**3GPP TSG-SA WG6 Meeting #49-bis-e S6-221765**

**e-meeting, 22nd June – 1st July 2022 (revision of S6-221723)**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **23.434** | **CR** | **0109** | **rev** | **1** | **Current version:** | **18.1.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network | **X** |

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|  |
| ***Title:***  | Enhance 5G TSC with time synchronization |
|  |  |
| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | S6 |
|  |  |
| ***Work item code:*** | eSEAL2 |  | ***Date:*** | 2022-06-16 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Time synchronization is needed for the DS-TTs involved in 5G TSC stream to satisfy the requirements of time sensitive QoS. How it is achieved is currently not specified in TS 23.434. |
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| ***Summary of change:*** | SEAL NRM server involved in managing the TSC stream availability discovery, creation, and deletion will also manage discovery, activation and deactivation of 5GS time synchronization capabilities for the managed TSC streams. |
|  |  |
| ***Consequences if not approved:*** | The requirements for 5G TSC communication cannot be fulfilled. |
|  |  |
| ***Clauses affected:*** | 14.2.2.3, 14.3.7.2, 14.3.7.3, 14.3.7.4, 14.3.2.24, 14.3.2.26 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **N** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **N** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **N** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

\* \* \* First Change \* \* \* \*

#### 14.2.2.3 On-network functional model for network resource management for 5G TSC

5G TSC refers to time sensitive communication service offered within the 5G system (i.e. without integration with a TSN system) by the 5GS for the UEs connected to the 5GS. The architecture for the 5G TSC is depicted in Figure 14.2.2.3-1. The SEAL NRM server acts as an AF towards the 5G Core Network and performs coordination of QoS flows to fulfill the end-to-end QoS requirements for the UEs involved in the TSC communication. It combines the roles of TSCTSF and TSC CNC (similar to the TSN CNC in the TSN integration case), which means that it controls the allocation of resources of TSC communication within the boundaries of the 5G domain and enables time synchronization for the DS-TTs.

Editor's note: The impact of combining the roles of TSCTSF and TSC CNC in the SEAL NRM server for time synchronization is FFS.

Upon request from a VAL server via the NRM-S reference point it configures the TSC end-to-end QoS flows and time synchronization in the 5GS. In line with other SEAL service enablers the SEAL NRM server provides a RESTful interface on the NRM-S reference point. As a TSCTSF the SEAL NRM server interacts with the 5GS PCF over the N5/N84 reference points to configure the 5G QoS, TSCAI parameters, and time synchronization parameters in the 5GS.



Figure 14.2.2.3-1: On-network functional model for network resource management for 5G TSC

\* \* \* Next Change \* \* \* \*

#### 14.3.7.2 TSC stream availability discovery procedure

The TSC stream availability discovery procedure is used by the VAL server to discover the availability of resources for TSC communication for the given stream specification (i.e., between the target UEs) prior to creating the stream.

Pre-conditions:

1. Each UE has an established Ethernet PDU session and DS-TTs are connected to the 5GS TSC bridge. The traffic classes are configured on each DS-TT.

2. The NRM server has collected the 5GS TSC bridge management, port management information, and time synchronization information. The port management information is related to the Ethernet ports located in the DS-TTs including bridge delay per DS-TT Ethernet port pair per traffic class. The time synchronization information is related to the availability of the time synchronization service and the capabilities of the service in terms of PTP capabilities of the DS-TTs, 5G clock quality, etc. as described in clause K.2.1 of TS 23.501 [10].

3. NRM server has calculated the bridge delay for each port pair, i.e. composed of (ingress DS-TT Ethernet port, egress DS-TT Ethernet port) including the UE-DS-TT residence time, packet delay budget (PDB) and propagation delay for both UL from sender UE and DL to receiver UE.



Figure 14.3.7.2-1: TSC stream availability discovery procedure

1. The NRM server receives a request from a VAL server on NRM-S reference point to discover the connectivity and available QoS characteristics between DS-TTs identified by the stream specification.

2. The NRM server validates the connectivity between the DS-TTs connected in the same 5GS TSC bridge based on the collected 5GS TSC bridge management and port management information, identifies the traffic classes supported by the DS-TTs and determines the end-to-end latency (including the UE-DS-TT residence times, PDBs and propagation delay) and the time synchronization availability and capabilities supported by the DS-TTs.

3. NRM server responds to the VAL server with the stream specification and a list of traffic specifications with the available end-to-end latency and the traffic classes supported by the DS-TTs and indication of time synchronization availability.

\* \* \* Next Change \* \* \* \*

#### 14.3.7.3 TSC stream creation procedure

This procedure allows the VAL server to create a TSC stream. The TSC stream creation procedure enables the VAL server to establish TSC connectivity with the required QoS between the UEs connected to the 5GS after the stream discovery procedure.

Pre-conditions:

1. Each UE has an established Ethernet PDU session for its DS-TT port MAC address.

2. Connectivity between the DS-TTs has been validated by the TSC stream availability discovery procedure.

3. NRM server maintains mapping from the traffic class to TSC QoS.



Figure 14.3.7.3-1: TSC stream creation procedure

1. NRM server receives a TSC stream creation request from a VAL server to create a TSC stream identified by a VAL Stream ID, between DS-TT ports in the stream specification and for the traffic class in the traffic specification.

2. NRM server calculates the schedule for the VAL Stream ID based on the information collected earlier from the 5GS via N5. It provides per-stream filtering and policing parameters (e.g. as defined in IEEE 802.1Q [IEEE8021Q]) used to derive the TSC QoS information and related flow information. NRM server also provides the forwarding rule (e.g. as defined in IEEE 802.1Q [IEEE8021Q]) used to identify the DS-TT MAC address of the corresponding PDU session. Based on the 5GS bridge delay information it determines the TSC QoS information and TSC Assistance information for the stream.

3. As a TSCTSF, the NRM server triggers via N5/N84 the Npcf\_PolicyAuthorization\_Create service operation as described in 3GPP TS 23.502 [11] for the TSC stream for both UL QoS flow (sender UE to UPF/bridge) and DL QoS flow (UPF/bridge to receiver UE). The Policy Authorization request includes the DS-TT port MAC address, TSC QoS information, TSC Assistance Information (3GPP TS 23.501 [1], cl.5.27.2.3), flow bit rate, priority, Service Data Flow Filter containing flow description including Ethernet Packet Filters, and PTP instance configuration (determined by the NRM server) for the DS-TTs as described in clause K.2.2 1 of TS 23.501 [10] and activation of the gPTP time distribution as described in clause 4.15.9.3 of TS 23.502 [11]. The QoS flow will be assigned for the PDU session for the source MAC address for the UL direction and for the PDU session for the destination MAC address for the DL direction. This information is delivered to the DS-TT by the 5GS.

Editor's note: Using gate control parameters for hold and forward buffering is FFS.

4. NRM server sends TSC stream creation response to the VAL server with the result of TSC stream creation for the VAL Stream ID.

\* \* \* Next Change \* \* \* \*

#### 14.3.7.4 TSC stream deletion procedure

This procedure allows the VAL server to delete a TSC stream.

Pre-conditions:

1. The TSC stream is configured in the 5GS and the DS-TTs.



Figure 14.3.7.4-1: TSC stream deletion procedure

1. NRM server receives a request from VAL server to delete a TSC stream for with a VAL Stream ID.

2. NRM server identifies the MAC addresses of the DS-TTs involved in the stream based on the stored information for the VAL Stream ID.

3. As a TSCTSF, the NRM server triggers via N5/N84 the Npcf\_PolicyAuthorization\_Update service operation defined in 3GPP TS 23.502 [11] for MAC addresses referred to by the VAL Stream ID. NRM server uses the procedure to delete both UL QoS flow (sender UE to UPF/bridge) and DL QoS flows (UPF/bridge to receiver UE) from the PDU sessions of the UEs referred to by the VAL Stream ID. The NRM server uses the procedures described in clause K.2.2 of TS 23.501 [10] to disable the corresponding PTP instance(s) in the DS-TT(s) and uses the procedure in clause 4.15.9.3 of TS 23.502 [11] to deactivate the gPTP time distribution.

4. NRM server sends TSC stream deletion response to the VAL server with the result of TSC stream deletion for the VAL Stream ID.

\* \* \* Next Change \* \* \* \*

#### 14.3.2.24 TSC stream availability discovery response

Table 14.3.2.24-1 describes the information flow TSC stream availability discovery response from the NRM server to the VAL server.

Table 14.3.2.24-1: TSC stream availability discovery response

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| Result | M | Result includes success or failure of the TSC stream availability discovery with the underlying network. |
| Stream specification | M | Stream specification includes MAC addresses of the source and destination DS-TT ports (e.g. as defined in IEEE 802.1CB [37]). |
| List of traffic specifications | M | The traffic classes supported by the DS-TTs and available end-to-end MaxLatency value per traffic class. The VAL server should not request lower latency than the available end-to-end latency. |
| Time synchronization indication | O | Indication whether time synchronization is available for the TSC stream. |

\* \* \* Next Change \* \* \* \*

#### 14.3.2.26 TSC stream creation response

Table 14.3.2.26-1 describes the information flow TSC stream creation response from the NRM server to the VAL server.

Table 14.3.2.26-1: TSC stream creation response

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| Result | M | Result includes success or failure of the TSC stream creation. |
| VAL Stream ID | M | It identifies the VAL stream. |
| Time synchronization indication | O | Indication whether time synchronization is available for the TSC stream. |

\* \* \* End of Changes \* \* \* \*