**SA WG2 Meeting #141E S2-200xxxx**

**19 August - 02 September 2020, Electronic meeting**

**Source: NTT DOCOMO**

**Title: KI#1: Sol#17: Updates on Solution #17**

**Document for: Discussion/Approval**

**Agenda Item: 8.5**

**Work Item / Release: FS\_IIoT / Rel-17**

*Abstract of the contribution: clarifications to Solution 17*

# 1 Discussion

# Xxx

# 2 Proposal

The following change is proposed for TR 23.700-20.

\*\*\* Start Change \*\*\*

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## 6.17 Solution #17: U-plane BMCA solution for the key issue#1

### 6.17.1 Introduction

The solution is proposed to solve Key Issue #1: the UL Time Synchronization. Specially, this solution resolves the BMAC part of UL Time Synchronization. It can work with Solution#1.

In the IEEE 802.1AS [6], before the time synchronization is performed, the time-synchronization spanning tree shall be established first for particular TSN time domain. The spanning tree is to 1) avoid the message loop for time synchronization and 2) determine the port state of the (g)PTP entity.

There are two methods to establish the time-synchronization spanning tree:

- BMCA (best master clock algorithm).

- The port states and grandmaster are configured.

To support the BMCA in the 5GS logical TSN Bridge, a centralized handling is required.

### 6.17.2 Functional Description

In the figure 6.17.2-1, it introduces a BMCA function in the NW-TT. All the BMCA related process is handled by BMCA function



Figure 6.17.2-1: 5GS TNS bridge support BMCA

When the DS-TT port or NW-TT port receives the Announce message, it forwards the message to BMCA function in U-plane.

The BMCA function runs the BMCA algorithm according to 802.1AS or IEEE 1588-2008. The BMCA function:

- determines the GrandMaster clock for a clock domain;

- determines and maintains the port state of DS-TT port and NW-TT port of the 5GS TSN bridge;

- runs a PortAnnounceTransmit state machine for each DS-TT port and NW-TT port to update and send Announce messages to nodes outside the 5GS.

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### 6.17.3 Procedures

The procedure for BMCA is described in Figure 6.17.3-1. It assumes there are 3 GM clock candidates. The clock-1 resides in the TSN network connect to the DS-TT1/UE1, the clock-2 resides in the network connect to the DS-TT2/UE2, and the clock-3 resides in the network connect to the NW-TT.



Figure 6.17.3.-1: Procedure for BMCA via 5G System

The NW-TT port is Port-N.

1. The DS-TT1/UE1 establish the PDU Session for TSC which is specified in the TS 23.502 [3]. The UPF/NW-TT allocates the Port-1 for the DS-TT1/UE1.

2. The DS-TT2/UE2 establish the PDU Session for TSC which is specified in the TS 23.502 [3]. The UPF/NW-TT allocates the Port-2 for the DS-TT2/UE2.

3. The gPTP Announce message from clock-3 arrives the Port-N (i.e. NW-TT).

4. The BMCA function in the UPF/NW-TT determine the clock 3 as GM clock for the time domain. The BMCA function locally assigns the state of port which receives the Announce message from clock 3 as SlavePort (i.e. Port-N), and Port-1 and Port-2 as MasterPort.

5. The BMCA function generates and forwards the Announce message(s), separately for each DS-TT and NW-TT port, from GM clock (i.e. clock-3) to MasterPort(s) based on the updated PortStates and AnnouceSendTimer of the port.

6. The gPTP Announce message from clock-2 arrives the Port-2 (i.e. DS-TT2/UE2). The DS-TT2/UE2 forwards the message to UPF/NW-TT.

7. The BMCA function in the UPF/NW-TT determine the clock 2 as GM clock for the time domain. The BMCA function locally assigns the state of port which receives the Announce message from clock 2 as SlavePort (i.e. Port-2), and Port-1 and Port-N as MasterPort.

8. The BMCA function generates and forwards the Announce message(s), separately for each DS-TT and NW-TT port, from GM clock (i.e. clock-2) to MasterPort(s) based on the updated PortStates and AnnouceSendTimer of the port.

9. The gPTP Announce message from clock-1 arrives the Port-1 (i.e. DS-TT1/UE1). The DS-TT1/UE1 forward the message to UPF/NW-TT.

10. The BMCA function in the UPF/NW-TT determine the GM clock and Port state are not changed. The BMCA function generates and forwards the Announce message(s) from GM clock (i.e. clock-2) to MasterPort(s) based on the existing PortStates according to AnnouceSendTimer of the port.

### 6.17.4 Impacts on services, entities and interfaces

NW-TT/UPF:

- There is BMCA function inside the NW-TT/UPF.

- The BMCA function run the BMCA algorithm according to 802.1AS or IEEE 1588-2008. It:

- determines the GrandMaster clock for a clock domain;

- determines and maintains the port state of DS-TT port and NW-TT port of the 5GS TSN bridge;

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- runs a PortAnnounceTransmit state machine for each DS-TT port and NW-TT port to update and send Announce messages to nodes outside the 5GS.