International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 4 Issue 7 ǁ July. 2016 ǁ PP. 01-04

The Bane of Public Switch Telephone Network (PSTN)in Nigeria

Julie C.Ogbulezie[1], Nsed A. Akonjom[2]&Sunday A. Ojomu[3]
A.O.Ezugwu[4]& I. E. Igajah[3]

[1](*Department of Physics (Electronics &Computer Technology Unit) University of Calabar, Nigeria)*
[2](*Department of Physics, Geophysics andGeology (Physics Electronics) Federal University Ndufu-Alike Ikwo Nigeria)*
[3](*Department of Electrical/Electronic Engineering Cross River State University of Technology, Calabar Nigeria)*
[4](*Department of Computer Science University of Nigeria Nsukka*)

Abstract: Measurements and analysis of Public Switch Telephone Network (PSTN) were carried out in seven cities in Nigeria. The cities are in the South Eastern (Aba and Enugu), South South (Calabar, Port Harcourt and Uyo) and North Central (Kaduna and Kano) parts of Nigeria. Average traffic carried varied from 8.30 to 157.0 erlang. Incoming answer bid rario (ABR) was from 3.2 to 47.40 for incoming calls while for outgoing calla they were 1.9 and 19.60 respectively. Answer seizure ratio (ASR) ranged from 3.2 to 47.80 for incoming calls and 1.9 to 23.80 for outgoing calls respectively. Even though the call completion rates were high for all the routes, the grade of service was still very low compared with international indices.
Keywords: Traffic Carried, Answer Bid Ratio, Answer Seizure Ratio

I. INTRODUCTION

Before the coming of GSM in Nigeria in 2001, Public Switch Telephone Network (PSTN) was the main telecommunication network and only the rich could have telephone lines. Advances in digital electronics have made the telecommunication system the largest integrated system in the world.

Individual subscribers widely separated can make contact using the system. Telecommunication satellites and new transmission media allow a telephone link to be established with an individual in the remotest part of the earth via his own radio transceiver, identified by his unique telephone number.

The PSTN is a telephone network that was developed to provide two- way voice communication to many users. It provides a means of interconnection between users. By interconnecting all users to a central switch and providing a switch to carry any other users, the number of required links can be greatly reduced. The size of any switch is a function of the number of users in that area.

In Nigeria, the switching centres have four- level hierarchy. The first is the local exchange which is made up of local switches and forms the lowest level. Each switch within a given area is connected to a central switch called a primary centre using a star connection. Within a large area, each primary centre is linked to a secondary switch. The fourth level is the International Direct Dialing (IDD) which links international telephone centre [1].

The PSTN in Nigeria has approximately 248 switching centres with 42 digitalized systems, while 206 exchanges are of analogue model [2].

This research is aimed at showing through measurements the reasons PSTN collapsed in Nigeria with the advent of GSM even though it is still very relevant in other countries.Possible way forward have been stated and discussed.

II. THEORY

Teletraffic theory is defined as the application of probability theory to the solution of problems concerning planning, performance evaluation, operation and maintenance of telecommunication systems [3]. The term teletraffic covers all kinds of data communication and telecommunication traffic. The instantaneous traffic intensity in a pool of resources is the number of busy resources at a given instant of time.

Feldman [4] used stochastic knapsacks with Poisson call arrivals to analyze telecommunication systems. Current researches have shown that the actual arrival processes in a telecommunication network are busty in nature having long range dependence. This has resulted in the development of more generic knapsack solutions for non- Poisson call arrivals [5].

In teletraffic theory, the word traffic is used to denote the traffic intensity i.e. traffic per unit time. The pool of resources may be a group of servers e.g. trunk lines. The statistical moments of the traffic theory may be calculated for a given period T. for the mean intensity we have

$$Y(T) = \frac{1}{T}\int_0^T n(t)dt \quad (1)$$

where n(t) denotes the number of occupied devices at the time t. Y is carried traffic by the group of servers during the time interval T [3].

The main operator of PSTN in Nigeria is the Nigerian Telecommunications Limited (NITEL). The teletraffic performance was accessed by considering certain events called key traffic event namely [6]:

(i) Trunks provided to carry traffic.
(ii) Trunks available at the time of traffic (trunks provided – faulty trunks).
(iii) Bids (call initiation by lifting handset).
(iv) Seizure (seizing of switching signaling path).
(v) Switch through (seizing of speech path).
(vi) Answer (successful call answered by the called subscriber).
(vii) Busy/no reply (unanswered call hat has successfully seized a speech path).
(viii) Traffic carried (as measured by the system).

The key performance indicators are bids per circuit per hour (BCH), answer seizure ratio (ASR), answer bid ratio (ABR), calls completion ratio (CCR), seizure traffic per circuit in Erlang. The theory of these indicators are explained in our earlier work [7].

III. MATERIALS AND METHOD

This research covered a number of cities in Nigeria over varying time intervals. The cities are namelyAba,Calabar, Enugu, Kaduna, Kano, Port Harcourt and Uyo.

The materials used included 10,000 subscribers' digital Electronic Switching (EWSD) model. The size and capacity of this switching system vary from one exchange to another; 20,000 and 25,000 for Enugu and Port Harcourt, respectively.At least 12,000 analogue and external plant network interfacing subscribers, EWSD secondary centres, International Switching Centre (ITSC), computerized Operations and Maintenance Terminals (OMT) with user friendly software for real time teletraffic measurements.

Two phases of measurements were undertaken. The busy hour was the average traffic level taken over several days at the assumed busiest period of one hour. The second phase was to determine the key performance indicators for the routes. Traffic measurements raw- data on the basis of 24 hours interval were collected from all the selected exchanges daily by the stations' switching managers. This was done daily for seven days to determine the busy hour for each route.

Data were collected for Calabar, Aba, Uyo and Port Harcourt routes for 8 weeks (June – August) at the busy hours. Enugu was for 32 weeks while Kaduna and Kano took 16 weeks [8].

IV. ANALYSIS

The charts below show the key performance indicators for the cities

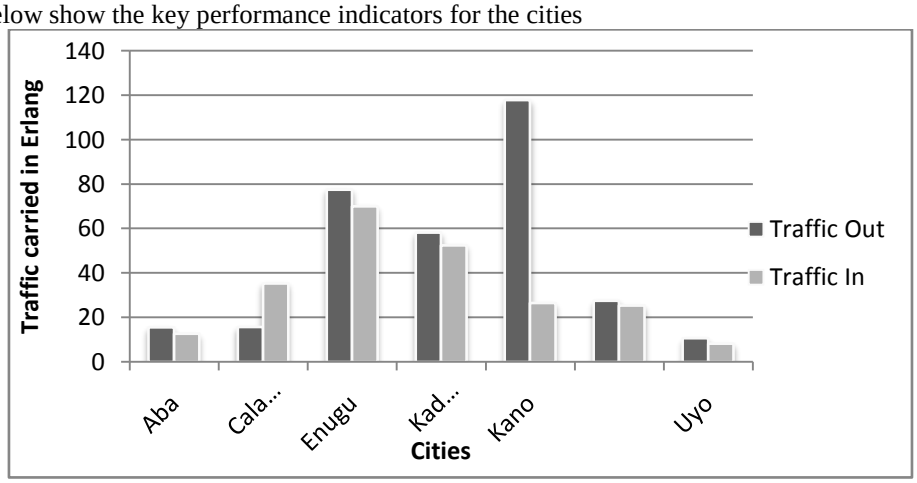

Figure 1: Traffic Carried in the Cities in Erlang

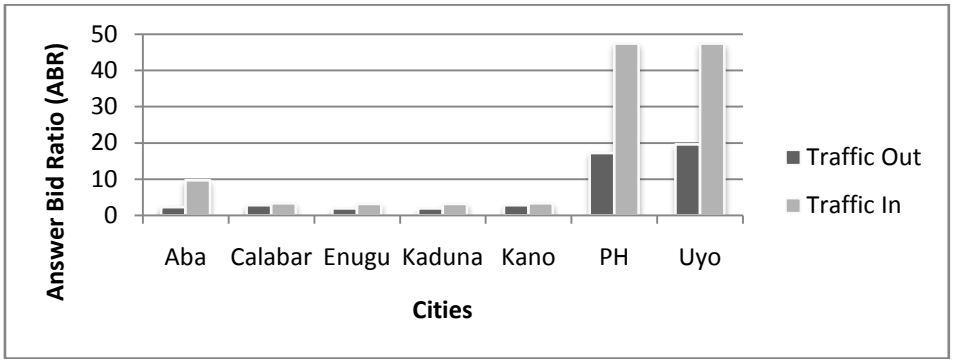

Figure 2: Answer Bid Ratio (ABR)

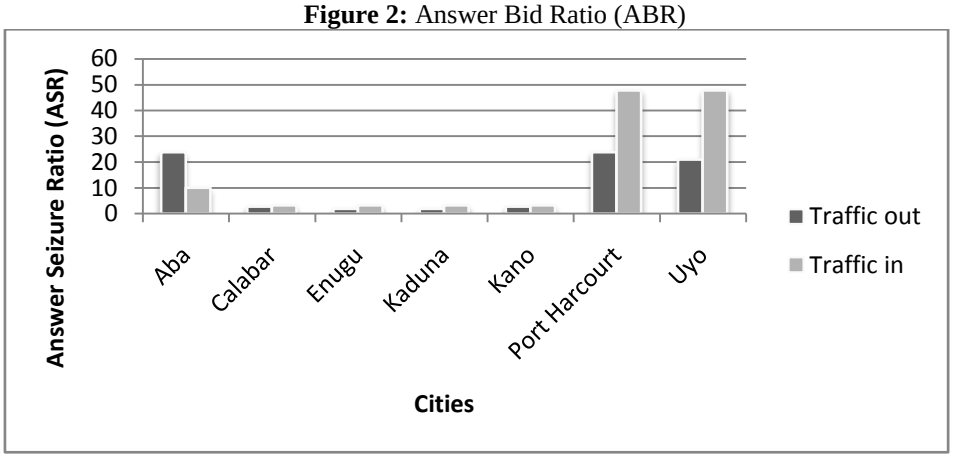

Figure 3: Answer Seizure Ratio

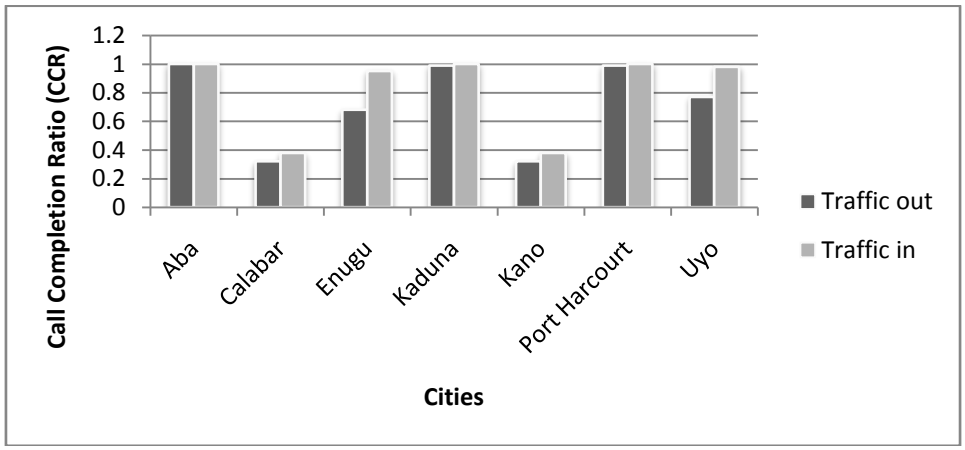

Figure 4: Call Completion Ratio (CCR)

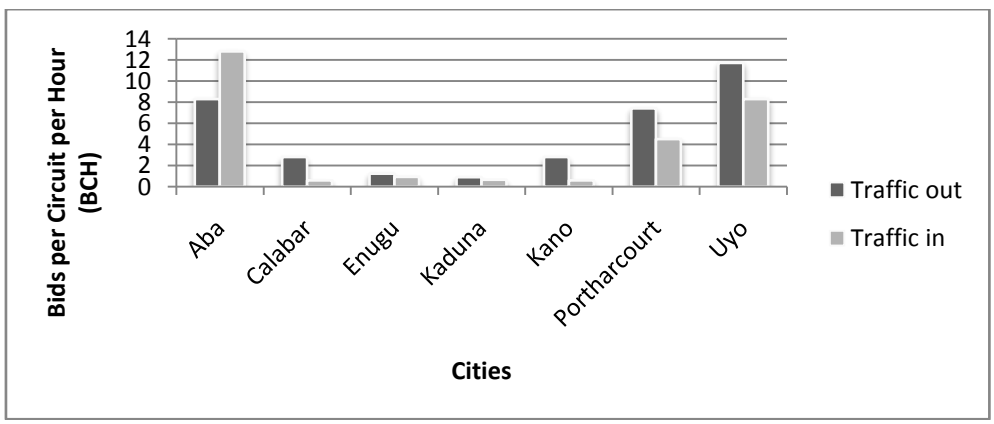

Figure 5: Bids per Circuit per Hour

For Aba the ABR was 9.70%, ASR 10.10% for incoming calls. These figures are extremely poor but the route recorded 100% call completion rte. This high call completion ratio has in no way made the grade of service for the route to be fairly okay. It simply means that the call termination up to the exchange switch was very good. The low values of ABR, ASK simply showed that the local loop networks were faulty or that subscriber lines were disconnected from service due to unreconciled bills. The congestion recorded was due to faulty digital multiplexer unit. The remaining plots follow the same pattern of low values of ABR, ASR, etc. even though the call completion rates were high.

Calabar primary centre total carried to be 18.6 and 35.4 erlangs for outgoing and incoming calls respectively. The route also had the same values for ABR and ASR of 2.8and 3.3 for outgoing and incoming calls respectively as seen in Fig. 1. Even with a high call completion rate, the performance of the exchange was low.

From Fig. 2,Enugu primary centre had ABR of 19% and 32% for outgoing and incoming traffic. It was further observed that there was a high call completion rate of 95% for incoming traffic and 69% for outgoing. This indicates the effectiveness of call completion up to the switching level.

Using ASR, ABR and CCR to determine the grade of service, it can be seen that the grade of service for the route was very low. Grade of service here is the perception of customers towards the network.

For Kano primary centre, the ASR was 3.3 seen in Fig. 2 while Kaduna primary centre had ABR of 1.8for outgoing calls and 3.4 for incoming calls. Port Harcourt primary centre had ABR of 17.20, ASR of 23.80,CCR of 76% and network efficiency of 76% for outgoing routes. The incoming routes recorded ABR of 47.40, ASR of 47.80, CCR of 85%and network efficiency of85%. Though these results were good when considering transmission and switching networks, the values obtained for ABR and ASR are indicators of poor termination of calls.

Looking at the bar chart in Fig. 1, it can be seen that there was very low traffic activity recorded on the Uyo route. The value of traffic carried for this route was 10.70 erlang. ASR and ABR were 21% and 19.60% respectively for outgoing calls and 47.8% and 47.40% for incoming calls respectively. Out of 629 calls successfully switched through the network only 172 were answered even though the call completion ratio was 77.70% which is an indication of that the switching facility was performing well.

From figures 2 and 3 it can be seen that the ABR and ASR for Calabar, Enugu, Kaduna and Kano were extremely minimal compared to those of the other cities.

V. CONCLUSION

Nigeria with a population estimate of 150 million had lo teledensity before the coming of GSM (Global System for Mobile communication) in 2001. Today in Nigeria, traffic is growing very fast on the GSM networks while the fixed line operators are losing customers by the day. The operators of the GSM networks are seeking to optimize their network traffic and interconnection management to gain revenue assurance.

The ABR and ASR ratios for all the routes considered in this work were very low. These performance indicators directly evaluate the service rendered. ASR and ABR are indicators or a reflection of the traffic flow in the network, pointing to the fact that the grade of service for the routes is far below the tolerance level.

Analysis of teletraffic measurements carried out in these exchanges show that they have very poor grade of service to end users compared to international indices. This was mainly due to inadequate switching, poor transmission and local loop plants, undue advantage of GSM operators over the fixed line operators, poor initial capitalization of NITEL, poor maintenance culture, lack of staff motivation, endemic corruptionetc.

REFERENCES

[1]. Bassey, D.E. Computer aided measurements and analysis of real –time teletraffic signals in some parts of South Eastern Nigeria. Ph.D Thesis, Department of Physics, University of Calabar, Nigeria, 2006.
[2]. Nigerian Telecommunication Journal, Published in Lagos, Nigeria, 2006.
[3]. Iversen, V.B.Teletraffic engineering and network planning. http:/www.com.dtu.dk/teletraffic, 2008, Pp1.
[4]. Fieldman, A. Characteristics of TCP connection arrivals, self, similar networks and performance evaluations. K. Park and W.Willinger (Eds). New York John Wiley and sons' Inc 2000, pp367-400.
[5]. Ogbulezie, J. C.; Onuu, M.U. and Bassey, D.E. Determination of some key performance indicators in public switch telephone switches in Calabar ,Nigeria. Asian Journal of Information Technology 7 (1), 2008,pp 15-18.
[6]. Asouzu,C. Guidelines for trunk traffic measurement. NITEL operational publications, Nigeria Telecommunications Limited, 2004.
[7]. Ogbulezie, J. C.; Onuu, M.U. and Bassey, D.E. Assessment of NITEL Exchange, Calabar ,Nigeria. Journal of Engineering and Applied Sciences 3 (1), 2008,pp 55-58.
[8]. Itam, M.O. Measurements and analysis of telephone traffic in Kano and Kaduna metropolises. Ph.D Thesis, Department of Physics, University of Calabar, Nigeria, 2007.