

Quality of Service in the Mobile Telecom Sector in Zambia

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Abstract:- In today's telecom sector business environment, consumers are constantly demanding for higher quality delivery of services and products. Although service quality in mobile sector is improving, evidence suggests that there are numerous quality service gaps existing in the mobile telecom sector in Zambia. At the same time, complaints from dissatisfied customers regarding poor service quality delivery have escalated lately. This study was conducted to measure the level of Quality of Service (QoS) being experienced by the end user of various services offered by service providers as compared to quality of service parameters set by the National Regulatory Authority (ZICTA). The study focused on Call Setup Time (CST), Call Drop Rate (CDR), Call Setup Success Rate (CSSR), Mean Opinion Score (MOS)/Audio Voice Quality, Successful SMS Rate (SSR) and SMS Delivery Time. The study has revealed that all the service providers operating in the Zambian mobile telecom sector have either failed to meet the minimum target as set in the quality of service guidelines or they are not consistent in the provision of their services.

I. INTRODUCTION

The telecommunications sector in Zambia has achieved significant developments over the years. The liberalization of the sector in 1995 coupled with the convergence of information technologies saw the coming of new players in the market and emergence of new regulatory frameworks for telecommunications sector. Under section 67(1) of 2009 ICT Act, all service providers are required, in respect of their specific services, to meet such minimum standards of quality of service as the Authority may specify and publish. In accordance with the aforementioned sections, the Authority shall publish the Quality of Service Guidelines containing standards and methods of measurement. These guidelines shall protect the consumers of major ICT services in the retail and wholesale markets. As at the end of March, 2019, the number of mobile subscription has increased from about 10.9 million in 2015 to 17,220,607 million. This shows penetration rate of 99.1%.

According to ITU (2013), "quality" is the "totality of features and characteristics of a product or services that bear on its ability to satisfy stated or implied needs". As indicated by NRA (ZICTA, 2018), service providers in Zambia have continued providing poor service delivery to the customers.

Mariana and Gan (2018) opine that managing quality is crucial for service providers in telecom sector because quality services help to maintain customer satisfaction. As suggested by Ibrahim and Irshad (2017), one of the competitive advantages that can propel a service firm such as the telecom sector is by differentiating itself by ensuring consistent delivery of higher quality than its competitors deliver. According to Rajeswari et al (2017), only by providing high quality products and services can a service provider separate or distinguish himself from competitors. To out perform rivals, service providers are hereby asked to adapt innovative ways to cater for customer needs effectively and efficiently (Sharma et al, 2018; and Moiescu, 2018). Kotler (2010) reaffirm that service suppliers should establish quality targets through the identification of customers' expectations regarding service quality.

Telecom sector is critical in the 21st century because commercial activities are mostly carried out through the use of information and communications technology (Santouridis and Trivellas, 2010). They argued that telecom sector is a catalyst for national economic growth regardless of the size of the economy since the time modern communication was introduced. The implication here is that the country's economy can be affected negatively if firms in telecom sector lack the culture of encouraging and supporting creativity and innovation. This is because poor service delivery by mobile service providers does not only affect individuals but also firms or companies doing business in the country. Matloub et al (2020) lament similarly that the survival of other firms in an economy are seriously threatened if telecom sector is not prepared to renew their products and processes on a continuous basis. This is the reason why NRA's must ensure that service providers meet the minimum target as set in the quality of service guidelines.

II. METHODOLOGY

Data for this study was collected using mobile and fixed monitoring equipment embedded in base stations located in various stations around the country to monitor quality of service. In trying to measure the mobile telephony, the live tests were done with the help of custom vehicles with antennas to gather Quality of Service data. In order to ensure that the quality of service of Mobile Network Operators (MNO) adhere to meet the minimum

standards of quality of service (QoS) as prescribed in the Quality of Service guidelines, pre-emptive and routine Quality of Service (QoS) monitoring activities are conducted. The main objective is to measure the level of QoS being experienced by the end user of various services offered by service providers during peak hours to determine the real effects of network congestion. In this context, the QoS monitoring were conducted in the areas where usage of mobile services is likely to occur and reflects end-user geographical distribution at varying locations where people reside and use mobile phones. These locations include the Central business districts, townships, and major roads depending on the population densities, tourism, and economic activities and where the complaints have been received. Having said that, the Mobile QoS drive tests were conducted in various cities and towns across the nation. These cities include Lusaka, Ndola, Kitwe, Kabwe, Chingola, Livingstone and Chipata. The total distance covered during QoS mobile monitoring was approximately 3,000 kilometres and the total number of test carried for both Fixed and Mobile were 26, 117 tests cases. This raw data was then converted into graphs and tables for easy interpretation and analysis.

III. MEASUREMENT PROCEDURE

In order to guarantee the quality of the tests collected, standards for data collection were done simultaneously covering the entire research area. Furthermore, subjectivity in data collection and tests were eliminated for the fact that all the tests were automated. As indicated by Joshua (2017), this type of data collection eliminates subjectivity inherent to human intervention or decision.

The graphical presentation below shows the trend of the performance of the three mobile operators in selected quarters in regards to the Quality of Service (QoS) parameters that were considered, monitored and measured by the authority and the number of escalated complaints. The quarters were selected randomly from 2017 to 2018

IV. KPI MEASUREMENTS

QoS has been defined in ITU recommendation E.800 as the collective effect of service performance that determines the degree of satisfaction a user derives from a service. It provides an indication of customer experience when using services on a mobile network and is measured in terms of Retainability, Accessibility and Fulfilment parameters among others.

- ✓ **Retainability** is defined as the ability of a call to stay connected through to a normal call tear-down process, without abnormally disconnecting from User network. It may be measured using Call Drop Rate (CDR).
- ✓ **Accessibility** is defined as the percentage of the number of times a user is rejected due to the unavailability of system resources when attempting to place a call. It may be measured using Call Setup Success Rate (CSSR).
- ✓ **Fulfilment** is the ability to deliver the service meeting the user’s quality expectations.

During the QoS monitoring, the following KPIs were used. The six sets of parameters reported are:

- i. Call Setup Time (CST)
- ii. Call Drop Rate (CDR)
- iii. Call Setup Success Rate (CSSR)
- iv. Mean Opinion Score (MOS)/Audio Voice Quality
- v. Successful Sms Rate (SSR)
- vi. SMS Delivery Time

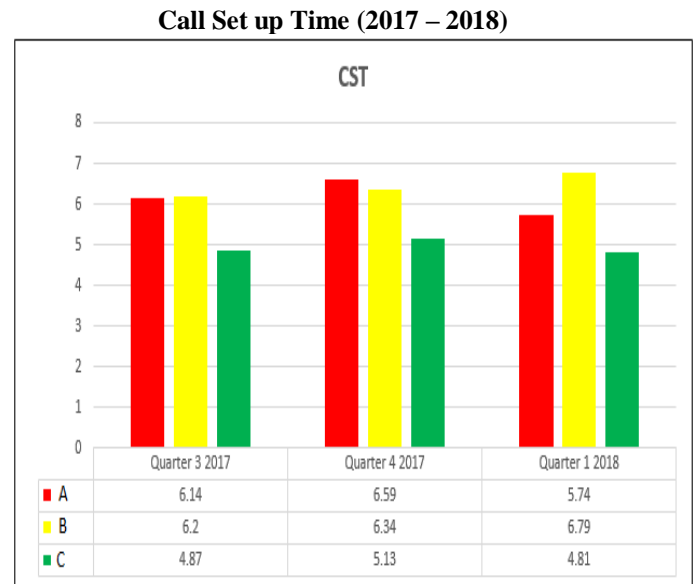


Figure 1.0: Call Set up Time (2017 – 2018)

Discussion

Call Setup Time is defined as “the period of time elapsing from the sending of a complete destination address (target telephone number) to the setting up of an alert of the call at the receiving terminal;”

$$\text{Call setup time [s]} = t_{\text{alerting-signal}} - t_{\text{address-sending}}$$

$t_{\text{alerting signal}}$ – Moment when an alerting signal is sent to the called terminal

$t_{\text{address sending}}$ – Moment user presses the SEND button on the calling terminal

The Quality of Service guidelines prescribe that whenever a subscriber is making a call, every attempted call should be set up or connected within a timeframe of ten seconds (10 sec). During the period under review all the operators met the minimum target as set in the Quality of Service guidelines. However, Company C’s Average CST was better than the other two service providers with the lowest being 4.81 seconds for 2018 first quarter.

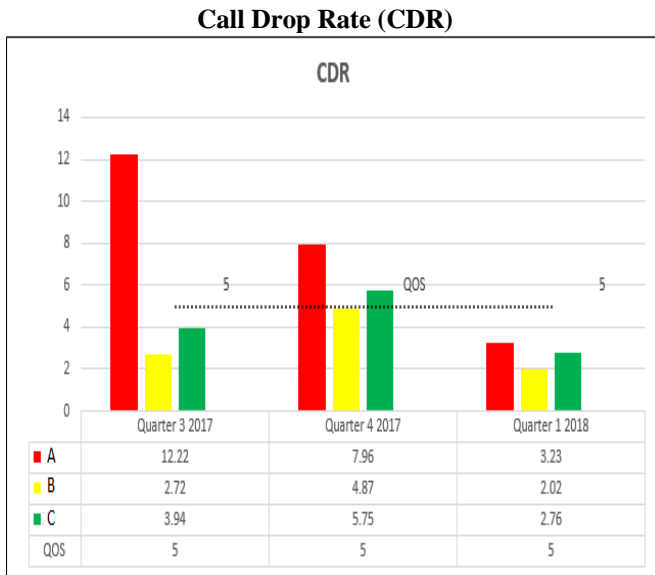


Figure 1.2: Call Drop Rate (CDR)

Discussion

Voice Call Drop Rate is the probability of a call terminating without any of the users’ will; and the CDR should be equal or less than five percent (5%). This is according to the quality of service parameters set by the regulator.

$$\text{Drop Rate [\%]} = \frac{\text{Number of Calls terminated unwillingly}}{\text{total Numbr of call attempt}} * 100\%$$

All the operators managed to meet the Quality of Service target during Quarter 1 of 2018. Company A was not **in compliance** with the CDR KPI as prescribed by the Quality of Service guidelines threshold of less than 5 percent (5%) in 3rd quarter of 2017. In the 4th quarter, only Company B managed to meet the quality of service target (4.87%) under the review period.

Call Set Up Success Rate (CSSR)

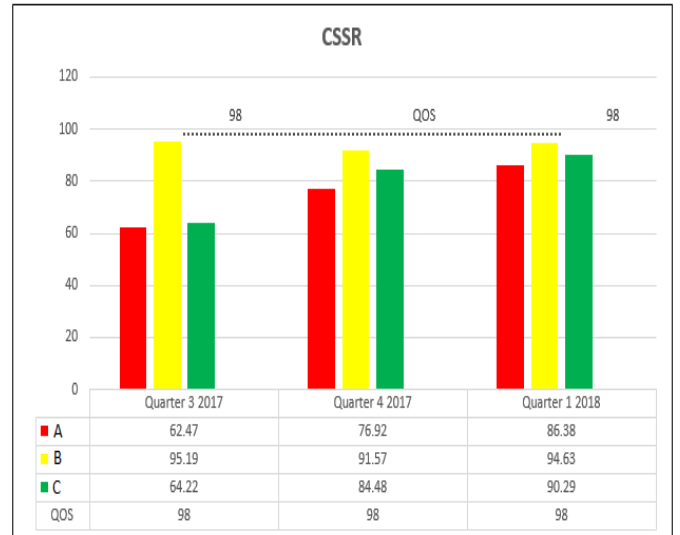


Figure 1.3: Call Set Up Success Rate (CSSR)

Discussion

Call Setup Success Rate may be defined as the probability that a call being attempted to be set up on the Airtel network will be successfully set up. This is simply the number of call attempts that successfully accessed a channel divided by the total call attempts expressed to the nearest percentage. The CSSR also measures the service accessibility.

$$\text{Call Setup Success Rate [\%]} = \frac{\text{Number of calls successful ly establishe d}}{\text{Total number of call attempts}} * 100\%$$

The set target in the QoS guidelines is 98% which means that a minimum of 98% of calls attempted to be set up on the network must successfully go through. If less than 98% of calls go through, then it means the operator has not attained the set target.

All the operators were NOT in compliance with the CSSR Quality of Service threshold of less than **Ninety-eight percent (98%)** as prescribed by the Quality of Service guidelines of 2010.

Perceptual Evaluation of Speech Quality (PESQ)

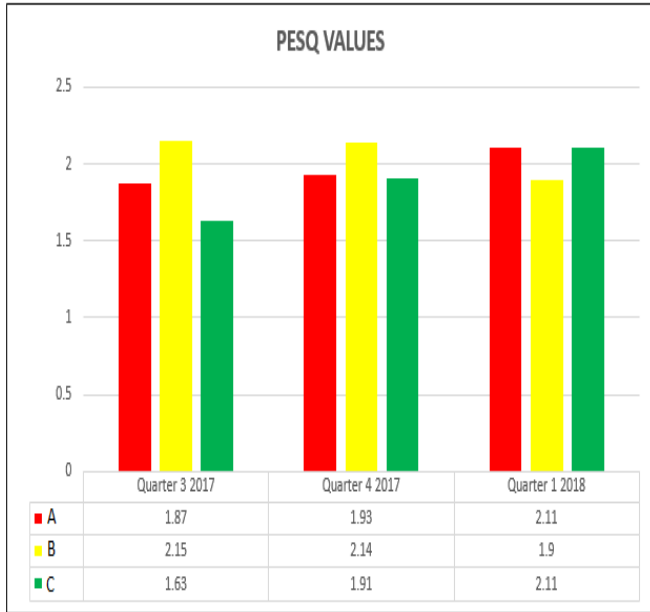


Figure 1.4: Perceptual Evaluation of Speech Quality (PESQ)

Discussion

PESQ is the perceptibility of the conversation during a call. Voice Call Audio Quality is measured by a parameter called the Mean Opinion Score (MOS) which categorizes speech samples in ranges from 0 to 5. Target required for MOS value should be above 3.

The average speech quality for the period under review was bad to Poor for all service providers. This does not meet the minimum requirement.



Figure 1.5: Successful Sms Rate (SSR)

Discussion

Successful SMS Rate is defined as Percentage of SMS and MMS successfully delivered. The Successful SMS Rate also measures the service accessibility.

The Successful SMS Rate should be equal or better than ninety-eight percent (98%). company A, company B and company C was **NOT in compliance** with the Successful SMS Rate Quality of Service threshold of less than **Ninety-eight percent (98%)** as prescribed by the Quality of Service guidelines of 2010.

Successful Sms Rate (SSR)

SMS Delivery Time

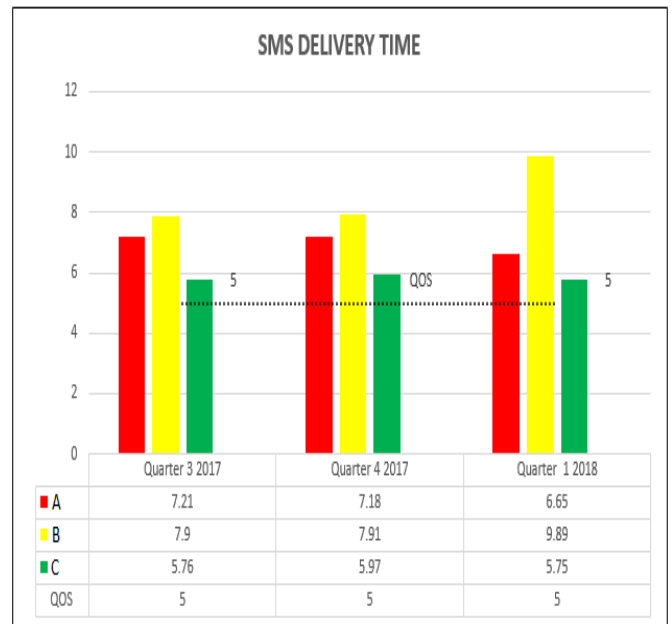


Figure 1.6: SMS Delivery Time

Discussion

SMS Delivery Time is defined as Time in seconds within which SMS is delivered end to end (from the sender terminal to the receiving terminal). SMS Delivery Time should be less than Five seconds (<5secs).

For calculation and Analysis Purposes the following equations illustrates the details.

$$\text{SMS Delivery time setup time [s]} = t_{\text{SMS Mobile Originated}} - t_{\text{SMS Mobile Terminated Delivered}}$$

$t_{\text{SMS Mobile Originated}}$ – Moment when user sends SMS

$t_{\text{SMS Mobile Terminated Delivered}}$ –

Moment user receives the SMS.

The average SMS Delivery Time for all service providers was **NOT in compliance** as prescribed in the Quality of service guidelines to have a threshold of less than five seconds (<5secs) in all available locations tested.

V. CONCLUSION

As earlier indicated, the Zambia Information and Communications Technology Authority (ZICTA), under section 67 (1) of the Information and Communication Technologies (ICT) Act No. 15 of 2009, is mandated by law to ensure that all service providers in respect of their specific services, are required to meet the minimum standards of quality of service (QoS) as the authority may specify and publish. The critical review of the results under the period observed indicate that service providers have not complied with the provision of meeting the minimum standards in a number of areas or they are not consistent in the provision of their services. These areas include but not limited to Successful Internet Log-ins parameter, Dropped Internet Sessions, SMS Delivery Time, Successful SMS Rate, perceptual evaluation of speech quality, call set up success rate, call drop rate and successful SMS ration. The findings of the study have confirmed that there are existing gaps in the management of service quality undertaken by mobile service providers in Zambia as compared to quality of service parameters set by the regulator. To succeed in this sector, service providers need to put more efforts to work on service quality dimensions from the consumer's perspective.

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