://example.com

description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

security:

- {}

- oAuth2ClientCredentials:

- ntsctsf-time-sync

paths:

/subscriptions:

post:

summary: Creates a new subscription to notification of capability of time synchronization service resource

operationId: TimeSynchronizationExposureSubscriptions

tags:

- Time Synchronization Exposure Subscriptions (Collection)

requestBody:

description: Contains the information for the creation the resource.

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/TimeSyncExposureSubsc'

responses:

'201':

description: Successful creation of the resource.

content:

application/json:

schema:

$ref: '#/components/schemas/TimeSyncExposureSubsc'

headers:

Location:

description: >

Contains the URI of the created individual time synchronization exposure

subscription resource, according to the structure

{apiRoot}/ntsctsf-time-sync/{apiVersion}/subscriptions/{subscriptionId}

required: true

schema:

type: string

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

callbacks:

subsEventNotification:

'{$request.body#/subsNotifUri':

post:

requestBody:

description: Notification of an event occurrence in the TSCTSF.

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/TimeSyncExposureSubsNotif'

responses:

'204':

description: The receipt of the notification is acknowledged.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

/subscriptions/{subscriptionId}:

get:

summary: "Reads an existing Individual Time Synchronization Exposure Subscription"

operationId: GetIndividualTimeSynchronizationExposureSubscription

tags:

- Individual Time Synchronization Exposure Subscription (Document)

parameters:

- name: subscriptionId

description: String identifying an Individual Time Synchronization Exposure Subscription

in: path

required: true

schema:

type: string

responses:

'200':

description: A representation of the resource is returned.

content:

application/json:

schema:

$ref: '#/components/schemas/TimeSyncExposureSubsc'

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'406':

$ref: 'TS29571\_CommonData.yaml#/components/responses/406'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

put:

operationId: ReplaceIndividualTimeSynchronizationExposureSubscription

summary: Replace an individual Time Synchronization Exposure Subscription

tags:

- IndividualTimeSynchronizationExposureSubscription (Document)

requestBody:

required: true

content:

application/json:

schema:

$ref: 'TS29522\_TimeSyncExposure.yaml#/components/schemas/TimeSyncExposureSubsc'

parameters:

- name: subscriptionId

description: String identifying an Individual Time Synchronization Exposure Subscription.

in: path

required: true

schema:

type: string

responses:

'200':

description: OK. Resource was successfully modified and representation is returned.

content:

application/json:

schema:

$ref: '#/components/schemas/TimeSyncExposureSubsc'

'204':

description: No Content. Resource was successfully modified.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

delete:

operationId: DeleteIndividualTimeSynchronizationExposureSubscription

summary: Delete an Individual TimeSynchronization Exposure Subscription

tags:

- Individual Time Synchronization Exposure Subscription (Document)

parameters:

- name: subscriptionId

in: path

description: String identifying an Individual Time Synchronization Exposure Subscription.

required: true

schema:

type: string

responses:

'204':

description: No Content. Resource was successfully deleted.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

/subscriptions/{subscriptionId}/configurations:

post:

summary: "Craete a new Individual Time Synchronization Exposure Configuration"

operationId: CreateIndividualTimeSynchronizationExposureConfiguration

tags:

- Individual Time Synchronization Exposure Configuration (Document)

parameters:

- name: subscriptionId

description: String identifying an Individual Time Synchronization Exposure Subscription.

in: path

required: true

schema:

type: string

requestBody:

description: Contains the information for the creation the resource.

required: true

content:

application/json:

schema:

$ref: 'TS29522\_TimeSyncExposure.yaml#/components/schemas/TimeSyncExposureConfig'

responses:

'201':

description: Successful creation of the resource.

content:

application/json:

schema:

$ref: '#/components/schemas/TimeSyncExposureConfig'

headers:

Location:

description: >

Contains the URI of the created individual time synchronization exposure

configuration resource, according to the structure

{apiRoot}/ntsctsf-time-sync/{apiVersion}/subscriptions/{subscriptionId}

/configurations/{configurationId}

required: true

schema:

type: string

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

callbacks:

configEventNotification:

'{$request.body#/configNotifUri':

post:

requestBody:

description: Notification of an event occurrence in the TSCTSF.

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/TimeSyncExposureConfigNotif'

responses:

'204':

description: The receipt of the notification is acknowledged.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

/subscriptions/{subscriptionId}/configurations/{configurationId}:

get:

summary: "Reads an existing Individual Time Synchronization Exposure Configuration"

operationId: GetIndividualTimeSynchronizationExposureConfiguration

tags:

- Individual Time Synchronization Exposure Configuration (Document)

parameters:

- name: subscriptionId

description: String identifying an Individual Time Synchronization Exposure Subscription.

in: path

required: true

schema:

type: string

- name: configurationId

description: String identifying an Individual Time Synchronization Exposure Configuration.

in: path

required: true

schema:

type: string

responses:

'200':

description: A representation of the resource is returned.

content:

application/json:

schema:

$ref: '#/components/schemas/TimeSyncExposureConfig'

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'406':

$ref: 'TS29571\_CommonData.yaml#/components/responses/406'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

put:

operationId: ReplaceIndividualTimeSynchronizationExposureConfiguration

summary: Replace an individual Time Synchronization Exposure Configuration

tags:

- IndividualTimeSynchronizationExposureConfiguration (Document)

requestBody:

required: true

content:

application/json:

schema:

$ref: 'TS29522\_TimeSyncExposure.yaml#/components/schemas/TimeSyncExposureConfig'

parameters:

- name: subscriptionId

description: String identifying an Individual Time Synchronization Exposure Subscription.

in: path

required: true

schema:

type: string

- name: configurationId

description: String identifying an Individual Time Synchronization Exposure Configuration.

in: path

required: true

schema:

type: string

responses:

'200':

description: OK. Resource was successfully modified and representation is returned.

content:

application/json:

schema:

$ref: '#/components/schemas/TimeSyncExposureConfig'

'204':

description: No Content. Resource was successfully modified.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

delete:

operationId: DeleteIndividualTimeSynchronizationExposureConfiguration

summary: Delete an Individual TimeSynchronization Exposure Configuration

tags:

- Individual Time Synchronization Exposure Configuration (Document)

parameters:

- name: subscriptionId

in: path

description: String identifying an Individual Time Synchronization Exposure Subscription.

required: true

schema:

type: string

- name: configurationId

description: String identifying an Individual Time Synchronization Exposure Configuration.

in: path

required: true

schema:

type: string

responses:

'204':

description: No Content. Resource was successfully deleted

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

components:

securitySchemes:

oAuth2ClientCredentials:

type: oauth2

flows:

clientCredentials:

tokenUrl: '{nrfApiRoot}/oauth2/token'

scopes:

ntsctsf-timesynchronization: Access to the Ntsctsf\_TimeSynchronization API

schemas:

TimeSyncExposureSubsc:

description: >

Contains the parameters for the subscription to notification of capability of time

synchronization service.

type: object

properties:

supis:

type: array

items:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

minItems: 1

gpsis:

type: array

items:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

minItems: 1

interGrpId:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/GroupId'

exterGrpId:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/ExternalGroupId'

anyUeInd:

type: boolean

description: >

Identifies whether the request applies to any UE. This attribute shall set to "true" if

applicable for any UE, otherwise, set to "false".

notifMethod:

$ref: 'TS29508\_Nsmf\_EventExposure.yaml#/components/schemas/NotificationMethod'

dnn:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Dnn'

snssai:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Snssai'

subscribedEvents:

type: array

items:

$ref: 'TS29522\_TimeSyncExposure.yaml#/components/schemas/SubscribedEvent'

minItems: 1

eventFilters:

type: array

items:

$ref: 'TS29522\_TimeSyncExposure.yaml#/components/schemas/EventFilter'

minItems: 1

subsNotifUri:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

subsNotifId:

type: string

description: Notification Correlation ID assigned by the NF service consumer.

maxReportNbr:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

expiry:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime'

repPeriod:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/DurationSec'

suppFeat:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

required:

- subsNotifUri

- subsNotifId

- dnn

- snssai

- subscribedEvents

oneOf:

- required: [supis]

- required: [interGrpId]

- required: [gpsis]

- required: [exterGrpId]

- required: [anyUeInd]

TimeSyncExposureSubsNotif:

description: Contains the notification of time synchronization service.

type: object

properties:

subsNotifId:

type: string

description: Notification Correlation ID assigned by the NF service consumer.

eventNotifs:

type: array

items:

$ref: '#/components/schemas/SubsEventNotification'

minItems: 1

SubsEventNotification:

description: >

Contains the notification of capability of time synchronization for a list of UEs.

type: object

properties:

event:

$ref: 'TS29522\_TimeSyncExposure.yaml#/components/schemas/SubscribedEvent'

timeSyncCapas:

type: array

items:

$ref: '#/components/schemas/TimeSyncCapability'

minItems: 1

required:

- event

TimeSyncCapability:

description: Contains the capability of time synchronization service.

type: object

properties:

upNodeId:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uint64'

gmCapables:

type: array

items:

$ref: 'TS29522\_TimeSyncExposure.yaml#/components/schemas/GmCapable'

minItems: 1

asTimeRes:

$ref: 'TS29522\_TimeSyncExposure.yaml#/components/schemas/AsTimeResource'

ptpCapForUes:

type: object

additionalProperties:

$ref: '#/components/schemas/PtpCapabilitiesPerUe'

minProperties: 1

description: >

Contains the PTP capabilities supported by each of the SUPI(s). The key of the map is the

SUPI.

ptpCapForGpsis:

type: object

additionalProperties:

$ref: '#/components/schemas/PtpCapabilitiesPerUe'

minProperties: 1

description: >

Contains the PTP capabilities supported by each of the GPSI(s). The key of the map is

the GPSI.

required:

- upNodeId

anyOf:

- required: [gmCapables]

- required: [asTimeRes]

PtpCapabilitiesPerUe:

description: Contains the supported PTP capabilities per UE.

type: object

properties:

supi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

gpsi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

ptpCaps:

type: array

items:

$ref: 'TS29522\_TimeSyncExposure.yaml#/components/schemas/EventFilter'

minItems: 1

required:

- ptpCaps

oneOf:

- required: [supi]

- required: [gpsi]

TimeSyncExposureConfigNotif:

description: Contains the notification of time synchronization service state.

type: object

properties:

configNotifId:

type: string

description: Notification Correlation ID assigned by the NF service consumer.

stateOfConfig:

$ref: '#/components/schemas/StateOfConfiguration'

required:

- configNotifId

- stateOfConfig

StateOfConfiguration:

description: >

Contains the state of the time synchronization configuration and the clock quality

acceptance criteria result.

type: object

properties:

stateNwtt:

type: boolean

description: >

When any of the PTP port state(s)in NW-TT is Leader, Follower or Passive, it is

included and set to trueto indicate the current state of the time synchronization

configuration for the NW-TT port(s) of the PTP instance is active; when

PTP port state isin any other case, it is included and set to false to indicate

the state ofconfiguration for the NW-TT port(s) of the PTP instance

is inactive. Default value is false.

stateOfDstts:

description: >

Contains the PTP port states and the clock quality acceptance criteria result of the

DS-TT(s).

type: array

items:

$ref: '#/components/schemas/StateOfDstt'

minItems: 1

StateOfDstt:

description: Contains the PTP port state of a DS-TT.

type: object

properties:

supi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

gpsi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

state:

type: boolean

description: >

When the PTP port state is Leader, Follower or Passive, it is included and set to true

to indicate the state of configuration for DS-TT port is active; when PTP port state is

in any other case, it is included and set to false to indicate the state of

configuration for DS-TT port is inactive. Default value is false.

clkQltIndOfDstts:

$ref: 'TS29522\_TimeSyncExposure.yaml#/components/schemas/AcceptanceCriteriaResultIndication'

required:

- state

oneOf:

- required: [supi]

- required: [gpsi]

TimeSyncExposureConfig:

description: Contains the Time Synchronization Configuration parameters.

type: object

properties:

upNodeId:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uint64'

reqPtpIns:

$ref: '#/components/schemas/PtpInstance'

gmEnable:

type: boolean

description: >

Indicates that the AF requests 5GS to act as a grandmaster for PTP or gPTP if it is

included and set to true.

gmPrio:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

timeDom:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

timeSyncErrBdgt:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

configNotifId:

type: string

description: Notification Correlation ID assigned by the NF service consumer.

configNotifUri:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

tempValidity:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/TemporalValidity'

covReq:

type: array

description: >

Identifies a list of Tracking Areas per serving network where time

synchronization service configuration is allowed.

items:

$ref: 'TS29534\_Npcf\_AMPolicyAuthorization.yaml#/components/schemas/ServiceAreaCoverageInfo'

minItems: 1

clkQltDetLvl:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/ClockQualityDetailLevel'

clkQltAcptCri:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/ClockQualityAcceptanceCriterion'

required:

- upNodeId

- reqPtpIns

- timeDom

- configNotifId

- configNotifUri

PtpInstance:

description: Contains PTP instance configuration and activation requested by the AF.

type: object

properties:

instanceType:

$ref: 'TS29522\_TimeSyncExposure.yaml#/components/schemas/InstanceType'

protocol:

$ref: 'TS29522\_TimeSyncExposure.yaml#/components/schemas/Protocol'

ptpProfile:

type: string

portConfigs:

type: array

items:

$ref: '#/components/schemas/ConfigForPort'

minItems: 1

required:

- instanceType

- protocol

- ptpProfile

ConfigForPort:

description: Contains configuration for each port.

type: object

properties:

supi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

gpsi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

n6Ind:

type: boolean

ptpEnable:

type: boolean

logSyncInter:

type: integer

logSyncInterInd:

type: boolean

logAnnouInter:

type: integer

logAnnouInterInd:

type: boolean

oneOf:

- required: [supi]

- required: [gpsi]

- required: [n6Ind]

# A.3 Ntsctsf\_QoSandTSCAssistance API

openapi: 3.0.0

info:

title: Ntsctsf\_QoSandTSCAssistance Service API

version: 1.1.0-alpha.4

description: |

TSCTSF QoS and TSC Assistance Service.

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externalDocs:

description: >

3GPP TS 29.565 V18.3.0; 5G System; Time Sensitive Communication and Time Synchronization function

Services; Stage 3.

url: 'https://www.3gpp.org/ftp/Specs/archive/29\_series/29.565/'

servers:

- url: '{apiRoot}/ntsctsf-qos-tscai/v1'

variables:

apiRoot:

default: https://example.com

description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

security:

- {}

- oAuth2ClientCredentials:

- ntsctsf-qos-tscai

paths:

/tsc-app-sessions:

post:

summary: Creates a new Individual TSC Application Session Context resource

operationId: PostTSCAppSessions

tags:

- TSC Application Sessions (Collection)

requestBody:

description: Contains the information for the creation the resource.

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/TscAppSessionContextData'

responses:

'201':

description: Successful creation of the resource.

content:

application/json:

schema:

$ref: '#/components/schemas/TscAppSessionContextData'

headers:

Location:

description: >

Contains the URI of the created individual TSC application session context resource,

according to the structure

{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId} or the

URI of the created events subscription sub-resource, according to the structure

{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}/

events-subscription}

required: true

schema:

type: string

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

description: Forbidden

content:

application/problem+json:

schema:

$ref: '#/components/schemas/ProblemDetailsTsctsfQosTscac'

headers:

Retry-After:

description: >

Indicates the time the AF has to wait before making a new request. It can be a

non-negative integer (decimal number) indicating the number of seconds the AF

has to wait before making a new request or an HTTP-date after which the AF can

retry a new request.

schema:

type: string

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

callbacks:

terminationRequest:

'{$request.body#/notifUri}/terminate':

post:

requestBody:

description: >

Request of the termination of the Individual TSC Application Session Context

required: true

content:

application/json:

schema:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/TerminationInfo'

responses:

'204':

description: The receipt of the notification is acknowledged.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

eventNotification:

'{$request.body#/evSubsc/notifUri}/notify':

post:

requestBody:

description: Notification of an event occurrence in the TSCTSF.

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/EventsNotification'

responses:

'204':

description: The receipt of the notification is acknowledged.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

/tsc-app-sessions/{appSessionId}:

get:

summary: Reads an existing Individual TSC Application Session Context

operationId: GetTSCAppSession

tags:

- Individual TSC Application Session Context (Document)

parameters:

- name: appSessionId

description: String identifying the resource.

in: path

required: true

schema:

type: string

responses:

'200':

description: A representation of the resource is returned.

content:

application/json:

schema:

$ref: '#/components/schemas/TscAppSessionContextData'

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'406':

$ref: 'TS29571\_CommonData.yaml#/components/responses/406'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

patch:

summary: Modifies an existing Individual TSC Application Session Context

operationId: ModAppSession

tags:

- Individual TSC Application Session Context (Document)

parameters:

- name: appSessionId

description: String identifying the resource.

in: path

required: true

schema:

type: string

requestBody:

description: Modification of the resource.

required: true

content:

application/merge-patch+json:

schema:

$ref: '#/components/schemas/TscAppSessionContextUpdateData'

responses:

'200':

description: >

successful modification of the resource and a representation of that resource is

returned.

content:

application/json:

schema:

$ref: '#/components/schemas/TscAppSessionContextData'

'204':

description: The successful modification.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

description: Forbidden

content:

application/problem+json:

schema:

$ref: '#/components/schemas/ProblemDetailsTsctsfQosTscac'

headers:

Retry-After:

description: >

Indicates the time the AF has to wait before making a new request. It can be a

non-negative integer (decimal number) indicating the number of seconds the AF

has to wait before making a new request or an HTTP-date after which the AF can

retry a new request.

schema:

type: string

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

callbacks:

eventNotification:

'{$request.body#/evSubsc/notifUri}/notify':

post:

requestBody:

description: Notification of an event occurrence in the TSCTSF.

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/EventsNotification'

responses:

'204':

description: The receipt of the notification is acknowledged.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

/tsc-app-sessions/{appSessionId}/delete:

post:

summary: Deletes an existing Individual TSC Application Session Context

operationId: DeleteTSCAppSession

tags:

- Individual TSC Application Session Context (Document)

parameters:

- name: appSessionId

description: String identifying the Individual TSC Application Session Context resource.

in: path

required: true

schema:

type: string

requestBody:

description: >

Deletion of the Individual TSC Application Session Context resource, request notification.

required: false

content:

application/json:

schema:

$ref: '#/components/schemas/EventsSubscReqData'

responses:

'200':

description: The deletion of the resource is confirmed and a resource is returned

content:

application/json:

schema:

$ref: '#/components/schemas/EventsNotification'

'204':

description: The deletion is confirmed without returning additional data.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

/tsc-app-sessions/{appSessionId}/events-subscription:

put:

summary: Creates or modifies an Events Subscription subresource

operationId: putEventsSubsc

tags:

- Events Subscription (Document)

parameters:

- name: appSessionId

description: String identifying the Events Subscription resource

in: path

required: true

schema:

type: string

requestBody:

description: Creation or modification of an Events Subscription resource.

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/EventsSubscReqData'

responses:

'201':

description: >

The creation of the Events Subscription resource is confirmed and its representation is

returned.

content:

application/json:

schema:

$ref: '#/components/schemas/EventsSubscReqData'

headers:

Location:

description: >

Contains the URI of the created Events Subscription resource,

according to the structure

{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}/

events-subscription}

required: true

schema:

type: string

'200':

description: >

The modification of the Events Subscription resource is confirmed and its representation

is returned.

content:

application/json:

schema:

$ref: '#/components/schemas/EventsSubscReqData'

'204':

description: >

The modification of the Events Subscription subresource is confirmed without returning

additional data.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

callbacks:

eventNotification:

'{$request.body#/notifUri}/notify':

post:

requestBody:

description: >

Contains the information for the notification of an event occurrence in the TSCTSF.

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/EventsNotification'

responses:

'204':

description: The receipt of the notification is acknowledged.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

delete:

summary: Deletes the Events Subscription subresource.

operationId: DeleteEventsSubsc

tags:

- Events Subscription (Document)

parameters:

- name: appSessionId

description: String identifying the Individual TSC Application Session Context resource

in: path

required: true

schema:

type: string

responses:

'204':

description: >

The deletion of the of the Events Subscription sub-resource is confirmed without returning

additional data.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

components:

securitySchemes:

oAuth2ClientCredentials:

type: oauth2

flows:

clientCredentials:

tokenUrl: '{nrfApiRoot}/oauth2/token'

scopes:

ntsctsf-qos-tscai: Access to the Ntsctsf\_QoSandTSCAssistance API

schemas:

TscAppSessionContextData:

description: Represents an Individual TSC Application Session Context resource.

type: object

required:

- notifUri

- afId

- qosReference

allOf:

- oneOf:

- required: [ueIpAddr]

- required: [ueMac]

- required: [ueId]

- required: [externalGroupId]

- not:

required: [ethFlowInfo, enEthFlowInfo]

- not:

required: [altQosReqs, altQosReferences]

- not:

required: [qosReference, altQosReqs]

properties:

ueIpAddr:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/IpAddr'

ipDomain:

type: string

description: The IPv4 address domain identifier.

ueMac:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/MacAddr48'

ueId:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

externalGroupId:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/ExternalGroupId'

dnn:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Dnn'

snssai:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Snssai'

notifUri:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

appId:

type: string

description: Identifies the Application Identifier.

ethFlowInfo:

type: array

items:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'

minItems: 1

enEthFlowInfo:

type: array

items:

$ref: 'TS29122\_CommonData.yaml#/components/schemas/EthFlowInfo'

minItems: 1

description: >

Identifies the Ethernet flows which require QoS. Each Ethernet flow consists of a flow

identifer and the corresponding UL and/or DL flows.

flowInfo:

type: array

items:

$ref: 'TS29122\_CommonData.yaml#/components/schemas/FlowInfo'

minItems: 1

afId:

type: string

description: Identifies the AF identifier.

tscQosReq:

$ref: 'TS29122\_AsSessionWithQoS.yaml#/components/schemas/TscQosRequirement'

qosReference:

type: string

description: Identifies a pre-defined QoS information.

altQosReferences:

type: array

items:

type: string

minItems: 1

description: Identifies an ordered list of pre-defined QoS information.

altQosReqs:

type: array

items:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/AlternativeServiceRequirementsData'

minItems: 1

description: >

Identifies an ordered list of alternative service requirements that include individual

QoS parameter sets. The lower the index of the array for a given entry, the higher the

priority.

aspId:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/AspId'

sponId:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/SponId'

sponStatus:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/SponsoringStatus'

evSubsc:

$ref: '#/components/schemas/EventsSubscReqData'

tempInValidity:

$ref: '#/components/schemas/TemporalInValidity'

suppFeat:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

TscAppSessionContextUpdateData:

description: >

Describes the authorization data of an Individual TSC Application Session Context created by

the PCF.

type: object

properties:

notifUri:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

appId:

type: string

description: Identifies the Application Identifier.

ethFlowInfo:

type: array

items:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'

minItems: 1

enEthFlowInfo:

type: array

items:

$ref: 'TS29122\_CommonData.yaml#/components/schemas/EthFlowInfo'

minItems: 1

description: >

Identifies the Ethernet flows which require QoS. Each Ethernet flow consists of a flow

identifer and the corresponding UL and/or DL flows.

flowInfo:

type: array

items:

$ref: 'TS29122\_CommonData.yaml#/components/schemas/FlowInfo'

minItems: 1

tscQosReq:

$ref: 'TS29122\_AsSessionWithQoS.yaml#/components/schemas/TscQosRequirementRm'

qosReference:

type: string

description: Identifies a pre-defined QoS information.

altQosReferences:

type: array

items:

type: string

minItems: 1

description: Identifies an ordered list of pre-defined QoS information.

altQosReqs:

type: array

items:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/AlternativeServiceRequirementsData'

minItems: 1

description: >

Identifies an ordered list of alternative service requirements that include individual

QoS parameter sets. The lower the index of the array for a given entry, the higher the

priority.

aspId:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/AspId'

sponId:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/SponId'

sponStatus:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/SponsoringStatus'

evSubsc:

$ref: '#/components/schemas/EventsSubscReqDataRm'

tempInValidity:

$ref: '#/components/schemas/TemporalInValidity'

allOf:

- not:

required: [ethFlowInfo, enEthFlowInfo]

- not:

required: [altQosReqs, altQosReferences]

- not:

required: [qosReference, altQosReqs]

EventsSubscReqData:

description: Identifies the events the application subscribes to.

type: object

required:

- events

- notifUri

- notifCorreId

properties:

events:

type: array

items:

$ref: '#/components/schemas/TscEvent'

minItems: 1

notifUri:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

qosMon:

$ref: 'TS29122\_AsSessionWithQoS.yaml#/components/schemas/QosMonitoringInformation'

usgThres:

$ref: 'TS29122\_CommonData.yaml#/components/schemas/UsageThreshold'

notifCorreId:

type: string

EventsSubscReqDataRm:

description: >

This data type is defined in the same way as the EventsSubscReqData data type, but with the

OpenAPI nullable property set to true.

type: object

required:

- events

properties:

events:

type: array

items:

$ref: '#/components/schemas/TscEvent'

minItems: 1

notifUri:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

qosMon:

$ref: 'TS29122\_AsSessionWithQoS.yaml#/components/schemas/QosMonitoringInformationRm'

usgThres:

$ref: 'TS29122\_CommonData.yaml#/components/schemas/UsageThresholdRm'

notifCorreId:

type: string

nullable: true

EventsNotification:

description: Describes the notification of matched events.

type: object

required:

- notifCorreId

- events

properties:

notifCorreId:

type: string

events:

type: array

items:

$ref: '#/components/schemas/EventNotification'

minItems: 1

EventNotification:

description: Describes a notification of an matched event.

type: object

required:

- event

properties:

event:

$ref: '#/components/schemas/TscEvent'

flowIds:

type: array

items:

type: integer

minItems: 1

description: Identifies the IP flows that were sent during event subscription.

qosMonReports:

type: array

items:

$ref: 'TS29122\_AsSessionWithQoS.yaml#/components/schemas/QosMonitoringReport'

minItems: 1

usgRep:

$ref: 'TS29122\_CommonData.yaml#/components/schemas/AccumulatedUsage'

appliedQosRef:

type: string

description: >

The currently applied alternative QoS requirement referring to an alternative QoS

reference or a requested alternative QoS parameter set. Applicable for

event QOS\_NOT\_GUARANTEED or SUCCESSFUL\_RESOURCES\_ALLOCATION.

altQosNotSuppInd:

type: boolean

description: >

When present and set to true it indicates that the Alternative QoS profiles are not

supported by NG-RAN. Applicable for

event QOS\_NOT\_GUARANTEED or SUCCESSFUL\_RESOURCES\_ALLOCATION.

AdditionInfoTsctsfQosTscac:

description: Describes additional error information specific for this API.

type: object

properties:

acceptableServInfo:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/AcceptableServiceInfo'

batOffsetInfo:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/BatOffsetInfo'

TemporalInValidity:

description: Indicates the time interval(s) during which the AF request is not to be applied.

type: object

properties:

startTime:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime'

stopTime:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime'

required:

- startTime

- stopTime

#

# ENUMERATIONS DATA TYPES

#

TscEvent:

description: Represents an event to notify to the AF.

anyOf:

- type: string

enum:

- FAILED\_RESOURCES\_ALLOCATION

- QOS\_MONITORING

- QOS\_GUARANTEED

- QOS\_NOT\_GUARANTEED

- SUCCESSFUL\_RESOURCES\_ALLOCATION

- USAGE\_REPORT

- BAT\_OFFSET\_INFO

- type: string

description: >

This string provides forward-compatibility with future extensions to the enumeration

and is not used to encode content defined in the present version of this API.

#

# ALTERNATIVE DATA TYPES OR COMBINATIONS OF DATA TYPES

#

ProblemDetailsTsctsfQosTscac:

description: Extends ProblemDetails to also include the acceptable service info.

allOf:

- $ref: 'TS29571\_CommonData.yaml#/components/schemas/ProblemDetails'

- $ref: '#/components/schemas/AdditionInfoTsctsfQosTscac'

# A.4 Ntsctsf\_ASTI API

openapi: 3.0.0

info:

title: Ntsctsf\_ASTI Service API

version: 1.1.0-alpha.3

description: |

TSCTSF Access Stratum time distribution configuration Service.

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externalDocs:

description: >

3GPP TS 29.565 V18.4.0; 5G System; Time Sensitive Communication and

Time Synchronization Function Services; Stage 3.

url: 'https://www.3gpp.org/ftp/Specs/archive/29\_series/29.565/'

servers:

- url: '{apiRoot}/ntsctsf-asti/v1'

variables:

apiRoot:

default: https://example.com

description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

security:

- {}

- oAuth2ClientCredentials:

- ntsctsf-asti

paths:

/configurations:

post:

summary: Creates a new Individual ASTI Configuration resource.

operationId: ASTIConfiguration

tags:

- ASTI Configurations (Collection)

requestBody:

description: Contains the information for the creation the resource.

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/AccessTimeDistributionData'

responses:

'201':

description: Successful creation of the resource.

content:

application/json:

schema:

$ref: '#/components/schemas/AccessTimeDistributionData'

headers:

Location:

description: >

Contains the URI of the created individual ASTI Configuration resource,

according to the structure

{apiRoot}/ntsctsf-asti/{apiVersion}/configurations/{configId}

required: true

schema:

type: string

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

callbacks:

astiNotification:

'{$request.body#/astiNotifUri}':

post:

requestBody:

description: Notification of an ASTI configuration change event.

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/AstiConfigNotification'

responses:

'204':

description: The receipt of the notification is acknowledged.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

/configurations/retrieve:

post:

summary: Request the status of the 5G access stratum time distribution for a list of UEs.

operationId: RequestStatusof5GAccessStratumTimeDistribution

tags:

- ASTI Configurations

requestBody:

description: >

Contains the information for the status of the 5G access stratum time distribution.

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/StatusRequestData'

responses:

'200':

description: >

Successful retrieval of the status of the 5G access stratum time distribution.

content:

application/json:

schema:

$ref: '#/components/schemas/StatusResponseData'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

/configurations/{configId}:

put:

summary: Modifies an existing Individual ASTI Configuration resource.

operationId: ModifyIndividualASTIConfiguration

tags:

- Individual ASTI Configuration (Document)

parameters:

- name: configId

description: String identifying an Individual ASTI Configuration.

in: path

required: true

schema:

type: string

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/AccessTimeDistributionData'

responses:

'200':

description: OK. Resource was succesfully modified and representation is returned.

content:

application/json:

schema:

$ref: '#/components/schemas/AccessTimeDistributionData'

'204':

description: No Content. Resource was succesfully modified.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'411':

$ref: 'TS29571\_CommonData.yaml#/components/responses/411'

'413':

$ref: 'TS29571\_CommonData.yaml#/components/responses/413'

'415':

$ref: 'TS29571\_CommonData.yaml#/components/responses/415'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

delete:

operationId: DeleteIndividualASTIConfiguration

summary: Delete an Individual ASTI Configuration

tags:

- Individual ASTI Configuration (Document)

parameters:

- name: configId

in: path

description: String identifying an Individual ASTI Configuration.

required: true

schema:

type: string

responses:

'204':

description: No Content. Resource was successfully deleted.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'400':

$ref: 'TS29571\_CommonData.yaml#/components/responses/400'

'401':

$ref: 'TS29571\_CommonData.yaml#/components/responses/401'

'403':

$ref: 'TS29571\_CommonData.yaml#/components/responses/403'

'404':

$ref: 'TS29571\_CommonData.yaml#/components/responses/404'

'429':

$ref: 'TS29571\_CommonData.yaml#/components/responses/429'

'500':

$ref: 'TS29571\_CommonData.yaml#/components/responses/500'

'502':

$ref: 'TS29571\_CommonData.yaml#/components/responses/502'

'503':

$ref: 'TS29571\_CommonData.yaml#/components/responses/503'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

components:

securitySchemes:

oAuth2ClientCredentials:

type: oauth2

flows:

clientCredentials:

tokenUrl: '{nrfApiRoot}/oauth2/token'

scopes:

ntsctsf-asti: Access to the Ntsctsf\_ASTI API

schemas:

AccessTimeDistributionData:

description: >

Contains the parameters for the creation of 5G access stratum time distribution

configuration.

type: object

properties:

supis:

type: array

items:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

minItems: 1

gpsis:

type: array

items:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

minItems: 1

interGrpId:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/GroupId'

exterGrpId:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/ExternalGroupId'

asTimeDisParam:

$ref: '#/components/schemas/AsTimeDistributionParam'

covReq:

type: array

description: >

Identifies a list of Tracking Areas per serving network where 5GS

Access Stratum Time Distribution parameters are allowed.

items:

$ref: 'TS29534\_Npcf\_AMPolicyAuthorization.yaml#/components/schemas/ServiceAreaCoverageInfo'

minItems: 1

astiNotifId:

type: string

description: Notification Correlation ID assigned by the NF service consumer.

astiNotifUri:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

suppFeat:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

required:

- asTimeDisParam

oneOf:

- required: [supis]

- required: [interGrpId]

- required: [gpsis]

- required: [exterGrpId]

AsTimeDistributionParam:

description: Contains the 5G access stratum time distribution parameters.

type: object

properties:

asTimeDisEnabled:

type: boolean

description: >

When this attribute is included and set to true, it indicates that the access stratum

time distribution via Uu reference point is activated.

timeSyncErrBdgt:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

tempValidity:

$ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/TemporalValidity'

clkQltDetLvl:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/ClockQualityDetailLevel'

clkQltAcptCri:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/ClockQualityAcceptanceCriterion'

StatusRequestData:

description: >

Contains the parameters for retrieval of the status of the access stratum time distribution

for a list of UEs.

type: object

properties:

supis:

type: array

items:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

minItems: 1

gpsis:

type: array

items:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

minItems: 1

oneOf:

- required: [supis]

- required: [gpsis]

StatusResponseData:

description: >

Contains the parameters for the status of the access stratum time distribution for a list of

UEs.

type: object

properties:

inactiveUes:

type: array

items:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

minItems: 1

inactiveGpsis:

type: array

items:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

minItems: 1

activeUes:

type: array

items:

$ref: '#/components/schemas/ActiveUe'

minItems: 1

ActiveUe:

description: >

Contains the UE identifier whose status of the access stratum time distribution is active

and the optional requested time synchronization error budget.

type: object

properties:

supi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

gpsi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

timeSyncErrBdgt:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

oneOf:

- required: [supi]

- required: [gpsi]

AstiConfigNotification:

description: >

Contains the report of a change in the 5G Access Stratum Time Distribution

parameters applied to the UE(s).

type: object

properties:

astiNotifId:

type: string

stateConfigs:

type: array

items:

$ref: '#/components/schemas/AstiConfigStateNotification'

minItems: 1

description: >

It is FFS the parameters of the AstiConfigEventNotification data type.

required:

- astiNotifId

- stateConfigs

AstiConfigStateNotification:

description: >

Contains the report of a change in the 5G Access Stratum Time Distribution

parameters applied to a UE.

type: object

properties:

supi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

gpsi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

event:

$ref: '#/components/schemas/AstiEvent'

required:

- event

oneOf:

- required: [supi]

- required: [gpsi]

#

# ENUMERATIONS DATA TYPES

#

AstiEvent:

anyOf:

- type: string

enum:

- ASTI\_ENABLED

- ASTI\_DISABLED

- CLOCK\_QUAL\_ACCEPTABLE

- CLOCK\_QUAL\_NON\_ACCEPTABLE

- type: string

description: >

This string provides forward-compatibility with future extensions to the enumeration

and is not used to encode content defined in the present version of this API.

description: |

Represents an ASTI event to notify to the AF/NEF.

Possible values are:

- ASTI\_ENABLED: Access stratum time distribution via Uu reference point is activated.

- ASTI\_DISABLED: Access stratum time distribution via Uu reference point is deactivated.

- CLOCK\_QUAL\_ACCEPTABLE: The UE meets the clock quality acceptance criteria.

- CLOCK\_QUAL\_NON\_ACCEPTABLE: The UE does not meet the clock quality acceptance criteria.

Annex B (normative):  
3GPP extensions for DetNet integration with 5GS

# B.1 3GPP extensions for DetNet integration with 5GS

## B.1.1 Introduction

The 5G System is integrated with the Deterministic Networking as defined in IETF RFC 8655[63] as a logical DetNet transit node as specified in 3GPP TS 23.501 [2], clause 4.4.8.4.

The support of deterministic networking is achieved by reusing the TSC framework for deterministic QoS and time synchronization services. To enable deterministic networking in 5GS, the DetNet controller collects interface information from the 5GS DetNet node via the TSCTSF using the 5GS DetNet node information reporting procedure described in clause 5.5.12.2 of 3GPP TS 23.513 [31] and provides DetNet Yang configurations for DetNet flow(s) as described in clause 5.5.12.3 of 3GPP TS 23.513 [31].

The TSCTSF offers to the DetNet controller RESTCONF (IETF RFC 8040 [30]) and/or NETCONF (IETF RFC 6241 [29]) interfaces and the data schema defined by the 3GPP Extended Deterministic Networking (DetNet) YANG model. The 3GPP Extended DetNet YANG model is based on the DetNet YANG model specified in IETF draft-ietf-detnet-yang [28] and extended by 3GPP Extensions described in table B.1.1-1.

The 3GPP Extended DetNet YANG Model offered by the TSCTSF is accessed by the DetNet controller as shown in figure B.1.1-1



Figure B.1.1-1: Representation of the access to 3GPP Extended DetNet YANG Model.

Table B.1.1-1 summarizes the 3GPP extensions to the DetNet YANG model defined in this specification.

Table B.1.1-1: 3GPP Extensions Descriptions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 3GPP Extension | Clause | Description | YANG File | Module Name | Annex |
| 3gpp-5gs-detnet-node | B.1.2 | Enables the report of 5GS DetNet node interface information and the provisioning and configuration of data for the DetNet flows. | 3gpp-5gs-detnet-node.yang | 3gpp-5gs-detnet-node | C.2 |

## B.1.2 3GPP Extension 3gpp-5gs-detnet-node

### B.1.2.1 Description

Deterministic Networking parameter provisioning allows a DetNet controller to configure deterministic networking parameters in 5GS and provide time-sensitive features that guarantee almost zero packet loss rates and bounded latency.

The DetNet controller communicates with the 5GS system through the TSCTSF as specified in 3GPP TS 29.513 [31] to collect 5GS DetNet node interface information and to provide DetNet flow-related parameters to configure the DetNet traffic in 5GS.

The TSCTSF may receive DetNet YANG configuration for DetNet flows as described in IETF draft-ietf-detnet-yang [28], that describes the traffic characteristics and QoS requirements for the DetNet flows. Additionally, when both, the TSCTSF and the DetNet controller support the 3GPP Extension 3gpp-5gs-detnet-node, the configuration of the DetNet traffic in 5GS also enable that:

- The DetNet controller may provide the maximum latency and/or maximum loss requirements the 5GS system needs to apply, as specified in clause B.1.2.2.

- The TSCTSF may provide to the DetNet controller 5GS specific status code information on the status of the configuration requested by the DetNet controller for the DetNet flow(s), as specified in clause B.1.2.3.

To enable the DetNet controller builds up network topology information, the 5GS DetNet node exposes interface information to the DetNet controller through the TSCTSF. When both, the TSCTSF and the DetNet controller support the 3GPP Extension 3gpp-5gs-detnet-node, the TSCTSF may provide to the DetNet controller 5GS DetNet node identification as specified in clause B.1.2.4.

### B.1.2.2 Provisioning of 5GS specific traffic characteristics and requirements

When both, the DetNet controller and the TSCTSF support the 3GPP Extension 3gpp-5gs-detnet-node, the DetNet controller may provide the following 5GS specific traffic characteristics and requirements within the "\_3gpp-5gs-node-requirements" YANG container:

- the maximum latency from 5GS node ingress to 5GS node egress(es) of a DetNet flow by providing the "\_3gpp-5gs-node-max-latency" attribute; and/or

- the maximum packet loss ratio parameter for the DetNet service between the 5G node ingress and the 5GS node egress(es) by providing the "\_3gpp-5gs-node-max-latency" attribute; and

- a reference to the DetNet flow identification within the "forwarding-sub-layer" attribute.

When the DetNet controller does not provide the "\_3gpp-5gs-node-max-latency" attribute and/or the "\_3gpp-5gs-node-max-latency" attribute but instead provides the IETF draft-ietf-detnet-yang [28] "max-latency" and/or "max-loss" attributes for the end-to-end flow, the TSCTSF may determine the corresponding maximum latency and/or maximum packet loss values based on a preconfigured mapping and applicable to the 5GS specific deployment.

NOTE: If the DetNet controller does not include the 5GS specific "\_3gpp-5gs-node-max-latency" nor the end-to-end "max-latency", the TSCTSF can derive the Requested 5GS Delay or, alternatively, the PCF can derive the PDB. Similarly, if the DetNet YANG configuration does not include the 5GS specific "\_3gpp-5gs-node-max-loss" nor the end-to-end "max-loss", the TSCTSF can derive the Requested Packet Error Rate or, alternatively, the PCF can derive the PER.

### B.1.2.3 Report of 5GS DetNet flow(s) status

The DetNet controller may be informed about the following 5GS specific events about status change of the configured DetNet flows:

- Notification about DetNet flow(s) deactivation in 5GS node. To notify the DetNet controller about DetNet flow deactivation in 5GS, the TSCTSF shall subscribe with the PCF to service data flow deactivation as specified in 3GPP TS 29.514 [20].

- Notification about resource allocation outcome in 5GS node. The TSCTSF shall subscribe with the PCF to notifications about the unsuccessful and/or successful resource allocation outcome as specified in 3GPP TS 29.514 [20].

- Notification about PDU session release.

When the TSCTSF receives from the PCF the notification about service data flow deactivation, or the notification about unsuccessful or successful resource allocation, or the notification about PDU session release and both, the DetNet controller and the TSCTSF support the 3GPP Extension 3gpp-5gs-detnet-node, the TSCTSF may notify the DetNet controller by including the following 3GPP 5GS specific failure reason:

- "3gpp-5gs-node-resource-allocation-failure", to notify about the failed resource allocation in the 5G System;

- "3gpp-5gs-node-resource-allocation-success", to notify about the successful resource allocation in the 5G System; or

- "3gpp-5gs-node-pdu-session-release", to notify about PDU session release.

When the TSCTSF or the DetNet controller do not support the 3GPP Extension 3gpp-5gs-detnet-node, the TSCTSF provides an IETF draft-ietf-detnet-yang [28] defined failure-reason, e.g. "resource-unavailable".

### B.1.2.4 Exposure of 5GS DetNet Node Identification

The TSCTSF collects 5GS DetNet node interface information from the NW-TT/UPF using Time Synchronization procedures as described in 3GPP TS 29.513[31]. When both, the TSCTSF and the DetNet controller support the 3GPP Extension 3gpp-5gs-detnet-node, the TSCTSF may provide to the DetNet controller 5GS DetNet node identification.

During PDU session establishment, i.e., when the TSCTSF receives the Npcf\_PolicyAuthorization\_Notify service operation defined in clause 4.2.5.16 of 3GPP TS 29.514 [20], the TSCTSF may use the received user-plane node Id to generate an identifier of the 5GS DetNet node and provide it to the DetNet controller within the "5GS-node-id" attribute.

# B.2 YANG Module Definitions

## B.2.1 Introduction

### B.2.1.1 General

As specified in IETF RFC 7590 [33], a YANG model is defined in a YANG module and is stored in a file with file extension ".yang". An extension to an existing YANG model is done via the definition of a new YANG module that contains the definitions of the new components.

A YANG module typically has the following layout:

module <module-name> {

// header information

<yang-version statement>

<namespace statement>

<prefix statement>

// linkage statements

<import statements>

<include statements>

// meta-information

<organization statement>

<contact statement>

<description statement>

<reference statement>

// revision history

<revision statements>

// module definitions

<other statements>

}

The YANG module with the 3GPP extensions for the DetNet YANG model shall follow the YANG model layout defined in clause 7.1 of IETF RFC 7590 [33] and represented above, where the linkage and module definitions statements contain the definition of the new components that represent the 5GS specifics.

### B.2.1.2 Module name

module <module-name>

To differentiate from other YANG modules, 3GPP extensions to DetNet YANG model module(s) shall start with the "3gpp-5gs-detnet" prefix.

### B.2.1.3 Header information

#### B.2.1.3.1 <yang-version statement>

According to IETF RFC 7590 [33], YANG version 1.1 shall be used.

#### B.2.1.3.2 <namespace statement>

The namespace for a YANG module's namespace shall follow section 4.9 of IETF RFC 8407.

The 3GPP extensions to DetNet YANG model shall follow the following form:

urn:3gpp:node:detnet:<module-name>

#### B.2.1.3.3 <prefix statement>

To ensure uniqueness of the prefix defined in the 3GPP extensions for the DetNet YANG model, the module(s) shall use prefixes ending with "3gppdnet". Prefixes should be short preferably not longer than 10 characters, but 13 characters at most.

### B.2.1.4 Meta-information

#### B.2.1.4.1 <organization statement>

The organization statement shall contain the organization developing and maintaining the YANG file with the 3GPP extensions for the DetNet YANG model, i.e. the string "3GPP CT3 Working Group".

#### B.2.1.4.2 <contact statement>

The contact statement contains contact information for the person or persons to whom technical queries concerning this module should be sent.

For the 3GPP extensions to YANG DetNet model it shall include a string with the CT3 WG web link.

contact

"CT3 WG Web: <https://www.3gpp.org/3gpp-groups/core-network-terminals-ct/ct-wg3>";

#### B.2.1.4.3 <description statement>

The description statement contains human-readable textual description for the module definition.

In addition, the YANG module with 3GPP extensions to YANG DetNet model shall also include the copyright notice as included in the front page of the present document and a reference to the present document.

EXAMPLE:

description

"3gpp-5gs-detnet-node module contains an extension of ietf-detnet YANG module with

additional parameters defined for interworking with 3GPP 5GS.

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All rights reserved.

This version of this YANG module is specified in:

3GPP TS 29.565 V18.1.0; 5G System;

Time Sensitive Communication and Time Synchronization Function Services.

url: http://www.3gpp.org/ftp/Specs/archive/29\_series/29.565/";

#### B.2.1.4.4 <reference statement>

This statement contains a human-readable cross reference to an external document that defines related information or additional information.

When included, it refers e.g., to other 3GPP Technical Specifications with related information.

EXAMPLE:

reference

"Additional information to this YANG module is specified in:

3GPP TS 23.501, System architecture for the 5G System (5GS)

3GPP TS 23.502, Procedures for the 5G System (5GS)

3GPP TS 23.503, Policy and charging control framework (5GS)

url: http://www.3gpp.org/ftp/Specs/archive/23\_series/";

#### B.2.1.4.5 <revision statement>

This statement contains the revision history of the module, including the initial revision. A series of revision statements detail the changes in the module’s definition. The argument is a date string in the format "YYYY-MM-DD" followed by a block of sub-statements with detailed revision information. A module should have at least one revision statement.

For the YANG module(s) with the 3GPP extensions to YANG DetNet model:

1. For a frozen release, only one revision statement shall be included and shall indicate the last revision of the module for that release version of the TS.

2. A non-frozen release may contain a series of revision statements that represent the list of changes approved in that release. At the freeze of the release, only the last revision statement shall be kept.

3. The date argument of the revision statement(s) shall contain a value corresponding to the CT plenary date that approved the latest changes to the YANG module.

4. To allow the YANG module could be updated with new components in new releases or with corrections in a frozen release, a version control mechanism is enabled. The description sub-statement shall be used to contain a string with the YANG module version. Version control for the 3GPP Extensions for the DetNet YANG shall follow the version control rules for SBI APIs specified in 3GPP TS 29.501 [5], clause 4.3.

EXAMPLE 1: Series of revision published by 3GPP of the 3GPP extension YANG module before the freeze of the Rel-18, with version included.

revision 2024-012-dd

// optional

{

description "version: v1.0.0-alpha.3"};

revision 2023-09-dd

// optional

{

description "version: v1.0.0-alpha.2"};

revision 2023-06-dd

// optional

{

description "version: v1.0.0-alpha.1"};

EXAMPLE 2: Final revision of the 3GPP extension of the YANG module published by 3GPP, with version included, published at the freeze of Rel-18.

revision 2024-06-dd

{

description "version: v1.0.0"};

EXAMPLE 3: The YANG module is evolved during the first plenary cycle corresponding to Rel-19, .

revision 2024-09-dd

{

description "version: v1.1.0-alpha.1"};

### B.2.1.2 Formatting rules

The following 3GPP specific guidelines should be used when documenting the YANG module for the 3GPP extensions to the DetNet YANG model:

- The YANG module should be considered a code component. The strings "<CODE BEGINS>" and "<CODE ENDS>" are used to identify each code component.

- The "<CODE BEGINS>" tag is followed by a string identifying the file name as specified in section 5.2 of IETF RFC 6020 [35].

- The YANG data nodes (leaf, leaf-list, container, list) shall be used for data modelling of the new YANG components.

- The style used for the specification of the YANG module shall be "PL" (Programming Language).

- Comments may be added by following the standard YANG 1.1 syntax ("//" or "/\*" and "\*/").

- Tabs shall not be used (e.g. within description fields).

- "Unbreakable" spaces (UTF-8 'NO-BREAK SPACE' (U+00A0)) shall not be used (e.g. within description fields). Only "normal" spaces (UTF-8 'SPACE' (U+0020)) shall be allowed.

- Trailing spaces (i.e. white spaces at the end of a line) should not be used.

## B.2.2 3gpp-5gs-detnet-node Module definition

### B.2.2.1 Introduction

The 3GPP extension to the IETF draft-ietf-detnet-yang [37] is defined in 3GPP as a YANG module which imports draft-ietf-detnet-yang [37] and adds the 3GPP specific parameters.

The module name shall be set to "3gpp-5gs-detnet-node".

The YANG version shall be set to "1.1".

The namespace for the 3gpp-5gs-detnet-node YANG module shall be set to "urn:3gpp:node:detnet:3gpp-5gs-detnet-node".

The prefix statement for the 3gpp-5gs-detnet-node YANG module shall be set to "5gs3gppdnet".

### B.2.2.2 Data Model

#### B.2.2.2.1 General

Table B.2.2.2.1-1 specifies the data types defined for the 3gpp-5gs-detnet-node Module.

Table B.2.2.2.1-1: 3gpp-5gs-detnet-node Module specific Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Clause defined | Description | Applicability |
| \_3gpp-5gs-node-configuration-outcome | B.2.2.2.2.3 | It is a container that represents the additional outcome the 5GS may provide to a configuration request. |  |
| \_3gpp-5gs-node-configuration-status | B.2.2.2.3.3 | It is an enumeration that represents the 3GPP specific configuration status that may be reported by the 5GS node. |  |
| \_3gpp-5gs-node-identity | B.2.2.2.2.4 | It is a container that represents the user-plane node Id handling the traffic of the reported DetNet flows/PDU session. |  |
| \_3gpp-5gs-node-requirements | B.2.2.2.2.2 | It is a container that represents the maximum delay and/or the maximum loss the 5GS needs to satisfy for the traffic of the DetNet flows indicated by the forwarding sublayer. |  |

Table B.2.2.2.1-2 specifies data types re-used by the \_3gpp-5gs-detnet-node Module from other YANG modules, including a reference to their respective specifications and when needed, a short description of their use.

Table BA.2.2.2.1-2: \_3gpp-5gs-detnet-node Module re-used Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Reference | Comments | Applicability |
| forwarding-sub-layer-ref | IETF draft-ietf-detnet-yang [28] | Contains a reference to the forwarding sublayer as specified in draft-ietf-detnet-yang-17 YANG module. |  |

#### B.2.2.2.2 Structured data types

##### B.2.2.2.2.1 Introduction

This clause defines the YANG structures to be used in 3gpp-5gs-detnet-node YANG Module.

##### B.2.2.2.2.2 Type: \_3gpp-5gs-node-requirements

The \_3gpp-5gs-node-requirements type is a YANG container that defines the maximum delay and/or the maximum loss the 5GS needs to satisfy for the traffic of the DetNet flows indicated by the forwarding sublayer.

Table B.2.2.2.2.2-1: Definition of type \_3gpp-5gs-node-requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| \_forwarding-sub-layer | forwarding-sub-layer-ref | M | 1 | The \_forwarding-sublayer leaf contains a reference to the forwarding sub-layer that the maximum delay and/or the maximum loss applies to. |
| \_3gpp-5gs-node-max-latency | uint32 | O | 0..1 | The \_3gpp-5gs-node-max-latency leaf contains the maximum latency from 5GS node ingress to 5GS node egress(es) for a single packet of the DetNet flow. It is specified as an integer number of nanoseconds. |
| \_3gpp-5gs-node-max-loss | uint32 | O | 0..1 | The \_3gpp-5gs-node-max-loss leaf contains the maximum Packet Loss Ratio (PLR) parameeter for the DetNet service between the 5GS node ingress and the 5GS node egress(es). |

##### B.2.2.2.2.3 Type: \_3gpp-5gs-node-configuration-outcome

The \_3gpp-5gs-node-configuration-outcome type is a YANG container that defines the additional outcome the 5GS may provide to a configuration request for the DetNet flows comprised by the forwarding sublayer.

Table B.2.2.2.2.3-1: Definition of type \_3gpp-5gs-node-configuration-outcome

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| \_forwarding-sub-layer | forwarding-sub-layer-ref | M | 1 | The \_forwarding-sublayer leaf contains a reference to the forwarding sub-layer that the reported configuration status applies to. |
| \_3gpp-5gs-node-configuration-status | \_3gpp-5gs-node-configuration-status | O | 0..1 | The \_3gpp-5gs-node-configuration-status leaf contains 3GPP specific configuration status codes that may be reported by the 3GPP 5GS node. |

##### B.2.2.2.2.4 Type: \_3gpp-5gs-node-identity

The \_3gpp-5gs-node-identity type is a YANG container that defines the 5GS node identity handling the traffic of the DetNet flows comprised by the forwarding sublayer.

Table B.2.2.2.2.3-1: Definition of type \_3gpp-5gs-node-configuration-outcome

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| \_forwarding-sub-layer | forwarding-sub-layer-ref | M | 1 | The \_forwarding-sublayer leaf contains a reference to the forwarding sub-layer the \_3gpp-5gs-node-Id applies to. |
| \_3gpp-5gs-node-id | string | O | 0..1 | The \_3gpp-5gs-node-id leaf contains 3GPP 5GS node identity (DetNet router identity). |

#### B.2.2.2.3 Simple data types and enumerations

##### B.2.2.2.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

##### B.2.2.2.3.2 Simple data types

The simple data types defined in table B.2.2.2.3.2-1 shall be supported.

Table B.2.2.2.3.2-1: Simple data types

|  |  |  |  |
| --- | --- | --- | --- |
| Type Name | Type Definition | Description | Applicability |
|  | <one simple data type > |  |  |

##### B.2.2.2.3.3 Enumeration: \_3gpp-5gs-node-configuration-status

The enumeration \_3gpp-5gs-node-configuration-status represents the configuration status that may be reported by the 3GPP 5GS node. It shall comply with the provisions defined in table B.2.2.2.3.3-1.

Table B.2.2.2.3.3-1: Enumeration \_3gpp-5gs-node-configuration-status

|  |  |  |
| --- | --- | --- |
| Enumeration value | Description | Applicability |
| \_3gpp-5gs-node-resource-allocation-success | Successful resource allocation within 5GS for the requested configuration. |  |
| \_3gpp-5gs-node-resource-allocation-failure | Failed resource allocation within 5GS for the requested configuration. |  |
| \_3gpp-5gs-node-port-release | Port release due to the termination of PDU session with the requested 5GS configuration. |  |

Annex C (normative):  
YANG module specification

# C.1 General

The present Annex contains the YANG file for the \_3gpp-5gs-detnet-node YANG module, that specifies the 3GPP extensions to support:

- The indication of the maximum loss and maximumd latency the 5GS system shall apply for the provided DetNet flows.

- 5GS specific status codes with information about the status of the configuration requested by the DetNet controller.

- Exposure of 5GS DetNet node identification.

# C.2 YANG module \_3gpp-5gs-detnet-node

<CODE BEGINS> file "\_3gpp-5gs-detnet-node.yang"

module \_3gpp-5gs-detnet-node {

yang-version 1.1;

namespace "urn:3gpp:node:detnet:\_3gpp-5gs-detnet-node";

prefix \_5gs3gppdnet;

import ietf-detnet {

prefix dnet;

reference

"draft-ietf-detnet-yang-18";

}

organization "3GPP CT3 Working Group";

contact

"CT3 WG Web: <https://www.3gpp.org/3gpp-groups/core-network-terminals-ct/ct-wg3>";

description

"\_3gpp-5gs-detnet-node module contains an extension of ietf-detnet YANG module with

additional parameters defined for interworking with 3GPP 5GS.

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This version of this YANG module is specified in:

3GPP TS 29.565 V18.4.0; 5G System;

Time Sensitive Communication and Time Synchronization Function Services.

url: https://www.3gpp.org/ftp/Specs/archive/29\_series/29.565/";

reference

"Additional information to this YANG module is specified in:

3GPP TS 23.501, System architecture for the 5G System (5GS);

url: https://www.3gpp.org/ftp/Specs/archive/23\_series/23.501/

3GPP TS 23.503, Policy and charging control framework (5GS)

url: <https://www.3gpp.org/ftp/Specs/archive/23_series/23.503/>

3GPP TS 29.513, Policy and Charging Control signalling flows and QoS parameter mapping

url: <https://www.3gpp.org/ftp/Specs/archive/29_series/29.513/>";

revision 2023-12-12 {

description "version: v1.0.0-alpha.2";

}

revision 2023-06-13 {

description "version: v1.0.0-alpha.1";

}

typedef \_3gpp-5gs-node-configuration-status {

type enumeration {

enum \_3gpp-5gs-node-resource-allocation-success {

description

"Successful configuration request.

Successful resource allocation within 5GS for the requested configuration";

}

enum \_3gpp-5gs-node-resource-allocation-failure {

description

"Unsuccessful configuration request.

Failed resource allocation within 5GS for the requested configuration";

}

enum \_3gpp-5gs-node-port-release {

description

"Port release due to the termination of PDU session with the requested

5GS configuration";

}

description

"\_3gpp-5gs-node-configuration-status type identifies the 3GPP specific configuration

status that may be reported by the 3GPP 5GS node.";

}

container \_3gpp-5gs-node-requirements {

description

"This container defines the maximum delay and/or the maximum loss the 5GS needs to satisfy";

leaf \_forwarding-sub-layer {

type dnet:forwarding-sub-layer-ref;

description

"Reference to the forwarding sub-layer that the maximum delay and/or the maximum loss

applies to";

}

leaf \_3gpp-5gs-node-max-latency {

type uint32;

units "nanoseconds";

description

"Maximum latency from 5GS node ingress to 5GS node egress(es) for a single packet of the

DetNet flow. It is specified as an integer number of nanoseconds";

}

leaf \_3gpp-5gs-node-max-loss {

type uint32;

description

"Maximum Packet Loss Ration (PLR) parameter for the DetNet service between the 5GS node

ingress and 5GS node egress(es)";

}

}

container \_3gpp-5gs-node-configuration-outcome {

description

"This container defines the additional outcome the 5GS may provide to a configuration

request";

leaf \_forwarding-sub-layer {

type dnet:forwarding-sub-layer-ref;

description

"Reference to the forwarding sub-layer the outcome to a configuration request applies to";

}

leaf \_3gpp-5gs-node-configuration-status {

type \_3gpp-5gs-node-configuration-status;

description "Changes on configuration status reported by the 3GPP 5GS node";

}

}

container \_3gpp-5gs-node-identity {

description

"This container defines the 5GS Node identity the 5GS provides to the DetNet controller";

leaf \_forwarding-sub-layer {

type dnet:forwarding-sub-layer-ref;

description

"Reference to the forwarding sub-layer that the 5GS node Id applies to";

}

leaf \_3gpp-5gs-node-id {

type string;

description

"5GS node identity. It is the user-plane node Id handling the traffic of the indicated

DetNet flows";

}

}

}

<CODE ENDS>

Annex D (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2021-08 |  |  |  |  |  | TS skeleton | 0.0.0 |
| 2021-08 | CT3#117e | C3-214576 |  |  |  | Inclusion of documents agreed in CT3#117e:  C3-214145, C3-214149, C3-214154, C3-214466, C3-214467, C3-214468, C3-214469, C3-214505, C3-214506, C3-214507, C3-214508, C3-214509, C3-214510 | 0.1.0 |
| 2021-10 | CT3#118e | C3-215473 |  |  |  | Inclusion of documents agreed in CT3#118e:  C3-215347, C3-215348, C3-215349, C3-215350, C3-215351, C3-215352, C3-215353, C3-215354, C3-215356, C3-215357, C3-215358, C3-215470 | 0.2.0 |
| 2021-11 | CT3#119e | C3-216517 |  |  |  | Inclusion of documents agreed in CT3#119e:  C3-216114, C3-216115, C3-216116, C3-216121, C3-216397, C3-216398, C3-216399, C3-216400, C3-216401, C3-216402, C3-216426, C3-216594, C3-215357, C3-216595 | 0.3.0 |
| 2021-12 | CT#94-e | CP-213208 |  |  |  | Presentation for information | 1.0.0 |
| 2022-01 | CT3#119bis-e | C3-220449 |  |  |  | Inclusion of documents agreed in CT3#119bis-e:  C3-220424, C3-220165, C3-220166, C3-220167, C3-220425, C3-220423, C3-220415, C3-220359, C3-220172 | 1.1.0 |
| 2022-02 | CT3#120e | C3-221512 |  |  |  | Inclusion of documents agreed in CT3#120e:  C3-221181, C3-221184, C3-221185, C3-221186, C3-221187, C3-221189, C3-221190, C3-221191, C3-221192, C3-221237, C3-221445, C3-221446, C3-221469, C3-221552, C3-221606, C3-221650 | 1.2.0 |
| 2022-04 | CT3#121e | C3-222482 |  |  |  | Inclusion of documents agreed in CT3#121e:  C3-222176, C3-222177, C3-222178, C3-222179, C3-222181, C3-222182, C3-222183, C3-222295, C3-222420, C3-222424, C3-222435, C3-222489, C3-222503, C3-222507, C3-222555, C3-222556, C3-222564, | 1.3.0 |
| 2022-05 | CT3#122e | C3-223505 |  |  |  | Inclusion of documents agreed in CT3#122e:  C3-223121, C3-223122, C3-223124, C3-223126, C3-223229, C3-223230, C3-223131, C3-223132, C3-223283, C3-223286, C3-223469, C3-223471, C3-223472, C3-223490, C3-223494, C3-223495, C3-223660, C3-223661, C3-223693, C3-223739, C3-223744, C3-223749, | 1.4.0 |
| 2022-06 | CT#96 | CP-221099 |  |  |  | Presentation to TSG CT for approval | 2.0.0 |
| 2022-06 | CT#96 | CP-221099 |  |  |  | Approved by TSG CT | 17.0.0 |
| 2022-09 | CT#97e | CP-222113 | 0001 | - | F | Add PUT method in table 6.1.3.1-1 | 17.1.0 |
| 2022-09 | CT#97e | CP-222113 | 0002 | 1 | F | Correction to 5G access time distribution | 17.1.0 |
| 2022-09 | CT#97e | CP-222114 | 0003 | 1 | F | Correction to initial provisioning of TSC related service information | 17.1.0 |
| 2022-09 | CT#97e | CP-222113 | 0004 | - | F | Correction to notification about TSC application session context event | 17.1.0 |
| 2022-09 | CT#97e | CP-222113 | 0005 | - | F | Correction to notification about TSC application session context termination | 17.1.0 |
| 2020-09 | CT#97e | CP-222113 | 0006 | 1 | F | Correction to subscription to events for the existing TSC application session context | 17.1.0 |
| 2022-09 | CT#97e | CP-222114 | 0007 | 1 | F | Correction to the procedure of creating a new subscription | 17.1.0 |
| 2022-09 | CT#97e | CP-222113 | 0009 | 1 | F | Corrections to the methods of Ntsctsf\_ASTI Service API | 17.1.0 |
| 2022-09 | CT#97e | CP-222113 | 0010 | 1 | F | Corrections to the methods of Ntsctsf\_QoSandTSCAssistance API | 17.1.0 |
| 2022-09 | CT#97e | CP-222113 | 0011 | - | F | Corrections to the methods of Ntsctsf\_TimeSynchronization API | 17.1.0 |
| 2022-09 | CT#97e | CP-222114 | 0013 | 1 | F | Handling of temporal validity condition | 17.1.0 |
| 2022-09 | CT#97e | CP-222113 | 0018 | - | F | Support of sponsored connectivity | 17.1.0 |
| 2022-09 | CT#97e | CP-222114 | 0019 | 1 | F | Correction to the references | 17.1.0 |
| 2022-09 | CT#97e | CP-222114 | 0020 | 1 | F | Correction to time synchronization capabilities subscription | 17.1.0 |
| 2022-09 | CT#97e | CP-222114 | 0021 | 1 | F | Data Model corrections | 17.1.0 |
| 2022-09 | CT#97e | CP-222114 | 0022 | 1 | F | Correction of the association of Time Sync Exposure subscriptions to AF sessions | 17.1.0 |
| 2022-09 | CT#97e | CP-222114 | 0023 | 1 | F | Correction of the handling of AM policies upon Time Sync configuration | 17.1.0 |
| 2022-09 | CT#97e | CP-222114 | 0024 | 1 | F | TSCTSF API corrections | 17.1.0 |
| 2022-09 | CT#97e | CP-222183 | 0025 | 1 | F | Mapping of GPSIs and Group Identifiers to a SUPI list | 17.1.0 |
| 2022-09 | CT#97e | CP-222113 | 0026 | - | F | Definitions of HTTP "403 Forbidden" response | 17.1.0 |
| 2022-09 | CT#97e | CP-222113 | 0027 | - | F | Initial provisioning of TSC related service information | 17.1.0 |
| 2022-09 | CT#97e | CP-222121 | 0028 | - | F | Update of info and externalDocs fields | 17.1.0 |
| 2022-12 | CT#98 | CP-223181 | 0029 | 1 | F | Corrections in the error budget calculation | 17.2.0 |
| 2022-12 | CT#98 | CP-223181 | 0030 | - | F | Miscellaneous corrections in the Time Synchronization API | 17.2.0 |
| 2022-12 | CT#98 | CP-223181 | 0033 | - | F | Correction to Ethernet flows | 17.2.0 |
| 2022-12 | CT#98 | CP-223188 | 0034 | - | F | Update of info and externalDocs fields | 17.2.0 |
| 2022-12 | CT#98 | CP-223191 | 0031 | - | F | Adding the mandatory error code 502 Bad Gateway | 18.0.0 |
| 2022-12 | CT#98 | CP-223192 | 0032 | 1 | F | TscEvent enumeration definition in the OpenAPI file | 18.0.0 |
| 2022-12 | CT#98 | CP-223190 | 0035 | - | F | Update of info and externalDocs fields | 18.0.0 |
| 2023-03 | CT#99 | CP-230179 | 0036 | 1 | B | Adding PER to TSC QoS inputs | 18.1.0 |
| 2023-03 | CT#99 | CP-230154 | 0038 | 1 | A | Correction to Ntsctsf\_TimeSynchronization Service | 18.1.0 |
| 2023-03 | CT#99 | CP-230154 | 0040 |  | A | Correction to Ntsctsf\_TSCQoSandAssistance Service | 18.1.0 |
| 2023-03 | CT#99 | CP-230154 | 0042 |  | A | Correction to Ntsctsf\_ASTI Service | 18.1.0 |
| 2023-03 | CT#99 | CP-230174 | 0043 |  | F | Generalization of QoS monitoring control description | 18.1.0 |
| 2023-03 | CT#99 | CP-230179 | 0044 | 1 | B | Service description – support of network timing synchronization status and reporting | 18.1.0 |
| 2023-03 | CT#99 | CP-230179 | 0045 | 1 | B | Provisioning of coverage area filters for ASTI service | 18.1.0 |
| 2023-03 | CT#99 | CP-230179 | 0046 | 1 | B | Notification of 5G Access Stratum Time Distribution enabled/disabled | 18.1.0 |
| 2023-03 | CT#99 | CP-230179 | 0047 |  | B | Provisioning of coverage area and notification of changes of capabilities configuration | 18.1.0 |
| 2023-03 | CT#99 | CP-230175 | 0048 |  | B | Specification of application errors for TSC QoS requests | 18.1.0 |
| 2023-03 | CT#99 | CP-230175 | 0049 | 1 | B | Indication of Alternative Service Requirements not supported | 18.1.0 |
| 2023-03 | CT#99 | CP-230154 | 0051 | 1 | A | Correction to QoS notification control | 18.1.0 |
| 2023-03 | CT#99 | CP-230179 | 0053 | 1 | B | Support of BAT window and capability for BAT adaptation | 18.1.0 |
| 2023-03 | CT#99 | CP-230162 | 0055 |  | F | Update of info and externalDocs fields | 18.1.0 |
| 2023-06 | CT#100 | CP-231143 | 0057 | 1 | B | Adding PER to QoS service operation description | 18.2.0 |
| 2023-06 | CT#100 | CP-231143 | 0058 | 1 | B | Network determined BAT offset and periodicity adaption | 18.2.0 |
| 2023-06 | CT#100 | CP-231143 | 0059 | 1 | B | The correction on the BAT window and BAT adaptation capability | 18.2.0 |
| 2023-06 | CT#100 | CP-231127 | 0060 | 3 | B | Support for network timing synchronization status and reporting | 18.2.0 |
| 2023-06 | CT#100 | CP-231131 | 0061 | 1 | F | Adding missing presence conditions | 18.2.0 |
| 2023-06 | CT#100 | CP-231149 | 0062 | 3 | B | Support of traffic characteristics and monitoring of performance characteristics | 18.2.0 |
| 2023-06 | CT#100 | CP-231143 | 0065 | 3 | F | Adding description for controlling time synchronization service | 18.2.0 |
| 2023-06 | CT#100 | CP-231180 | 0068 | 1 | A | Correction on setting Packet Delay Failure report Threshold | 18.2.0 |
| 2023-06 | CT#100 | CP-231134 | 0071 | 1 | F | Adding the time domain to procedures for provisioning TSC information | 18.2.0 |
| 2023-06 | CT#100 | CP-231131 | 0072 |  | F | Corrections to the redirection mechanism description | 18.2.0 |
| 2023-06 | CT#100 | CP-231151 | 0073 | 1 | B | 3GPP extensions to DetNet YANG model to support 5GS specifics | 18.2.0 |
| 2023-06 | CT#100 | CP-231151 | 0074 | 1 | B | Definition of 3gpp-5gs-detnet-node YANG file | 18.2.0 |
| 2023-06 | CT#100 | CP-231141 | 0075 |  | F | Update of info and externalDocs fields | 18.2.0 |
| 2023-09 | CT#101 | CP-232105 | 0077 | 1 | B | TSCTSF handling when it receives the time sync request from AF and subscription from UDM and the data model definition | 18.3.0 |
| 2023-09 | CT#101 | CP-232098 | 0078 |  | F | Remove the trailing slash in the relative path after API URI | 18.3.0 |
| 2023-09 | CT#101 | CP-232185 | 0079 | 2 | F | Corrections to the definition of AF requested QoS for a UE or group of UEs | 18.3.0 |
| 2023-09 | CT#101 | CP-232098 | 0080 |  | F | Corrections to the redirection mechanism description | 18.3.0 |
| 2023-09 | CT#101 | CP-232098 | 0081 |  | F | Update the apiVersion in the QoSandTSCAssistance Service API | 18.3.0 |
| 2023-09 | CT#101 | CP-232105 | 0082 | 1 | B | Resource and data model for the Ntsctsf\_ASTI API | 18.3.0 |
| 2023-09 | CT#101 | CP-232105 | 0083 | 1 | B | Service description for the Ntsctsf\_ASTI service | 18.3.0 |
| 2023-09 | CT#101 | CP-232085 | 0084 | - | F | Update of info and externalDocs fields | 18.3.0 |
| 2023-12 | CT#102 | CP-233245 | 0086 | 1 | F | Reslove the EN about AF requested QoS for a UE or group of UE(s) | 18.4.0 |
| 2023-12 | CT#102 | CP-233228 | 0087 |  | F | HTTP RFCs obsoleted by IETF RFC 9113 | 18.4.0 |
| 2023-12 | CT#102 | CP-233200 | 0088 | 2 | B | Support the status information on ASTI service | 18.4.0 |
| 2023-12 | CT#102 | CP-233248 | 0089 | 1 | B | Clarification on time synchronization service | 18.4.0 |
| 2023-12 | CT#102 | CP-233266 | 0091 | 3 | B | Solving remaining Editor's Note(s) for DetNet | 18.4.0 |
| 2023-12 | CT#102 | CP-233248 | 0092 | 1 | B | Correction to clock quality information | 18.4.0 |
| 2023-12 | CT#102 | CP-233248 | 0094 | 1 | B | Update to the time synchronization status and the report | 18.4.0 |
| 2023-12 | CT#102 | CP-233248 | 0095 | 1 | F | Removal of Editor’s Note | 18.4.0 |
| 2023-12 | CT#102 | CP-233229 | 0096 | 1 | F | ProblemDetails RFC 7807 obsoleted by RFC 9457 | 18.4.0 |
| 2023-12 | CT#102 | CP-233201 | 0097 | 1 | F | Update the time synchronization status parameters | 18.4.0 |
| 2023-12 | CT#102 | CP-233266 | 0098 | 1 | B | Completion of YANG module for 3GPP extensions to IETF DetNet | 18.4.0 |
| 2023-12 | CT#102 | CP-233269 | 0099 | 1 | A | Miscellaneous Corrections | 18.4.0 |
| 2023-12 | CT#102 | CP-233135 | 0100 | 2 | B | Notification of Access Stratum Time Distribution configuration changes | 18.4.0 |
| 2023-12 | CT#102 | CP-233269 | 0101 | 1 | F | Update of info and externalDocs fields | 18.4.0 |