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| 3GPP TR 28.863 V18.0.0 (2023-12) | |
| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Services and System Aspects;  Study on Key Quality Indicators (KQIs) for 5G service experience  (Release 18) | |
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Contents

Foreword 5

1 Scope 6

2 References 6

3 Definitions of terms, symbols and abbreviations 7

3.1 Terms 7

3.2 Symbols 7

3.3 Abbreviations 7

4 Issues and potential solutions 7

4.1 Issue # 1: Definition of KQI 7

4.1.1 Description 7

4.1.1.1 TR 21.905 8

4.1.1.2 TR 32.862 8

4.1.1.3 ETSI GS F5G 005 8

4.1.1.4 Background description of 5G service experience related studies in ITU-T 8

4.1.1.4.1 ITU-T SG12 8

4.1.1.4.2 ITU-T SG9 9

4.1.2 Potential solutions 9

4.1.2.1 Potential solution #1: Definition of KQI 9

4.1.2.1.1 Introduction 9

4.1.2.1.2 Description 9

4.1.2.2 Potential solution # 2: Difference of KPI, KQI and QoE 9

4.1.3 Conclusion - Impact on normative work 10

4.2 Issue # 2: Scenarios for 5G KQI 10

4.2.1 Description 10

4.2.2 Potential solutions 10

4.2.2.1 Potential solution #1: Scenarios for 5G KQI 10

4.2.2.1.1 Introduction 10

4.2.2.1.2 Description 10

4.2.3 Conclusion - Impact on normative work 10

4.3 Issue # 3: KQIs for Video Uploading 10

4.3.1 Description 10

4.3.2 Potential solutions 11

4.3.2.1 Potential solution #1: KQIs for Video Uploading 11

4.3.2.1.1 Introduction 11

4.3.2.1.2 Description 11

4.3.3 Conclusion - Impact on normative work 11

4.4 Issue # 4: KQIs for URLLC 11

4.4.1 Description 11

4.4.2 Potential solutions 12

4.4.2.1 Potential solution #1: KQIs for URLLC 12

4.4.2.1.1 Introduction 12

4.4.2.1.2 Description 12

4.4.3 Conclusion - Impact on normative work 12

4.5 Issue # 5: KQIs for Cloud VR 12

4.5.1 Description 12

4.5.1.1 General 12

4.5.1.2 Background 12

4.5.1.2.1 ITU SG9-TD896 GEN 12

4.5.1.2.2 ITU SG12 G.QoE-VR 13

4.5.1.3 Use case 13

4.5.1.3.1 Use case for stalling of 5G KQIs 13

4.5.2 Potential solutions 14

4.5.2.1 Potential solution #1: KQIs for Cloud VR 14

4.5.2.1.1 Introduction 14

4.5.2.1.2 Description 14

4.5.3 Conclusion - Impact on normative work 14

4.6 Issue # 6: Relation of KQI with the SLS requirements 14

4.6.1 Description 14

4.6.2 Conclusion - Impact on normative work 15

Annex A (informative): Change history 16

# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# 1 Scope

The present document investigates the definition and scenarios for KQI. The KQIs and the evaluation of the KQIs for each of the identified scenarios will be investigated. It also provides the analysis for the relation of KQI with the SLS requirements.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TR 32.862: "Study on Key Quality Indicators (KQIs) for service experience"

[3] ETSI GS F5G 005: "F5G High-Quality Service Experience Factors Release #1"

[4] ITU-T Y.1540: Internet protocol data communication service - IP packet transfer and availability performance parameters

[5] ITU-T P.1201: Parametric non-intrusive assessment of audiovisual media streaming quality

[6] ITU-T P.1202: Parametric non-intrusive bitstream assessment of video media streaming quality

[7] ITU-T P.1203: Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport

[8] ITU-T P.1204: Video quality assessment of streaming services over reliable transport for resolutions up to 4K

[9] ITU-T GSTR-5GQoE: Study of existing QoE requirements for 5G services

[10] ITU-T P.10/G.100 (11/2017): Vocabulary for performance and quality of service.

[11] ITU-T G.1035: Influencing factors on quality of experience for virtual reality services

[12] Draft ITU-T P.1320 (ex P.QXM): QoE assessment of eXtended Reality (XR) meetings

[13] Draft ITU-T G.1036 (ex G.QoE-AR): Quality of experience (QoE) influencing factors for augmented reality (AR) services

[14] Draft ITU-T G.QoE-VR (G.QoE-VR) "Influencing Factors on Quality of Experience (QoE) for Virtual Reality Services"

[15] ITU-T SG 9 TD 896-GEN: "Output - Draft New Recommendation J. Cloud-VR "E2E Network Requirements of Cloud-VR Services"

[16] 3GPP TS 26.247: "Transparent end-to-end Packet-switched Streaming Service (PSS); Progressive Download and Dynamic Adaptive Streaming over HTTP (3GP-DASH)".

[17] 3GPP TS 28.554: "Management and orchestration; 5G end to end Key Performance Indicators (KPI)"

[18] 3GPP TS26.501: "5G Media Streaming (5GMS); General description and architecture"

[19] 3GPP TS26.511: "5G Media Streaming (5GMS); Profiles, codecs and formats"

[20] 3GPP TS26.512: "5G Media Streaming (5GMS); Protocols"

[21] 3GPP TS28.535 Management and orchestration; Management services for communication service assurance; Requirements

[22] GSMA NG.116 Generic Network Slice Template, Version 7.0, 17 June 2022

[23] 3GPP TS28.541 Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

Key Quality Indicator: For purposes of TR 28.863, the term is defined to be an indicator which reflects the end-to-end service experience as perceived by the end user. It may be derived from a combination network layer measurements, service layer measurements and includes qualitative as well as quantitative components.

## 3.2 Symbols

Void

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

KQI Key Quality Indicators

# 4 Issues and potential solutions

## 4.1 Issue # 1: Definition of KQI

### 4.1.1 Description

In this clause, the background survey of the definition of KQI is provided. The TS/TR related to KQI will be listed here as the basis of the study.

#### 4.1.1.1 TR 21.905

In TR 21.905 [1], no definition or abbreviation of KQI is provided.

#### 4.1.1.2 TR 32.862

TR 32.862 [2] gives a description of KQI and some related survey on that:

*- The introduction of Key Quality Indicators (KQIs), which reflect the end-to-end service performance and quality, could be used to better represent real customer experience. NGMN NGCOR has defined principles for KQIs which could be used to evaluate the customer experience for fixed and mobile networks. It is proposed that SA5 takes the responsibility to study how to standardize the related service KQIs providing a standardised common base for end-to-end measurements and to fulfil the NGCOR requirements.*

*- The intention of KQI for the service experience is to try to reflect the customer experience with indicators reflecting them for example how many stalls occur while watching a movie, time delay before seeing the first screen of a movie. With this information, KQI could closely reflect the customer experience. The KPIs defined in the current specifications, e.g. TS 32.450, are not differentiated by services, they only measure the bearer.*

#### 4.1.1.3 ETSI GS F5G 005

ETSI GS F5G 005 [3] gives a description of KQI:

*The Key Quality Indicators (KQI) are composed by the QoS metrics, which have the largest impact on QoE, namely*

*user centric and service specific quality patterns that directly influence the user perception for each service category.*

*QoS is a measure of the performance of networked services at the network or application level. QoS also refers to a set*

*of techniques that enable the network administrator to manage the network performance differentiating between*

*different users. QoS metrics may include network layer measurements such as packet loss, delay or jitter or application*

*level measurements such as video frame loss, frame freezing, image distortion.*

#### 4.1.1.4 Background description of 5G service experience related studies in ITU-T

##### 4.1.1.4.1 ITU-T SG12

There are some studies related to KQIs, or relevant to, 5G service experience, with below a list of related ITU-T Recommendations and other output documents such as Technical Reports by ITU-T SG12, as well as work items under study.

There are also the different prediction models for speech and video quality available from SG12’s work (e.g. P.1201, P.1202, P.1203, P.1204 for video), which can directly provide KQI related information.

List of related in-force ITU-T Recommendations and Technical Reports are given according to video streaming and cloud VR:

Video streaming related documents:

– ITU-T Y.1540 [4]: Internet protocol data communication service - IP packet transfer and availability performance parameters

– ITU-T P.1201 [5]: Parametric non-intrusive assessment of audiovisual media streaming quality

– ITU-T P.1202 [6]: Parametric non-intrusive bitstream assessment of video media streaming quality

– ITU-T P.1203 [7]: Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport

– ITU-T P.1204 [8]: Video quality assessment of streaming services over reliable transport for resolutions up to 4K

– ITU-T GSTR-5GQoE [9]: Study of existing QoE requirements for 5G services

– ITU-T P.10/G.100 (11/2017) [10]: Vocabulary for performance and quality of service.

Cloud VR related documents:

– ITU-T G.1035 [11]: Influencing factors on quality of experience for virtual reality services

Consented draft ITU-T Recommendations:

– Draft ITU-T P.1320 (ex P.QXM) [12]: QoE assessment of eXtended Reality (XR) meetings

– Draft ITU-T G.1036 (ex G.QoE-AR) [13]: Quality of experience (QoE) influencing factors for augmented reality (AR) services

– Draft ITU-T G.QoE-VR (G.QoE-VR) [14] "Influencing Factors on Quality of Experience (QoE) for Virtual Reality Services" (for consent)

##### 4.1.1.4.2 ITU-T SG9

Cloud VR related documents:

– ITU-T SG 9 TD 896-GEN [15]: "Output - Draft New Recommendation J. Cloud-VR "E2E Network Requirements of Cloud-VR Services"

### 4.1.2 Potential solutions

#### 4.1.2.1 Potential solution #1: Definition of KQI

##### 4.1.2.1.1 Introduction

In 5G there are some new services defined in 3GPP. The new services of video uploading (uplink media streaming), URLLC and cloud VR have requirements e.g. related to latency, reliability and UL throughput for 5G networks or the combination of them. The metrics of network performance are defined as Key Performance Indicators (KPIs) for the 5G network, defined in TS28.554 [17]. However, it is not enough to only define separate network performance indicators. The ultimate goal of network management of services is to provide a good service experience to the user. Network resources are limited. Only focusing on the network management may not ensure optimal service experience. User experience-driven management may be enabled with key quality indicators (KQIs) which are used to better represent a user’s experience.

KQIs are important for service management. In user experience-driven management, KQIs may be used to propose service management objectives and express experience optimization requirements. Experience optimization requirements may be mapped to the network, and are ultimately achieved through network resource assurance and network performance optimization.

##### 4.1.2.1.2 Description

KQI (Key Quality Indicator): An indicator which reflects the end-to-end service experience as perceived by the end user. It may be derived from a combination network layer measurements, service layer measurements and includes qualitative as well as quantitative components.

#### 4.1.2.2 Potential solution # 2: Difference of KPI, KQI and QoE

TS 28.554 [17] specifies end-to-end Key Performance Indicators (KPIs) for the 5G network and network slicing.

KQI (Key Quality Indicator) is defined to be a measure of the experience perceived by the user.

In ITU-T P.10/G.100 [10] the definition of QoE is given:

*Quality of experience (QoE)*

*The degree of delight or annoyance of the user of an application or service.*

QoE is defined as the degree of delight or annoyance of the user of an application or service. It includes the complete end-to-end system effects (client, terminal, network, services infrastructure, etc.) and may be influenced by user expectations and context.

From the above definition of QoE we see that QoE is an overall value to reflect the degree of the user experience.

There are also measurements in SA4 that may be used to estimate QoE. These measurements are collected by the client and may be reported to the OAM or QoE server in the QoE metrics reporting. How to make use of these QoE metrics is not specified. One difference is that the QoE measurements are collected from the client side for all of the aspects of the media e.g. the buffer, play list, MPD information besides network aspects. KQIs may be calculated from KPIs, or calculated based on some of the collected QoE metrics. QoE metrics may be one component of KQI.

### 4.1.3 Conclusion - Impact on normative work

In Issue#1 the definition of KQI is provided. It is proposed to introduce the term of KQI and the definition of KQI to the service management related specification in release 19.

In Issue#1 the difference of KPI, KQI and QoE is provided. It is for better understanding the difference of the terms in the study item phase and can be considered as basis for the further study of the network and service indicators.

## 4.2 Issue # 2: Scenarios for 5G KQI

### 4.2.1 Description

In 5G there are various new services. Different services bring different service experience. The service experience of video uploading requires good quality of video and high efficiency of uploading; while for AR/VR requires good interaction additionally. For different service different KQIs are required to express the different service experience. It is important to select the most typical services and investigate the KQIs for such services.

### 4.2.2 Potential solutions

#### 4.2.2.1 Potential solution #1: Scenarios for 5G KQI

##### 4.2.2.1.1 Introduction

This clause provides the proposed scenarios for 5G KQI.

##### 4.2.2.1.2 Description

Video uploading is widely used in e.g. transportation, smart city; URLLC is important for industry automation and telemedicine; Cloud VR is also expected to be widely used in daily life. In the present document the 5G KQIs will be described for the following scenarios:

- Video uploading

- URLLC

- Cloud VR

### 4.2.3 Conclusion - Impact on normative work

In Issue#2 the scenarios for 5G KQI is proposed. The scenarios of video uploading, URLLC and Cloud VR are 3GPP defined scenarios. These scenarios are proposed to be the typical 5G services for a future service related study. No normative work is needed for this issue.

## 4.3 Issue # 3: KQIs for Video Uploading

### 4.3.1 Description

The scenario of video uploading means the uplink media streaming. In TS 26.501 [18] the service of 5G media streaming, including uplink media streaming and downlink media streaming is defined; In TS 26.511 [19] the profiles, codecs and formats for media streaming are defined; and in TS 26.512 [20] the protocols for media streaming are defined..

Video uploading is widely used in transportation, smart city, telemedicine and industry automation. In these scenarios, a large number of videos are captured and uploaded to the server and are required to be low latency and High-definition. There are various requirements for the service experience of video uploading. For example, real-time video transmission is required in industrial control scenarios such as ports and mines, which requires short video transmission delay; in addition, for transmission of high-definition video, the high video transmission rate is required.

KQIs for video uploading is important for the management: In user experience-driven management, KQIs are used to declare management objectives of video uploading and indicate whether user experience need to be optimized.

### 4.3.2 Potential solutions

#### 4.3.2.1 Potential solution #1: KQIs for Video Uploading

##### 4.3.2.1.1 Introduction

In this potential solution, KQIs for Video Uploading is provided.

##### 4.3.2.1.2 Description

End-to-end uplink delay is an important indicator for end users to perceive smooth and real-time media streaming for video uploading service. In most industrial scenarios real-time video transmission is required either to monitor the industrial system or to do some real-time operation based on the video; in addition, for transmission of high-definition video, the high video transmission rate is required which consequently requires short end-to-end delay.

Uplink mean throughput and uplink peak throughput are also important indicators which are required for the user since in 5G scenarios massive videos are transmitted thus requires large uplink throughput.

Uplink average packet loss rate and uplink burst packet loss rate are important indicators which will influence the end user’s feeling of the video. Packet loss greatly degrades the quality of multimedia content because in the event of a packet loss containing an I-frame, all subsequent frames depending on that frame will be lost, which may cause frame blocking, and video output stall. During packet loss measurement, packet loss is classified into average packet loss ratio measurement and burst packet loss ratio measurement. Burst packet loss has greater impact and needs to be considered separately.

### 4.3.3 Conclusion - Impact on normative work

In Issue#3, the service of video uploading only corresponding to the uplink media streaming. The downlink media streaming part is for further study.

In this chapter, the description of KQIs and several KQIs of video uploading is proposed. But the detailed definition and the measurements of these KQIs are not defined. The measurements may be realized in the UE app which are already discussing in other groups. More cooperation with other 3GPP work groups is needed to realize the measurement on service layer and to send the information to management system;

It is proposed that how these KQIs are measured and how the KQIs are used to support the operator’s end-to-end service to outside the 3GPP system needs further study.

## 4.4 Issue # 4: KQIs for URLLC

### 4.4.1 Description

URLLC is one of the typical 5G services. URLLC is used in 5G SA (Stand-alone) networking to meet ultra-low latency requirements. Real-time interactive services are mainly small-packet transmission services, which do not require network bandwidth but require ultra-low latency. For industrial-grade URLLC services, too big delay may cause service failures instead of performance problems. Therefore, it is important to analyze the delay and the delay fulfillment boundary.

Furthermore, the packet loss is also an important factor to be considered. As URLLC refers to “ultra-reliability” and packet loss is one of the most important factors to reflect reliability. If the packet loss rate is too high, the control instruction fails. Therefore, the packet loss rate and the threshold of the packet loss rate need to be considered when defining the quality indicator for the service.

### 4.4.2 Potential solutions

#### 4.4.2.1 Potential solution #1: KQIs for URLLC

##### 4.4.2.1.1 Introduction

In this potential solution, KQIs for URLLC is provided.

##### 4.4.2.1.2 Description

End-to-end delay is an important indicator for end users to perceive the quality of the service. In URLLC real-time transmission services, ultra-low latency are required. For industrial-grade URLLC services, if the delay does not meet the requirements, it may lead to service failures.

Uplink/downlink average packet loss rate and uplink/downlink burst packet loss rate are important indicators which will influence the quality of the service. As URLLC are required to be ultra-reliability and minimum packet loss plays the most important role. If the packet loss rate is too high, the service may directly fails.

### 4.4.3 Conclusion - Impact on normative work

In Issue#4, the description of KQIs and several KQIs of URLLC is proposed. But the detailed definition and the measurements of these KQIs are not defined. Further study is needed in the service management related topics. No normative work is proposed at the current stage.

## 4.5 Issue # 5: KQIs for Cloud VR

### 4.5.1 Description

#### 4.5.1.1 General

Cloud VR (Cloud Virtual Reality) is a new cloud computing and cloud rendering technology for VR services, as describe in ITU SG9-TD896 GEN. It applies to scenarios such as VR games, VR 360-degree video, VR live broadcast, giant-screen cinema, and VR education. With fast and stable transport networks, VR content is stored and rendered in the cloud, and video and audio outputs are coded, compressed, and transmitted to user terminals. The large-scale deployment of Cloud VR services requires the joint effort from the enterprises to address E2E quality management and monitoring. Therefore, the development of measurable and manageable key quality indicators will be a key basis for operator to ensure the satisfaction of consumers. There are already some standards for studying the KQIs for Cloud VR. In this clause, the background and the use case of the KQI of the cloud VR are provided.

#### 4.5.1.2 Background

##### 4.5.1.2.1 ITU SG9-TD896 GEN

It describes the service indicators based on the experience evaluation factors of VR in ITU SG9-TD896 GEN, the experience evaluation factors of VR include sense of reality, interaction, and pleasure. The sense of reality depends on resolution, colour depth, frame rate, and encoding compression technologies. Cloud VR implements computing and rendering on the cloud, any latency from remote processing compromises the sense of immersion and imagination. The sense of pleasure depends on the smoothness of VR services.

The Cloud VR includes the service indicators:

Table 4.5.1.2.1-1: Service indicators

|  |  |
| --- | --- |
| Factors | service indicators |
| Sense of reality | Resolution |
| Frame rate |
| Field of View (FoV) |
| Color depth |
| Coding compression |
| Sense of interaction | Initial buffer time |
| Motion sensory conflict |
| Operation latency |
| Sense of pleasure | Stalling(time and duration percentage) |
| Artrafacts(times and duration/area percentage) |
| Effective frame rate in gaming |

##### 4.5.1.2.2 ITU SG12 G.QoE-VR

In ITU SG12 G.QoE-VR, it describes that the VR QoE is assessed by the level of immersion provided by the VR system combined with the quality of the interaction between the user and the VR environment, and the level of immersion can be determined by the quality of the immersive media and the presentation quality delivered by the device. It also summarizes some key influences factors that impact quality of the immersive media, presentation quality, and interaction quality.

It includes the key influences factors:

Table 4.5.1.2.2-1: Service indicators

|  |  |
| --- | --- |
| Category | Key influence factors |
| Quality of Immersive media | Degrees of freedom (DoF) |
| Video Three-dimensionality |
| Video Field of View (FoV) |
| Video Spatial resolution in pixels per degree (PPD) |
| Video Frame-rate |
| Video Compression |
| Audio Three-dimensionality |
| Audio Channels |
| Audio sample rate |
| Audio Compression |
| Presentation quality | Playback quality(e.g. smoothness and number of freezes, video/audio quality change) |
| Audio and video spatial alignment. |
| Audio and video synchronization. |
| Interaction quality | Intractability with objects in the VR environment |
| Response time between human action and adaptation in sound and display |
| Spatial precision between human action and adaptation in sound (3D audio) and visual information |

#### 4.5.1.3 Use case

##### 4.5.1.3.1 Use case for stalling of 5G KQIs

Stalling is an important indicator for end users to perceive the smoothness of streaming media when using Cloud VR services (e.g. VR games). In the process of VR video, there will be a certain amount of buffer. Because the download rate of the network is not enough to meet the output requirements of video coding quality, there will be no data in the buffer for playback, which will cause stalling and affect the end users’ experience. Therefore, This KQI is of great importance to estimate the service quality.

### 4.5.2 Potential solutions

#### 4.5.2.1 Potential solution #1: KQIs for Cloud VR

##### 4.5.2.1.1 Introduction

In this potential solution, KQIs for Cloud VR is provided.

##### 4.5.2.1.2 Description

Stalling frequency (StallingFre)

Stalling frequency indicates the number of times frame stalling occurs in a unit of time during video playback. The calculation the video stalling frequency is as follows: The number of stalling is described in TS26.247 [16], the video stalling frequency is the number of video stalling times during video playback devided by the video playback duration. The unit is times/minute. The KQI type is Float.

Stalling duration (StallingDur)

Stalling duration indicates the duration of the stalling. The stalling start time and stalling end time is described in TS26.247 [16]. 3GPP management system collects the stalling start time and the stalling end time. The formula for calculating the stalling duration is the stalling end time minus the stalling start time. The KQI unit is ms and the KQI type is Float.

### 4.5.3 Conclusion - Impact on normative work

In Issue#5, the background, the use case and the solution for KQIs for the service of Cloud VR are provided. The topic of service management are still under discussion, no normative work is proposed for this issue.

## 4.6 Issue # 6: Relation of KQI with the SLS requirements

### 4.6.1 Description

SLS is already agreed in SA5 as the service level specification. In TS28.535 [21] gives the abbreviation and definition of SLS:

* Abbreviation:

*SLS Service Level Specification*

* Definition of the term:

*Service level specification, specification of the minimum acceptable standard of service.*

In GSMA NG.116 [22] and TS28.541 [23] gives the relation between GST and ServiceProfile. GST attributes are used by 3GPP as inputs to network slice Network Resource Model (NRM) ServiceProfle and then further translated into relevant attributes of constituted network slice subnets SliceProfile (i.e. 5GC SliceProfile and NG-RAN SliceProfile) and TN requirements, and finally, being translated into different 5G domain configuration parameters (i.e. 5GC domain and NG-RAN domain). The related service performance requirements (ServiceProfile) given in 3GPP are SLS requirements.



SLS requirements are used between the CSC and the CSP: The CSC provides the SLS requirements for an assured communication service to the CSP, the CSP provides the corresponding communication service. The CSP also provides feedback to the CSC.

The goal of a CSP is to meet service experience requirements. KQI reflects the end-to-end service experience as perceived by the end user. KQIs are used to evaluate service quality, identify poor service scenarios. The management system will take a series of management process to improve and optimize service quality under a service experience degradation.

### 4.6.2 Conclusion - Impact on normative work

In Issue#6 the relation of KQI with the SLS requirements are studied. Which KQIs should be specified and how to apply them in to the SLS requirements need further study.

Annex A (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2022-04 | SA5-142e | S5-222673 | - | - | - | TR 28.863-0.0.0 initial skeleton | 0.0.0 |
| 2022-04 | SA5-142e | S5-222674  S5-222109  S5-222675 |  |  |  | Update to implement the agreed pCRs in SA5#142e:  S5-222674 pCR TR28.863 Skeleton proposal for TR28.863  S5-222109 pCR TR 28.863 add scope  S5-222675 pCR TR 28.863 Key Issue # 2 Scenarios for 5G KQI | 0.1.0 |
| 2022-05 | SA5-143e | S5-223741 |  |  |  | Update to implement the agreed pCRs in SA5#143e:  S5-223741 pCR TR 28.863 Key Issue #1 Definition of KQI | 0.2.0 |
| 2022-08 | SA5-145e | S5-225778  S5-225869 |  |  |  | Update to implement the agreed pCRs in SA5#145e:  S5-225778 pCR TR 28.863 Issue#1 Background description of KQI definition  S5-225869 pCR TR 28.863 Key Issue # 1: add a description of KQI in ETSI GS F5G 005 | 0.3.0 |
| 2022.11 | SA5-146e | S5-226391  S5-226390  S5-226389 |  |  |  | Update to implement the agreed pCRs in SA5#146e:  S5-226391 pCR TR 28.863 Key Issue # 5: KQIs for cloud VR- the background survey of the Cloud VR  S5-226390 pCR TR 28.863 Key Issue # 5: KQIs for cloud VR- use case of the Cloud VR  S5-226389 pCR TR 28.863 Key Issue #5 KQIs for Cloud VR- the solution of KQIs for cloud VR | 0.4.0 |
| 2023.3 | SA5-147 | S5-232866 |  |  |  | Update to implement the agreed pCRs in SA5#147:  S5 232866 pCR TR 28.863 Issue 3 Video uploading description | 0.5.0 |
| 2023.4 | SA5-148e | S5-233469 |  |  |  | Update to implement the agreed pCRs in SA5#148e:  S5-233469 pCR TR 28.863 Issue#1 definition of KQI | 0.6.0 |
| 2023.8 | SA5-150 | S5-235586 |  |  |  | Update to implement the agreed pCR in SA5#150：  S5 235586 TR 28.863 Issue 1 Correction of the background information | 0.7.0 |
| 2023.10 | SA5-151 | S5-237187  S5-237189  S5-237240 |  |  |  | Update to implement the agreed pCRs in SA5#151:  S5-237187 pCR TR 28.863 Issue # 3: Description for KQIs for Video Uploading  S5-237189 pCR TR 28.863 Issue # 3: Solution of KQIs for Video Uploading  S5-237240 pCR TR 28.863 Issue5 Description of SLS requirements | 0.8.0 |
| 2023.11 | SA5-152 | S5-237648  S5-237650  S5-237654  S5-238278  S5-238279  S5-238280 |  |  |  | Update to implement the agreed pCRs in SA5#152:  S5-237648 pCR TR 28.863 Issue1 Conclusion for Definition of KQI  S5-237650 pCR TR 28.863 Issue#2 Conclusion for scenarios for 5G KQI  S5-237654 pCR TR 28.863 Rapporteur clean up  S5-238278 pCR TR 28.863 Issue#4 Description of URLLC  S5-238279 pCR TR 28.863 Issue#4 Solution of URLLC  S5-238280 pCR TR 28.863 Issue#5 Conclusion for Cloud VR | 0.9.0 |
| 2023-12 | SA#102 | SP-231525 |  |  |  | Presented for information and approval | 1.0.0 |
| 2023-12 | SA#102 |  |  |  |  | Upgrade to change control version | 18.0.0 |