**3GPP TSG-SA5 Meeting#146-bis-e S5-231081**

**e-meeting, 16-19 January 2023**

**Source: Huawei**

**Title: DP on way forward of 5G KQI SI**

**Document for: Endorsement**

**Agenda Item: 6.1.1**

# 1 Decision/action requested

*This document provide the discussion of the way forward of 5G KQI.*

# 2 References

[1] 3GPP TS 28.863: "Study on Key Quality Indicators (KQIs) for 5G service experience"

[2] 3GPP TS28.530: "Management and orchestration; Concepts, use cases and requirements"

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

[4] 3GPP TS 28.554: "5G end to end Key Performance Indicators (KPI)"

[5] 3GPP TS22.104: "Service requirements for cyber-physical control applications in vertical domains"

[6] 3GPP TS22.261: "Service requirements for the 5G system"

# 3 Discussion

Note: This discussion paper relates to the PM\_KPI\_5G\_Ph3 WI.

3.1 Requirements on communication services using network slices

In 3GPP TS28.530 [2] in chapter 4.1.3 - Communication services using network slices describes as follows:

*As an example, a variety of communication services provided by multiple network slice(s) are illustrated in the figure 4.1.3.1. Figure 4.1.3.1 is only for illustrative purposes to highlight the combination and relationship of communication services to network slices without depicting any UE.*

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*Figure 4.1.3.1: A variety of communication services provided by multiple network slices*

In 3GPP TS28.530 [2] chapter 4.1.4 - Communication services requirements describes as follows:

*eMBB service type aims at supporting high data rates and high traffic densities as outlined in TS 22.261 [2], Table 7.1-1 "Performance requirements for high data rate and traffic density scenarios". URLLC service type aims at supporting the requirements in TS 22.261 [2], Table 7.2.2-1 "Performance requirements for low-latency and high-reliability services." related to high reliability and low latency scenarios. mIoT service type aims at supporting a large number and high density of IoT devices efficiently and cost effectively, see TS 23.501 [3].*

*Depending on the service type (eMBB, URLLC, mIoT), different service types may include different network slice related requirements, for example:*

*- Area traffic capacity requirement; -Charging requirement; - Coverage area requirement; - Degree of isolation requirement; - End-to-end latency requirement; - Mobility requirement; - Overall user density requirement; - Priority requirement; - Service availability requirement; - Service reliability requirement; - UE speed requirement*

Observation1: From TS28.530 [2] we know that communication services will be provided by one or multiple network slices. In order to support the communication services, there will be corresponding network slice related requirements. However, in the current specification the description of the requirements are just generic. There are not specific and sufficient requirements for a network slice producer to support a certain communication service.

3.2 Service KPIs

In TS28.535 [3] in chapter 4.3 - the communication service assurance service mentions ‘service KPIs’:

*In Figure 4.3.1 the controlled entity represents the resources used by a communication service and the assurance of this communication service is provided by the closed control loop between the different management services provided by the management system.*

*The input to the closed control loop is the data concerning the resources used by the communication service and corrresponding service KPIs which is monitored by the closed control loop and step "Monitor", analyzed by the closed control loop step “Analyze”, a decision on potential solution by the closed control loop step "Decide" which may be a possible action for the closed control loop step "Execute", The role of the decision support services is to provide variable degrees of automated decision making and human oversight support. The following two examples demonstrate how a closed control loop can be used:*

*- when a service experience degradation is detected (for example due to resource shortage or faults in the network), the resources used by a communication service may be adjusted automatically to improve the service experience*

*- the data associated with the communication service is monitored by the management services for data collection, this management service provides information to an assurance root cause analysis management service (example of an analytics service) and based on that information the assurance root cause analysis takes place, followed by proposing activities, mitigation or suggestions to solve the problem. The proposed activities, for example mitigation or problem-solving suggestion(s) are executed through provisioning services to bring the behaviour of the communication service within the requested boundaries of the metrics (SLS goals) that are controlled by the closed control loop.*

*And in* TS28.535 [3] in chapter6.1.4 - Communication service SLS assurance control given the UC of communication service assurance. In such case the SLS for network slice assurance are captured in ServiceProfile associated to network slice.

Observation2: The service KPIs are the requirements for the assurance of a communication service supported by a closed control loop. The service KPIs are monitored by the management system and if the servie experience degradation is detected, the corresponding optimization will be excuted to improve the service experience. SLS for network slice assurance are captured in ServiceProfile associated to network slice. However, the SLS requirements are generic and not specific for supporting a certain communication service.

3.3 Existing KPIs on service aspect

TS28.554 [4] specifies end-to-end Key Performance Indicators (KPIs) for the 5G network and network slicing.

Some of the KPIs, e.g the following KPIs:

* Delay related KPIs (Downlink latency in gNB-DU, Downlink delay in gNB-CU-UP, Uplink delay in gNB-DU, Uplink delay in gNB-CU-UP);
* Throughput related KPIs (DL RAN UE throughput, UL RAN UE throughput);
* QoS flow Retainability;
* Packet transmission reliability related KPIs (Packet transmission reliability KPI in DL, Packet transmission reliability KPI in UL)

These KPIs can optionally be split into KPIs per QoS level (mapped 5QI or QCI in NR option 3). Under this situation, the KPI is corresponding to QoS characterictics mapping with a certain resource type, packet delay and packet error. Only with a group of KPIs the example service such as audio, video, emails or interactive gaming corresponding to the QoS level can be supported.

3.4 Requirements for communication services of video uploading, remote controlling and Cloud VR

In the SI of 5G KQI the communication services of video uploading, remote controlling and Cloud VR are introduced.

Video uploading is widely used in transportation, smart city, telemedicine and industry automation. In order to support this communication service, a large number of videos are captured and uploaded and are required to be low latency and High-definition. There are various requirements for assurance of 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 tranmission of high-definition video, the high video transmission rate is required. In scenarios such as telemedicine and live broadcast, smooth video playback is required. Therefore, low packet loss rate of video transmission is required. If the packet loss rate is too large, video stall occurs, which affecting service experience. So for video uploading low latency, high throughput, low packet loss rate will be required.

The service of remote controlling is defined in TS22.104 [5]/TS22.261 [6]. Remote controlling is characterised by a UE being operated remotely by a human or a computer. E.g. the remote control of mobile cranes, mobile pumps and fixed portal cranes. In remote controlling scenario, real-time interactions are involved. URLLC is used in 5G SA (Single Access) 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, unqualified delay may cause service failures instead of performance problems. Therefore, it is important to analyze the delay and the delay fulfillment boundary. For example, if the SLA requirement is 10 ms, the evaluation focuses on ensuring that most service measurements are within the 10 ms boundary, or the proportion that exceed the delay boundary is as low as possible. Furthermore, the packet loss is also an important factor to be considered in remote controll. If the packet loss rate is too high, the control instruction fails. Therefore, the packet loss rate and the threshold of the packet loss rete need to be considered when defining the requirements to support the service.

Cloud VR (Cloud Virtual Reality) may become one of the most preferred eMBB services for many commercial 5G operators. It introduces the concepts and technologies of cloud computing and cloud rendering to VR service applications. With a high-speed and stable network, the cloud display output and audio output are encoded, compressed, and then transmitted to users' terminals. In this way, VR service content can be migrated to the cloud and rendered to the cloud. Cloud VR service experience is affected by various factors, such as media quality, network quality, and terminal quality. For the network quality, average throughput, the throughput variance, the e2e delay, the delay variance, the average packet loss rate, burst packet loss rate are the potential requirements for supporting the service.

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, the requirement is of great importance to estimate the service quality.

3.4 SI of 5G KQI

In the SI of 5G KQI, the following way forward are proposed:

1. In the SI the objective indicators which influence the customer experience will be studied.
2. The KQIs will be a group or series of requirements to support one service.
3. For supporting the service of video uploading, the requirements of low latency, high throughput, low packet loss rate will be introduced as a group of service KPIs; For the service of remote controlling, ultra-low latency, the stability of the delay (the proportion that exceed the delay boundary), and low packet loss rate will be condidered; For supporting the service of Cloud VR, average throughput, the throughput variance, the e2e delay, the delay variance, the average packet loss rate, burst packet loss rate are the potential requirements.

# 4 Detailed proposal

It is proposed that the way forward of the SI of 5G KQI be approved:

1. In the SI the objective indicators which influence the customer experience will be studied.
2. The KQIs will be a group or series of requirements to support one service.
3. For supporting the service of video uploading, the requirements of low latency, high throughput, low packet loss rate will be introduced as a group of service KPIs; For supporting the service of remote controlling, ultra-low latency, the stability of the delay (the proportion that exceed the delay boundary), and low packet loss rate will be condidered; For supporting the service of Cloud VR, average throughput, the throughput variance, the e2e delay, the delay variance, the average packet loss rate, burst packet loss rate are the potential requirements.