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Analysis Of Network Traffic Characteristics:End-To-End Performance On The University Intra-Domain Links

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***Abstract:** We present our latest study on monitoring and analyzing the behavior of the Federal University Oye-Ekiti Nigeria (FUOYE) Internet traffic for a host on the network over three month's usage.*

It evaluates the current state of the internet traffic on the University Dual Campus network, the traffic engineering techniques and the challenges in implementing effective end-to-end traffic engineering strategies.

It focuses mainly on analysing the Links and nodes with a particular attention on the technical perspectives aspects related to support Multi-Protocol Label Switching (MPLS), traffic engineering, fault tolerance, Inteserve and diff serve, rather than the financial and political view of intelligent traffic handling bearing in mind the network loads and other performance metrics. We describe in detail the general architecture of the nodes and inter-domain Links and its utilization with particular emphasis on the Class of service (CoS).

Our results serves as a guide for the formulation of an institutional traffic management strategy that improves the end-to-end performance metrics of the internet connectivity for ICT unit by eliminating irrelevant traffic and implementing Inteserve and diff serve,

***Keywords** Bandwidth, Utilization, load balancing, Class of Service, Data Center, Service Discovery, Connectivity*

I. INTRODUCTION

End-to-End Network operation with a 100% up links and down links thrives on constant network traffic monitoring and analysis. The new federal University Oye-Ekiti dual campus was established for the learning hosts of Campus based networks that delivers services to users i.e. staff and student that often require low-latency high bandwidth connectivity to the internet.

A well-known, widely-used point-to-point radio wireless network communication, which offers a high degree of internet service support connects the dual campus to the internet provider –MTN. The dual campus network data centre consist of network infrastructure that provides internet services via an allocated bandwidth to hosts with the access points and data centre servers.

Most down time and network issues on the internet go unnoticed due to automatic traffic rerouting and could be traced to application mix and user behaviour. We consider Federal University Oye-Ekiti and Ikole Campus as our case study. A dual campus data centre network [Figure 1.0] consist of packet nodes is one of autonomous decentralized networks.

The university internet connection was installed in 2012 with aim of providing a technology resource for use in assisting the University system to fulfil its mission in teaching and research programs and activities. This is arguably justified because the Internet connectivity was installed for a traffic of about 3,500 staff and student inclusive.

Today, the institution has grown with an estimated population of over 2,000 staffs and 4,000 students in five faculties, around 3,000 end-hosts and average bandwidth utilization of 20 Mbps. This growth has generated high traffic congestion because the few available network resources are not enough to be shared as everyone is on-line to share the few available bandwidth either at the peak period or off peak period. Even though, what is experienced is not a 100 % efficiency and throughput. Need as the network links are operating at 60 % rate or below. Various factor could lead to the underutilization of the available links from the provider. Such factors can be found in [1].

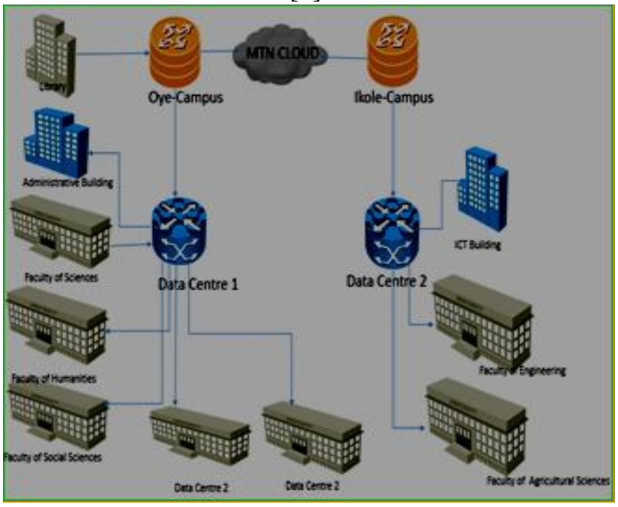

Figure 1: The Schematic Diagram of Federal University Oye-Ekiti Nigeria Oye – Ikole Campus

We assume in the dual campus network environment, set of host in the network and the network topology are frequently changing due to the host appearance and host movement so that it is not easy for users in the network to obtain the services provided in the network. Therefore, without the service discovery scheme, it is impossible to inform the users in the network of the service information provided in the network. However, since there are no centralized data centre servers in the dual campus environment, the self-organized mechanism must be examined to collect service information in the network and disseminate them to the users. Besides, since the changes of users or the services in the network occur many times with time, they should be reflected as short time as possible. Therefore, we propose a new scheme for self =organizing real-time service dissemination and collection using …..antenna/ bandwidth or packet agents in the dual campus network data centre environment. Packet agents migrate among packet nodes to collect the service information in the network and disseminate them to the users in the network and intelligent traffic handling bearing in mind the network loads and other performance metrics also consider geographical factors The topographical location of the dual campus is such that the Internet Service Performance is the throughput is not of maximum impact. Geographical factors like Rocky Mountains has hindered the line of sight of communication for the point-to-point radio serving the dual campus.

We investigate the traffic characteristics in Ikole intranet and analyse the traffic and user behaviour at Ikole Campus. We also analyse the link failures caused by unwanted application mix which reduced throughput. Our analyses use packet traces collected throughout April 2016 at the border router in Ikole ICT Centre. Federal University Oye-Ekiti.

In this paper we also attempt to research queries such as: the current state of internet connectivity in Federal University ye-Ekiti Nigeria dual campus. The bandwidth techniques deployed by the ICT management team in conserving the shared bandwidth and the identified challenges the ICT management faces and strategies in effective bandwidth management

This paper is organized as follows. Section 2 brings a more detailed description of the problem statement and introduces the network model. In Section 3 the recent related work is presented. Section 4 proposes a network wide coverage with equal load balancing at the service point as a solution to a high performing service delivered with algorithm and further explains the computational model used in the heuristic approach. Section 5 describes the experimental scenarios. In Section 6 and 7 a mathematical model and a heuristic for the problem are presented, respectively. In Section 8 the computational results of the simulations are shown and Section 9 concludes the work

Finally we conducted simulation experiments to show the service performance of the proposed scheme with respect to the service dissemination time and Load Balancing Benefits.

II. PROBLEM STATEMENT: INTERNET CONNECTIVITY

As laboratories are necessary for the training of students so is the availability of un-interrupted internet connectivity to facilitate quality research with cutting-edge technology to deliver internet network resources.

The current demand for bandwidth has posed a problem on campus as the bandwidth is not enough for access and effective internet usage as the. If the university must grow at a commensurate level with its high–quality research, there is a need to invest in the internet connectivity rate by purchasing more bandwidth or proper managing of the available magnitude. Some of the major challenges experienced by the university system since inception is as follows:

- ✓ Poor Quality of Service (QoS) due to Interrupted connections from the Service provider
- ✓ Students misuse of internet applications
- ✓ Unrestricted Peer-to-Peer file sharing
- ✓ Poor Quality of Experience (QoE)
- ✓ Lack bandwidth management strategy or technique

This research work proposed solutions to the current challenges identified in the research queries by Investigating the current population or traffic level vis-à-vis student and staff ratio. We surveyed the current Internet usage level per kpbs for each host on the network. The applications used on the network and the CDN.

Also, we investigated the current network coverage and topology: Oye campus and Ikole Campus statistics and geographical data mapping.

In addition, we explored the performance assessments of the internet connectivity with the use of bandwidth calculation software tool and simulated the nodes and links with ns2 or P2A simulator, TSTAT PATGR.

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A. THE CURRENT NETWORK TOPOLOGY

- ✓ The current state of the network model is based a point-to-point network on a logical bus topology, meaning that the signal has to run through the network from end to end. A linear LAN architecture in which transmissions from various stations on the network are reproduced over the length of the medium and are accepted by all other stations.

Network Service	University Campus		
	oye-Ekiti	Ikole-Ekiti	
No of Networked PCs.			
No of Users			
Size of Bandwidth	Mbps	Mbps(256kbps)	
Type of Internet Link	Radio/Fibre	VSat Leased Line	

Table 1: Current Internet connectivity Status

B. PROBLEM SPECIFICATION

III. RELATED WORK

We carried out this research via the qualitative and quasi experimental methodology. We targeted the respondents in the Information and Communication Technology department such as the network administrators, ICT principal engineers and other relevant stakeholders at the management level across board. A similar work of author S. Dyllan et al [1] reveals that the impact of network performance and its congestions was useful in predicting the future data network traffic and congestion. They argued that in order to maximize end-to-end performance and network utilization, the issue of vulnerability of the network at peak period and off peak period should be investigated to check the capacity usage of the network resources. In investigating the impact of failures on traffic from providers end, R. Duarte et. al conducted an impact analysis study on reachability disruptions on the inter-domain links of the Brazilian national research network (RNP) and discovered that the impact of disruptions was traced to network topology and the performance disruptions was traced to location and failed links. Even though our focus is not on the failed links but rather on the traffic characteristics on the inter-domain link.

A. TRAFFIC CHARACTERISTICS

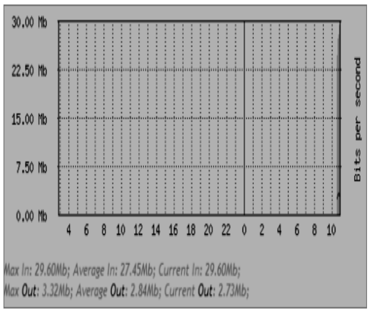
Researchers have characterized traffic in CENIC [5] and Sprint [1]. In these networks, two common types of disruptions are scheduled maintenance and intermittent connectivity problems caused by malfunctioning hardware. These studies also show that no link is free of failures, but that some links are more likely of experiencing failures than others (e.g., due to different link-layer technologies). Recent work has characterized failures in datacentre networks [22], [23]. They show that, in datacenter networks, middleboxes dominate failure occurrences with short software related faults and that middlebox and network redundancy is only partially successful in mitigating failures. Our study complements these prior studies by characterizing the impact of different failures on the network traffic as well as on user behavior. We are unaware of other prior studies using information from operational networks, possibly because operators seldom publish details on their networks and datacenters.

IV. EVALUATION CRITERIA

For the purpose of this study, we base our evaluation on the Administrative link. We monitored the daily, weekly, monthly network traffic resource of a host on the network with a maximum of 5gig download links. We focus on the following parameters: maximum input bit per second, minimum input per second and average input and

V. PERFORMANCE EVALAUTION

In this study only the downlink is considered i.e the data transmission from Internet provider to a host on the network where high data rates are needed, unlike the uplink where low data rates are sufficient for its needs. The Ikole Intranet interface is simulated using Ns2 and analysed with wire shark analyser.



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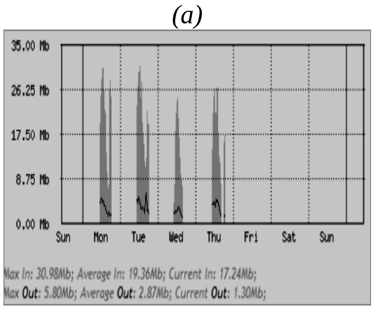

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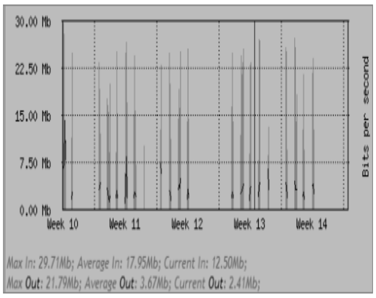
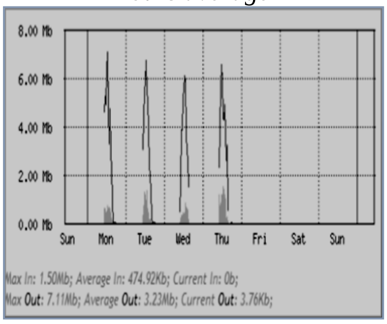


(c)

Figure 2: Traffic resources graphs at three average values for faculty of Engineering Statistics Ikole Campus. (a) Output of the daily performance graph at 5 minutes average (b) Output of the weekly performance graph at 30 minutes average (c) Output of the monthly performance graph at 2 hours average



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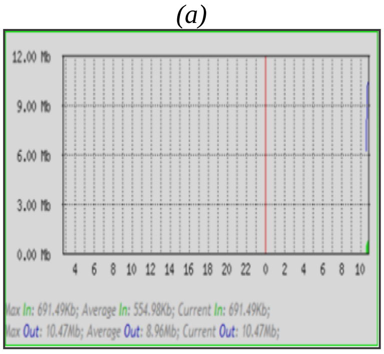

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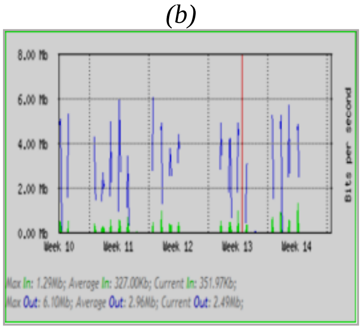

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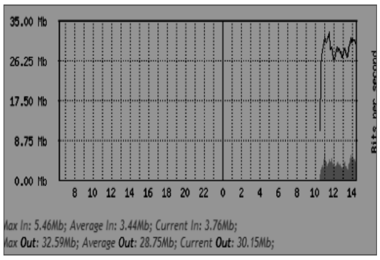
Figure 3: Traffic resources graphs at three average values for Backbone link Internet provider MTN VLAN 852 Interface (a) Output of the daily performance graph at 5 minutes average (b) Output of the weekly performance graph at 30 minutes average (c) Output of the monthly performance graph at 2 hours average



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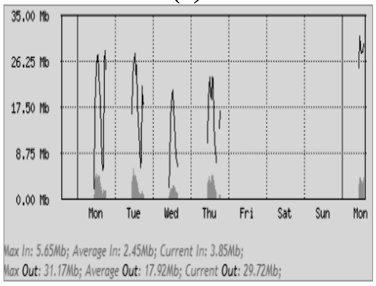

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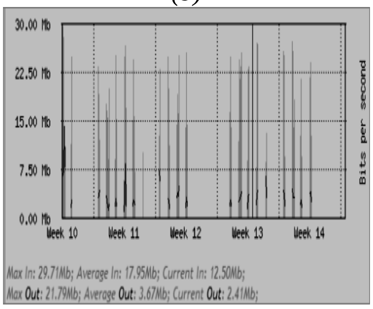

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Figure 1: Traffic resources graphs at three average values for Ikole Intranet Statistics (a) Output of the daily performance graph at 5 minutes average (b) Output of the weekly performance graph at 30 minutes average (c) Output of the monthly performance graph at 2 hours average

VI. NETWORK EVALUATION

IP address:	196.40.165.232
bytes up/down:	30.0 KiB / 356.7 KiB
connected:	6s
status refresh:	1m

A. EVALUATION AND RESULTS ANALYSIS

We base our evaluation on the eleven interfaces that serves the internet connectivity within the University. It show that the daily graph has off peak season with about ….mps and …..mps at peak period.

The weekly graph in fig …

The monthly graph for April We split traffic into three sets: Ikole intranet traffic, with destination in Ikole Campus; Oye Campus traffic, with destination out of Oye; and traffic to MTN services. We separate traffic toward MTN services because they continue reachable during reachability disruptions through RNP's S˜ao Paulo exchange point. Moreover, a significant fraction of the university's traffic is directed to Youtube, provided by Google (Sec. III-B). We split traffic into Ikole and Oye using MaxMind's free IP geolocation database. Even though inaccuracies of IP geolocation databases are well known, MaxMind's database's accuracy is enough for our coarse-grained localization [12].

To identify traffic towards MTN we resolve IP addresses of MTN services (e.g., youtube.com, gmail.com, google.com) at MTN_vlan852. We then obtain the set of BGP prefixes containing Google IP addresses from S˜ao Paulo exchange point's route server. We label traffic to destinations in these prefixes as toward Google.

Load Balancing Benefits' Equations should be numbered consecutively throughout the paper. The equation number is enclosed in parentheses and placed flush right, as in (1). Your equation should be typed using the Times New Roman font (please no other font). To create multileveled equations, it may be necessary to treat the equation as a graphic and insert it into the text after your paper is styled.

$$\{\varepsilon\}_e = [B]\{\delta\}_e$$

Coverage,

Usage and Bandwidth Calculation for Dual Campus

VII. CONCLUSIONS AND FUTURE WORKS

We have presented the traffic characteristics of radio link sessions monitored at the Faculty of Engineering Building at Ikole Campus and Auditorium Building, Oye Campus of the Federal University Oye-Ekiti. The long holding times and the high variability of holding time and

Inter arrival time can be found in other publications as well and seem to be typical for Internet traffic. We have also shown that the user behaviour is heavily influenced by the employed telephone tariffing scheme.

Finally a simple mathematical description of the holding time as well as of the interarrival time was presented. Note that the current modelling approach captures the overall behaviour of the traffic. As depicted in Figure 6 the traffic characteristics vary during the course of the day.

Therefore, a model describing traffic load only during the busy hours of internet traffic as well as of telephone traffic would be helpful for network dimensioning.

We like to point out, that our results are based on empirical data of a special user group (students and university staff members) and might not describe general Internet traffic. Also the behaviour was strongly influenced by the telephone tariffing scheme in Germany and it should be mentioned that the fast Internet access itself was provided for free.trade-off between dissemination time and overhead Comparism with respect to self-organisation.

REFERENCES

[1] S. Dyllan. H. Dahimene, P. Wright and P. Xiao "Analysis of HTTP Usage on the University Internet Backbone Links" Journal of Industrial and Intelligent Information Vol. 2. No.1 March 2014. pp. 67 -70

[2] L. Chitanana " Bandwidth Management in universities in Zimbabwe: Towards a responsible user base through effective policy implementation" International Journal of Education and Developmentusing Information and Communication Technology (IJEDICT), 2012, Vol.8 Issue 2 pp. 62 -76

[3] R. Duarte, A. B Vieira, I. Cunha and J. Almeida "Impact of Provider Failures on the Traffic at a University Campus" ISBN 978-3-901882-68-5 2015 IFIP.

[4] S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, "A novel ultrathin elevated channel low-temperature poly-Si TFT," IE