

Determination of Quality of Service (QoS) in Mobile Network

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Abstract: Quality of service (QoS) is the compiled result of service accomplishment which decides the degree of fulfillment of a user of the service. It is the principal guide of the performance of a telecommunication network and of the degree to which the network complies to the agreed benchmark set by the Regulatory body. There is need for the stipulated service demands to be achieved by the Network Operators. Twenty base transceiver base stations at Amuwoodofin Lagos were investigated through the operation and maintenance center of the client station. The key performance indicator tool was used to measure the traffic volume such as the offered traffic, carried traffic, lost traffic and traffic channels. Then QoS parameters such as grade of service, call completion rate, call utilization rate, call drop rate were calculated and analyzed for the stations. It was found that the majority of the stations were operating below the Nigerian Communications Commission (NCC) recommended value for QoS metrics. Methods for improving quality of service were suggested so as to ensure good network performance is not farcry from expectations of Nigerians.

Keywords: Quality of Service, Grade of Service, Call Completion Rate, Channel Utilization rate, Call Drop Rate, Call Blocking, Key Performance Indicator.

INTRODUCTION

Communication plays a major role in today’s world and to support it, quality of service has to be given greatest importance. Quality of service checks the performance accuracy and applicability of a telecommunication service or mobile network.

It is the capability of the Network Providers to provide an acceptable service with signal strength, excellent voice quality and low call blocking probability. Inabilities to connect and talk on the phone are highly undesirable and no one wants to get low quality service. QoS is mainly judged from the customer’s perspective. Certain metrics such as coverage, accessibility and audio quality are also used to weigh the quality of service of a network [1]. A decisive measure of QoS in mobile communication network is the grade of service or call blocking probability of which these performance degrees are influenced by a radio resource management [2]. QoS parameters and measures are necessary to provide an indication of how well a service or product is. In assessing the network to check if it delivers the quality that the Network Providers has been required to target, certain tools such as Network Management System, protocol analyzers, drive test, operation and maintenance measurement are used for QoS measurement.

THEORY OF WORK

The quality of service indicators used in this research includes:

Grade of service

It refers to the proportion of unsuccessful calls relative to the total number of calls or the ratio of lost traffic to the offered traffic. An acceptable GoS is 0.02 (2%) which means that during the call busy hour, two users out of a hundred will experience a call denial. GoS is a standard to define a performance level of a trunked system and how much it is capable to allow users access the available channels in a system. Grade of Service is directly related to the call blocking probability.

$$GoS = \frac{Lost\ Traffic}{Offered\ Traffic} \dots \dots \dots (1)$$

Call completion rate (CCR)

It is the percentage of the carried traffic to the total available channels

Sixty percent (60%) is the value recommended by the Nigerian Communications Commission

$$CCR = \frac{Carried\ Traffic}{Offered\ Traffic} \dots \dots \dots (2)$$

Channel utilization rate (CUR)

It is the percentage of the carried traffic to the total available channels

$$CUR = \frac{Carried\ Traffic}{Total\ Available\ Channels} \times 100\% \dots \dots \dots (3)$$

Sixty percent is the value recommended by the Nigerian Communications Commission

Call drop rate (CDR)

It is the number of dropped calls divided by the total number of call attempts.

An acceptable CDR Value recommended by the Nigerian Communications Commission is two percent (2%).

$$CDR = (1 - Call\ Completion\ Ratio) \times 100\% \dots \dots \dots (4)$$

<http://www.ncc.gov.ng>

METHODOLOGY

QoS parameters were achieved by using the Key Performance Indicator tool in the Operation and Maintenance Client stations. Base Transceiver station was selected as network element and twenty Base Transceiver Stations in the measurement object selection tab. Traffic parameters such as offered traffic, carried traffic, lost traffic and available traffic channels were selected as the measurement counters. The measurement period and time was set at weekly for three weeks. When the measurement period ends, the configuration module performs, monitors, collects, analyze information about the base transceiver station. The results of defined counters calculated through a preset formula were sent to the performance server which saves the information in the performance database. The performance module ends the information to the Operation and Maintenance Client Station.

The performance tool outputs the result which showed the offered traffic, carried traffic, lost traffic and available channels. Equation1-4 were used to calculate the QoS parameters

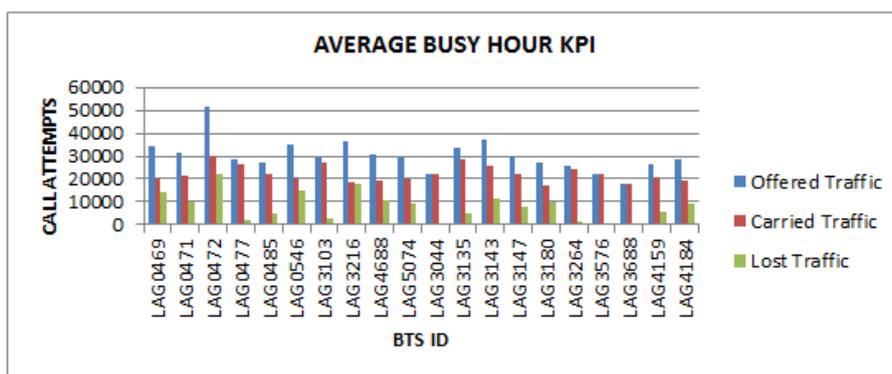
DATA ANALYSIS AND RESULT

Average busy hour key performance indicator for the twenty base transceiver stations were shown in Table 1

Table 1: Average busy hour Key Performance Indicator for the three weeks

S/N	BTS ID	Busy hour attempted call(BHAC)	Successful call during busy hour(SCDBH)	Busy hour call blocked(BHCB)	Available traffic channels(ATCH)
1	LAG0469	34049.33	19652.33	14397	18342
2	LAG0471	31249.67	21131.67	10118	20564
3	LAG0472	51593.33	29779	21814.33	21600
4	LAG0477	28628.33	26739.33	1889	27998
5	LAG0485	27252	22129.67	5122.333	22321
6	LAG0546	35417.67	20502.33	14915.33	19567
7	LAG3103	29617	26945.33	2671.667	27824
8	LAG3216	36813.67	18706.67	18107	17211
9	LAG4688	30434.33	19628	10806.33	19275
10	LAG5074	29534.67	19961.67	9573	22982
11	LAG3044	22218.33	22218.33	0	37654
12	LAG3135	33490.33	28918.33	4572	32672
13	LAG3143	37005.33	25457.67	11547.67	18926.67
14	LAG3147	29843.67	22246	7597.667	17697.67
15	LAG3180	27412.67	17443	9969.667	19919
16	LAG3264	25518	24143	1375	24987
17	LAG3576	21970	21970	0	37840
18	LAG3688	18107.33	18107.33	0	30675
19	LAG4159	26283.33	20600.67	5682.667	18863
20	LAG4184	28633	19385.67	9247.333	15724

Table 1 was further analyzed in fig 1 using Microsoft excel chart tool.

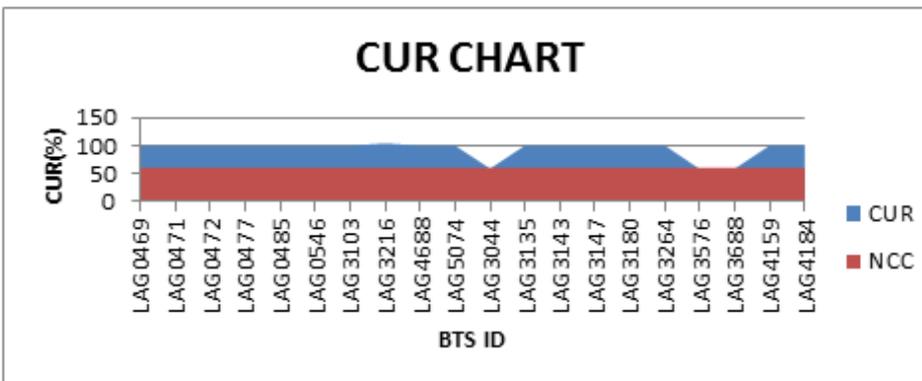
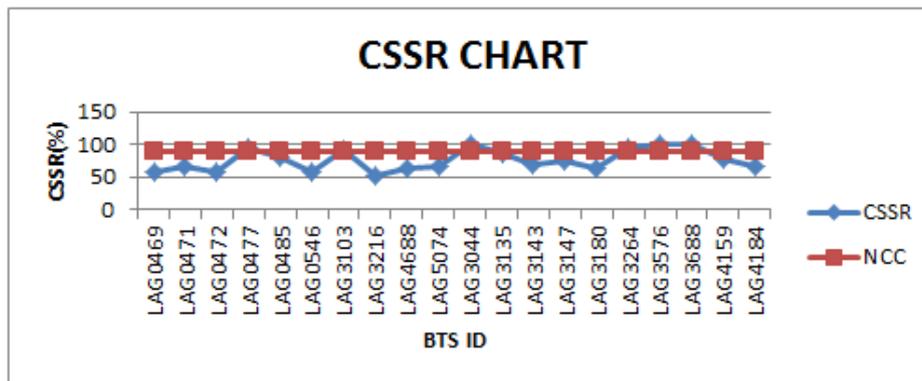
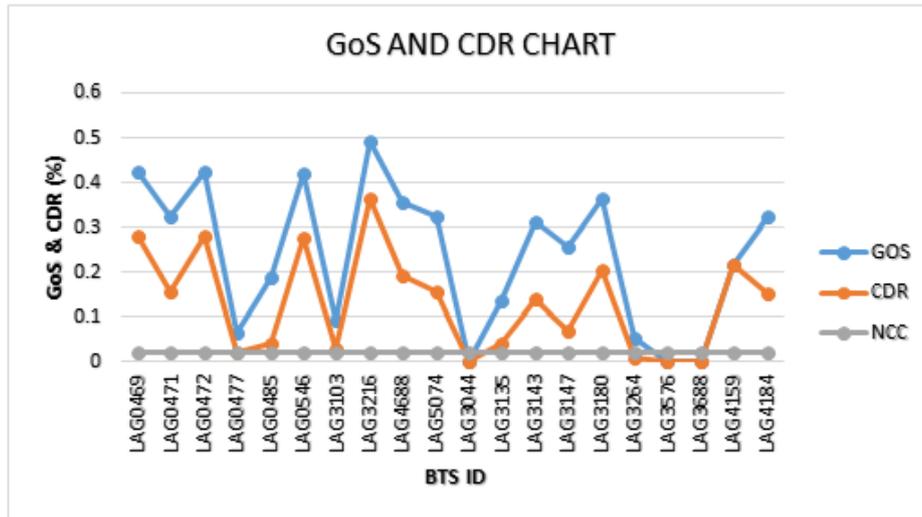


The graph showed that there are more call attempts, less successful calls during busy hour and more calls blocked. The calculated Grade of Service (GoS), Call Completion Rate (CCR), Call Utilization Rate (CUR) and Call Drop Rate (CDR) from using table 1 and equation 1-4 were presented in table 2.

Table-2: QoS parameters

S/N	BTS ID	GoS	CSSR	CUR	CDR
1	LAG0469	0.422828	57.71723	99.99152	0.278535
2	LAG0471	0.323779	67.62205	99.98896	0.154724
3	LAG0472	0.422813	57.7187	99.99328	0.278516
4	LAG0477	0.065984	93.40164	99.94518	0.02
5	LAG0485	0.187962	81.20383	99.98042	0.04
6	LAG0546	0.421127	57.88731	99.99187	0.276409
7	LAG3103	0.090207	90.97928	99.96043	0.03
8	LAG3216	0.491855	50.81446	103.9948	0.0364819
9	LAG4688	0.35507	64.49295	99.98981	0.193838
10	LAG5074	0.324128	67.58724	99.98831	0.155159
11	LAG3044	0	100	59.00657	0
12	LAG3135	0.136517	86.3483	99.97695	0.04
13	LAG3143	0.312054	68.79459	99.99084	0.140068
14	LAG3147	0.254582	74.54178	99.98652	0.068228
15	LAG3180	0.363688	63.63117	99.98854	0.20461
16	LAG3264	0.053884	94.61165	99.9255	0.01
17	LAG3576	0	100	58.06025	0
18	LAG3688	0	100	59.02961	0
19	LAG4159	0.216208	78.3792	99.97897	0.216208
20	LAG4184	0.322961	67.70393	99.98797	0.153701

The results of the QoS parameters were analysed and compared with the Nigerian Communication Commission (NCC) recommended values in Fig 2.



The results showed that the majority of the BTS are operating below the NCC recommended values and therefore network performance should be improved so that customers should enjoy the best quality of service.

RECOMMENDATIONS

Network Operators needs to understand and characterize customers perception of the QoS provided by their respective technologies because Customer satisfaction is a factor for success [3]. Schemes to improve the QoS in cellular networks are an adaptive traffic model so as to ensure increased network utilization and reduction of capacity congestion, Dynamic channel allocation so as to increase capacity and handle more traffic, install additional base stations so as to create room for the network to handle more traffic. Operators should upgrade and optimize all existing base stations and

finally incessant power failures should be addresses by the government so as to stop the over dependencies on generators for power supply.

CONCLUSION

Quality of Service is the most important parameter for measurement of network performance. Poor quality of service in telecommunication network would lead or proceed to customer discontent towards the operator. It is obvious from this research that the quality of service delivered by the network operators is below anticipation. Network performance should be improved so that customers could enjoy the best quality of service

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