**TSG SA Meeting #SP-102 SP-231xxx**

**11 - 15 December 2023, Edinburgh, Scotland (revision of SP-231705)**

**Source: Huawei (Moderator)**

**Title: New SID on Study on enhancement of TSC&URLLC, and LAN**

**Document for: Approval**

**Agenda Item: 6.4.2**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: Study on enhancement of Timing Resiliency, TSC&URLLC, and LAN

Acronym: FS\_eURLLC\_LAN

Unique identifier:

{A number to be provided by MCC at the plenary}

Potential target Release: Rel-19

# 1 Impacts

{For Normative work, identify the anticipated impacts. For a Study, identify the scope of the study}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Affects: | UICC apps | ME | AN | CN | Others (specify) |
| Yes |  | X | X | X |  |
| No | X |  |  |  |  |
| Don't know |  |  |  |  |  |

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

### This work item is a

|  |  |
| --- | --- |
| **X** | Study  |
|  | Normative – Stage 1 |
|  | Normative – Stage 2 |
|  | Normative – Stage 3 |
|  | Normative – Other\* |

## 2.2 Parent Work Item

For a brand-new topic, use “N/A” in the table below. Otherwise indicate the parent Work Item.

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
|  |  |  |  |

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work /Study Items (if any) |
| Unique ID | Title | Nature of relationship |
| 820019 | Enhancement of Ultra-Reliable Low-Latency Communication support in the 5G Core network | Related Work Item in Release 16 (SA2) |
| 900008 | Support of Enhanced Industrial IIoT | Related Work Item in Release 17 (SA2) |
| 970024 | Timing Resiliency and URLLC enhancements | Related Work Item in Release 18 (SA2) |
| 970069 | Generic group management, exposure and communication enhancements | Related Work Item in Release 18 (SA2) |

**Dependency on non-3GPP (draft) specification:**

None

# 3 Justification

**URLLC related:**

3GPP specifies replication mechanisms since Rel-16 for URLLC however the drawback is that the URLLC replication is either done for all traffic or no traffic for a given application. However, the current replication mechanism assumes that application layer protocols are used to control the traffic over multiple user plane paths for high reliability, with no control available within 3GPP system for operators.

Besides, capacity utilization is a key point for supporting demanding applications and services such as URLLC applications and XR services. ). But currently the network can only support limited terminals (due to URLLC devices requiring more recourse). It is noticed 5GS has transferred many unnecessary bits: For example, Ethernet has a minimum frame size of 64 Bytes, comprising an 18-Byte header and a payload of 46 Bytes. The application-layer packet payload of industrial applications is usually small, e.g. 20 Bytes.

**Loop prevention:**

In 5G-VN, two UEs (one at the beginning and one at the end of a conveyor belt, may make a ring out of the linear topology of the Ethernet LAN over the 5GS. A loop prevention protocol e.g. MSTP avoids circling Multicast/Unicast frames. Additionally, this setup allows a media redundancy using the 5GS – if the wireline breaks, every node is still reachable through the 5GS. 5GS enhancements for support of MSTP needs to be studied in order to support prevention of loops.

For the scenarios not related to 5G VN, Ethernet PDU sessions (specific DNN+S-NSSAI) integrated with LAN. So far, the STP support (loop prevention) is an implementation in the UPF. The benefit of the study is to enable 5G with the flexibility to enable/disable/configure the STP via c-plane.

# 4 Objective

Following are the objectives for this study:

**WT-1: Void**

**WT-2: General URLLC enhancements**

WT-2.1 Support for 3GPP system-controlled E2E replication/elimination for redundancy for both Ethernet and IP type PDU Sessions.

In the user plane the solution may support the IEEE FRER frame format in the case of Ethernet PDU sessions, and/or the IETF DetNet packet format in the case of IP PDU Sessions to make the solution extensible to replication and elimination endpoints outside of 5GS, and evaluate whether other frame or packet format needs to be supported.

The study will investigate using 3GPP signalling in cases when replication and elimination endpoints are at 3GPP defined entities.

The work task addresses architecture and protocol aspects for the 3GPP network operators. The work tasks address the following scenarios for both Ethernet and IP type PDU Sessions:

a) 3GPP system-controlled configuration of frame/packet replication and elimination at the UE side when the two PDU Sessions carrying the redundant traffic are established from a single UE.

b) 3GPP system-controlled configuration of frame/packet replication and elimination at the UE side when the two PDU Sessions carrying the redundant traffic are established from different and independently registered UEs.

c) 3GPP system-controlled configuration of frame/packet replication and elimination at the network side.

NOTE: Inter-working with a controller for the IEEE FRER or IETF DetNet that is outside of 5GS.

The work task focuses on the above scenarios when the replication and elimination is performed at 3GPP defined entities.

NOTE 15: Configurations and mechanisms of IEEE TSN network or IETF DetNet will not be impacted by WT 2.1.

WT 2.2 Void

WT 2.3 Void

WT 2.4 Void

WT 2.5 Void

WT-3: Void

**WT-4: Loop prevention**

WT-4.1:

* WT-4.1.1: Void
* WT-4.1.2: Void
* WT-4.1.3.1: How to define support of the Multiple Spanning Tree protocol in the UPF for 5G VN scenarios to ensure loop prevention and enhancements for its activation/deactivation.
* WT-4.1.3.2: How to define support òf Multiple Spanning Tree protocol or Rapid Spanning Tree protocol in UPF in Ethernet PDU Sessions which are not related to 5G VN.

NOTE 18: This WT applies only for single SMF scenario, i.e. if multi-SMF scenario requires a different solution from the single SMF scenario, it is out of scope.

WT-4.2 Void

WT-4.3 Void

WT-4.4 Void.

WT-4.5 Void.

## TU estimates and dependencies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Work Task ID | TU Estimate(Study) | TU Estimate(Normative) | RAN Dependency(Yes/No/Maybe)  | Inter Work Tasks Dependency  |
| WT#1 | 0 | 0 | Yes | WT#1 is self-contained |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| WT#2 | 2 | 1.5 |  | WT#2 is self-contained |
| WT#2.1 | 2 | 1.5 | No |  |
|  |  |  |  |  |
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|  |  |  |  |  |
|  |  |  |  |  |
| WT#4 | 1 | 1 | No | WT#4 is self-contained |
| WT#4.1.3.1 | 0.5 | 0.5 | No |  |
| WT#4.1.3.2 | 0.5 | 0.5 | No |  |

Total TU estimates for the study phase: 3

Total TU estimates for the normative phase: 2.5

Total TU estimates: 3 +2.5 = 5.5

# 5 Expected Output and Time scale

***{If this WID covers both stage 2 and stage 3, clearly indicate the different completion dates.}***

|  |
| --- |
| New specifications {One line per specification. Create/delete lines as needed} |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Rapporteur |
| Internal TR | 23.abc | Study on enhancement of Timing Resiliency, TSC&URLLC, and LAN |  |  |   |
|  |  |  |  |  |  |

{Note 1: Only TSs may contain normative provisions. Study Items shall create or impact only TRs.
"Internal TR" is intended for 3GPP internal use only whereas "External TR" may be transposed by OPs.}

{Note 2: The first listed Rapporteur is the specification primary Rapporteur. Secondary Rapporteur(s) are possible for particular aspect(s) of the TS/TR. In this case, their responsibility has to be provided as "Remarks".}

|  |
| --- |
| Impacted existing TS/TR {One line per specification. Create/delete lines as needed} |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
|  |  |  |  |
|  |  |  |  |

# 6 Work item Rapporteur(s)

# 7 Work item leadership

SA2

# 8 Aspects that involve other WGs

Security aspects are considered by SA3.

RAN aspects are considered by RAN WGs.

# 9 Supporting Individual Members

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| --- |
| Supporting IM name |
| Huawei |
| HiSilicon |
| Samsung |
| NICT |
| China Unicom |
| SIA |
| China Mobile |
| Siemens |
| ZTE |
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