**3GPP TSG-SA5 Meeting #143-e *S5-223466***

**e-meeting, 9- 17May 2022**

**Source: Huawei**

**Title: pCR 28.865 Add issue provisioning of network functions related to DCSA**

**Document for: Approval**

**Agenda Item: 6.5.21**

# 1 Decision/action requested

***The group is asked to discuss and approve the proposal.***

# 2 References

[1]  [SP-211442](https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3693): "New SID on deterministic communication service assurance"

[2] S5-222745: "draft TR 28.865 Study on deterministic communication service assurance"; v0.1.0

# 3 Rationale

Deterministic communication services include periodic and aperiodic types, as defined in TS 22.104 and TS 23.501. URLLC scenarios that 5G needs to support include factory automation, autonomous driving, and electric power industry automation etc. These applications have higher requirements on latency and reliability. 5G network could provide deterministic transmission for specific applications, including bounded delay, low jitter, high reliability, and end-to-end high-precision time synchronization.

To support deterministic communication services, 3GPP provides network functions such as URLLC, Industrial IoT, 5GS integration with TSN, 5G positioning etc in RAN and CN domain respectively.

It is proposed to add issue provisioning of network functions related to DCSA in draft TR 28.865.

# 4 Detailed proposal

This document proposes the following changes in TR 28.865.

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| **1st Change** |

# 5 Issues and potential solutions

*Editor's note: this clause will contain the key issues and potential solutions for deterministic communication service assurance.* *Relation and potential enhancements to eCOSLA will also be studied for the related key issues.*

## 5.X Issue #1: Provisioning of network functions related to deterministic communication service

*Editor's note: this clause will contain the description and potential solutions for provisioning of network functions related to deterministic communication service, e.g. URLLC related network functions, 5GS integration with TSN related network functions.*

### 5.X.1 Description

Editor’s note: This clause provides a description of the key issue#1.

The concept of deterministic communication service is described in TS 22.261, TS 22.104 and TS 23.501 respectively.

**In TS 22.261:**

Communication in automation in vertical domains follows certain communication patterns. The most well-known is periodic deterministic communication, others are a-periodic deterministic communication and Smart Grid.

**In TS 22.104:**

Communication services supporting cyber-physical control applications need to be ultra-reliable, dependable with a high communication service availability, and often require low or (in some cases) very low end-to-end latency.

Communication in automation in vertical domains follows certain communication patterns. The most well-known is periodic deterministic communication, others are aperiodic deterministic communication and non-deterministic communication.

Determinism refers to whether the delay between transmission of a message and receipt of the message at the destination address is stable (within bounds). Usually, communication is called deterministic if it is bounded by a given threshold for the latency/transmission time. In case of a periodic transmission, the variation of the interval is bounded.

In Table 5.2.1 in TS 22.104, Periodic deterministic communication service performance requirements are provided for some cyber-physical control services, e.g. Motion control, video-operated remote control etc. The requirements are classified in characteristic parameter and influence quantity parameters.

The characteristic parameters include the following:

* Communication service reliability: mean time between failures;
* End-to-end latency: maximum;
* Service bit rate: user experienced data rate;
* Message size [byte]

The Influence quantity parameters include the following:

* Transfer interval: target value
* Survival time
* # of UEs
* Service area

**In TS 23.501:**

The definition of TSC is provided as follows:

Time Sensitive Communication (TSC): A communication service that supports deterministic communication (i.e. which ensures a maximum delay) and/or isochronous communication with high reliability and availability. It is about providing packet transport with QoS characteristics such as bounds on latency, loss, and reliability, where end systems and relay/transmit nodes may or may not be strictly synchronized.

In Table 5.7.4-1 the standardized 5QI to QoS characteristics mapping, the delay critical GBR QoS is specified from 5QI value 82 to 90.

Standards related to 3GPP 5G deterministic communications include network aspects and management aspects. The following tables list the main features.

RAN functions related to deterministic communication service:

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| **Category** | **Features** | **Reference** |
| **NR URLLC** | Management aspects were studied in TR 28.832 | TR 28.832 |
| **Industrial IoT****Note 1**: Management aspects related to deterministic communication service will be studied in FS\_DCSA.**Note 2**: Some features reuse support from NR URLLC**Note 3**: Details of TSC support see below | PDCP packet duplication enhancements | TS 38.323 |
| RAN support for higher layer multi-connectivity | TS 38.331, TS 37.340 |
| SPS scheduling enhancements | TS 38.321, TS 38.331 |
| Intra-UE prioritization | TS 38.321 |
| NR support of TSC | TS 38.331, TS 38.321, 38.423 |
| **NR support of 5GS Integration with TSN****Note**: Management aspects related to deterministic communication service will be studied in FS\_DCSA. | Sychronization with 5G Grand Master (GM) clock | TS 38.331 |
| TSCAI QoS based scheduling | TS 38.321 |
| Ethernet Header Compression (EHC) | TS 38.323 |
| **NR positioning support**Note: Management aspects related to deterministic communication service will be studied in FS\_DCSA. | RAT-dependent positioning techniques | TS 37.355 |
| RAT-independent positioning technologies | TS 37.355 ? |

CN functions related to deterministic communication service:

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| **Category** | **Features** | **Reference** |
| **5G LAN** | Management aspects were studied in TR 28.833 | TR 28.833 |
| **NPN** | Management aspects were studied in TR 28.907, specified in TS 28.557 | TS 28.557, TR 28.907 |
| **MEC** | Management aspects were studied in TR 28.903, specified in TS 28.538 | TS 28.538, TR 28.903 |
| **5G core network to support URLLC**Note: Management aspects related to deterministic communication service will be studied in FS\_DCSA. | Redundant transmission for high-reliability communication- Dual Connectivity based end to end Redundant User Plane Paths; - Support of redundant transmission on N3/N9 interfaces;- Support for redundant transmission at transport layer | TS 23.501, TS 23.502 |
| QoS Monitoring - Per QoS Flow per UE QoS Monitoring;- GTP-U Path Monitoring | TS 23.501, TS 23.502 |
| Dynamic division of Packet Delay Budget | TS 23.501, TS 23.502 |
| Enhancements of session continuity | TS 23.501, TS 23.502 |
| **5GS Integration with IEEE TSN**Note: Management aspects related to deterministic communication service will be studied in FS\_DCSA. | 5GS architecture enhancement to support integration with TSN  | TS 23.501 |
| Time synchronization | TS 23.501 |
| TSC QoS control- delay critical GBR 5QIs- TSN configuration maps to 5G QoS framework | TS 23.501 |
| TSCAI information- Provide time-sensitive communication assistance information to 5G RAN to support optimal scheduling of time-sensitive services | TS 23.501 |
| **Enhancement to the 5GC LoCation Services**Note: Management aspects related to deterministic communication service will be studied in FS\_DCSA. | General Concepts, e.g. Type of Location Requests, LCS Quality of services | TS 23.273 |
| High Level Features, e.g. LMF selection, UE LCS privacy handling; | TS 23.273 |
| Location Service Procedure | TS 23.273 |

Management aspects for End to end network:

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| **Category** | **Features** | **Reference** |
| **Management and orchestration of network slice** | Concept of network slice managementProvisioning of network slice | TS 28.530TS 28.532 |
| SLS management (serviceProfile, sliceProfile) | TS 28.541 |
| Closed loop SLS assurance | TS 28.535, TS 28.536 |

Functions related to the management aspects, such as management of network slice, URLLC RAN aspects, NPN, 5G LAN, MEC etc are covered in SA5 related studies and specifications. This document mainly addresses the management aspects of Industrial IoT, 5GS integration with TSN and 5G positioning reated to deterministic communication service, e.g., the related requirements, provisioning, performance measurements and fault management etc.

DCSA\_REQ X1: The 3GPP management system should provide the provisioning capability of URLLC related network functions to support deterministic communication service assurance.

DCSA\_REQ X2: The 3GPP management system should provide the provisioning capability of Industrial IoT related network functions.

DCSA\_REQ X3: The 3GPP management system should provide the provisioning capability of 5GS Integration with TSN related network functions.

DCSA\_REQ X4: The 3GPP management system should provide the provisioning capability of NR positioning and 5GC LoCation Services elated network functions.

### 5.X.2 Potential solutions

#### 5.X.2.a Potential solution #<a>: <Potential Solution a Title>

##### 5.X.2.a.1 Introduction

Editor's Note: This clause describes briefly the potential solution for key issue#1 at a high-level.

##### 5.X.2.a.2 Description

Editor's Note: This clause further details the potential solution and any assumptions made for key issue#1.

### 5.X.3 Conclusion - Impact on normative work

Editor's Note: This clause provides the conclusion from the aspect of impact on normative work for key issue#1.

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| **End of change** |