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Assessment of NITEL Exchange, Calabar, Nigeria

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Abstract: Measurements and analyses of telephone in public switches in Calabar were undertaken in Nigerian Telecommunications Limited (NITEL), Calabar exchange. Data collected from 6 routes were analysed. Results show that the answer-bid ratio for the routes was in the range 9.70-47.40, answer-seizure ratio, 10.10-47.80 and call completion ratio, 77.70-100. This means that not up to half the number of calls were effectively carried, thereby implying poor performance compared to international evaluation indices.

Key words: NITEL exchange, public switches answer-bid ratio and answer-seizure ratio

INTRODUCTION

The astronomical growth in technology has influenced growth in telecommunication capacity, thereby making information and communication technology to be the order of the day in most nations. This growth is the index that measures the developmental strides of such nations. Telecommunication innovators have, through intensive research works improved telephony from fixed-wireless and today we have complete wireless networks.

The basic mechanism of planning a switching network is to ensure that the right size of equipment is provided to meet the needs of the customer in the most economical way. To enable this procedure to function, there must be a measure of equipment usage and a measure of the service given to customers (Calhoun, 1988). This measure is called quality of service. To ensure this, the administrators of an exchange base the provision of their switching equipment on the highest levels of traffic. Measurement of traffic is necessary to determine period of traffic peaks. This traffic peak period is usually called the busy-hour. The busy hour refers to the traffic volume or number of call attempts and is that continuous 1 h period being wholly in the time interval concerned for which the quantity (ie, traffic volume or call attempts) is greatest (Freeman, 1999).

The objectives of this investigation are to assess the performance of fixed wire line NITEL exchange, Calabar by studying traffic pattern along its major routes and determining the grade of service.

Theory: In teletraffic theory the word traffic is usually used to denote traffic intensity i.e., traffic per unit time. Therefore, the instantaneous traffic intensity in a pool of resources is the number of busy resources at a given instant of time.

Feldmann (2000) has used the stochastic knapsack with Poisson call arrivals in analyzing telecommunication systems. Wide Web, researchers have shown that the actual call arrival processes in the network are busty in nature with long range dependence. As a result, more generic knapsack solutions for non-Poisson call arrival were developed in order to study the current networks (Sarangan *et al*., 2005).

The pool of resources may be a group of servers e.g., trunk lines. The statistical moments of the traffic intensity may be calculated for a given period of time, T, for the mean traffic we get (Iversen, 2006)

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

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.

The key performance indicators in the exchange considered are the following according to Asouzu (2004).

Bids per Circuit per Hour (BCH): This is a measure of demand or calling pressure on a route during a particular period. BCH is given by the expression

$$BCH = \frac{\text{Bids}}{\text{Availible circuit}} \quad (2)$$

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Answer Seizure Ratio (ASR): This is the direct measure of traffic offered. It is given by

$$ASR = \frac{\text{Answered calls}}{\text{Total seizure}} \quad (3)$$

Answer Bid Ratio (ABR): This is the percentage ratio of answered calls to totals bids. It is expressed as

$$ABR = \frac{\text{Answered calls}}{\text{Total bids}} \quad (4)$$

Call Completion Rate (CCR): This indicates the effectiveness of call completion up to switching level.

$$CCR = \frac{\text{Answer} + \text{No reply} + \text{Number unobtainable}}{\text{Total seizure}} \quad (5)$$

MATERIALS AND METHODS

To assess the Calabar exchange of Nigeria Telecommunication Limited (NITEL) involved measuring and analyzing data collated from 6 routes (Calabar-Aba, Aba-Calabar, Calabar-Uyo, Uyo-Calabar, Calabar-port Harcourt, Harcourt-Calabar). These are the lines that enter and leave Calabar exchange. It involved using 10000 subscribers' digital electronic switching (EWSD) equipment, 12,000 analogue and external plant network interfacing subscribers, 144 megabits/sec digital carrier network and computerized Operation and Maintenance Terminal (OMT).

Two phases of measurements were employed. The first phase involved determining the busy hour of the routes in the exchange while the second was for the determination of the quality of service offered by the Calabar exchange. Measurement of traffic for a period of 24 h at 30 min interval was carried out using the OMT. This was done for seven days and the busy hour for each route was determined.

Data were collected for eight weeks (June 12 2006, August 15, 2006) at the busy hour to determine key performance indication of the exchange. Due to the high volume of data involved, mean values were used in the analysis.

RESULTS AND DISCUSSION

Traffic patterns of the routes are shown in Fig. 1-3 for the 6 routes and the results of the mean values of the measured parameters are specified in Table 1-3. Using the values obtained in Table 1-3 and the Eq. 3-5 for ASR, ABR and CCR, the performance of the exchange was assessed (Table 4).

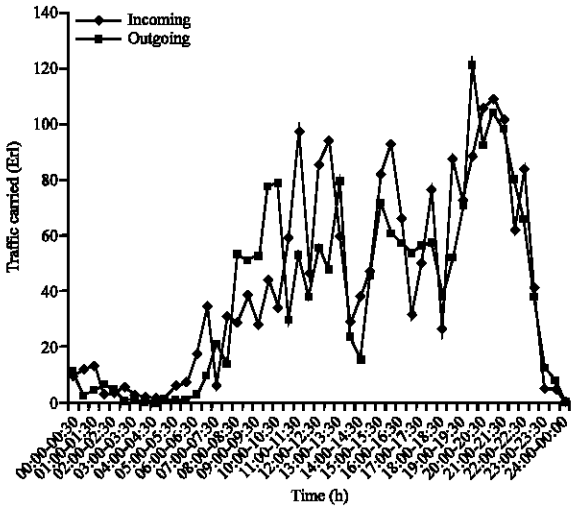

Fig. 1: Traffic patterns: Calabar to Aba, Aba to Calabar

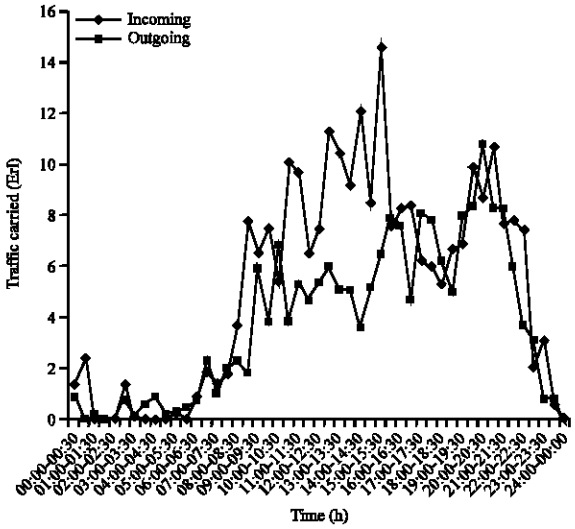

Fig. 2: Traffic patterns: Calabar to Uyo, Uyo to Calabar

Table 1: Busy hour key teletraffic performance indicators at Calabar-Uyo primary centre

Key traffic event measurements	Outgoing traffic scanning time (19.30-20.30 h)	Incoming traffic scanning time (14.30-15.30 h)
Trunks provided	75	75.0
Trunks available	75	75.0
Bids	879	625.0
Seizures	810	619.0
Switch-through	629	609.0
Answered	172	296.0
Busy/no reply	457	313.0
Traffic carried (DERL)	11	8.3

Table 2: Busy hour key traffic events at Calabar-Aba primary centre

Key traffic event measurements	Outgoing traffic scanning time (20.30-21.30 h)	Incoming traffic scanning time (20.00-21.00 h)
Trunks provided	150	150
Trunks available	122	122
Bids	1,014	1,563
Seizures	987	1,498
Switch-through	987	1498
Answered	235	151
Busy/no reply	643	1158
Congestion	109	189

Table 3: Busy hour key traffic events at Calabar-Port Harcourt primary centre

Key traffic event measurements	Outgoing traffic scanning time(12.30-13.30 h)	Incoming traffic scanning time (19.00-20.00 h)
Trunks provided	402	402
Trunks available	402	402
Bids	2,987	1,796
Seizures	2,152	1,783
Switch-through	2,149	1783
Answered	513	451
Busy/no reply	1,179	1261
Congestion	448	71

Table 4: Busy hour key telegraphic performance indicators for the routes

	Calabar-Uyo primary centre		Calabar-Aba primary centre		Calabar-Port Harcourt primary centre	
Key teletraffic performance indicators	Outgoing traffic	Incoming traffic	Outgoing traffic	Incoming traffic	Outgoing traffic	Incoming traffic
Answer Bid Ratio (ABR)	19.60	47.40	9.23	9.70	17.20	25.10
Answer Seizure Ratio (ASR)	21.00	47.80	23.80	10.10	23.80	25.30
Call Completion Rate (CCR)	77.70	98.40	100.00	100.00	99.90	100.00

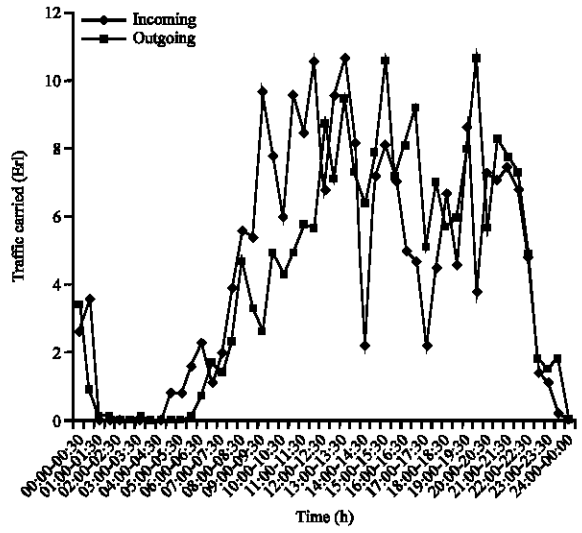

Fig. 3: Traffic patterns: Calabar to Port Harcourt, Port Harcourt to Calabar

Along the Calabar-Uyo route, there was very low traffic activity recorded in this route. This can be seen through the rate of traffic carried ASR and ABR recorded 21 and 19.60%, respectively. These values indicate power performance on this route. Out of 629 calls that successfully switched through the network and terminated at the exchange only 172 calls were answered. However, a call completion rate of 77.77% was recorded on this route showing that the switching facility is performing very well. Looking at the ASR, ABR and CCR values, it can be seen that though the CCR is very high, the very low values of ASR and ABR imply that the quality of service is low for this route. Quality of service here is the perception of the customers towards the network.

Considering the Uyo-Calabar route, the effectiveness of traffic offered as presented by ASR was 47.80% and ABR of 47.40%. These values ABR and ASR were indications of the near average effectiveness on this route. From the values of ASR and ABR above, it was concluded that the quality of service for this route is better than that of Uyo even though the call completion ratio is high.

Along Calabar-Aba, ASR was 23.80%, ABR was 9.23% even though CCR was 100%. This 100% CCR indicates the effectiveness of call completion up to the switching level. The low levels of ASR and ABR show poor termination of calls at the subscriber's. end which could be attributed to poor local loop network or lines placed on temporary out of service mode. The quality of service for this route is therefore poor.

For the Aba-Calabar route ABR and ASR are 9.70 and 10.10%, respectively. These figures are extremely poor even though CCR along this route was 100%. The low values of ABR and ASR simply show that the most subscribers were disconnected from service due to unreconciled bills. The values of ABR and ASR for Calabar-Port Harcourt route were 17.20 and 23.80%, respectively. Here also it is seen that the values are very

low. For Port Harcourt-Calabar, ABR was 25.10% and ASR was 25.30%, CCR was 100%. Trunks provided and trucks available were the same showing a good digital multiplexer unit. The call CCR was good and the route had good digital multiplexer unit showing good transmission and switching networks.

CONCLUSION

Considering the 6 routes involved in the Calabar exchange, the ABR was in the range 9.23-47.40, ASR 10.10-47.80 and CCR, 77.70-100. This means that out of hundred calls, not up to 50 calls were effectively carried or successfully seized the switch even though the call completion rates for all the switches were very high. Result thus showed that the quality of service for Calabar exchange is poor, implying poor performance compared to international evaluation indices. It was found that the main reason for the low quality of service was poor local loop network (i.e., poor termination at the subscriber's end).

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