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User-response Study of Computer Networking Cables in Parts of South-eastern Nigeria

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Abstract: The type of cables used in computer networking is so important that network administrators have to make choice of cables to use for a particular network. In this study, response models are developed in relation to the use to which some networking cables are put in Akwa Ibom, Cross River, Imo and Rivers States in South Eastern Nigeria. Generally, it is shown that the best available relationships that fit the data well for all the states are exponential response curves of the form %R = a exp(b)N and CR= a' exp(b')N where %R and CR are percentage and cumulative responses respectively, N is frequency and a, b, a' and b' are constants that characterize the States. Percentage responses on preferred cables and those currently in use have been determined for each of the states.

Key words: Response curves, Regression models, Cables, Computer Networking.

INTRODUCTION

In considering computer networking using cables there are usually three types of cables to choose from namely, coaxial, unshielded twisted pair and optic fibre cables. The choice of these cables for computer networking in some parts of South-Eastern Nigeria is studied with a view to finding the computer networking administrators' complaint and responses to the use of these cables. Many times there are problems in choosing a particular cable due to lack of knowledge of the characteristics of the cables available [2]. Hence, there is the need to sample administrators' responses as regards the use of these cables. This study focuses on network administrators in four states of the South-Eastern Nigeria. This is so because the network administrators are the people who should know the reasons for choosing a particular type of cable for computer networking. The four states are Akwa Ibom, Cross River, Imo and Rivers.

Cables: The word cable has been used in many quarters to mean different things. For instance, it has been used as a term in the foreign exchange market for the US Dollar/British Pound rate. It has also been defined as a flexible steel rope made up of numerous wire strands that are twisted helically together around a core of wire, wire rope, fibre, plastic or other materials[3]. The cable used in computer networking has its parameters like characteristic impedance, signal-to-noise ratio, nears and far end cross talks and attenuation.. [7] in his book on transmission and cabling stated that the quality of signal received at the end of transmission depends largely on these parameters. In his view [9] stated that the integrity of data transmitted in a computer network is a function of the cables vulnerability to tapping. Also contributing to the cable factor in a computer networking, [5] on computer networking cable principles opined that the use of networking cables must be such that the signal should be distinguished from noise in what he called the signal-to noise ratio of a cable.

Many of the Local Area Networks (LANs) are done using cables which could be coaxial, unshielded twisted pair or optic fibre cables. Coaxial cable is a cable of two conductors sharing a common axis, hence the name coaxial [8]. This happens to be the first cable type used in LANs.

Coaxial cable is reasonably easy to install. The cables are robust, difficult to damage and connectors can be installed with inexpensive tools and a bit of practice. Coaxial lines have low loss, but also have undesirable characteristics [1]. Because of this, they cannot be run along or attached to anything conductive as extended fields will induce current in the nearby conductors causing unwanted radiation and detuning of the line [6].

Unshielded twisted pair cable is the second type of computer networking cable, its characteristics are similar in many ways to that of shielded twisted pair, differing only in attenuation and electromagnetic interference characteristics. Unshielded twisted pair (UTP) is the most popular type of computer networking cable in this part of the world.

The quality of unshielded twisted pair Cable may vary from telephone-grade wire to extremely high-speed cable. The cable has four pairs of wires inside the jacket. Each pair is twisted with a different number of

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twists per millimeter to help eliminate interference from adjacent pairs and other electrical devices. The tighter the twisting the higher the supported transmission rate and the greater the cost per meter. The EIA/TIA (Electronic Industry Association/Telecommunication Industry Association) have established standards of unshielded twisted pair cable and rated seven categories from category 1 to category 7 showing their use from voice (telephone wire) to data at 200Mbps (faster ethernet).

If networking is to be done using light rays, the optic fibre cable becomes inevitable. The first practical optic fibre for communications was invented in 1970 by researchers Robert D. Maurer, Donald Keck, Peter Schultz, and Frank Zimar working for American glass maker Corning Glass Works [4]. They manufactured a fibre with 17 dB optic attenuation per kilometer by doping silica glass with titanium. Optic Fibre cable is a very fine glass rod of diameter 125mm. It is made of a core surrounded by a glass coating or cladding of smaller refractive index than the core, it works on the principle of light propagation. It is also a dielectric waveguide used for the propagation of electromagnetic energy at optical frequencies [10]. The centre conductor is a fibre that consists of highly refined glass designed to transmit high frequency signals with little loss. The cladding is used to confine the light to the core while the buffer protects the fibre. Because of its high bandwidth and immunity from electromagnetic interference it is highly recommended for data transmission. Optic Fibre is useful not only because of its immunity from electromagnetic interference but also because of its enormous bandwidth; up to 50Mb/s in a 10 km range, up to 140 Mb/s in 6 to 8km range.

Significance of study: Computer networking has come to stay in the present day Information and Communications Technology (ICT). Cables, apart from wireless devices are used in computer networking for the purpose of communication and it is necessary to examine the responses of network administrators in respect of the use of these cables. More so, the frequency of use of these cables (number of respondents) is also important in this technology. This calls for the development of regression models in the user-response studies for prediction purposes, at least, in this part of the Fedral Replublic of Nigeria.

Methodology: This study comprised social survey and statistical analysis. In the social survey, a total of 2000 questionnaires were distributed to computer network administrators in four states of South-Eastern Nigeria in the following order: Akwa Ibom State 450, Cross River State 490, Imo State 510 and Rivers State 550. Of these a total of 1,904 were returned/collected from respondents. This gave a response rate of 95.2% (Table 1). Percentage response rates for each of the states is also shown in Table 1. the questionnaire comprised of 40 items. Some of the questionnaires are on cable used for a network and what effect does it have on transmission.

RESULTS AND DISCUSSION

Akwa Ibom State: In Akwa Ibom State, regression analysis shows that the percentage response, %R and cumulative response, CR are related to the number of respondents N using optic fibre cable according to the equations;

$\%R = 0.894\exp(0.188)N$
and
$CR = 0.8409\exp(0.217)N$ respectively (Fig. 1). The respective values of the square of the regression coefficients R^2 are 0.9806 and 0.9992.

Cross River State: Expressions for Cross River State were obtained as follows:
$\%R = 0.0891(0.0262)N$ and
$CR = 0.788\exp(0.0186)N$ (fig. 2) with respective R^2 values of 0.9581 and 0.9933.

Imo State: Considering the network administrators responses in Imo State it was found that the percentage response, %R and cumulative response, CR are related to the frequency N of use according to the equations:
$\%R = 0.8409\exp(0.0168)N$ and
$CR= 0.7848\exp(0.0158)N$ (Fig.3)
with regression coefficients R^2 of 0.9677 and 0.994 respectively.

Rivers State: In Rivers State, regression analysis shows that the percentage response %R and cumulative response are closely related to the frequency N of use according to the equations shown below:
$\%R = 0.8519\exp(0.0155)N$ and
$CR = 0.7947\exp(0.017)N$ with regression coefficient R^2 values of 0.9656 and 0.9929 respectively.

Generally describing r^2 as the proportion of the variance of the dependent variables, %R and CR, that can be attributed to its exponential regression on the dependent variable, N; r calculated to be between 0.9788 and 0.9996 indicates that between 97.88 and 99.96 of the variance of the independent variables are explained by the independent variable N. Thus, the curves fit the data well implying that the claim that the responses are exponentially dependent on the number of respondents, N is appropriate. Parameters for the exponential regression for each of the states are summarized in Table 2.

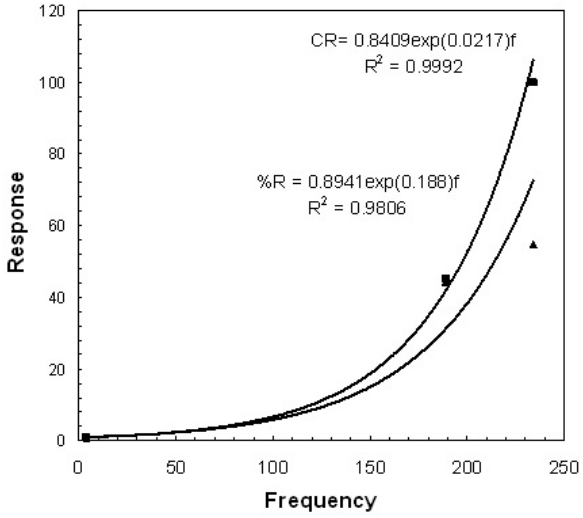

Fig. 1: Response curves for Akwa Ibom State.

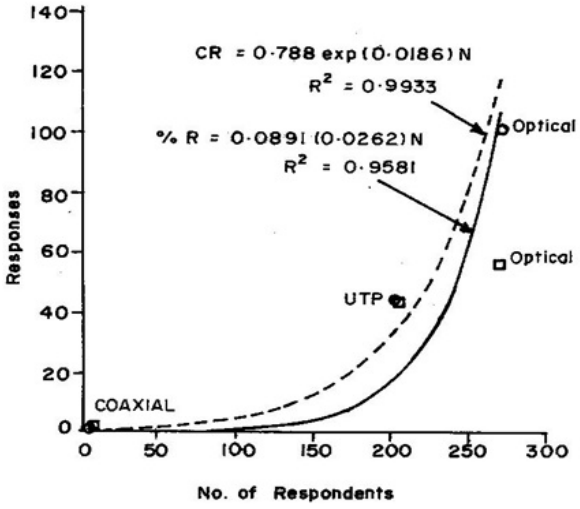

Fig. 2: Response curves for Cross River State.

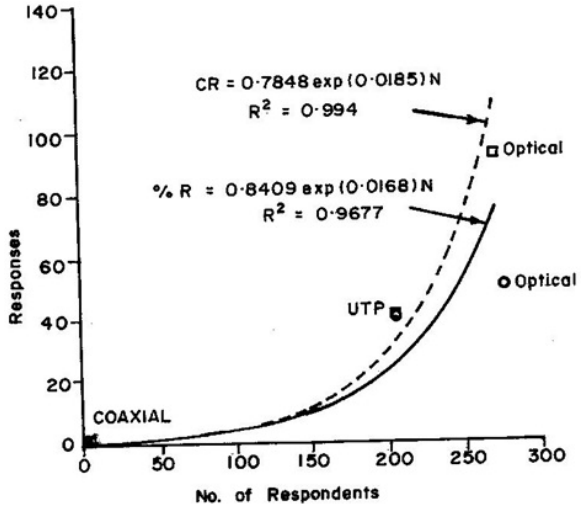

Fig. 3: Response curves for Imo State.

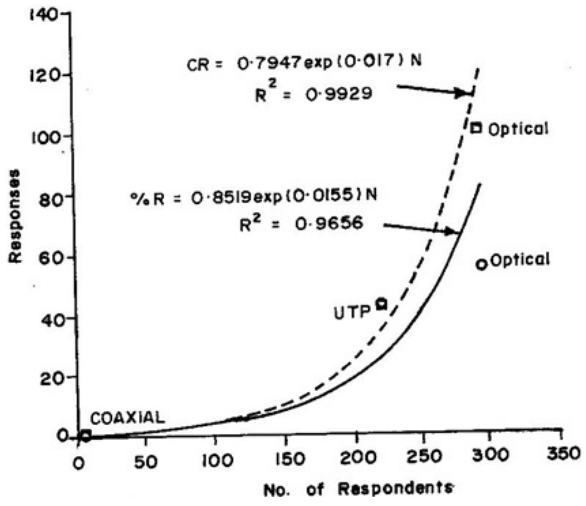

Fig. 4: Response curves for Rivers State.

Table 1: Total number of questionnaire distributed and responses in the four States.

State	Total number of questionnaires distributed	Total number of responses	% Responses
Akwa Ibom (AK)	450	427	94.9
Cross River (CR)	490	477	97.3
Imo (IM)	510	480	94.1
Rivers (RV)	550	520	94.5
Total	2000	1904	95.2

Table 2:

State	Responses regressed on f	a, a'	b, b'	Correlation coefficient r
Akwa Ibom	%R	a = 0.8941	b= 0.1880	0.9902
	CR	a' = 0.8409	b' = 0.0217	0.9996
Cross River	%R	a = 0.0891	b= 0.0262	0.9788
	CR	a' = 0.7880	b' = 0.0186	0.9966
Imo	%R	a = 0.8409	b= 0.0168	0.9837
	CR	a' = 0.7848	b'= 0.0185	0.9970
Rivers	%R	a = 0.8519	b= 0.0155	0.9826
	CR	a' = 0.7947	b'= 0.0170	0.9964

Equation estimated is of the form %R = a exp(b) N and CR= a'exp(b')N
Where %R, CR and N have their usual meaning.

Conclusion: It has been found in this study that the best available relationships that exist between responses and the number of respondents regarding the use of networking cables in Akwa Ibom, Cross River, Imo and Rivers States in South Eastern Nigeria are of the form:

%R = a exp(b)N and

CR= a'exp(b')N

where %R, CR, a, b, a', b' and N have their usual meaning.

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