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Research Article

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Quality of Ka-Band Internet Service based on users' experience

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Abstract Yahclick is the Ka-band based high speed broadband Internet service from Yahsat, covering 28 countries across Africa, Middle East and South West Asia. In Africa, the Ka-band internet service is a make and break in many situations, with limited access and expensive rates that abounds. This paper assesses the access rate of a used ka-band service in a typical Nigeria University. Salem University as an Educational and Social System, has subscribed for C and Ku bands services before that of Ka band, which constitutes the case study of this study. The rate of access of service by users was used to describe the quality of service of the satellite band. How many people (Staff and Students) were able to access the Ka-band Internet service installed on the said University Campus as subscribed was determined. Questionnaire was designed and administered, responses were retrieved and analysed from which conclusion and recommendations were made. From all indications, it was concluded that Ka-band Satellite services would not carry a university campus network.

Keywords Ka-band, Internet Services, Quality of Service

1. Introduction

The Internet continues to never look the same. The current issue reflects these recent changes while at the same time provide room for longer-lasting academic controversies in the field that should not be neglected [1-2]. The advent of Ka-band technology can be viewed as a new generation of cost-effective skyscrapers. This technology adopted within a social system can have profound consequences on whether the innovation is ultimately adopted and most importantly on how its use is "re-invented" by the users of said technology [3]. Ka -band is the latest satellite technology in the satellite broadband industry. It has speeds way beyond current ku and c band technologies. Its costs are as low as terrestrial broadband service. It is the logical successor of ku band with an increasing demand for more capacity.

Furthermore, the potential of the Internet as an instrument of social research remains largely unknown [4].

2. Literature Review

Satellite Systems which provides seamless covering have become an important system in the next generation global personal communication system [5]. The high bandwidth available in the ka spectrum and frequency re-use capabilities across multiple beams enables the delivery of more capacity at faster speeds to smaller dishes. Thus, it opens the door to faster speeds at lower costs for more users. The advent of High Throughput Satellites (HTS) enables network service providers to offer a new generation of communications solutions [1]. In the context of Very Small Aperture Terminal (VSAT) network services, ka band provides up to 24 times more bandwidth than C-band and 8 times more bandwidth than Ku-band, therefore opening the door for dramatic increase in a population (capacity) of a city. The slogan "faster and cheaper" is often used by Ka-band Marketers to describe its preference over Ku and C bands. It is viewed as a new generation of cost-effective skyscrapers which can be built within the existing city and with minimal planning restrictions.

Ka-band as a satellite system has a large available disadvantages. These include disadvantages at downlinks such as rain dissipating three to ten times more energy at Ka-band than at Ku-band (11 GHz vs 20GHz). At uplink, rain dissipates 63 to 400 times more energy at Ka-band than at Ku-band (14GHz vs. 30GHz). However, many existing and proposed Ka, C and Ku-band HTS systems has been evaluated. From perspectives, conclusions about their potential use for customers in remote or harsh operating environments, who generally place a higher priority on network accessibility, reliability and user throughput was reached. Some of these conclusions indicates that Ka-band has dishes with small diameter, yet seems faster compare to Ku and C bands. C-band seemed to be more reliable in service in hash weather (cold, hot etc) over others. Ku-band seemed to be good only in a warm and or hot weather [1]. Particularly, the evaluation involved in this research covers primarily Ka-band Internet service accessibility of users within the concerned environment.

Many Ka based systems are also proprietary or closed networks that require specific satellite modern technology or configurations that are not available with other providers [1-4]. The much smaller wavelength and higher frequency of Ka band makes its links far more susceptible to disruption from weather and other atmospheric disturbances than Ku and C bands links [1-4]. Obtaining the same level of link availability (say 99 %) in a Ka spot beam, would require exponentially more transponder power than a comparable link and antenna size in Ku and C bands. It is therefore much more difficult and expensive to provide high availability and reliable services in Ka-band than in C or Ku-band, particularly in regions (like African countries) where heavy rain fall is common [1- 5].

Networks expand the list of accessible resources far beyond those provided in most Organizations [6]. In Nigerian Universities, the Internet is a major source of resources accessible to Staff and Students. The Internet service has been particularly broadband based, which allows the propagation of multiple signals at the same time through different Channels [7, 8].

A network may not be accessible due to several problems (caused by say 20 possible sources) [9]. Isolating such a problem(s) may take more time than solving it. The Ka-band VSAT platform, which could only serve 10% of the Internet users on a campus in Nigeria was a challenge [10]. There could be questions over the implication of the Internet being centrally increasing to everyday life and work, particularly in institutions of learning [11, 12].

Also, the internet provides a platform through which networked individuals can form a "Fifth Estate" [13]. A virtual classroom which is one of the key benefits of internet service in a University System requires a better accessibility of users (Staff and Students) which enhances Students-Teacher interaction without being in contact physically [14]. Poor accessibility does not provide such virtual environment for e-learning. With the increasing levels of deployment of various forms of high-speed (or broadband) services within today's Internet, there is new impetus to find some usable answers that allow both providers and users to place some objective benchmarks against the service offerings [15].

It was concluded that, Plateau State University (PSU) would better implement a presented topology (hybrid), to provide the desired improvement of network performance for the Campus [16]. A reliable satellite services will be necessary to better achieve the performance need. The rudiments of these performance would include good puts which may need to be 73 % or above, packets loss below 28% and delay below 24 ms if it has to perform better than this existing one [17]. Hence, Plateau State University stands to benefit from this study.

3. Methodology

This research is exploratory in nature. By this it means that the quality of internet service will be determined by the way respondents' expresses their experiences in terms of service-awareness of the internet and accessibility of the service.

First, a survey questionnaire was prepared to collect information on the category of target participants. The questionnaire also includes questions that retrieves information on whether or not certain participants knows there is Internet on campus. It also seeks to capture how much of the target customers accesses the Internet services.

Next, the questionnaire was distributed to the target participants. 150 questionnaires were administered and only 100 were retrieved. This will be discussed in the survey results' section of this study.

4. Survey Results

A hundred and fifty (150) questionnaires were distributed to both Staff (academic and non-academic) and Students of a private University that subscribed to Ka-band internet service. But,only 100 participants responded. While tables 1, 2 and 3describes the categories and other responses of the respondents, the graphs give the corresponding description of the tables. Table 1explains how many staff and students participated in the survey, whose responses where retrieved. Table 2 presents the responses of respondents on whether or not there is Internet on the campus under study, revealing how much the existing Ka-band services has been able to reach the expected consumers. Table 3 presents where the Internet service consumers where able to access the Ka-based services. Table 1 shows that 100 people filled and returned their questionnaires which were made up of 40 Staff and 60 Students.

Table 1: Survey's Participants

Number of Staff	Number of Students	Total
40	60	100

Table 2 shows that 35 Staff and Students acknowledge that there is Internet Service on the Campus. This means that there is actually Internet service on the campus, for the fact that there is acknowledgment of Internet access. But, inaccessible by some people where indicated which happened to be the majority responses, 65 people in particular. This by implication connotes that the services could not carry the campus to a point where some people could not know that there was Internet service in the campus.

Table 2: Internet Service Acknowledgment

Is there Internet Service	Number of Staff	Number of Students	Total Responses
Yes	15	20	35
No	25	40	65
Total Participants	40	60	100

Table 3 indicates that 25 people actually access the internet services whose existence was acknowledged by 35 people. More so, 45 people indicated that they could not access the internet service. Also, 30 people said they sometimes access the services. By implication, even some people who acknowledged that there were internet services could not actually access it always.

Table 3: Internet Service Accessibility

Access Internet Service?	Number of Staff	Number of Students	Total Responses
Yes	10	15	25
No	20	25	45
sometimes	10	20	30
Total Participants	40	60	100

In essence, table 1 presents the categories of respondents; students or staff. Table 2 indicates the respondents' awareness of the Ka-band based internet service. This determined if they could acknowledge that there is Internet or not. Table 3 further specifies whether or not the respondents were able to access the available internet service, which happens to be Ka-band based. Even though the total of those that claimed they ever access the services actually exceeded those that never accessed it, a number of them only accessed it sometimes as described in Figure 1.

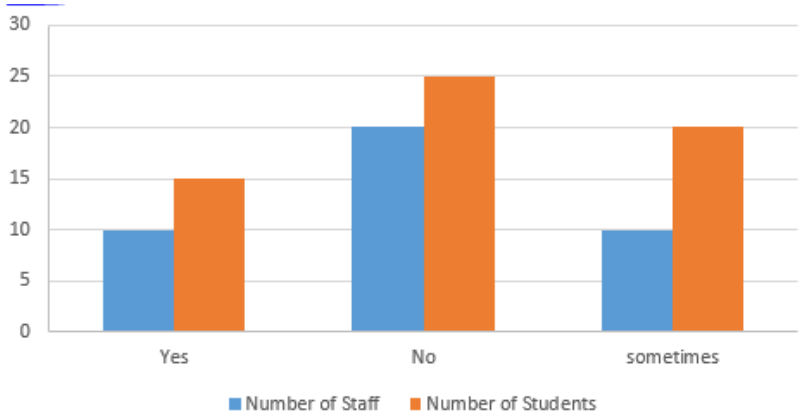

Figure 1: Access to Ka-band based Internet service

Figure 1 depicts a histogram that describes a situation where participants acknowledges if they were able to access the Internet service or not. Some indicated they could, others they could not and a number they do sometimes access. As indicated in table 3, the figure emphasized that majority could not access. Among those that claimed that they access, much fewer accessed the services all through.

Respondents that say "yes" there is Internet service on the Campus were indicated in the blue nodes while the orange nodes on the graph represents those that say "no". It will be observed that the number of clients that say "yes" or "no" corresponds with the number of clients that admitted whether or not there is Internet service in table 2.

Beside advantage(s), Ka-band services have Drawback(s) and Limitation(s). Ka-band Satellite services have gained general customer acceptance and is widely viewed as "The wave of the future" for SATCOM. Her equipments and subscriptions are cost-effective; they are cheaper compare to C and Ku bands in terms of cost-of-equipments, cost-of-Installation and subscription charges.

The much smaller wavelength and higher frequency of Ka-band makes its links more susceptible to disruption from weather and other atmospheric disturbances like high rain fall, humidity etc. Unlike C and Ku-band, which is more sustainable and reliable in such weather. The small spot of Ka-band HTS suffer a severe cost disadvantage in harsh climate regions like Africa. In the University, ka band service was breaking when there is heavy rain fall or hash sun shine. C band services seemed to be more stable in hash climatic condition over Ku and Ka bands.

5. Limitation of the Ka-band Services

By limitation, ka-band service is more reliable in regions of less rain fall. Such regions, unlike Africa experience more of the "faster …" slogan used to describe the betterness of its service speed compare to C and Ku bands. The Ka band Internet service could not carry much people at a time compare to that of C and Ku.

6. Conclusion and Recommendations

Conclusion and Recommendation(s) over the research are necessary to shed more light on the research relevance. It can therefore be concluded that Ka-band based services would not serve a campus area network to expectation as noticed in the analysis of this survey. This shows that its quality is not of university campus network requirement.

Based on the conclusion in this research, Ka-band will be good for Cafes, for business purposes, especially because of the cost-effectiveness of the installation and subscriptions. Also, Departments in Institutions of higher learning can have it for departmental research since the less cost involved is affordable.

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