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

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**Title:** **KI #2, evaluation: aligning UE to UE TSN traffic with the 3GPP architecture**

**Document for: Agreement**

**Agenda Item: 8.5**

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*Abstract of the contribution: We propose a number of principles to progress the outstanding questions on Key Issue #2 on UE to UE traffic.*

# Introduction

The paper discusses the main outstanding issues for Key Issue #2 on UE to UE communication. A separate paper S2-200xxx discusses Ethernet bridging principles. In that paper, among other things we have clarified that all Ethernet hosts can always communicate with each other on the same Ethernet network; no pre-configuration is needed for connectivity. Therefore, UE-UE communication is always possible between UEs connected to the same Ethernet network.

We build on these general Ethernet bridging principles and propose to take a number of principles as a way forward for Key Issue 2.

# Setup of bridge forwarding rules

The setup of bridge forwarding is not a TSN specific question; both non-TSN and TSN traffic requires the setup of bridge forwarding rules. Note that in common deployments the communicating endhosts may first exchange non-TSN traffic before engaging in TSN communication. As mentioned above, in an Ethernet network all hosts can always communicate, so there is no pre-configuration needed for UE to UE communication.

The bridge forwarding may use a number of mechanisms or a combination of them. The basic Ethernet flooding in combination with MAC learning may be used; or the CNC may also explicitly set static filtering entries. The central CNC control may be necessary for the CNC to be able to control the forwarding path considering the TSN stream characteristics and their relationship to bridge delay. CNC static filtering entries may be also needed to consider the VLANs and/or multicast destination addresses that are in common use for TSN streams.

We therefore conclude on the following principles.

**Principle 1: There is no pre-configuration needed to enable UE to UE communication; this is always possible by default when the UEs are in the same Ethernet network.**

**Principle 2: The setup of bridge forwarding is logically independent from the setup of TSN streams, since both non-TSN and TSN traffic needs to be forwarded.**

**Principle 3: Static filtering entries provided by the CNC also need to be supported besides other already specified means of bridge forwarding.**

In some solutions the PCC rules which are derived from TSN stream information are used to setup forwarding rules. This can be problematic, since the PCC rules may not include the necessary information for a forwarding rule (destination MAC address and VLAN mapped to the outgoing port), as the flow filtering may be based on another header field. But the main problem is that the forwarding needs to be independent from the PCC rules that are meant for QoS only. The forwarding rules are necessary for both non-TSN and TSN traffic, hence they cannot be tied to PCC rules that are specific to a TSN stream.

**Principle 4: PCC rules derived from TSN stream information are not used to derive forwarding rules.**

# 3GPP system awareness of UE to UE traffic?

The TSN AF needs to be aware that a given stream is UE to UE, since it needs to identify the involved DS-TTs and associated PDU Sessions and provide the stream specific QoS parameters separately to the PCF(s) for the PDU session carrying the uplink traffic, and for the PDU session(s) carrying the downlink traffic. Besides that, the question can be asked whether other control entities (the PCF and the SMF) really need to be aware of UE to UE traffic?

As we have seen above, the bridge forwarding is set up independently from the TSN stream QoS information, so there is no need for the awareness of UE to UE traffic in the PCF or SMF from the point of view of packet forwarding.

For QoS setup, the PCF and the SMF ensure that the QoS requirements on a given PDU Session are met, as already specified. For UE to UE traffic, the 5GS bridge delay is calculated by summing the delay on the uplink PDU session and on the downlink PDU session (plus the residence times in the devices and the UPF). Therefore, it is sufficient for the PCF and SMF to only consider the single PDU session that they are responsible for, and they don’t need to consider that the traffic is UE to UE. Once the QoS requirements in the individual PDU sessions are met, it is guaranteed that the overall system QoS requirements are also met. So for fulfilling the QoS requirements, there is no need for the PCF and the SMF to be aware that the PDU session is carrying a UE to UE traffic flow.

As UE to UE traffic awareness in the SMF and PCF is not necessary for traffic forwarding setup or for QoS, we conclude that the SMF and PCF do not need to be aware that the PDU session carries a UE to UE traffic stream. This is also in line with the current 3GPP system architecture where a PDU session only deals with carrying traffic between the UE and the UPF with the appropriate QoS, which is not dependent on whether that traffic flow will be forwarded to another UE or not.

**Principle 5: The PCF and the SMF are not aware of whether the PDU session carries a UE to UE traffic flow or not.**

# Opportunistic QoS optimizations after the establishment of TSC

We assume that time sensitive communication is established using the following two phases in general.

1. Verify whether the application requirements in terms of guaranteed delay can be satisfied by the system based on the 5GS bridge delay that is reported in advance.

2. If yes, the time sensitive communication is established, and the system needs to observe the delay guarantees that it has reported.

This means that time sensitive communication is started only if the delay requirements could be satisfied already from the very beginning. It may be possible for the 3GPP system to try to further optimize the QoS, but for the application point of view the important thing is to satisfy the requirement that was communicated before the communication was started.

Therefore, opportunistic QoS optimizations, e.g., to further lower the delay of an ongoing flow beyond the guarantees that were given in advance, are of little importance. It is proposed not to standardize mechanisms for such opportunistic QoS optimizations. This does not prevent operators or vendors to optimize the QoS, but for time sensitive communications there is no need to standardize such opportunistic QoS optimizations.

**Principle 6: For TSC the guaranteed QoS is based on the 5GS bridge delay that is reported by the 5GS bridge in advance. Opportunistic QoS optimizations after the time sensitive communication has been started are left to implementation and are not to be standardized.**

# Proposal

It is proposed to add the principles to 23.700-20 as part of the conclusions for Key Issue #2.

**\* \* \* \* Start change \* \* \* \***

## 8.2 Key Issue #2: UE-UE TSC communication

Editor's note: This clause will capture conclusions for Key Issue #2.

The following is taken as the basis for the way forward:

* There is no pre-configuration needed to enable UE to UE communication; this is always possible by default when the UEs are in the same Ethernet network.
* The setup of bridge forwarding is logically independent from the setup of TSN streams, since both non-TSN and TSN traffic needs to be forwarded.
* Static filtering entries provided by the CNC also need to be supported besides other already specified means of bridge forwarding.
* PCC rules derived from TSN stream information are not used to derive forwarding rules.
* The PCF and the SMF are not aware of whether the PDU session carries a UE to UE traffic flow or not.

- For TSC the guaranteed QoS is based on the 5GS bridge delay that is reported by the 5GS bridge in advance. Opportunistic QoS optimizations after the time sensitive communication has been started are left to implementation and are not to be standardized.

- TSN AF or any AF provides information (e.g. QoS requirements such as delay, burst size, periodicity, burst arrival time) about a UE-UE TSC stream.

- TSN AF or any AF sends the request separately for talker (uplink traffic) and listeners (downlink traffic).

**\* \* \* \* End change \* \* \* \***