Issues towards Utilization of Fiber Optic Communication: The Case of Seacom Submarine Fiber Optic Cable in Tanzania

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Abstract - **This paper identifies, discusses and examines the possible theoretical issues towards successful utilization of fiber optic communication, and then attempts to find out how the identified issues are reflected in the Tanzanian context so as to pinpoint specific issues in the Tanzanian environment. The case of SEACOM Submarine Fiber Optic cable was taken.**

Six issues were identified towards the utilization of fiber optic communication in Tanzania. Which are: unavailability of national backbone network made of fiber optic cable, lack of backhaul connectivity, un-affordability of last mile connectivity, unfavourable infrastructure for operators to connect to SEACOM, access to the Internet is predominantly by use of Satellites. And, some institutions that own fiber optic networks have not commercialized the networks.

The construction of fiber optic national backbone network, availability of fiber optic networks built by some institutions (TAZARA, TANESCO, TTCL, TRL and SONGAS); and open access to SEACOM whose operation is influenced by neither the government nor the incumbent operator were identified as the opportunities of paramount significance since will tremendously enhance the utilization of fiber optic communication in Tanzania and neighbouring countries.

In order to benefit from utilization of fiber optic communication in Tanzania, we recommend enhancement of: last mile connectivity, infrastructure for connecting to SEACOM; learn from other countries; and the need to encourage investment in backbone networks.

Keywords – Fiber- optic, SEACOM, connectivity, national backbone network, communication

I. INTRODUCTION

Tanzania has been one of the countries lacking broadband Internet access. Thus, instead of using submarine fiber-optic connectivity, which provides for the cheapest and best technology for connecting to the Internet and for phone calls, Tanzania had to rely on satellite links. This has kept international phone calls overpriced and Internet access very expensive and slow.

On July 23, 2009 the SEACOM international fiber optic undersea cable was commissioned for operation in Tanzania. The cable is expected to provide high capacity and inexpensive bandwidth, thus removing the bottleneck in international infrastructure.

In this paper we discuss and examine issues towards successful utilization of fiber optic communication in Tanzania taking the case of SEACOM submarine fiber optic cable.

II. LITERATURE REVIEW

Deployment of undersea fiber-optic cables is growing rapidly. Reasons for the growth include: Internet data growth, International data traffic, high speed Internet access, electronic mail, data transfer, imaging, on-line information services, private networks and virtual private networks, interest in video transmission, video programming, business video applications, new forms of financing and operations, VoIP, gaming, mobile phones and 3G. In absence of trans-border fiber optic connectivity, many contiguous nations in the developing world are forced to route their traffic via nodes in North America or

Europe, a proposition that is both technically and economically irrational [1].

A. Fiber Optic Communication in Africa

Given that Africa is the most unwired continent in the world, most of its internal communication (voice, data, and video) has to be resolved internationally. This costs the continent a fortune and as a result the cost of communications is significantly higher in Africa than elsewhere in the world. Ninety percent (90%) of calls from African countries to other African countries are routed through Europe. It has been estimated this routing of traffic costs the continent US$400 million a year. Internet usage is only at 1.1 percent of population for the continent [2]. Broadband penetration rate in Sub-Saharan Africa is low. Two key factors underlie the very low rates of usage of broadband in Sub-Saharan Africa – high prices and limited availability. Price is a major determinant of broadband take-up [3]. Accordingly, internet access is generally 2000 to 3000 percent more expensive than in other countries [4].

However, the fact that Internet usage is growing, despite the constraints imposed by high prices, poor quality and limited availability is an indication of the potential demand for broadband in Sub-Saharan Africa. The Information and Communication Technology industry is responding to this demand by investing in international infrastructure such as submarine fiber-optic cable projects which are currently underway on both the East and West coasts of the continent. Major mobile operators are upgrading their networks to be able to support data services [4].

The provision of supplying broadband connectivity to end-users involves a combination of different network elements. These can be thought of as the "supply chain". At the top of the chain is the international connectivity that provides the link to the rest of the world. The second level is the domestic and regional backbone networks that carry traffic from the landing point of the international communications infrastructure and within the country. The third level is the access network (last mile connection) that links the backbone network to the customer. Land-locked countries require an additional element of the supply-chain, that is, the regional networks which connect them to the nearest connection to the international submarine fiber infrastructure [5].

The backbone network infrastructure in Sub-Saharan Africa is characterized by widespread, low-capacity networks generally owned and operated by the incumbent operators focusing primarily on voice services. Competing operators and service providers are therefore not able to obtain access to affordable backbone capacity. This results in lack of competition and the incumbent operator is able to maintain high wholesale prices for backbone services. So neither competition nor regulation is controlling whole sale prices [6].

In some countries, mobile operators have been required by law or regulation to use the incumbent's network for backbone services. This was the case, for example, in South Africa until the new Electronic Communications Act came into force in 2005. Following the change in the legal framework, there has been a rapid growth in backbone networks as operators have invested in competing fiber-optic infrastructure [5].

In several countries in Sub-Saharan Africa, other infrastructure networks such as railways and electricity transmission networks have developed fiber optic communications networks and are operating as carrier networks [1]. Whereby, in most European countries, the incumbent operator typically owns and operates a backbone network that covers the majority of the country and sells wholesale backbone services on regulated terms. There are also multiple competing operators providing services in major urban areas and on inter-urban routes in competition with the incumbent [7].

The pattern of backbone network development in India is similar to that seen in Europe. The incumbent operator, which remains state-owned, has a very extensive backbone network. It is also required to provide wholesale backbone services (i.e. leased lines) on regulated terms. Since market liberalization, multiple network operators have entered the market. These network operators have also built out backbone networks and are competing to provide backbone services [8].

B. Fiber Optic Deployment in Tanzania

Tanzania's existing fiber optic cable infrastructure consists of segments owned by public institutions , namely, Tanzania- Zambia Railway (TAZARA) - 120kms; Tanzania Railway Limited (TRL) – 600kms; SONGAS - gas company; Tanzania Electric Supply Company (TANESCO) – 2,050kms; Tanzania Telecommunication Company (TTCL). Tanzania has put in place appropriate policies, legal and regulatory framework [9].

The Government of Tanzania and NEPAD has an agreement to construct an undersea fibre-optic cable – known as the Uhuru-Net – and Umoja Net [10] which will be 10,000kms in length. It will cover all district headquarters (120 districts) throughout Tanzania. It is projected to be completed at the end of 2011. The network will connect to submarine cables SEACOM, Eastern African Submarine – cable System (EASSY) and The East African Marine Systems (TEAMS) as well as to neighboring countries [10].

SEACOM is a privately funded venture which built, owns, and operates a submarine fiber optic cable. SEACOM's business model is to provide

affordable bandwidth via volume discounts and large bandwidth growth. It provides African retail carriers with *equal and open access* to inexpensive bandwidth. The cable is expected to reduce Internet costs by up to 95% to wholesale customers, whilst providing a far greater speed of Internet connection. SEACOM announced that it would offer even more subsidised costs of between $10 and $25 to schools, research and health institutions [11].

Nevertheless, existing Internet service providers will have to base their charges on other factors like infrastructural charges, marketing charges and distribution charges [12]**.** This means that the Government might not be directly involved in regulating the charges. The Tanzania Communication Regulatory Authority (TCRA) will only come in when the market fails to regulate itself [12]**.** The cost of services to end-users might not go down promptly, since the service-providing companies were still having contracts with satellite service providers [13]**.**

It may take a long time for the benefits to reach ordinary citizens, particularly those who live in remote rural areas without electricity [14]**.**Five local institutions are already utilizing SEACOM, namely, national electricity company TANESCO, TTCL, TRL and the Universities of Dar es Salaam and Dodoma**.** TTCL's Internet traffic has been switched entirely to the cable effective 28 July 2009 [13]**.**

III. METHODOLOGY

In order to study the theoretical issues towards utilization of fiber optic communication, questionnaires were distributed to ISPs, data operators, Internet users, and the existing literature on the optic fibre communication and deployment was extensively reviewed.

The questionnaire were pilot tested by mailing them to one (1) ISP , one (1) data operator and five (5) internet users who agreed to participate.We selected randomly ten (10) registered ISPs and data operators by (TCRA and fifty (50) experienced internet users. The size was manageable and minimized resources in terms of time and cost. All respondents answered the questionnaire online. At the end of the research, 43 participants responded, yielding an effective respond rate of 71.6%.

IV. RESULTS AND DISCUSSIONS

Data analysis revealed the following to be issues in using fiber optic communication in Tanzania.

A. Un-availability of National Backbone Network Made of Fiber Optic Cable

Currently there is no national backbone infrastructure, however, construction is underway. 71% of respondents were of opinion that once construction is completed, coverage and capacity of the infrastructure will be adequate. Respondent were responding to the question if the coverage of the planned national backbone is adequate. Backbone networks lie at the heart of connectivity and therefore are an integral component in the provision of affordable broadband connectivity. Therefore, lack of national backbone is an issue.

B. Lack of Backhaul connectivity

The study revealed that currently Tanzania has no high capacity fiber optic connections with neighboring countries. This situation has led countries like Rwanda to obtain backhaul connectivity via Uganda and Kenya.

Backhaul connectivity is crucial because it enables transmission of intra-regional and other international traffic. Operators in land-locked countries wishing to access submarine fiber-optic cable infrastructure need backhaul connectivity to access the infrastructure. Even operators in countries with direct access to submarine fiber-optic cables may need regional backbone networks in order to have access to alternative landing points on the submarine cable so as to provide back-up routing. With the presence of SEACOM, the volume of data traffic being carried by the submarine fiber-optic infrastructure is expected to go up, and therefore cross-border routes (backhaul connectivity) will become more profitable. Therefore, the government of Tanzania may generate abundant income.

C. Un-affordability of Last mile Connectivity

The study learnt that only 15 % of were of opinion that last mile last mile connectivity is affordable to most of Tanzanians. This suggests that the costs o installing connectivity from ISPs to homes and businesses is not affordable to majority of Tanzanians. The few, who afforded it, mostly use wireless technology.

Therefore, the cost of fiber optic for last mile connectivity is unaffordable and hence becomes an issue in the utilization of fiber optic communication.

Without adequate and high capacity (broadband) last mile connectivity, the SEACOM cable may largely be underutilized.

D. Unfavourable Infrastructure to Connect to SEACOM

From the study it was learnt 55% of respondents were of opinion that it is difficult for operators, in terms of infrastructure, to connect to SEACOM. This may discourage some ISPs to connect to SEACOM and hence SEACOM's high capacity may be underutilized. Furthermore, if the infrastructure problem is in cost, it may cause the low price offered by SEACOM to be neutralized by the cost of connecting to SEACOM.

E. Access to the Internet is Predominantly by Use of Satellites

Study showed that 47.22% of respondents are still using Satellite technology to connect to the Internet this is an issue because it makes prices for Internet access very high. However, with presence of undersea cables like SEACOM, and others still under construction, the use of Satellites is expected to go down.

F. Some Institutions that Own Fiber Optic Networks Have not Commercialized their Networks

It was revealed that only TTCL and TANESCO have commercialized the networks. This situation slows down the pace of using fiber optic cable for communication in Tanzania. There is need for those institutions to open up access to their networks so as to increase availability of fiber optic infrastructure – and therefore, introduce competition to other institutions. Such competition could be a driver for cheaper prices on the part of end users. In Uganda, for instance, the electricity transmission network sells capacity to telecommunications operators. This shows that wholesale markets for backbone capacity are feasible even in Tanzania.

V. CONCLUSION

This paper discusses and examines the issues towards utilization of fiber optic communication in the Tanzanian context. The case of SEACOM Submarine Fiber Optic cable was taken. Six issues towards fruitful utilization of fiber optic communication in Tanzania, namely: unavailability of national backbone network made of fiber optic cable; lack of backhaul connectivity; un-affordability of last mile connectivity; unfavourable infrastructure for operators to connect to SEACOM; access to the Internet is predominantly by use of Satellites; and some institutions that own fiber optic networks have not commercialized the networks were identified.

However, two opportunities were identified. This is the national fiber optic backbone which is under construction. This is Government's initiative to deploy the infrastructure to link all districts and provide backhaul connectivity will serve as the foundation upon which broader, high capacity and affordable connectivity could be achieved across the country and to neighbouring countries. Thus, the network will also solve the issue of backhaul connectivity.

Other opportunities which were identified include availability of fiber optic networks built by some institutions (TAZARA, TANESCO, TTCL, TRL and SONGAS) which can be part of national fiber optic backbone in order to increase coverage of the national fiber optic coverage; and open access to SEACOM whose operation is influenced by neither the government nor the incumbent operator.

VI. RECOMMENDATIONS

A. Enhance Last Mile Connectivity

In order to have fiber optic networks for last mile connectivity, there is a need to encourage private-investment in this area through subsidizing network providers to extend networks to homes and businesses.

One way to implement this would be to start with deployment of fiber to the higher density areas, that is, to areas that are intensive users of ICT such as colleges, universities and researchers. Another way forward, is to deploy fiber optic networks to public access points such as Internet cafes. This will address the lack of broadband to every home as well as the lack of computers and general lack of readiness of many individuals and businesses, especially those in rural areas, to receive electronic services.

In addition to providing financial incentives for private sector investment, the Government can complement and stimulate private sector efforts by making investments in infrastructure to connect less density areas, such rural areas –in which private operators are always not interested. Such infrastructure should then be open to all operators.

A. *Enhance Infrastructure for Connecting to SEACOM*

In order to take advantage of the SEACOM international submarine cable, bottlenecks in accessing the cable should be overcome. Otherwise, the lower prices and other related benefits of SEACOM will not be realized. In order to ensure easy, affordable and maximum utilization of SEACOM, there is a need to ensure the provision of robust connectivity to SEACOM's landing stations.

It will be necessary for competing operators and service providers to be allowed to construct or lease from other operators the links from their operation centers to the cable landing stations.

This may require the regulation of domestic leased lines, the liberalization of the provision of spectrum for microwave point-to-point links, the right to dig trenches for cables and access to roof space for antennae. It may also be necessary to ensure that operators can purchase a leased line supplied by the incumbent operator or rival from the landing stations and then interconnect to their own networks.

B. Learn from Other Countries

Tanzania has an opportunity to observe and learn from the strategies adopted by other countries that have taken an active role in encouraging broadband deployment and affordable use in their jurisdictions. For instance, while the Government is working towards providing fiber optic infrastructure throughout the country, once the network is in place the Government should not directly involve itself in providing the service. Rather, it should play the role of infrastructure provider. In this way the regulator will have less incentive to create an uneven playing.

This same physical infrastructure can support Internet access, 3G mobile service, and even Voice over Internet Protocol (VOIP). With several levels of services being offered, the private sector would benefit from open access and there will be no competition with the giant national telecom. Meanwhile, the Government would benefit from an increased level of traffic on the infrastructure. The result of this will be financial gain in maximizing the number of internet services provided. Finally, the consumer would benefit from lower prices and more choices of access resulting from increased competition.

C. Encourage Investment in Backbone Networks

One way of encouraging investment in backbone networks is to permit building of backbone networks and then selling capacity to other operators such as mobile operators or ISPs. The advantage of this approach is that it encourages investment and competition specifically in the backbone segment of the market. Such carrier networks are a common feature of backbone network markets in developed countries in which there are several companies that have built networks and provide services on a purely wholesale basis to other operators.

The potential opportunity for these types of operators is shown in Kenya, where Kenya Data Networks (KDN) has developed 1900km of fiber network infrastructure, and in Nigeria, where there are over 20 licensed fixed operators, including two national carriers and seven national long-distance operators developing high-capacity backbone networks. Thus institutions (such as TRL, TAZARA) which have already constructed fiber optic networks should open up access to their networks so as to increase availability of fiber optic infrastructure – and therefore, introduce competition. Such competition could be a driver for cheaper prices on the part of end users.

REFERENCES

[1] M. Ruddy. "Undersea Cable Markets and the Developing World'," September 30, 2009;[Online]Available: http://www.terabitconsulting.com/public/downloads/Terabit%20Consulting%20%20Undersea%20Cable%20Markets%20and%20the%20Developing%20World.htm

[2] ViaAfrica, *Creating local and regional IXPs to save money and bandwidth, Draft discussion paper prepared for IDRC and ITU for the 5th Annual Global Symposium of Regulators*, 2004.

[3] R. D. Atkinson, D. K. Correa, and J. A. Hedlund, *Explaining International Broadband Leadership*, The Information Technology and Inovation Foundation (ITIF), 2008.

[4] R. Alden. "International Undersea fiber optic cable promises much needed bandwidth to East Africa but specter of monopoly pricing threatens project's benefits," 22/08, 2009;[Online]Available:http://newsroom.cisco.com/dlls/2006/ts_053106.html.

[5] M. Williams, *Broadband for Africa Policy for Promoting the Development of Backbone Networks*, Working Paper 44628, 2008.

[6] A. Gilwald, "Between Two Stools: Broadband Policy In South Africa," *The southern African journal of information and communication* no. 8, 2007.

[7] EC, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Comittee and the Comittee of the Regions on Market Reviews Under the EU Regulatory Frameworks (2nd Report)*, European Union, 2007.

[8] TRAI, *Study Paper on Analysis of Internet and Broadband Tariffs in India* Telecom Regulatory Authority Of India (TRAI), New Delhi, 2006.

[9] P. Machira. "Tanzania needs ICT backbone to survive," October 02, 2009;[Online]Available: http://www.safarilands.org/index.php/news/more/tanzania_needs_ict_backbone_to_survive/.

[10] J. Dhliwayo. "Developing a fiber optic backbone for Africa," 09/09,2009;[Online]Available:www.corning.com/docs/corporate/discovery.../NTR100763.pdf.

[11] C.V. Merwe. "Seacom undersea cable goes live, boosts connectivity" August 28, 2009;[Online] Available: http://www.engineeringnews.co.za/article/seacom-undersea-cable-goes-live-boosts-connectivity-2009-07-23.

[12] S. Kamndaya, and B. Kinyori. "JK to Switch On Seacom Cable Today," September 02,2009;[Online]Available: http://allafrica.com/stories/200907221049.html.

[13] D. Semberya. "New SeaCom fibre-optic technology boosts TTCL's prospects" September 08, 2009;[Online]Available: http://www.businesstimes.co.tz/index.php?option=com_content&view=article&id=438:new-seacom-fibre-optic-technology-boosts-ttcls-prospects&catid=34:national-business-news&Itemid=62.

[14] TeleGeography. "Work begins on Tanzania's Seacom connection'," September 02, 2009;[Online]Available: http://www.telegeography.com/cu/article.php?article_id=27335.