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การวิเคราะห์ประสิทธิภาพการใช้แบนด์วิดท์ของวิทยาลัยคอมพิวเตอร์ DMMMSU-SLUC

Performance Analysis on Bandwidth Consumption of the College of Computer Science DMMMSU-SLUC

Floribeth Cuison and Belinda Dungan

บทคัดย่อ

การวิจัยครั้งนี้มุ่งเน้นไปที่การประเมินผลโดยรวมของโครงสร้างพื้นฐานของเครือข่ายของวิทยาลัยวิทยาศาสตร์คอมพิวเตอร์ ในการดำเนินการผู้วิจัยได้ระบุแหล่งข้อมูลที่มีอยู่ของเครือข่าย มีการตรวจสอบแอพพลิเคชันที่ใช้แบนด์วิดท์เป็นจำนวนมากผ่านเครือข่าย และจัดสรรความต้องการใช้แบนด์วิดท์ต่อจำนวนผู้ใช้ ผู้วิจัยได้ใช้วิธีการวิจัยเชิงบรรยายตลอดการศึกษาในครั้งนี้ จากการศึกษาและวิเคราะห์เอกสารที่เกี่ยวข้อง ผลการศึกษาพบว่าถึงแม้ว่าสิ่งอำนวยความสะดวกของเครือข่ายจะมีความสมบูรณ์ แต่ก็มีจำนวนไม่เพียงพอกับความต้องการของผู้ใช้ ซึ่งมีสาเหตุมาจากการใช้อินเทอร์เน็ตในทางที่ผิด จากการสำรวจเครือข่ายพบว่ามีการใช้แอพพลิเคชันที่ใช้แบนด์วิดท์เป็นจำนวนมาก และเป็นแอพพลิเคชันที่ไม่เกี่ยวข้องกับการศึกษา นอกจากนี้ผลการวิจัยยังได้มีการกล่าวถึงการจัดสรรแบนด์วิดท์สำหรับผู้ใช้ประเภทต่างๆ อีกด้วย

คำสำคัญ: การวิเคราะห์การใช้แบนด์วิดท์/ เน็ตเวิร์ค/ เน็ตเวิร์คโพรไฟล์

ABSTRACT

This study focuses in the overall evaluation of the network infrastructure of the College of Computer Science. In order to do so, the researchers identified the available resources of the network, investigated applications consuming large amount of bandwidth over the network and elicited desired bandwidth allocation per user. Throughout the study, the researchers have employed descriptive and longitudinal research methodology.

Upon examining the results of the documentary analysis, the researchers educed that the network facility, though complete, is not sufficient with the demand of the users. This is caused by the misuse of the internet connection. Based from the 10 days observation of the network, it was discovered that there are applications consuming large amount of bandwidth which are not relevant to education. Furthermore, computations for bandwidth allocation for different type of users are discussed.

KEYWORDS: BANDWIDTH ANALYSIS/ NETWORK/ NETWORK PROFILE

Introduction

Internet has become an integral part to higher educational institutions. The evolution on ways on how to deliver education particularly the millennial have rapidly changed over the years. Blended learning, e-learning and m-learning invaded the classrooms making it more interactive and engaging. With these change, universities have also reinvented and called "smart classes" which has direct connection over the internet. With the rapid technology advancement, the internet revolutionized how learning is facilitated. With the upheaval of internet in the educational institutions, so thus its demand.

Villegas (2013) pointed out that the educational institutions find it hard to satisfy the demand on internet access. Improving the performance of the information delivery chain is urgent. Chitanana (2012) in his study, observed that universities in Zimbabwe faces pressure in providing good connectivity. He pointed out that robust network is a necessity in order for universities to participate effectively on the global national society. The insufficiency of the bandwidth is due to different factors that affects the network. Chitanana (2012) enumerated reasons which slow down the network. It may be cause by the increase use of internet, the increase use of electronic resources in teaching and learning, accessing hungry bandwidth applications and among others. With these, bandwidth consumption shoots up making it not enough for

the network. Bandwidth consumption differs from users, in as much as it should be restricted for educational purposes only, it unavoidable that users access invaluable resources. Most often than not, users are accessing as described by Chitanana (2012) as low priority, bandwidth hungry and non-educational purposes.

In the Philippines, major players in providing internet connections can only provide as fast as 5.5 Mbps. As a result of the recently concluded survey published by Akamai (2016) the country ranked last tied with India along the Asia Pacific Region. Looking into the demand of an internet user compared to the services that internet providers can supply, it would really not suffice. Even so, since this problem is beyond control, the only means that could be done lies on managing the network. In order to attain seamless operation, optimization of bandwidth be then taken into consideration. Since internet connection is an investment of the universities, it should be used in its full capacity.

In the College of Computer Science, one core issue is its network management system. Though Internet connection is available, no prior study was conducted to plan the bandwidth allocation needed to supplement the college's needs. Internet connection is intended to be used in delivering lectures and for educational purposes. However, misuse can take place for no clear implementations on policy were crafted in the use of internet connection.

With the above mentioned, the researchers aim to come up with a reliable network infrastructure that would be used for the college. It is a progressive study which would lead to the formation of policy, monitoring and implementation. However, the scope of this study would only provide the analysis on the bandwidth consumption of the college and the computation of bandwidth requirement.

Research Objectives

This study aims to determine the network performance of the College of Computer Science. Specifically, it sought to attain the following objectives:

1. Determine the network profile of the College of Computer Sciences to
    a. Hardware
    b. Software
    c. Speed/bandwidth
2. Identify network based application responsible for the consumption of valuable bandwidth of the college network system.
3. Compute the total bandwidth requirement needed for the College of Computer Science.

Research Methodology

The study would use descriptive design. It was used in determining the speed/bandwidth of the network and also the unproductive applications while descriptive will be used in determining the network infrastructure as to hardware and software.

In order to determine the available resources of the college as to hardware and software, the researchers have used the documentary analysis and check list method. The researchers inspected each officers and recorded the different resources present. As to the hardware, they have included devices used to network the computer units. As to the softwares present in each office, the researchers only recorded the software that requires internet connection. Furthermore, the researchers have used the application iperf in order to validate the speed of the internet connection presently used in the college.

In identifying the network based applications which consumes valuable amount of bandwidth and unproductive applications, the researchers used the PfSense to observe the network performance of the college. The observation was administered for 10 working days which runs from 8:30 in the morning to 4:30 in the afternoon. Thirty minutes was spared from the morning and afternoon session which was intended for the gathering or daily results.

Research Findings

The network profile of the College of Computer Science

Hardware

Based from the observation and documentary analysis conducted by the researchers, it was recorded that the college is using six (5) laboratories which are fully equipped with computer units. Laboratory one and two located at the second floor of the building both have 35 units each while the two laboratories which are three and four are with 36 units each while the fifth laboratory located in the College Library have 40 computer units. Each of the computer unit comprises a display monitor, mouse, keyboard and AVR. Forty five (45) uninterrupted power supplies are purchased and were deployed to these different computer laboratories. Furthermore, each laboratory is also equipped with smart televisions which are used for discussions. As part of the network, three offices are connected in the local area network. The research lab is installed with five computer units while the faculty room and the dean's office are with one computer each. BYOD policy is implemented in the research laboratory so students are allowed to connect to the internet with their own device. In the faculty room, faculty members are also given the privilege to connect to the internet with their own device.

As to connecting the computer units, the college uses networking devices such as routers and switches. Computer laboratories are using six 16-ports and six 24-port type of switches and are connected using CAT 5 type of cable following the star topology. These computer units are further connected in the server room were internet connections are supplied. From among the computer laboratories, computer laboratory six does not have network connections due to the fact that it is located on a different building making it not a part of the network. It is used for professional subjects which do not require connections.

Since internet connections are present, they are distributed with the use 3 routers located in the research laboratory room, faculty room and in the office of the dean.

Software

Table 1 Softwares used that requires internet connection

Software	Mbps
Coursesites.com	1.5 mbps
Kahoot.it	2 mbps
Google Classroom	.5 mbps
Facebook group	.5 mbps
Team Viewer	1.5 mbps
Tina	.5 mbps
Wordpress	1.5 mbps
You-tube	1.5 mbps
Pluralsight	2 mbps

Looking into the syllabus and learning plans of the faculty members, the researchers have elicited the softwares relevant to the course they are teaching which is shown in table 1. The researchers have only considered softwares which requires internet connection. As to determining the bandwidth requirement, the researchers have consulted the different sites to identify minimum needed to run a site or application over the internet. As we can notice, you-tube and plural sight was included in the list even these sites are so called bandwith hungry sites because it is used by faculty members for tuitorial purposes only.

Speed/ Bandwidth

According to the contract made by the college to the internet service provider which is the PLDT, the company is providing 5.5 mbps which was validated with the use of Iperf.

Network based application responsible for the consumption of valuable bandwidth

Table 2 List of sites responsible for bandwidth consumption

Application/Site	Total Bandwidth
You-tube	2.15 GB
Facebook	1.78 GB
Clash of Clans	933 MB
Google	924 MB
Instagram	314 MB

From the ten day observation, the researchers have elicited the top five sites and applications which mainly use the bandwidth for the whole college. The Pfsense was connected to the trunk line of the internet connection to record all the activities of the network as far as bandwidth consumption is concerned. Based from the result you-tube topped the list consuming 1.78 Gigabytes. It can also be noticed that Clash of Clans and Instagram, which are applications not included in the syllabus is a part of the list consuming a noticeable 933 MB and 314 MB respectively.

Compute the total bandwidth requirement needed for the College of Computer Science

The researchers have used the formula N*T=BN where N is the number of users, T is the estimated bandwidth needed for one user, and BN is the bandwidth needed. According to Wlodarz users can be categorized according to their bandwidth consumption. Light users, moderate users and heavy users are to be allotted with 50Kbps, 80Kbps and 120Kbps. With the given formula, the researchers have computed the bandwidth requirement per office. The results shown in table 2 is expressed in megabits per second (mbps)

Table 3 Computed Bandwidth requirement for each type of users.

Office	Light User	Moderate User	Heavy User
Laboratory Room	1.95	3.13	4.69
Research Laboratory	.98	1.56	3.52
Faculty Room	.89	1.40	2.11
Dean's Office	.098	.16	.23

In the computation for the laboratory room, the researchers have defined 40 computer units. For the computation, one computer laboratory was only taken into account. For the research laboratory, since BYOD policy is being followed, the researchers have only computed for 20 units including the five computer units installed in the room. For the faculty room, 18 units were used in the computation for there are only 18 faculty members using the room. And lastly for the Office of the Dean, two users are credited for the Dean and his secretary.

With the given requirement for each of the offices and laboratory rooms, it can then be computed for the total bandwidth to sustain the whole network. If all users are to be categorized as light users, the college would need 3.92 mbps internet connection, for moderate users, 6.25 is required while if all users are categorized as heavy users, the college should be allocating 10.55 mbps.

Conclusion and Discussion

The existing network profile of the College reflected a network infrastructure upgrade. The absence of a network facility, that comprises (1) a licensed network software which will monitor, filter and generate usage analysis (2) state-of-the-art and scalable network server (3) other network equipment and (4) additional certified network administrator.

The College needs to upgrade its network facility. In addition, there is a need to adapt a procedure in designing a network infrastructure framework. The administrators should consider its affordability, scalability and

manageability. There must be full support from the administration in the hiring and/or designation of Network Administrator. Laboratory technicians must have intensive technical training for effective implementation of ICT should be considered of utmost priority. There is a need to implement the proposed ICT trainings and seminar-workshop for administrators, faculty and staff on computing and information literacy skills, curriculum integration and technical skills. These should be given adequate and proper budget allocations to fully attain the objectives of the College. There is a need to draft policies for network infrastructure in the College.

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Authors

Floribeth P. Cuison, Don Mariano Marcos Memorial State University
Email: beth.panay@gmail.com

Belinda M. Dungan, Don Mariano Marcos Memorial State University
Email: belinda.dungan@dmmmsu-sluc.com