**3GPP TSG-SA5 Meeting #144-e *S5-224217***

**e-meeting, 27 June – 1 2022**

**Source: Huawei**

**Title: pCR 28.865 Update solultion of service assurance for PLC control**

**Document for: Approval**

**Agenda Item: 6.9.5.4**

# 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] S5-223735: "draft TR 28.865 Study on deterministic communication service assurance"; v0.2.0

# 3 Rationale

This tdoc addresses the solution update of service assurance for PLC control.

It is proposed to add solution update of service assurance for PLC control 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 issues and potential solutions for deterministic communication service assurance.* *Relation and potential enhancements to eCOSLA will also be studied for the related issues.*

## 5.Z Issue #3: Service assurance for PLC control

*Editor's note: this clause will contain the description and potential solutions for the service assurance of PLC control, e.g. service requirements, related measurements and service performance analysis. PLC control is one of the deterministic communication services in cyber-physical control scenarios described in TS 22.104.*

### 5.Z.1 Description

Editor’s note: This clause provides a description of the issue#3.

### 5.Z.2 Potential solutions

#### 5.Z.2.a Potential solution #1: PLC control

##### 5.Z.2.a.1 Introduction

Editor's Note: This clause describes briefly the potential solution for issue#3 at a high-level.

In the deterministic communication service requirement analysis phase, network requirements (data rate, delay, and reliability) are analyzed. Network deployment requirements of different areas need to be considered for network preparation. Deterministic communication services have high SLS requirements. For example, the planning of PLC control services focus on E2E latency, interactive latency, PLC control period, burst packet loss ratio etc. It demands on high delay stability and periodic deterministic of small data packets. The network requirements need to be derived based on the application characteristics of specific services. For example, network preparation information, such as network capacity, coverage, reliability, and data rate estimation, needs to be output based on the three-layer service requirement model of the PLC control service.

##### 5.Z.2.a.2 Description

Editor's Note: This clause further details the potential solution and any assumptions made for issue#3.

**1. Data collection**:

Collect service experience data and network performance data of PLC control services based on the three-layer service requirement modeling. For example, the following data may collected: latency and throughput related performance data defined in TS 28.552 and TS 28.554. Abnormal information such as large round-trip delay, large interactive delay, large jitter, low data rate distribution, high packet loss rate, and service quality deterioration etc.

**2. Analytics and demarcation**

Service and network analysis of deterministic communication services includes monitoring, poor-QoE identification, demarcation, and root cause analysis. Identify abnormal issues, determine the impact scope, and restore services.

Monitoring and the poor-QoE identification requires two steps:

- Builds the three-layer service requirement model based on service characteristics, including poor experience information.

- Collects experience, service quality, and network-related indicators and abnormal incidents to identify poor-QoE users and services.

Fault demarcation is used to generate service interruption/ poor experience incident when a service anomaly occurs. The E2E network KPI, alarm information, terminal exceptions are correlated and analzed. Demarcation results for video monitoring services are provided accordingly.

**3. Optimization and verification**

**Optimization**:

For PLC control services, delay-related optimization are mainly considered. To optimize delay-related problems, it is needed to analyze the average delay, delay jitter, and delay reliability. It can analyzed the delay-related factors of the air interface, such as the uplink and downlink slot assignment proportion, air interface resource capacity, and scheduling policy.

**Verification:**

According to the service assurance objective of deterministic communication, that is, the quality of experience indicator of each service meets the deterministic requirement after optimization, it is further verified that the network capability meets the deterministic requirement. Select indicators that reflect PLC control service experience, such as PLC control period, survival time, interactive delay, interruption etc, or indicators that reflect network performance, such as packet loss rate, rate, and delay.

To support the analysis and optimization of PLC control services, some data collection requirements are as in the following table:

| **Number** | **measurements** |
| --- | --- |
| 1 | RTT: the average RTT at the minute’s level based on the time of the Job, Ack\_Data, and Ack messages of the S7Comm protocol. |
| 2 | PLC response rate: the ratio of minute’s level Ack\_Data to the number of Job messages. |

To support the analysis and optimization of PLC control services (TCP-based), some data collection requirements are as in the following table:

| **Number** | **measurements** |
| --- | --- |
| 1 | PLC client interruption: This event is triggered when the job request from the PLC controller was not received within a detection period. |
| 2 | PLC server interruption: This event is triggered when a Job request was sent from the PLC control end but an Ack\_Data response was not received from the PLC execution end within a detection period. |
| 3 | High packet loss rate on the server: This event is triggered when the packet loss rate of the Ack\_Data response corresponding to a job request is greater than the packet loss rate threshold within a detection period. |
| 4 | Excessive RTT: This event is triggered when the number of RTTs greater than the threshold within a detection period is greater than the threshold. |

To support the analysis and optimization of PLC control services, some data collection requirements are common for all services:

| Category | Indicator Name |
| --- | --- |
| Data rate | Average downlink data rate of TCP/UDP connection |
| Average uplink data rate of TCP/UDP connection |
| UL data rate of TCP/UDP connection at Communication Terminal Side |
| latency | Round-trip delay for TCP connection |
| Uplink delay of TCP connection (From communication terminal to Application Server) |
| Downlink delay of TCP connection (Communication Terminal to Service Terminal) |
| Packet data loss rate | Uplink packet loss rate at server side for the TCP connection |
| Downlink packet loss rate at server side for the TCP connection |
| Uplink packet loss rate at UE side for the TCP connection |
| Downlink packet loss rate at UE side for the TCP connection |
| Jitter | Average uplink RTT jitter for TCP |
| Average downlink RTT Jitter for TCP |
| traffic | Average packet data length |
| Number of uplink Packets |
| Number of payload packets for uplink for TCP |
| Number of payload packets for downlink for TCP |
| Number of downlink payload packets for TCP |
| Number of transmitted packets in uplink for TCP connection |
| Number of transmitted packets in uplink for UDP connection |
| Number of transmitted packets in downlink for TCP connection |
| Number of transmitted packets in downlink for UDP connection |

To support the analysis and optimization of PLC control services, some data collection requirements for abnormal data are common for all service:

| Number | Abnormal indicators |
| --- | --- |
| 1 | Abnormal round-trip delay |
| 2 | Abnormal packet loss rate |
| 3 | Abnormal average data rate. |
| 4 | The average downlink RTT jitter (TCP) is too large |
| 5 | The average uplink RTT jitter (TCP) is too large |
| 6 | Connection interruption |
| 7 | Traffic interruption |

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

Editor's Note: This clause provides the conclusion from the aspect of impact on normative work for issue#3.

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| **End of change** |