

Communication and connectivity as veritable tools for information sharing in Nigeria

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ABSTRACT

This paper discusses the contributions of communication technologies to modern civilization and globalization and the role of connectivity as facilitator to efficient global information sharing today. The background study of networks, satellites, statement of the problem and the objectives of the paper were looked into. A brief historical development of Nigeria communications and their beneficial applications today were presented. Presentation was made on why internet communications in Nigeria is dominated by wireless/satellite link. It was adduced that the absence of information technology infrastructure, particularly the complete absence of fiber optics backbone and weak telecommunication base were responsible for the predominant wireless internet application in Nigeria. The paper concludes that a good information technology infrastructure base such as the construction of domestic optics backbone as ongoing by some of the GSM operators such as Globacom and MTN, launching of domestic communication satellite such as Nigcomsat1 in December, 2012; and the interlinking of our communication will enhance information sharing and as well reduce the cost of internet applications and motivate a larger population to participate in our new information society.

Keywords: Communication; Connectivity; Wireless; Satellite; Infrastructure and Interlinking

1. INTRODUCTION

Internet and satellite communication networks deal with the science and technology of inter-connectivity of networks and the role of satellite as packet channel agent in a complex web of global networks. Networks are all about interconnection of independent nodes to exchange and share information.

2. THE INTERNET

Information Technology (IT) is the convergence of micro-electronics telecommunications and computer technology. This explains UNESCO'S definition, which states that IT is "the scientific, technological and engineering disciplines and the management technologies used in information handling and process, their application, computers and their interaction with man, machines and associated socio-economic and cultural matters". The computer networks have become so developed that they span the entire globes. The convergence of computer technology and telecommunications has necessitated the need to

research for international open standards that could make possible for dissimilar networks and topologies to link and share information without hiccups.

An article concludes that “(the internet) has become a mass medium used most by relatively passive consumers, and as such major content providers” (Margolis and Resnick, 1999). The book (Winston, 1998) also presents the internet as the next step in the evolution of mass media.

3. THE SATELLITE

According to Osuagwu (2002), a satellite can be defined as a powerful radio transmitter with transponders positioned aerodynamically in the orbit at 36,000ft above sea level. They amplify, sort or route signals. Unlike wireless ground repeaters which relay signals between two fixed locations; satellite interconnect many locations, both fixed and mobile over a wide area. It receives microwave signals from equipment on the earth in a given frequency band (uplink) and re-transmits them at a different frequency to earth stations (downlink).



Nigcomsat 1R

A satellite is anything that orbits something else just as the moon orbits the earth. However, a satellite is a specialized wireless transmitter/receiver that is launched by a rocket and placed in orbit around the earth. Satellite can be used either for security, weather forecasting, identifying mineral deposits, television broadcast, amateur radio communications, internet communications, global positioning system (GPS), Motor vehicle tracking system, e.t.c.

There are three major categories of satellite systems namely:

(i) A geostationary satellite – which orbits the Earth directly over the equator, approximately 22,000 miles up. It then takes 24 hours to make one complete revolution around the earth. Hence, it remains at the same spot on the earth’s surface at all times, and stays in the sky from any point on the surface from which it can be “seen”. E.g. weather satellites are in this category. Images can be viewed from these satellites on the internet via the Purdue weather processor. One of these satellites can view approximately 40 % of the earth’s surface and such three of it can view the whole world.

(ii) A low-earth orbit (LEO) – satellite system employs a large fleet of “birds,” each in a circular orbit at a constant altitude of a few hundred miles. Each revolution takes approximately 90 minutes to a few hours. The fleet is arranged in such a way that, from any point on the surface at any time, at least one satellite is on a line of sight. In this type of satellite, the transponders are moving rather than being fixed, and are in space rather than on the earth. The good thing about this satellite is that it makes it possible for anyone to access the internet via wireless from any point on the planet using an antenna.

(iii) Elliptical orbit satellite system – revolve around the earth in elliptical orbits. These satellites move rapidly when they are in their lowest altitude and slowly when they are in their highest altitude. Such satellites are used by amateur radio operators, and by some commercial and government services. They require directional antennas whose orientation must be constantly adjusted to follow the satellite’s path across the sky. (Prince, 2011).



Earth Station

STATEMENT OF THE PROBLEM

The present communication network in Nigeria is poised with a lot of problem such as network failure when by a caller and the receiver cannot hear each other at times while the caller’s credit is being deducted.

Even the short messages (SMS) sent were not delivered but the sender is being charged. These immense problems had led the researchers to find the best means of sharing vital information in Nigeria communication system so that the network user will not be disappointed and lose confidence in the ability of the service provider whenever they make call.

OBJECTIVES

- (i) To ascertain how wireless internet, satellite and fiber optics are tools for information sharing;
- (ii) To determine the effect and the best tool for information sharing;
- (iii) To make projections for the future role of internet, satellite and fiber optics.

BRIEF HISTORICAL DEVELOPMENT OF COMMUNICATION IN NIGERIA

Telecommunications facilities in Nigeria were first established by the colonial administration. At independence in 1960, with a population of about 40 million people, Nigeria had only about 18,724 telephone lines for use which translated to teledensity of about 0.5 % telephone lines per 1000 people. The telephone network consisted of 121 exchanges of which 116 were the manual (magneto) type and only 5 were automatic type.

Between 1960 and 1985, the telecommunication sector consisting of the department of posts and telecommunications (P & T) limited in charge of internal network and, the Nigerian external telecommunications (NET) limited, responsible for the external telecommunications services provided the gateway to the outside world. The installed switching capacity at the end of 1985 was about 200,000 lines as against the planned target of about 460,000 lines. All the exchanges were analogue. Telephone penetration remained poor as one telephone line to 100 inhabitants was recommended by international telephone union (ITU) for developing countries. The equality of service was largely unsatisfactory, unreliable, congested, expensive and customer unfriendly.

Arising from the foregoing, in January 1985, the erstwhile posts and telecommunications department was split into postal and telecommunications limited (NITEL), a limited liability company. The main objective of establishing NITEL was to harmonize the planning and coordination of the internal and external telecommunications development, and provide accessible, efficient and affordable services.

Forty six years ago after independence, the Nigeria telecommunication PLC (NITEL); had roughly half a million lines available to over 120 million Nigerians. NITEL, the then only national carrier, had a monopoly on the sector, and was synonymous with epileptic and unreliable services and poor management. On assumption of office on the 29th of May, 1999; former president Olusegun Obasanjo's administration swung to gear to make a reality, the complete deregulation of the telecommunications sectors, most especially, the much touted granting of licenses to GSM service providers and setting in motion the privatization of NITEL. Also, this administration immediately changed the management of Nigerian Communication Commission (NCC) with a new breed of professionals in the telecommunication industry. The commission duly organized and successfully executed the first ever digital mobile license auction for the provision of GSM services in Nigeria namely, MTN, M-Tel (which went out of business) and ECOMtel (now Etel). Out of the seven companies that applied for the digital mobile license only three mentioned above were qualified upon the payment of two hundred and eighty five (₦285) million Naira capitalization fee each. This proactive approach by federal government of Nigeria to the telecom sector has made it possible for over 2.5 million Nigerians clutch to GSM cell phones and handsets today.

Similarly, the advent of GSM in Nigeria has created the habit of time management and conservation. This phenomenon can be seen from the curtailment of telephone conversations, while at the same time eliminate long journey for pleasure and businesses.

Also, Nigerians are now able to operate their savings, current, mobile money transfer, recharging of GSM, DSTV, searching for old friends whom they have lost contact for years via cell phones or handsets. (Agbasi *et al*, 2007).

4. METHOD

Discussion will be used in this paper throughout which is employed in the analysis of both present and future communications system in Nigeria.

5. FIBER OPTICS

According to Maaki (2004), the idea of fiber optic cable is a fairly new but old technology that was borne in some years back which is designed to be used in data transmission and networking nodes. It is a new technology whereby the cable is made to transmit data that is converted to light pulses. Fiber optics are either made of glass or plastic and conducts light just as copper wire conducts electrons. They are very small in diameters and measure about 6-200 μm (microns). A micron is about 10^{-6}m . The glass or plastic is made of a fiber, often included with a metallic covering to protect it from environmental hazards when buried underground.

This fiber optics technology is realistic because of the use of lasers. This cable transmits its data for a long distance without loss of information or what is known as attenuation. Though very expensive but can carry a huge amount of data over long distance and it is said to have a very high bandwidth. It was found to be very useful when a laser light, which was directed into the fiber, remained into it until it emerged at the other end with the same intensity. That showed that there was no loss of light as it travelled along the length of the fiber. When it is used in data transmission between nodes, a converter is attached to one node which converts the electrical signals that are emerging from the node into light signals to travel along the fiber until a converter at the other node converts it back into the electrical signals as it enters the node at the other end. The fiber has advantages over other transmission media because of its weight, size, efficiency, huge bandwidth and physical tempering.

According to John (2011), a fiber optic cable use light pulses to transmit information down lines instead of using electronic pulses to transmit information down copper lines. Light pulses move easily down the fiber optic line because of the principle of “total internal reflection”. In this principle, when the angle of incidence exceeds a critical value, light cannot get out of the glass; instead the light bounces back. This principle was applied to the construction of fiber optic strand, which made it possible to transmit information down fiber lines in the form of light pulses.

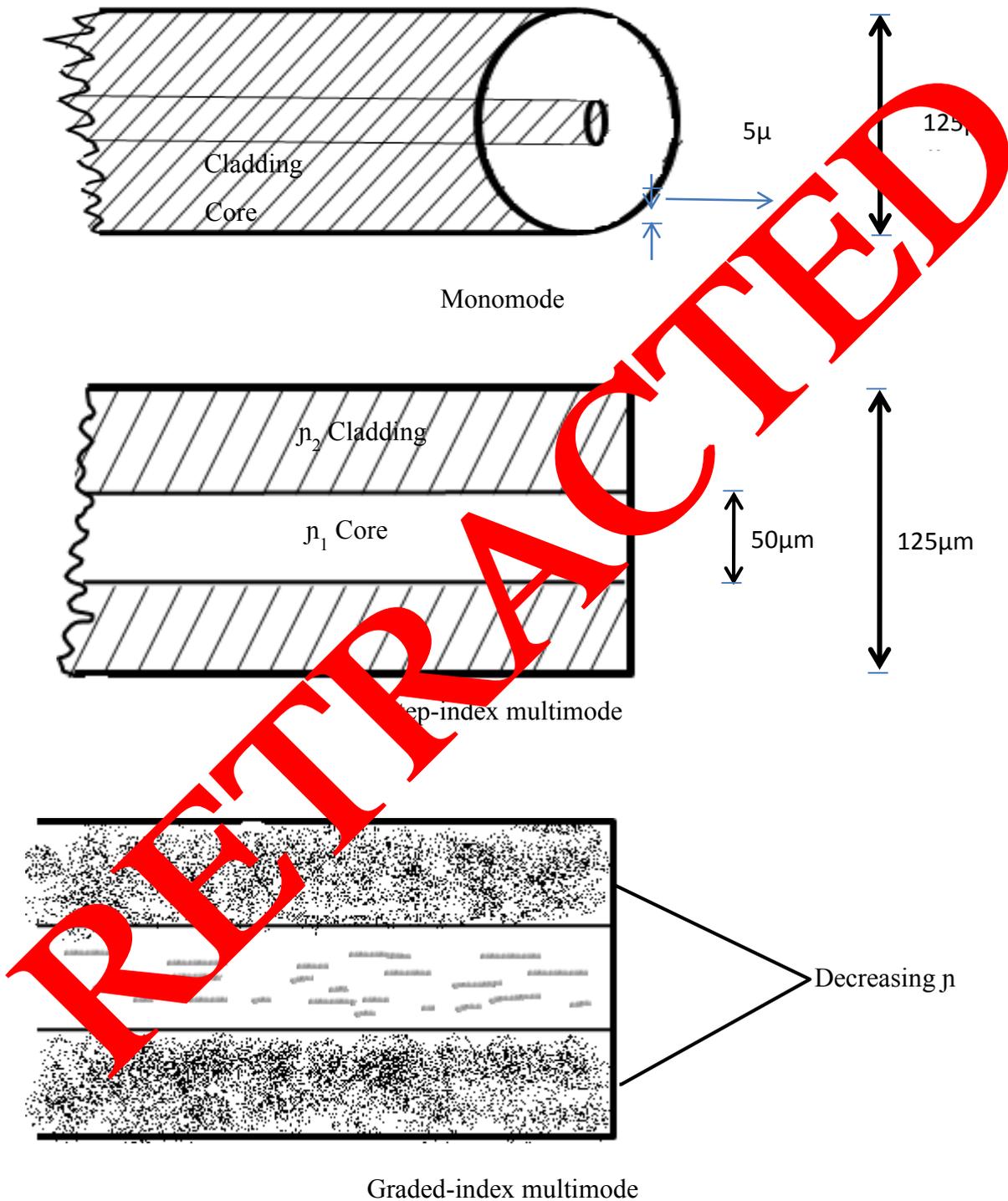
6. OPTICAL FIBERS IN COMMUNICATION

Nelkon and Parker (1997) in their book title “Advanced level Physics”. Light signals can travel along very fine long glass fibers roughly the same diameter as the human hair. Optical fibers have replaced the copper cables previously used in telecommunications. The fiber is a very fine glass rod of diameter about $125\ \mu\text{m}$ ($125 \times 10^{-6}\text{m}$) with a central glass core surrounded by a glass coating or cladding of smaller refractive index than the core.

The fibers are classified into two main types namely:

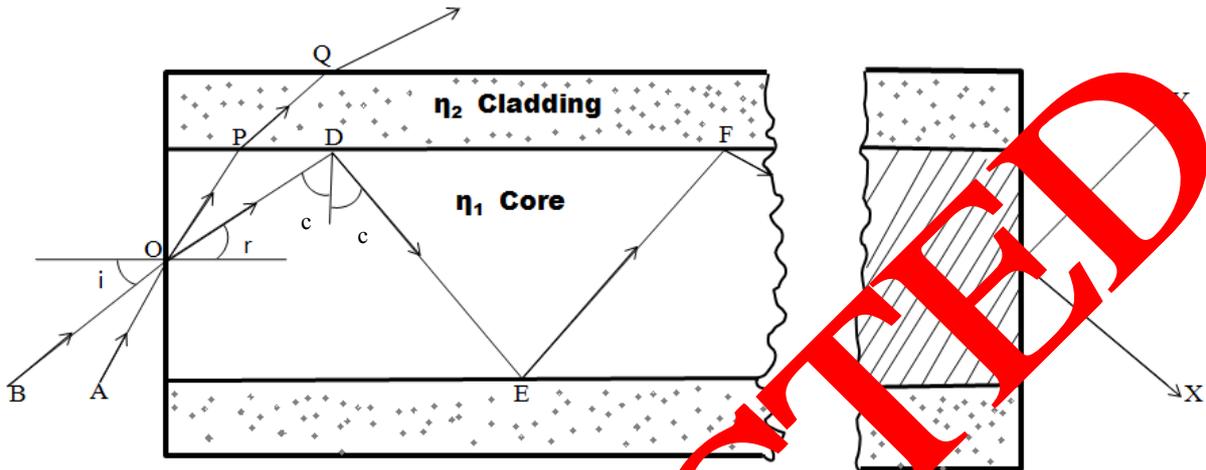
- (i) Monomode – This fiber has a very narrow core of diameter approximately $5\ \mu\text{m}$ ($5 \times 10^{-6}\text{m}$) or less and as such the coating (cladding) is relatively big.
- (ii) Multimode – This type of fiber has a core of relatively large diameter that is approximately $50\ \mu\text{m}$. In one form of multimode fiber, the core has a constant refractive index n_1 such as 1.52 from its center to the boundary with the coating (cladding). The refractive index then changes to a lower value n_2 such as 1.48 which remains constant throughout the cladding. This is called a *step index* multimode fiber since the refractive index ‘steps’ from 1.52 to 1.48 at the boundary with the cladding.

- (ii) To transmit light signals more efficiently, a multimode fiber is made whose refractive index decreases smoothly from the middle to the outer surface of the fiber. There is no noticeable between the core and cladding. This is called a Graded-Index multimode fiber.



OPTICAL PATHS IN FIBERS

Let's see what happens when a light signal enters one end of an optical fiber. The figure below shows a step-index fiber. With a large angle of incidence, a ray OA entering one end at O is refracted into the core along OP and then refracted along PQ in the cladding at Q. In this case, only a very small amount of light, due to reflection, passes along the fiber.



Light path by total internal reflection - multiple reflections.

With a small angle of incidence, however, a ray such as BO is refracted in the core along OD and meets the boundary between the core and cladding at their critical angle, C. In this case, since $n_1 \sin i$ is constant

$$n_1 \sin C = n_2 \sin 90^\circ = n_2$$

where n_1 is the core refractive index and n_2 the slightly smaller cladding refractive index. Since, $n_1 = 1.52$ and $n_2 = 1.48$,

$$\text{Hence, } \sin C = n_2 / n_1 = 1.48 / 1.52 = 0.974 \\ C \approx 77^\circ$$

The ray OD is now totally reflected at D along DE, where it again meets the core-cladding boundary at the critical angle. At E, therefore, it is totally reflected along EF.

In this way, by total internal reflection, a ray of light entering one end of a fiber can travel along the fiber by multiple reflections with a fairly high light intensity. At the other end of the fiber, the ray emerges in a direction X (odd number of multiple reflections) or a direction Y (even number of multiple reflections).

7. DISCUSSION

So far we have seen that optical fiber has thin glass core coated by glass of smaller refractive index which make total internal reflections occurring repeatedly at the interface of

the glasses all along the fiber. Telecommunication industries took advantages of the fact that light in glass travels faster than electrical signals in copper cable, more messages per cable length can be sent and clearer sound can be heard to employ and deploy optical fiber to boost their business activities.

8. OPTICAL FIBER VIEWING SYSTEMS

Even though optical fibers have found their main application in high speed communications, they are also used to make remote viewing systems for medical and other purposes where access to the scene is restricted. The idea is that very large numbers of tiny fibers are packed together to form a flexible bundle: one end is placed in contact with the scene, the other end forms a remote image of the scene which may be around a corner or on the other side of the small aperture. Each individual fiber transmits light along its length from the scene to the viewer. Individual fiber is incapable of forming an image: they merely collect light from a small area of the scene and transmit it to the viewer. However, since each fiber 'sees' a slightly different part of the scene, they collectively transmit an image from the scene to the viewer. It is important to ensure that the fibers do not change their relative positions over the length of the bundle; otherwise the image will be scrambled at the viewer's end and will be totally unintelligible. Small bundles of fibers need not be much larger than a hypodermic needle, and can easily be inserted without pain into a patient. Part of the bundle carries illumination from the outside, while the other part transmits the image. Using such techniques, 'keyhole' surgery can be performed, without the need for any major incision.

9. FOCUS ON THE FINDING

The finding focus is on the deployment of fiber optic infrastructure as the most effective and efficient reliable tool for communication among the various nodes on the internet.

10. CONCLUSION

The internet has been described as the greatest invention of man after the industrial revolution. This revolutionary marvel has been made possible by satellite and microwave communication links. M'boya-former UNESCO scribe rightly pointed out over a decade ago, "information technology has opened up such tremendous vistas for modern societies that any failure to master it would mean a life of permanent insubordination". The technology among others has the ability to make use of other techniques to give or to refuse access to a whole range of scientific data and knowledge and thus to design new models of development.

Joining our new international information society in Nigeria is plagued with several bottlenecks such as the absence of information technology infrastructures like optical fiber backbone, weak telecommunications backbone, and epileptic power supply.

Recommendations

- (i) Nigeria has to urgently overhaul the existing copper cable and wireless networks and replace them with well-structured underground cabling manhole ducts to take care of fiber systems and future expansions.

- (ii) Developed National information super highway infrastructure base on a nationwide fiber backbone linked to Africa on fiber network for fast and easy link to the rest of the world.
- (iii) Encourage foreign investors to establish an industry that will manufacture optic fiber cable locally in order to reduce the cost of purchasing, transportation and installation which in turn reduce the cost of service provision that will negatively affects the end users.

It is pertinent at this junction to point out that Monomode optic fiber infrastructure is the best communication tool that should urgently be employed and deployed in Nigeria in order to boost and overcome the problems of network connectivity experienced over the years. Even though it is more expensive than multimode optic fiber, it gives a higher transmission rate of up to fifty-times more than multimode. This is because the small core and single light-wave virtually eliminate any distortion that could result from overlapping light pulses, thereby providing the least signal attenuation which is the highest transmission speed of any fiber cable type.

Though, multimode fiber gives a high bandwidth at high speed (4B) over medium distances than monomode; but by virtue of the fact that light waves (laser) are dispersed into numerous paths as they travel through the cable's core makes it typically to cause signal distortion at the receiving end, thereby resulting in an unclear and incomplete data transmission as is the case with wireless services we have today in Nigeria. Hence, new monomode optic fiber cable should be designed to use Gigabyte and beyond.

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