IJRD International Journal of Research & Development Organisation

Journal Of Electrical And Electronics Engineering

Analysis of Call Quality in Telecommunication Network

Mr. Raj Kapoor Kr. Gaund, Mr. Dinesh Kr. Yadav

ABSTRACT

The paper is focused on deriving the call quality parameters from end users perspective and visualize, escalate the critical call quality. The method of measurement of call charges based on call quality parameters. The measures certain call parameters during the call and provide average scores at the end of the call. Call quality for the bundle of calls is derived based on the aggregation of successful call parameters which gives the overall call quality measure. The call were Signal Strength, the successful call rate, normal drop call rate, handover drop rate. GPS coordinates are also used to locate the location and quality of the individual calls. The methodology of extracting the parameters used is basically the signal strength and number of successful and un-successful calls in a bundle of 10 calls. At the end of 10th call the average parameter value has been computed for each of the parameter mentioned that are used for deriving the final call quality. A model using the SMS feature for tackling the critical quality and escalation has been proposed and developed as a part of the system. The results of the call quality correlation with the subjective scores are also presented. Various call charging methods based on call quality perceived by the end user are proposed, which satisfies the subscribers and helps the operators to reduce the charging and increase the ARPU. The results of the proposed and developed system are given.

Keywords: Measurement of Call Quality(MCQ), Signal Strength(SS), Successful Call Rate(SCR), Normal Drop Call Rate(NDCR), Handover Drop Rate (HDR), Location Area Code(LAC), Band width Quality (BWQ),Average Revenue per User (ARPU).

1. INTRODUCTION :

The speech quality measurement techniques use the subjective listening tests called Mean Opinion Score (MOS). It's based on the human perceived speech quality based on the scale of 1 to 5, where 1 is the lowest perceived quality and 5 is the highest perceived quality. Subjective listening tests are expensive, time consuming and tedious. So, currently most of the systems use objective .The evaluation of speech quality using some mobile computing techniques. Objective testing systems are use automated speech quality measurement techniques. The three well known objective measurement techniques are (1) Perceptual Speech Quality Measure (PSQM), (2) Perceptual Analysis Measurement System (PAMS) and (3) Perceptual Evaluation of Speech Quality (PESQ).

Objective speech quality measurement techniques mostly are based on input-output approach [7]. In input-output objective measurement techniques basically works by measuring the distortion between the input and the output signal. The input signal would be a reference signal and output signal would be a received signal. Input-output based speech quality assessment in objective speech quality measurement gave good correlations with reaches up to 99% in some cases [8]. Estimating the speech quality without the presence of input signal or reference signal is latest area of research. Input-output based speech quality assessment in objective speech quality measurement gave good correlations with reaches up to 99% in some cases [5].

The performance of objective measurement is basically achieved by correlating their results with the subjective quality measure.

2. CALL QUALITY ANALISYS :

The paper is focused on call quality measurement. Measuring Call Quality to ensure the quality of mobile network and its reliability is essential. The system logs the signal strength information for every 5ms if there is change in the signal strength information. The system records the number of successful and un-successful call attempts made for every ten call attempts. The successful and un-successful call attempts are classified based on whether the call is successfully connected by the network. The call drop information such as normally dropped from either of the party or dropped due to handover during the cell change is also recorded. The average signal strength of successful calls, normal dropped and handover dropped with there average scores are recorded. The overall successful call rate score is also derived based on below scale parameter:
successful calls 1-2 score : 1(Very Bad)
successful calls 3-4 score : 2
successful calls 5-6 score : 3
successful calls 7-8 score : 4
successful calls 9-10 score : 5(Excellent)
Normally dropped call rate score is derived based on scale parameter:
Normal dropped calls >8 score : 5(Excellent)
Normal dropped calls < 7 & <8 score : 4
Normal dropped calls < 6 & < 7 score : 3
Normal dropped calls < 4 & < 6 score : 2
Normal dropped calls < 4 score : 1 (Very Bad)
The call quality is derived from the scores computed from the above parameters as below: [4]
(Average signal strength score of all successful calls + successful call rate score + normal dropped calls rate score)/3.
The system has the ability to send the signal strength information to the particular number. It has the provision of setting the mobile number, to which the sms would be sent automatically at the end of call. The system has the option of setting to send the sms always, less than bad etc. at the end of 10 calls the call statistics would also be sent as sms

General Signal_Measure on the basis of given Signal Meter flowchart [6] (over view)
1. Get the preferences for log_change, log_location
2. Get total_calls, Call_attempts_failed, call_attempts_successfull, normal_dropped_calls, handover_dropped calls
3. if (total_calls =10) reset all variables to zeros
4. if (call_attempt = failed)
total_calls=total_calls+1
call_attempts_failed=call_attempts_failed+1
5. While (phone_status != idle && call_attempt = successful)
6. total_calls=total_calls+1
7.all_attempts_successful=call_attempts_successful+1
8. End of call
9. Calculate average_signal_strength
10. Calculate
average_call_quality=(score_successful_attempts+score_successful_call_rate+score_handover_success_calls_rate)/3
11. Write("calls_stats", total_call_attempts_failed, total_call_attempts_successful, score_successful_attempts, normal_dropped_calls,score_normal_dropped, handover_dropped_calls,score_handover_dropped,score_successfull_call_rate,score_handover_success_calls_rate, average_call_quality)
12. if(sendSMS = Manual && want_to_send_sms= yes)
set(mobile_number)
sendSMS(signal_stength, SignalQuality,call_drop_information)

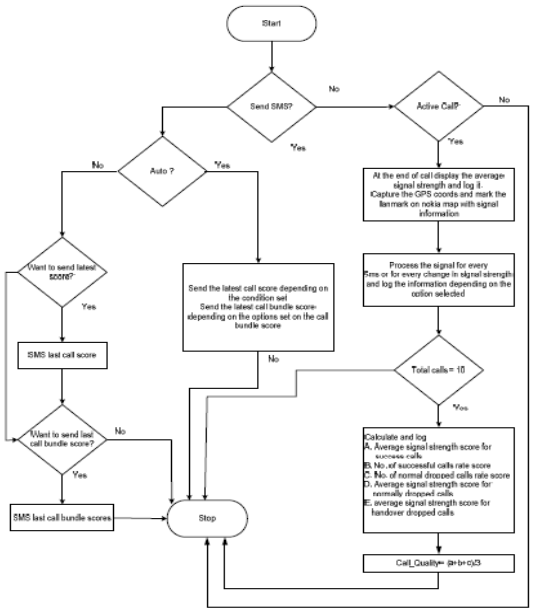

Figure 1: Signal Meter flowchart

Table 1 shows final call quality classification based on the score for a bundle of 10 calls.

Table 1: Call Quality Score on the performance based

S. No.	Score Classification	Score Classification	Grade
1	0-1	Extremely Bad	E

2	1-2	Bad	D
3	2-3	Average	C
4	3-4	Good	B
5	4-5	Excellent	A

3. ANALISYS OF SUBJECTIVE SCORES :

The results of SM are compared with the MOS (Mean Opinion Scores) of the same calls for which the call quality scores are computed using SM. For each individual call the MOS is observed and classified based on Table 2. The classification for MOS and SM are relatively same. Hence the average call quality computed for the below mentioned calls are compared with subjective average scores. The comparison is done in two folds as shown in Table 3 and Table 4 [8], [9]. This is to ensure the call quality scores correlates with MOS scores in all the cases from low number of calls to high number of calls at different locations. The SM (Signal Meter) call quality based on the parameters computed as mentioned in table 2.

Table 2: MOS Classification on the performance based

S. No.	MOS	QUALITY	Grade
1	1	Extremely Bad	E
2	2	Bad	D
3	3	Average	C
4	4	Good	B
5	5	Excellent	A

Table 3: Call Quality Vs MOS up to 100 calls

S. No.	No. of Calls	MOS (Average)	MOS Quality	SM (Average Call Quality)	SM Quality
1	20	6	Average	5.4	Average
2	40	8	Good	7.6	Good
3	60	8	Good	7.8	Good
4	80	10	Excellent	9.6	Excellent
5	100	10	Excellent	9.6	Excellent

Table 4: Call Quality Vs MOS up to 600 calls

S. No.	No. of Calls	MOS (Average)	MOS Quality	SM (Average Call Quality)	SM Quality
1	200	4	Good	3.6	Good
2	300	5	Excellent	4.6	Excellent
3	400	5	Excellent	4.8	Excellent
4	500	5	Excellent	4.9	Excellent
5	600	5	Excellent	4.8	Excellent

The correlation between SM call quality and MOS scores shows that SM quality scores are very close to the MOS listening scores. Therefore, the SM can used to carry out the subjective evaluation of call quality instead of using human being which would be cumbersome[12].

4. CHARGING RATE VS QUALITY :

The new charging rates are proposed based on the four call quality parameters derived in [8]. The proposed tariff structures as per the parameters are improved version proposed in [6].The variable Z is the normal charging rate per minute, 'n' is the number called minutes in the bundle of 10 call attempts.
The Table 5 below is the new charging rate proposed based on average signal strength of successful calls in a bundle .

Table 5: Proposed charging rate Vs Average signal strength of successful calls

S. No.	Average signal Strength of success full calls Score	Charges
1	5	Z*n
2	4	Z*n
3	3	Z*n*0.60
4	2	Z*n*0.40
5	1	No Charge
Total=5	16	**********

The Table 6 below is the new charging rate proposed based on successful call attempts in a bundle of 10.

Table 6: Proposed Charging Rate Vs Successful call Attempts

S. No.	Average signal Strength of success full calls Score	Charges
1	5(Very good)	Z*n
2	4 (Good)	Z*n
3	3 (Average)	Z*n*0.60
4	2 (Bad)	Z*n*0.40
5	1 (Very Bad)	No Charge
Total=5	16	**********

The Table 7 below is the new charging rate proposed based on average signal strength of normal dropped calls in a bundle of 10. [10]

Table 7: Proposed Charging Rate Vs Normal Dropped Rate

S. No.	Normal Dropped Rate Score	Charges
1	5(Very good)	Z*n
2	4 (Good)	Z*n

3	3 (Average)	Z*n*0.60
4	2 (Bad)	Z*n*0.40
5	1 (Very Bad)	No Charge
Total=5l	=16	**********

The Table 8 below is the new charging rate proposed based on total call quality of calls in a bundle of 10.

Table 8: Proposed Charging Rate Vs Call Quality

S. No.	Call Quality	Charges
1	5(Very good)	Z*n
2	4 (Good)	Z*n
3	3 (Average)	Z*n*0.60
4	2 (Bad)	Z*n*0.40
5	1 (Very Bad)	No Charge
Total=5	=16	**********

5. ANALISYS RESULTS :

Different call quality measurement parameters proposed with final average call quality analysis

2016/01/21 - 13:20:35 : : Current network info
Location Area Code = 012 Cell Id =8800968894
2016/01/21 - 13:20:36 : : Signal strength is = 80 dBm,
Sample Call Statistics :
2016/01/24 - 07:45:33 : : 0 call attempts failed
2016/01/24 - 07:55:33 : : 10 call attempts successful ::
Score: 3 (Average)
2016/01/24 - 07:59:33 : : 10 calls was normally dropped ::
Score: 3 (Average)
2016/01/24 - 07:45:33 : : ……etc.

6. CONCLUSION :

The proposed paper uses the parameters in measuring the call quality in mobile telecommunications networks. This paper presents comprehensive amalgamation of research from different call quality measurement parameters proposed with final average call quality measurement, correlating the call quality scores with subjective scores, call quality escalation and tariff proposition based on call quality parameters proposed. The paper proposed and published is highly useful for telecom industry to understand call quality from end-users perspective and take the necessary measures proposed to reduce the churn and increase the ARPU.

REFERENCES :

[1] Chen, G. and Parsa, V. "Output-based speech quality evaluation by measuring perceptual spectral density distribution," IEE Electronics Letters, 40, p-p. 783-785, 2004.

[2] Akram Aburas, J. G. Gardiner and Z. Al-Hokail, “Perceptual Evaluation of Speech Quality-Implementation Using a Non-Traditional Symbian Operating System,” Accepted for publication in the 5th IEEE-GCC Conference on Communication and Signal Processing: IEEE-GCC March 17 – 19, 2009, Kuwait City, Kuwait.

[3] Jin Liang and Robert Kubichek, “Output-based Objective Speech Quality," Vehicular Technology Conference, 1994 IEEE 44th vol.3, p-p. 1719-1723.

[4] D. Picovici and A.E. Mahdi, “Output-based objective speech quality measure using self-organizing map,” IEEE Proceedings of ICASSP-2003, vol. 1, p-p. 476–479, 2003.

[5] Aruna Bayya and Marvin Vis. "Objective measure for speech quality assessment in wireless communications," Acoustics, Speech, and Signal Processing, ICASSP-96, IEEE International Conference 1996, vol.1, pp. 495-498.

[6] Chiyi Jin and Robert Kubichek, "Output-Based Objective Speech Quality Using Vector Quantization Techniques," Signals, Systems and Computers, Conference Record of the 29th Asilomar Conference, IEEE 1995, vol.2, p-p. 1291-1294.

[7] ITU-T Rec. P.862, "Perceptual Evaluation of Speech Quality (PESQ), An objective method for end to end speech quality assessment of narrowband telephone networks and speech codecs,” 2001.

[8] Aruna Bayya and Marvin Vis. "Objective measure for speech quality assessment in wireless communications," Acoustics, Speech, and Signal Processing, ICASSP-96, IEEE International Conference 1996, vol.1, pp. 495-498.

[9] Akram Aburas, J.G. Gardiner and Zeyad Al-Hokail, “Emerging Results on symbian based perceptual evaluation of speech quality for telecommunication networks,” CCCT 2009, Orlando, Florida, USA

[10] Akram Aburas, J. G. Gardiner and Z. Al-Hokail, “Symbian Based Perceptual Evaluation of Speech Quality for Telecommunication

Networks," The 6th International Conference on Computing, Communications and Control Technologies: CCCT 2008, Orlando, Florida, USA.

[11] Akram Aburas, Professor J.G. Gardiner and Dr. Zeyad Al-Hokail, "Call Quality Measurement for Telecommunication Network and Proposition of Tariff Rates," CCCT 2010, Orlando, Florida, USA.