

Performance Evaluation of GSM Mobile System in Nigeria.

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ABSTRACT

The adoption of the GSM system of communication in Nigeria is a long awaited development expected in the telecommunication industry. It is expected that its introduction will bring about effective telecommunication services that will support good speech quality, roaming, spectral efficiency, and minimized crosstalk, just to mention few items. Its deployment into the market was well embraced by Nigerians and found to be relatively efficient. But this efficiency is now being hampered by some factors leading to the degradation in services offered by operators. Among these factors is the epileptic nature of our electricity supply which had forced operators to depend solely on generators. This paper has appraised the performance of GSM operators in Nigeria and examined the problems facing the industry. Also, methods for improvements were suggested.

(Keywords: network accessibility, call drop, efficiency, congestion)

INTRODUCTION

GSM stands for Global System for Mobile Communications. The GSM revolution in Nigeria started in August 2001 and this brought a great change in the face of Information and Communication Technology (ICT) in Nigeria. Since it was launched, mobile telephony has rapidly become the most popular method of voice communication in Nigeria. Growth in this sector has been so rapid that Nigeria has been rightly described in various media as "one of the fastest growing GSM market in the world". Indeed, these developments have been truly explosive according to statistics from the Nigeria Communications Commission (NCC).

This explosive growth has brought huge revenue to both the operators and government through tax and license fees. As revolutionary as GSM may seem to be, many problems have bedeviled the sector in the recent past. Some of the problems are:

- Instability in power supply
- Security of infrastructure
- Inter-Network connectivity
- Network congestion – Network efficiency (call set up)
- (Call Drop) – Termination of calls.

All these factors contribute in one way or the other to the poor quality of services rendered by GSM operators in the country.

Worried by the state of development in the industry, the nation's lawmakers (upper legislative house) last year set up a committee to investigate the inefficiency of the service providers. While this was going on, the House of Representative on July 18, 2007 invited the service providers to appear before its *ad hoc* committee mandated to investigate the activities of the service providers. They maintained that this became necessary due to the public outcry on the epileptic services, as well as its economic and social implications. The NCC, in a statement through Mr. Bashir Gwandu the executive commissioner in charge of licensing and consumer affairs, maintained that "the situation of service inefficiency is unacceptable to the commission. Nigerians cannot pay for services that they can not get. It is not done anywhere in the world. People should expect to get a better quality of service". The Commission went even further and directed that operators should stop all forms of promotion until their quality of service improves.

HISTORICAL BACKGROUND

The idea of a cell-based mobile radio system was first conceived at Bell Laboratories (USA) in the early 1970s. However, mobile cellular systems were not introduced for commercial use until the 1980s. During the 1980s, analog cellular telephone systems experienced a very rapid growth in Europe, particularly in Scandinavia, and in United Kingdom. In the beginning of the cellular system, each country developed its own system which was an undesirable situation for the following reasons:

- The equipment was limited to operate only within the boundaries of each country
- The market for each mobile equipment was limited

In order to overcome these problems, the conference of European Posts and Telecommunications (CEPT) in 1982, formed the Groupe Special Mobile (GSM) in order to develop a pan-European mobile cellular radio system (with this, the GSM acronym became “global system for mobile communication”). This group came up with a digital system that has to meet the following criteria:

- Spectrum efficiency
- Good subjective voice quality
- International roaming
- Compatibility with other systems such as ISDN
- Low Mobile and base stations cost

A digital system was adopted by the group (CEPT) as opposed to the then analog cellular systems like AMPS in the United States and TACS in the United Kingdom. The reason for this is on the aspect of quality of service. For example, analog systems do pass physical disturbance in radio transmission to the receiver. These disturbances do decrease signal quality because they produce effects such as fadeouts, crosstalk, hisses, etc. On the other hand, digital systems avoid these effects. Phase 1 of the GSM specifications was published in 1990.

Commercial services started mid-1991 and by 1993, there were 36 GSM networks in 22 countries. By the beginning of 1994, there were 1.3 million subscribers world wide, which grew to 55 million by October 1997.

FACTORS AFFECTING SERVICE EFFICIENCY

- Instability in Power Supply
- Security of Infrastructure
- Call Drop
- Network Accessibility

SECURITY OF INFRASTRUCTURE

Outside of the armed forces and Nigeria Police, the three leading GSM operators, MTN, CELTEL (now ZAIN), and GLOBACOM have the highest number of security guards on their payroll. These security guards were employed to guard their infrastructural equipment against theft and vandalism. As of October 2007, Zain had 2500 base stations, MTN – 2900, and Globacom – 3000. This translates to having 5000, 5800, and 6000 security guards, respectively, on their payrolls (since two personnel were guarding every base station). The direct implication of this is that the cost incurred for these security guards goes into the total cost of operation and subsequently leads to increases in call tariffs.

The presence of these security guards at the base stations, however, has not totally prevented armed robbers, thugs, and hoodlums from vandalizing and carting away generators and valuable equipment at base station sites. In addition, some base stations have been shut down due to these nefarious activities. The technical implication of this is that once a base station is shut down, call transmission for subscribers in that location would automatically be transferred to another nearby base station which will lead to network congestion. Subsequently, subscribers within this area will experience poor quality of service.

INSTABILITY IN POWER SUPPLY

A recent study revealed that 78% of the total cost of operations by GSM operators goes into the provision of generators and fuel. The epileptic nature of our power supply system in the country has necessitated the over-dependence on generators. The direct implication of this is that call tariffs will drastically increase. Apart from this, it is obvious that the cost of procurement and fueling is also enormous. If our power supply system is stable, this huge amount could have been used in upgrading and optimizing existing base stations in order to improve service

efficiency. Also, additional base stations and switching centers could be built for network expansion which will eventually alleviate congestion and the network will have capacity to handle more calls. So, the network problems experienced in the country can not be completely divorced from instability in power supply.

CALL SET UP

One of the major problems encountered by subscribers is the inability to access the network when initiating a call. This is worrisome to the extent that subscribers often have to dial several times before getting connected. Worse still, when connected, it may not be to the number actually dialed. In this situation, one is often embarrassed to hear "WRONG NUMBER" from the other end of the call.

According to an earlier survey carried out by the NCC, all three major operators were found to perform poorly in the area of numbers of times that users had to dial before a proper connection is made. The survey shows that less than half of the subscribers on each of the networks do get their calls through on the first or 2nd attempt (Zain – 49%, MTN – 46% GLO – 47%). In other words, subscribers who dial 3 times or more were: Zain – 49%, GLO – 50%; and MTN – 50%. Results of sampled opinion are shown in the tables and figures below:

Table 1: Subscribers Dialing Three or More Times before getting Connected.

| CITY | ZAIN % | MTN % | GLO % |
|------------------|--------|-------|-------|
| Abuja | 56 | 63 | 67 |
| Kaduna and Zaria | 39 | 50 | 45 |
| Kano | 61 | 53 | 39 |
| Maiduguri | 41 | 42 | 53 |
| Jos | 33 | 38 | 48 |
| Bauchi | 57 | 68 | 49 |
| Ibadan | 46 | 41 | 42 |
| Calabar | 45 | 79 | 50 |
| Port-Harcourt | 44 | 47 | 20 |
| Owerri | 63 | 54 | 45 |
| Enugu | 37 | 59 | 61 |
| Benin | 51 | 60 | 58 |
| Lagos | 35 | 39 | 50 |
| Kwara | 46 | 36 | 33 |

AGGREGATE, ZAIN = 47%, MTN = 50%, GLO = 49%

Table 2: Subscribers Connected to Numbers not Dialed.

| CITY | ZAIN % | MTN % | GLO % |
|------------------|--------|-------|-------|
| Abuja | 38 | 35 | 27 |
| Kaduna and Zaria | 41 | 36 | 28 |
| Kano | 39 | 42 | 35 |
| Maiduguri | 69 | 68 | 54 |
| Jos | 46 | 29 | 34 |
| Bauchi | 19 | 60 | 31 |
| Ibadan | 15 | 27 | 22 |
| Calabar | 15 | 14 | 20 |
| Owerri | 33 | 31 | 41 |
| Enugu | 19 | 33 | 13 |
| Benin | 22 | 51 | 23 |
| Lagos | 31 | 27 | 22 |
| Kwara | 40 | 25 | 32 |

AGGREGATE, ZAIN = 34%, MTN = 32%, GLO = 28%

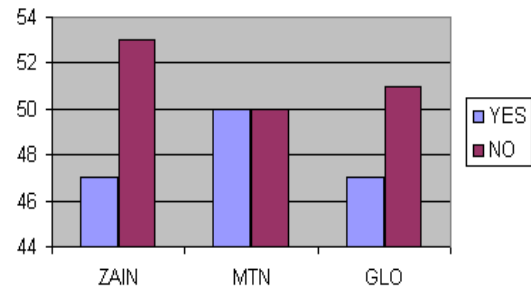


Figure 1: Whether Subscribers Dialed Three or More Times Before Getting Connected.

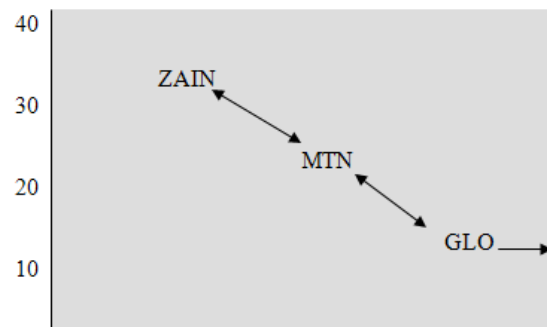


Figure 2: Subscribers Dialing One to Two Times Before Getting Connected.

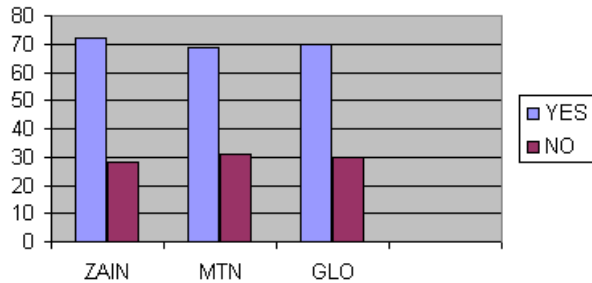


Figure 3: Whether Subscribers Get Connected by have no Voice Audio.

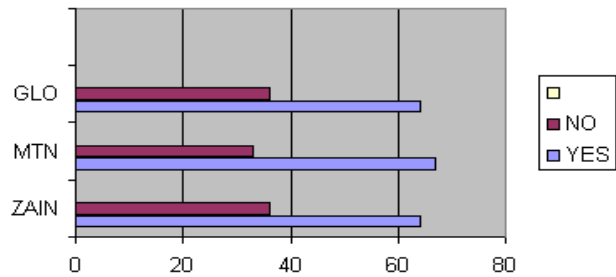


Figure 4: Whether Subscribers Experience Dropped Calls while Conversing.

DROPPED CALLS

This is a situation whereby an established call is abruptly terminated while conversation is still ongoing. Calls are dropped if a mobile subscriber moves is out of a coverage area (dead spot) and the signal cannot be maintained between the phone and the network. This may be due to several reasons. For example, calls may be dropped upon handoff between cells within the same provider's network. It may be due to an imbalance of traffic between the two cell sites area of coverage.

If the new cell site is at capacity, it will not be able to accept the additional traffic of the call trying to "hand in". It may also be due to the network configuration not being set up properly such that one cell site is not aware of the incoming traffic. If the phone can not find an alternative cell to handoff to the call is lost.

Calls can also be lost if the mobile phone at the other end losses battery power or stops transmitting. Also while one is receiving a call, supposing due to path loss or shadowing, the received signal level falls to about - 95dB, then the call will be dropped. Practically, the signal level for an ideal call should be (Transmit + 43dB, receive - 60 to - 80 dB).

A survey conducted by NCC showed clearly that one of the most important customer perceived problems that affects quality of service is in the area of dropped calls. Data from the survey showed MTN - 67%; Zain - 64%; and Globacom - 64%. This is further represented in Figure 4.

SUMMARY OF CALLS CUT OFF AND LOCATIONS

Table 3 shows a summary of dropped calls and their locations. As shown in Table 3 dropped calls are more prominent in Port-Harcourt than in any other place, with a complaint level of over 78%. On the other hand, Maiduguri experienced less dropped calls with a complaint level of over 42% on aggregate compared to most other parts of Nigeria.

Table 3: Summary of Dropped Calls and their Locations.

| CITY | ZAIN % | MTN % | GLO % |
|------------------|--------|-------|-------|
| Abuja | 67 | 69 | 60 |
| Kaduna and Zaria | 29 | 67 | 59 |
| Kano | 74 | 77 | 73 |
| Maiduguri | 47 | 34 | 34 |
| Jos | 57 | 64 | 74 |
| Bauchi | 32 | 36 | 58 |
| Calabar | 65 | 59 | 75 |
| Owerri | 52 | 62 | 51 |
| Enugu | 69 | 57 | 60 |
| Benin | 62 | 71 | 70 |
| Port-Harcourt | 84 | 78 | 79 |

Aggregate: Zain 64%, MTN 67%, Glo 64%

SUGGESTED METHODS OF IMPROVEMENT

Having evaluated the parameters that attributed to poor quality of service by operators, the following under listed methods are suggested towards improving network performance.

1. Operators should upgrade and optimize all existing base stations. If this is done, it will stem call set up failures due to increases in traffic volumes.
2. Install additional base stations across the country. This would create room for the network to handle more traffic.
3. Build additional switching centers across the country and increase capacity to handle more traffic.
4. If a particular base station is to be taken "off-line" (either for schedule maintenance, repairs, upgrades, etc.), all neighboring base stations should have their communication power levels increased. This will increase the coverage area, thereby reducing congestion and dropped calls.
5. Operators should invest heavily in transmission network development and have proper radio planning. This would ensure increased network resilience, improved bandwidth utilization, and alleviation of capacity bottlenecks.
6. Operators should continue to give back to the society and aim to enhance social security. Because no amount of security personnel can deter hoodlums from attacking base station sites. Also, if the government can create more jobs for its citizens, poverty levels would be reduced and a lot of boys and girls will be taken off the streets. Hence we would have a secured environment.
7. Incessant power failures should be addressed by the government. This will stop the over-dependence on generators for power supply. If this is achieved, call tariffs would drastically go down.

DISCUSSION

As can be seen in our presentation, this paper reflects the experiences of subscribers as they perceived the quality of service offered to them by their respective providers. In general, all the networks performed fairly well in dialing few times before getting call connections to the number

dialled, but they did poorly respect to dropped calls, and worse in connections without voice audio. Though, the situation of each network might have subsequently changed, the present result indicates that the performance of GSM networks in Nigeria is still a far cry from the expectations of the consumers. Urgent improvement is needed in specific locations where comparatively large proportions of subscribers have complained.

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