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BIF RESPONSE TO TRAI CP ON VOICE SERVICES TO LTE USERS (Incl. VoLTE & CS Fall Back)

Q1: Whether prescribed QoS parameters, as per existing QoS Regulations, are sufficient to effectively monitor QoS of VoLTE/CSFB calls? Please provide suggestions with justifi- cations.

BIF RESP:

ITU-T Recommendation G.1028 regarding end-to-end quality of service for voice over 4G mobile network, has defined End-to-end quality indicators and corresponding network KPIs for Voice over 4G mobile network. Some of them are Registration success rate (KPI related to IMS), Post-Dialing Delay (PDD), voice quality (MOS-LQ) and call drop rate, which are parameters for measurement of customer experience for voice service. On the other hand, GSMA also considered QoS parameters defined by ITU-T in its recommendation G.1028 and defined the quality of service (QoS) parameters based on field measurements and their computation in its document IR.42. Some of the parameters identified by GSMA for VoLTE are IMS Registration Success Ratio, IMS Third-party Registration Success Ratio, VoLTE MO/MT Session Setup Time, VoLTE speech quality (SpQ MOS-LQO and SpQ R-Factor-LQ), SRVCC (PS-CS) Quality Parameters etc.

Telephony speech quality is an indicator representing the quantification of the end-to-end speech transmission quality of the Mobile Telephony Service. As measurement of call quality is a very subjective area, therefore Mean Opinion Score (MSO) is generally used in telecommunications to assess the users' opinion of call quality. The validation of the end-to-end quality is made using MOS-LQO scales. These scales describe the opinion of users with speech transmission and its troubles (noise, robot voice, echo, dropouts and so on), according to ITU-T Recommendation P.862/P.863.

ITU-T recommendation P.863 is a mobile voice quality testing standard and also is known as Perceptual Objective Listening Quality Analysis (POLQA). It has been especially developed for super wideband (SWB) requirements of HD Voice, 3G, VoLTE (4G), VoHSPA and VoIP (Voice over Internet Protocol). It considers many new conditions which are there in emerging technologies like LTE e.g.,

- New types of speech codecs as used in 3G/LTE and audio codecs, e.g. AAC and MP3
- Voice Enhancement systems, Noise Reductions, Discontinuous transmission (DTX)
- Codecs that modify the audio bandwidth, e.g. SBR (Spectral Band Replication)
- Measurements on signals with very high background noise levels
- Correct modeling of effects caused by variable sound presentation levels
- Support of NB (300 to 3400 Hz) and SWB (50 to 14000 Hz) mode
- Handling of time-scaling and warping as seen in VoIP and 3G packet audio

While the above is an ITU recommended methodology, the implementation of the above is difficult for each call and the actual implementation using engineering phones is not cost effective.

Further, 3GGP also identified KPI parameters for E-UTRAN [3GPP TS 32.451] and IMS [3GPP TS 32.454] that are equivalent to parameters identified in ITU-T Recommendation G.1028, like Initial Registration Success Rate of S-CSCF, Third Party Registration Success Rate, Call Drop Rate of IMS Sessions, E-RAB Retainability (reflect abnormal releases of the service) etc. QoS monitoring and reporting at critical network points (end-user part/ access part/ core part) can help regulator and service providers to troubleshoot the concerns/issues related to customer experience.

In India, LTE is still in the evolution stage but growing at a rapid pace, thereby posing the need to closely analyze the problems related to Quality of Services for Voice over LTE . For voice calls of LTE users via CSFB methods, call quality assessment may be required to be assessed and suitable additional parameters may need to be appropriately defined. ...

In certain cases, VoLTE calls would also move into the CS network by conducting SRVCC Handovers and these can also be monitored with KPI's like Handover Success Rates, Average time for Handover. The failure of these can also effect the QoS of the calls. The actual values to avoid long periods of speech delay can be captured and perhaps can be defined over a period of time when the services are more matured.

We feel that over and above the mechanism proposed, there should be an alternate mechanism to capture the voice samples of the end-customer (Eg. by calling into a toll free no.) through an App (approved by TRAI) which will permit capture of actual voice samples and report actual experience as faced by the end-customer. This method can permit capture of not just issues like mute, but also for inferior speech, or inaudible speech.

This will enable assessment of the end-customer voice quality for not just VoLTE and CSFB services, but also for voice services like VoIP, VoWi-Fi services in near future.

Issues that could also arise due to devices could also be addressed though this mechanism.

Q2: If existing QoS parameters are not sufficient to monitor QoS of VoLTE/CSFB calls, then what new parameters can be introduced? Please provide details with justifications.

BIF RESP:

For voice calls of LTE users via CSFB methods, call quality assessment may be required to be assessed and suitable parameters may need to be appropriately defined. For CSFB scenarios, range of parameter values which affect user experience but not properly reflected in QoS assessment may be required to be discovered for general network conditions and prescribed appropriately. Inappropriate values may result into longer call set up delay, silence periods or voice muting etc. Certain cases which may require setting values beyond normally permissible limits for longer periods may need proper justification and to be recorded.

Indicator for CSFB performance measurement

ITU-T Recommendation G.1028 regarding end-to-end quality of service for voice over 4G mobile network, has defined End-to-end quality indicators and corresponding network KPIs for Voice over 4G mobile network. Some of them are Registration success rate (KPI related to IMS), Post-Dialing Delay (PDD), voice quality (MOS-LQ) and call drop rate, which can reflect the poor customer experience for voice service.

GSMA also considered QoS parameters defined by ITU-T in its recommendation G.1028 and defined the quality of service (QoS) parameters based on field measurements and their computation in its document IR.42. Some of the parameters identified by GSMA for CSFB are Setup Time Telephony (equivalent to PDD), CSFB Return to LTE Success Ratio, Speech Quality on Call Basis (SpQ), Call Completion Ratio Circuit Switched Telephony etc.

Post-Dialing Delay (PDD), voice quality (MOS-LQ) and call drop rate may be relevant parameters to identify and quantify QoS degradation in voice services via CSFB. QoS monitoring and reporting at critical network points (end-user part/ access part/ core part) can help regulator and service providers to troubleshoot the concerns/issues related to customer experience.

Accessbility parameter like registration attempts to IMS and Bearer Setup with IMS can also be captured in case of VoLTE.

Some of KPI's like PDD and CSFB Call setup delay will give an indication on the overall assessibiity of the service, but the more robust mechanism of capturing the actual samples for a 30 to 60 sec call can help provide a clearer picture of the end user experience.

Q3. How to define instance of silence/voice mute? How many such instances may be accepted during voice call? Whether existing parameters like packet loss, jitter, latency, end-to-end delay are sufficient to identify or measure silence/voice mute or some other parameters are also need to be factored to measure it? Please provide details with justifications.

BIF RESP:

In case of packet switched (IP) network, there is another difference from circuit switched network that error or loss free and timely delivery of voice packets by radio networks may not be enough to ensure end

to end performance. In packet switched network, IP packets might get lost or delayed in core or transport networks. Even during handover phase, voice packets yet to be delivered might be required to be handled appropriately. Delay or variations in delay in delivery of packets or loss of packets or errors in packets may result into poor QoS experience for VoLTE users. Such instances may result into silence period or voice mute observed by the users. Extent to which this is experienced by the user during a call before dropping of call may also be implementation specific.

Readiness of all LTE devices to support interoperable VoLTE client with serving LTE network may take time. Interoperability issues may be operator specific and even if operator has launched VoLTE in the area, VoLTE may not be available to all types of LTE device users. LTE users having devices interoperability with IMS of that operator may be served using VoLTE while other LTE users may be served via CSFB for voice services. Therefore, QoS for voice services assessed for a particular LTE network may vary for VoLTE and CSFB users. There might be some issues which may be observed more in cases of CSFB e.g. delay in call set up time, registering incoming call attempt as miss call by phone while there was no alert to user most probably due to improper behaviour of network or incomplete execution of call set up procedure involving multiple types of radio networks.

QoS issue like silence/voice mute cannot be captured for the VoLTE users or users served by CSFB, have little correlation with the DCR statistics available from the networks. Packet Loss, Jitter and end to end delay can provide an indication to the QoS measurements, at a cell level.

As in the case of other CS based technologies, the RF conditions, counter or timer values clearly indicate the quality of RF condition, since the signaling and speech paths are 'Always ON' connections. E.g. An additional parameter Radio Link Timeout (RLT) for GSM based radio access network was defined in the fifth amendment of regulations. High RLT value i.e. 48 and higher configured in the network for more than three days is required to be recorded with proper justifications. Similarly, for VoLTE call quality assessment, range of timer and constant values, which affect user experience but not properly reflected in QoS assessment, may be required to be discovered for general network conditions and prescribed appropriately. Inappropriate values may result in longer call set up delay, silence periods or voice muting etc.

These can be captured by conducting drive test using engineering phones with mechanism to capture audio samples, as per ITU P.863, which is not feasible to capture across the country like India as it would involve multiple teams not to mention the huge logistic costs.

In LTE, various timers (such as T304, T301, T311 etc) and constants (such as N310, N311 etc) are defined by 3GPP in its documents [3GPP TS 36.331] and can be measured in parallel. Optimization of such timers and constants is very essential from the users experience prospective. Some of the constants and timers whose values may impact QoS but improve DCR statistics or call set up success rate are mentioned as per Annexure I of the TRAI Consultation Paper. Inappropriate value configuration of such timers and constants in the network may lead to situations like; frequent call drops, longer call set up delay, silence periods or voice muting. In case of voice muting, there could be cases when the call may not get dropped but customers experience a prolonged silence period (Mute) during a voice call.

Q4. How to measure report and evaluate network or service from perspective of silence/voice mute problem? Which ITU measurement tools can be used to prepare framework for measurement of silence/voice mute problem? Please provide details with justifications.

BIF RESP:

Response to this Q is given above in Response to Q3.

Q5. Whether certain range of timers and constants are required to be prescribed which may affect VoLTE call quality assessment? If yes, which may be those timers and constants and what may be the suggested ranges of timers and constants? Please provide details with justifications.

BIF RESP:

Detailed Response is provided in Response to Q3 above

Q6. What parameters like Post Dialing Delay (PDD) may be introduced to measure performance of users being served voice via CSFB? What may be the threshold? How to measure report and evaluate? Please provide details with justifications.

BIF RESP:

ITU-T Recommendation G.1028 regarding end-to-end quality of service for voice over 4G mobile network, has defined End-to-end quality indicators and corresponding network KPIs for Voice over 4G mobile network. Some of them are Registration success rate (KPI related to IMS), Post-Dialing Delay (PDD), voice quality (MOS-LQ) and call drop rate, which can reflect the poor customer experience for voice service.

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Post-Dialing Delay (PDD), voice quality (MOS-LQ) and call drop rate may be relevant parameters to identify and quantify QoS degradation in voice services via CSFB.

However, QoE monitoring using Voice Listening Quality is equally important and relevant at critical network points (end-user part/ access part/ core part) and can help the Regulator and service providers to troubleshoot the concerns/issues related to customer experience.

Q7. Any other issue which is relevant to this subject?

BIF RESP:

None