**3GPP TSG-SA WG6 Meeting #62 *S6-243157***

**Maastricht, NL, 19 - 23 August, 2024**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **23.433** | **CR** | **0075** | **rev** | **-** | **Current version:** | **19.2.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network | **X** |

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|  |
| ***Title:***  | Support of QoS measurement for Multi-Modal traffic in SEALDD layer |
|  |  |
| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | SA6 |
|  |  |
| ***Work item code:*** | XRM\_Ph2\_App |  | ***Date:*** | 2024-07-25 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-19 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | Solution#4 is recommended for normative work for the QoS monitoring in the XR scenario. See more details in 3GPP TR 23.700-23. |
|  |  |
| ***Summary of change:*** | Enhancement of the QoS measurement in the SEALDD layer for XR traffic. |
|  |  |
| ***Consequences if not approved:*** | Impossible to measure the QoS metrics for the XR scenario. |
|  |  |
| ***Clauses affected:*** | 3.1, 9.7.2.1, 9.7.2.2, 9.7.2.3, 9.7.3.1, 9.7.3.3, 9.7.3.4 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ... |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
| ***()*** |  |
| ***This CR's revision history:*** |  |

**Additional discussion(if needed):**

**Proposed changes:**

\* \* \* First Change \* \* \* \*

## 3.1 Terms

For the purposes of the present document, the terms given in 3GPP 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 3GPP TR 21.905 [1].

**Application connection:** Association between the VAL client and the VAL service to provide the VAL service.

**Application traffic:** a set of signaling messages or a set of media packet constituting a application service flow. E.g., one or more picture(s) may be an application traffic, the audio stream and the video stream are two different application traffic.

**Crossflow QoS measurement** is an E2E measurement between SEALDD client and SEALDD server that considers traffic routes in combination of uplink direction and downlink direction for same application.

**SEALDD–S connection**: Association between the SEALDD server and the VAL server to achieve data delivery of the application traffic. One application connection may have one SEALDD-S connection, e.g., for all the application traffic flows, or have more SEALDD-S connections, e.g., one for application signaling flow, and the other or application media traffic flow(s). A SEALDD-S connection shall be uniquely identified between the VAL server and the SEALDD server.

**SEALDD-S flows**: a set of packets have the same attributes, e.g., the same 5-tuple, media type. The application traffic flow may be mapped to one ore more SEALDD-S flow(s). A SEALDD-S flow should be uniquely identified with the SEALDD-S connection.

**SEALDD-UU connection**: Association between the SEALDD server and the SEALDD client to achieve the data delivery of the application traffic from the VAL server or the VAL client. One SEALDD-S connection may be associated with one SEALDD-UU connection or multiple SEALDD-UU connections. A SEALDD-UU connection shall be uniquely identified between the SEALDD client and the SEALDD server.

**SEALDD-UU flows**: a set of packets have the same attributes, e.g., the same 5-tuple, media type, QoS requirements. One SEALDD-S flow(s) may be mapped to one or multiple SEALDD-UU flows. A SEALDD-UU flow should be uniquely identified with the SEALDD-Uu connection.

\* \* \* Next change \* \* \* \*

#### 9.7.2.1 Data transmission quality measurement

Figure 9.7.2-1 illustrate the procedure for SEALDD enabled data transmission quality measurement. The SEALDD client and SEALDD server is enhanced to carry out the data transmission quality measurement.

Pre-conditions:

1. The SEALDD server and SEALDD client are synchronized to the time source provided by 5GS as specified in 3GPP TS 23.501 [5].

2. The VAL server discovers and selects the SEALDD server by CAPIF functions.



Figure 9.7.2.1-1: SEALDD enabled data transmission quality measurement procedure

1. An on-going regular data transmission connection is established according to clause 9.2.2.2.

2. The VAL server sends a SEALDD transmission quality measurement subscription request to the SEALDD server. The request includes the identifiers of the application traffic (e.g. VAL service ID, VAL server ID), requirement of transmission quality measurement (e.g. latency, jitter, bitrate, packet loss rate) and measurement target UE (e.g. a single UE, a group of UEs or all UEs), flow(s) traffic descriptor(s), and may also include reporting criteria, reporting frequency, spatial condition and temporal condition.

NOTE 1: The spatial and/or temporal condition can be used by SEALDD server to apply when and where the measurement is performed. For instance, the measurement is expected to be done for a group of VAL UEs with a scheduled route (from city A to city B via highway A2 and A3), from 9:00 a.m. to 11:00 a.m. on Tuesday and from 1:00 p.m. to 5:00 p.m. on Thursday.

3. Upon receiving the request, the SEALDD server performs an authorization check. If authorization is successful, the SEALDD server sends a response to the VAL server with the subscription ID, expiration time.

4. If the transmission quality measurement requirement list provided by VAL server in step 2, indicates that the latency is needed to be measured, the SEALDD server initiates the DL packet delay measurement. The SEALDD server encapsulates the DL monitoring packet (i.e. DL SEALDD packet with SEALDD DL monitoring header and VAL traffic as payload, or dummy DL SEALDD packet generated for data transmission quality monitoring) with local time T1 when the SEALDD server sends out the DL monitoring packets. The SEALDD server considers the spatial and/or temporal conditions when starting/resuming the transmission quality measurement. If the conditions are not satisfied, the SEALDD server stops/suspends the transmission quality measurement.

NOTE: For other metrics in transmission quality measurement requirement list (e.g. bitrate), the transmission quality result can be obtained by performance detection on the SEALDD server within a period of time.

5. The SEALDD client receives the DL monitoring packet, and records the local time T2. If the endpoint for the SEALDD traffic is located at the tethered device, the SEALDD client in 5G UE measures the QoS between the SEALDD client in 5G UE and the SEALDD client (i.e. for architecture that has the SEALDD client on the tethered device) or the VAL client (i.e. for architecture that without the SEALDD client on the tethered device) in tethered device, e.g., the SEALDD client may measure the tethered link delay using the ICMP ping protocol as defined in IETF RFC792 [RFC792]).

NOTE 2: The tethered link measurement between SEALDD client and VAL client is based on the business agreement assumption between the VAL provider and the SEALDD provider, which request the VAL client to respond to ICMP Ping packet.

NOTE 3: Only RTT can be measured for the link between SEALDD client and the tethered device.

6. Similarly, the SEALDD client encapsulates the UL monitoring packet (i.e. UL SEALDD packet with SEALDD UL monitoring header and VAL traffic as payload, or dummy UL SEALDD packet generated for data transmission quality monitoring) with local time T2 recorded in step 5 and local time T3 when the SEALDD client sends out the UL monitoring packet. If the endpoint for the VAL traffic is located at the tethered device, the measurement delay in the tethered link (step 5) is considered in T2 and T3 timestamps, e.g., T2 timestamp includes the half of the measurement delay and T3 timestamp excludes the half of the measurement delay.

NOTE 4: With ICMP ping over tethered link, it is assumed that the UL packet delay and the DL packet delay are the same between the tethering UE and the tethered device.

7. The SEALDD server records the local time T4 when the SEALDD server receives the UL monitoring packet and calculates the latency with T1, T2, T3, T4. The SEALDD server can also calculate the bitrate, jitter and packet loss rate over a certain period over a specific SEALDD connection by recording the status of the SEALDD packets carrying VAL traffic or dummy SEALDD packets generated for transmission quality measurement reports. The SEAL DD server also evaluates the reporting criteria if present in the SEALDD transmission quality measurement subscription request in order to generate the transmission quality measurement report.

8. The SEALDD server reports the data transmission quality measurement results (e.g. latency, jitter, bitrate, packet loss rate) to the VAL server via the notification message.

When a VAL group ID or a list of VAL UE IDs or all VAL UEs indication is received in step 2, step 4 to step 7 is repeated for VAL UEs in the group/list or for all VAL UEs. The SEALDD server maps the VAL UE group ID to a list of VAL UE IDs if a VAL group ID is received. The SEALDD server identifies SEALDD connections corresponding to the desired VAL UE(s) or flow(s) traffic descriptor(s) to trigger measurement. And depending on the reporting requirement for multiple UEs, the SEALDD server calculates the needed report for the VAL server. When the VAL server decides to update or unsubscribe transmission quality measurement subscription after performing step 2 and step 3, the VAL server can send data transmission quality measurement subscription update request and data transmission quality measurement unsubscribe request to SEALDD server, as specified in Table 9.7.3.9-1 and Table 9.7.3.11-1, respectively.

\* \* \* Next change \* \* \* \*

#### 9.7.2.2 Data transmission quality query

Figure 9.7.2.2-1 illustrate the procedure for SEALDD enabled data transmission quality query. This procedure is used to obtain the historical transmission quality result already measured as described in clause 9.7.2.1.

Pre-conditions:

1. The SEALDD server performs the data transmission quality measurement procedure, as described in clause 9.7.2.1.

 

Figure 9.7.2.2-1: SEALDD enabled data transmission quality query procedure

1. The consumers (e.g. VAL server, SEALDD server, NSCE server, ADAE server) can send a SEALDD transmission quality query request to the SEALDD server to obtain the transmission quality measurement result. The request includes the identifiers of the application traffic (e.g. VAL service ID, VAL server ID), VAL UE ID or VAL UE group ID, flow(s) traffic descriptor(s), or crossflow measurement information.

2. The SEALDD server responds with the transmission quality measurement result (e.g. packet delay, bitrate, packet loss rate).

\* \* \* Next change \* \* \* \*

#### 9.7.2.3 Data transmission quality measurement reported by SEALDD client

Figure 9.7.2.3-1 illustrate the procedure for SEALDD enabled data transmission quality measurement for VAL traffic. The SEALDD client receives transmission quality measurement requirement, decides to start VAL data transmission monitoring and generates measurement reports.



Figure 9.7.2.3-1: VAL data transmission quality measurement reported by SEALDD client

1. An on-going regular data transmission connection is established according to clause 9.2.2.2.

 The transmission quality measurement can be triggered by VAL server or VAL client, which is described in step 2 to step 5 and step 6, correspondingly.

 The request may include the crossflow measurement information (e.g. {[traffic descriptor 1, UL]; [traffic descriptor 2/DL]}) associated in the same multi-modal service for crossflow RTT measurement.

2. The VAL server sends a SEALDD transmission quality measurement subscription request to the SEALDD server. The request includes the identifiers of the application traffic (e.g. VAL service ID, VAL server ID), requirement of transmission quality measurement (e.g. latency, jitter, bitrate) and measurement target UE (e.g. a single UE, a group of UEs or all UEs), and may also include reporting criteria, reporting frequency, spatial condition and temporal condition.

NOTE 1: The spatial and/or temporal condition can be used by SEALDD client to apply when and where the measurement is performed. For instance, the measurement is expected to be done for a group of VAL UEs with a scheduled route (from city A to city B via highway A2 and A3), from 9:00 a.m. to 11:00 a.m. on Tuesday and from 1:00 p.m. to 5:00 p.m. on Thursday.

3. Upon receiving the request, the SEALDD server performs an authorization check. If authorization is successful, the SEALDD server responds to the VAL server.

4-5. The SEALDD server sends a SEALDD transmission quality measurement subscription request to the SEALDD client and the SEALDD client responds to the SEALDD server. The SEALDD client, based on the received service quality guarantee policy including thresholds and action, can take corrective action as described in clause 9.7.2.3.

 If crossflow RTT measurement requirement is received from the VAL server, the SEALDD server identifies the SEALDD connections for the involved VAL UEs and sends to the SEALDD client(s) with crossflow RTT measurement requirement including corresponding UL/DL flow information.

6. The VAL client triggers the SEALDD transmission quality measurement procedure to the SEALDD client, in order to collect the measurement report information.

7. After SEALDD client determines to start measurement process, upon UL packet arrival, the SEALDD client initiates the UL packet delay measurement. The SEALDD client encapsulates the UL monitoring packet (i.e. UL SEALDD packet with SEALDD UL monitoring header and VAL traffic as payload for VAL data transmission quality monitoring) with local time T1 when the SEALDD client sends out the UL monitoring packet. The SEALDD client considers the spatial and/or temporal conditions when starting/resuming the transmission quality measurement. If the conditions are not satisfied, the SEALDD client stops/suspends the transmission quality measurement.

 For crossflow RTT measurement, the SEALDD client received UL flow information starts recording local time T1 when sending out the 1st UL packet matching the UL flow information to the SEALDD server. The T1 is sent in the encapsulated UL monitoring packet to the SEALDD server.

8. The SEALDD server receives the UL monitoring packet, and records the local time T2.

9. Similarly, the SEALDD server encapsulates the DL monitoring packet (i.e. DL SEALDD packet with SEALDD DL monitoring header and VAL traffic as payload, or dummy UL SEALDD packet generated for data transmission quality monitoring in case there is no DL VAL traffic for DL packet delay monitoring) with local time T2 recorded in step 8 and local time T3 when the SEALDD server sends out the DL monitoring packet.

NOTE 2: When the SEALDD server sends the dummy UL packet as monitoring response to the SEALDD client depends on SEALDD server implementation.

 For crossflow RTT measurement, when the 1st DL packet matching the received DL flow information is to be sent, the SEALDD server encapsulates the DL monitoring packet with previously received T1 and sends the DL monitoring packet to the SEALDD client.

10. The SEALDD client records the local time T4 when the SEALDD client receives the DL monitoring packet and calculates the latency with T1, T2, T3, T4. The SEALDD client can also calculate the bitrate and jitter over a certain period over a specific SEALDD connection by recording the status of the SEALDD monitoring packets. The SEALDD client also evaluates the reporting criteria if present in the SEALDD transmission quality measurement subscription request in order to generate the transmission quality measurement report.

 For crossflow RTT measurement, if T1 is received in the DL packet, the SEALDD client records local time T2 and calculates RTT based on T1 and T2.

 Depending on which entity triggers the data transmission quality measurement, step 11 and step 12 corresponds to step 2 to step 5, step 13 corresponds to step 6.

11-12. The SEALDD client reports the data transmission quality measurement results (e.g. latency, jitter, bitrate) to the VAL server via the SEALDD server.

13. The SEALDD client reports the data transmission quality measurement results to the VAL client.

NOTE 3: The crossflow RTT measurement calculated by the SEALDD client in step 10 can be used as an estimation of the lower bound for the Motion-to-Photon latency in the XR scenarios.

When a VAL group ID or a list of VAL UE IDs or all VAL UEs indication is received in step 2, step 4 to step 11 is repeated for VAL UEs in the group/list or for all VAL UEs. The SEALDD server maps the VAL UE group ID to a list of VAL UE IDs if a VAL group ID is received. The SEALDD server identifies SEALDD connections corresponding to the desired VAL UE(s) to trigger measurement. And depending on the reporting requirement for multiple UEs, the SEALDD server collects and aggregates the needed report for the VAL server.

Editor's note: Whether identifying packet in PDU set is necessary in crossflow RTT measurement is FFS.

\* \* \* Next change \* \* \* \*

#### 9.7.3.1 SEALDD enabled data transmission quality measurement subscription request

Table 9.7.3.1-1 describes the information flow from the VAL server to the SEALDD server for subscribing to the data transmission measurement service.

Table 9.7.3.1-1: SEALDD transmission quality measurement subscription request

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| Application traffic identifiers | M | Identify of the application traffic (e.g. VAL server ID, VAL service ID) |
| Identity | O(See NOTE) | Identifier of the VAL UE or VAL user for which measurements need to be provided. |
| VAL UE/user group ID | O(See NOTE) | Identifier of a specific VAL UE/user group, as defined in clause 7.5 of 3GPP TS 23.434 [4].  |
| Identity list | O(See NOTE) | Identifies a list of VAL UEs, e.g. the list of UE ID, or a list of VAL users. |
| All VAL UEs or VAL users Indication | O(See NOTE) | Indicates all VAL UEs or VAL users of the application identified by application traffic identifiers. |
| Flow(s) traffic descriptor(s) | O(See NOTE) | Indicates the flow(s) traffic descriptor(s) (Address/port or URL) for the measurement. |
| Crossflow measurement information | O(see NOTE) | Represents the crossflow measurement information, e.g., list of pairs traffic descriptor with traffic direction (UL or DL).Example of the crossflow measurement information: {[traffic descriptor 1, UL]; [traffic descriptor 2, DL]}. |
| Measurement conditions | O | Indicates the temporal and/or spatial conditions. |
| Transmission quality measurement requirements list | M | The measurement requirement information  |
| > Measurement ID  | M | Measurement identifiers, e.g. UL/DL/E2E latency, UL/DL bitrate, UL/DL/E2E packet loss rate, UL/DL/E2E jitter, and crossflow identifier (e.g., crossflow latency, crossflow bitrate, crossflow packet loss rate, crossflow jitter). |
| > Reporting frequency | O | The reporting frequency of measurement results (e.g. periodic reporting). If not present, it implies periodic reporting. |
| > Reporting periodicity | O | If the reporting frequency is periodic, the reporting periodicity shall be provided. For multiple UEs/users, it is recommended to give sufficient time to allow report aggregation. |
| > Reporting granularity | O | The reporting granularity indicates whether the measurement report is for individual VAL UE/user or for VAL UE/user group or for all VAL UEs/users, if VAL UE/user group or all VAL UEs/users is the measurement target. |
| > Measurement period window | O | Indicates the measurement period window for transmission quality measurements |
| > Measurement expiration time | O | Indicates the measurement expiration time |
| > Reporting criteria | O | Indicates the criteria for reporting measurement results, e.g. if the latency or bitrate reaches below or above a certain value. It also includes a unique identifier for each criteria of more than one criteria is specified. |
| NOTE: One of them shall be present as the measurement target UE or traffic descriptor. |

\* \* \* Next change \* \* \* \*

#### 9.7.3.3 SEALDD enabled data transmission quality measurement notification

Table 9.7.3.3-1 describes the information flow from the SEALDD server to the VAL server for notifying the transmission quality measurement reports.

Table 9.7.3.3-1: SEALDD transmission quality measurement notification

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| Subscription ID | M | Subscription identifier corresponding to the subscription. |
| Transmission quality measurement reports list  | M | The generated transmission quality results in SEALDD server, as specified in Table 9.7.3.3-2. |

Table 9.7.3.3-2 describes the information elements for the transmission quality measurement reports list, provided by the SEALDD server after performing transmission quality measurement.

Table 9.7.3.3-2: SEALDD transmission quality measurement reports list

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| > Measurement ID | M | Measurement identifiers, (e.g. UL/DL/E2E latency, UL/DL bitrate, UL/DL/E2E packet loss rate, UL/DL/E2E jitter) and crossflow identifiers (e.g., crossflow latency, crossflow bitrate, crossflow packet loss rate, crossflow jitter). |
| > VAL UE/user ID(s) or flow(s)traffic descriptor(s) | O(see NOTE) | It indicates the VAL UE(s) or VAL user(s) under SEALDD measurement. For a single VAL UE/user or flow(s)traffic descriptor(s), it can be omitted and the associated measurement values are for the single VAL UE/user. For multiple VAL UEs/users or flow(s)traffic descriptor(s) with reporting granularity set to individual UE/user or flow traffic descriptor, the associated measurement values are for individual VAL UE/user or flow traffic descriptor as indicated in this IE. For multiple VAL UEs/users with reporting granularity set to VAL UE/user group/list or all VAL UEs/users, the associated measurement values are aggregation for all VAL UEs/users or the VAL UE/user group/list and this IE includes the measured VAL UEs/users. |
| > Crossflow measurement information | O(see NOTE) | Represents the crossflow measurement information, e.g., list of pairs traffic descriptor with traffic direction (UL or DL).Example of the crossflow measurement information: {[traffic descriptor 1, UL]; [traffic descriptor 2, DL]}. |
| > Average measurement value | O | The average measurement value of measurement results |
| > Minimum measurement value  | O | The minimum measurement value of measurement results  |
| > maximum measurement value | O | The maximum measurement value of measurement results |
| > Standard deviation measurement value | O | Standard deviation measurement value of measurement results |
| > kPercentile measurement value | O | Indicates the kpercentile measurement value of measurement results |
| > Measurement period | O | Indicates the measurement period  |
| > Timestamp | O | Indicates the timestamp of measurement results |
| NOTE: These IEs are mutually exclusive. |

\* \* \* Next change \* \* \* \*

#### 9.7.3.4 SEALDD enabled data transmission quality query request

Table 9.7.3.4-1 describes the information flow from the other consumers (e.g. SEALDD server, NSCE server, ADAE server) to the SEALDD server for querying the data transmission quality measurement result.

Table 9.7.3.4-1: SEALDD transmission quality query request

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| Application traffic identifiers | M | Identify of the application traffic (e.g. VAL server ID, VAL service ID) |
| VAL UE/user ID(s) or flow(s) traffic descriptor(s) | O(see NOTE) | Identifier of VAL UE(s), VAL user(s), or flow(s) traffic descriptor(s) need to be queried, e.g. single VAL UE/user, multiple VAL UEs/users, flow(s) traffic descriptor(s), or VAL UE/user group. |
| Crossflow measurement information | O(see NOTE) | Represents the crossflow measurement information, e.g., list of pairs traffic descriptor and traffic direction (UL or DL).Example of the crossflow measurement information: {[traffic descriptor 1, UL]; [traffic descriptor 2, DL]}. |
| NOTE: These IEs are mutually exclusive. |

\* \* \* End of changes \* \* \* \*