**3GPP TSG-SA WG2 Meeting #140e S2-200xxyy**

**August 19 – September 02, 2020, Online (revision of *S2-200xxyxy*)**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **23.501** | **CR** | **???** | **rev** | **-** | **Current version:** | **16.5.1** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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| ***Title:***  | 5GS BMCA support and PTP port state configuration |
|  |  |
| ***Source to WG:*** | Qualcomm Incorporated, Ericsson |
| ***Source to TSG:*** | SA WG2 |
|  |  |
| ***Work item code:*** | Vertical LAN |  | ***Date:*** | 2020-07-17 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** | Rel-16 |
|  | *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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | In the LS in S2-2004336 IEEE 802.1 points out that Best Master Clock Algorithm (BMCA) support is mentioned in TS 23.501 but there is no mention how this is done.As IEEE 802.1 illustrates, the gPTP instances in 5GS are distributed (the DS-TT and NW-TT Ethernet ports) but there is no coordination amongst them with respect to evaluation of Announce messages and subsequent selection of the best clock as required for BMCA. There is currently also no coordination how the PTP port states are configured for DS-TT and NW-TT ports to achieve a time-synchonization spanning tree based on BMCA. In fact, such clock selection and PTP port state coordination would need to be done centrally as also argued in S2-2004336. This however has not been specified in Rel-16.Given that Rel-16 only supports TSN GM connected to NW-TT and furthermore, given that IEEE 802.1AS also supports a model where the PTP port states are configured without use of BMCA (method b defined in IEEE 802.1AS [104] clause 10.3.1.1) the PTP port states can be configured locally in DS-TT and NW-TT as follows:- For DS-TT ports the PTP port state is MasterPort for all TSN working domains.- For one of the NW-TT ports (per each TSN working domain) the PTP port state is SlavePort while for all other NW-TT ports of the same TSN working domain the PTP port state is either PassivePort or SlavePort (depending on implementation).-Clarify that When 5GS is master, all NW-TT ports are in master state |
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| ***Summary of change:*** | Update clause 5.27.1 to - remove statements about BMCA support- clarify that PTP port state is assumed to be locally configured in - For DS-TT ports the PTP port state is MasterPort for all TSN working domains.- For one of the NW-TT ports (per each TSN working domain) the PTP port state is SlavePort while for all other NW-TT ports of the same TSN working domain the PTP port state is either PassivePort or SlavePort (depending on implementation). |
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| ***Consequences if not approved:*** | Interoperability issues with other Ethernet switches connected to 5GS due to incorrect statements about BMCA support for 5GS- |
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| ***Clauses affected:*** | 5.27.1.1 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

<<< Start of changes >>>

#### 5.27.1.1 General

For supporting TSN time synchronization, the 5GS is integrated with the external network as a TSN bridge as described in clauses 4.4.8 and 5.28.1. It shall be modelled as an IEEE 802.1AS [104] compliant entity according to TS 22.104 [105]. For TSN Synchronization, the entire E2E 5G system can be considered as an IEEE 802.1AS [104] "time-aware system". Only the TSN Translators (TTs) at the edges of the 5G system need to support the IEEE 802.1AS [104] operations. UE, gNB, UPF, NW-TT and DS- TTs are synchronized with the 5G GM (i.e. the 5G internal system clock) which shall serve to keep these network elements synchronized. The TTs located at the edge of 5G system fulfil some functions related to IEEE 802.1AS [104], e.g. (g)PTP support, timestamping, rateRatio. Figure 5.27.1-1 illustrates the 5G and TSN clock distribution model via 5GS.



Figure 5.27.1-1: 5G system is modelled as IEEE 802.1AS compliant time aware system for supporting TSN time synchronization

Figure 5.27.1-1 depicts the two synchronizations systems considered: the 5GS synchronization and the TSN domain synchronization, as well as the Master (M) and Slave (S) ports considered when the TSN GM is located at TSN working domain.

- 5GS synchronization: Used for NG RAN synchronization. 5G RAN synchronization is specified in TS 38.331 [28].

- TSN domain synchronization: Provides synchronization service to TSN network. This process follows IEEE 802.1AS [104].

The two synchronization processes can be considered independent from each other and the gNB only needs to be synchronized to the 5G GM clock.

To enable TSN synchronization, the 5GS calculates and adds the measured residence time between the TTs into the Correction Field (CF) of the synchronization packets of the TSN working domain.

In this release, 5GS only supports method b) defined in IEEE 802.1AS [104] clause 10.3.1.1 for determining the grandmaster PTP Instance and the time-synchronization spanning tree.

This implies that in this release the PTP port states are assumed to be locally configured as follows:

- For DS-TT ports the PTP port state is MasterPort for all TSN working domains.

- When the TSN GM is external to the 5GS, for one of the NW-TT ports (per each TSN working domain) the PTP port state is SlavePort while for all other NW-TT ports of the same TSN working domain the PTP port state is either PassivePort or SlavePort (depending on implementation).

- When the 5GS is configured as master for the connected networks, all NW-TT ports are in MasterPort state.

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