Network Monitoring Support System (NMSS): Performance Evaluation Tools and Testing

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Abstract— Network Monitoring Support System (NMSS) is all-inclusive applications which are providing capability to monitor and manage NCO network performance such as video conferencing bandwidth network utilization. Typical components in network management systems are Network Monitoring System (NMS), Aset Management, HelpDesk System and Patch Management System. This paper demonstrates an evaluation of testing parameters used for Network Monitoring Support System (NMSS), with emphasis on testing bandwidth on-utilization of video conferencing to proof that the application is reliable in our organization. Results analysis were obtained from several network devices application on performance monitoring system implemented and tested in selected areas in Malaysia.

Index Terms—NMSS,NMS, QoS, SNMP, CORBA, SNMP, SMTP, HTTP, FTP, SSH, QoE, PhP, GUI, CPU, NOC.

I. INTRODUCTION

There are several network performance monitoring tools/device have been developed and implemented over the past few years. Some of them are free, open source, while some of them are certainly not. These tools enabled us to test dissimilar aspects of network performance parameters and they are developed by individuals, private sector, NGOs and government sectors. There are some of example of network performance monitoring tools that have been developed and implemented between 1997 and 2005. Such as NetNow, Mapnet, Keynote, NetOps, JetMon, EdgeScape, AdventNet, WireShark, Anritsu Argus and etc.[1]

Figure 1 show a block diagram of network management system which consists of several types of network monitoring tools including packet capture tools, flow monitor and application monitor. [2]
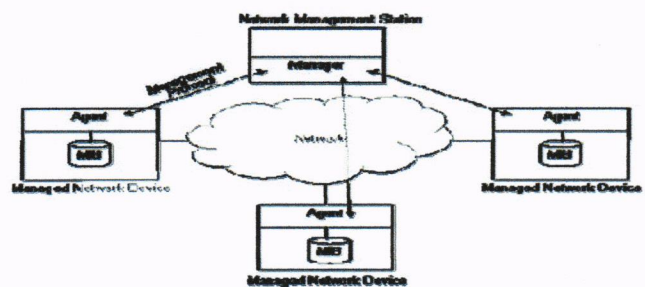

Figure 1: A network management system composed of a management station and tools agents

There are different approaches and measures are being used to characterize the performance of communication networks. Systems administrators should evaluate how their systems are working prior to improve network system quality of service. To manage network system performance, it is important for administrators evaluate system usability factors such as throughput, processing time and times take to process data and so on.[3] The complexity of the performance evaluation increasingly occurs in the field of the emerging multimedia services: a wide set of parameters is taken into consideration are delivered the services over IP networks (data/audio/video/text/graphics). The parameters of the required level of QoS/QoE (Quality of Experience/Quality of Service), security, interactivity and reliability are taken into consideration. QoS are used to meet the objective of parameters such as network delay, jitter, packet loss, etc. that can be measured at network level. [4]

Another important role in network performance monitoring is the requirement of a holistic vision for both networking and computing resources in a Cloud environment, which are lead to a convergence of network performance and Cloud service provisioning.[5] The main contribution from the studies is a new approach to modeling converged network-Cloud service capabilities and analyzing end-to-end delay performance of converged services. The developed modeling

and analysis techniques are unsure to network system monitoring and cloud implementations; thus are applicable to various network-Cloud services.[6]

II. SYSTEM EVALUATION AND TESTING PROCEDURES

System evaluation and testing procedures implemented are defined based on the standard SOP in order to suit and customize from the end user requirements. After success the certain evaluation then follow to next test procedures on evaluation on bandwidth utilization of video conferencing at several selected places area in Malaysia. The flow chart of the testing and evaluation process performed is shown in figure 2.
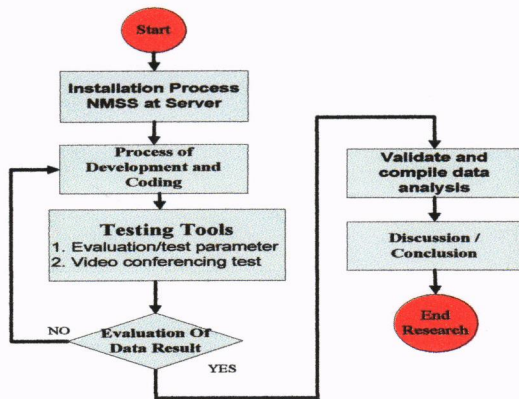
Figure 2: Flowchart of testing and evaluation

1. Installation Process NMSS Software at Server

Network Monitoring Support System (NMSS) application software was installed in a dedicated server at Network Operation Centre (NOC) in Malaysia central region. During the initial development phase, Nagios Core based on Open Source Linux OS is installed for all 4 modules application. This research work was only focusing on the installation and testing performance software of Network Monitoring System (NMS).

Nagios Core engine database was chosen from its capabilities to provide a central view of the network traffic and bandwidth data as well as potential network compromises. The powerful home dashboard provides an at-a-glance view of critical network flow data sources, server system metrics, and abnormal network behavior for quick assessment of network health.[7] On this development the host monitor of NMSS has been running on Unix/Linux and display on desktop/laptop by Microsoft Windows. Figure 3 shows the related software and selected applications used in the research work.
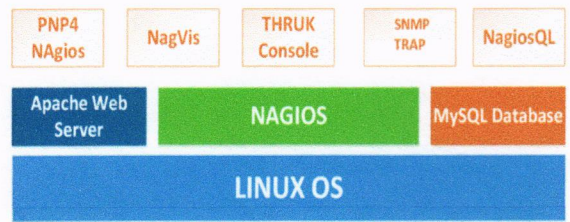

Figure 3: Different Combination of Programming Application

2. Process of Development and Coding

Starting with creating the main interface, and then continue to the development of four modules in NMSS. Developers are used C Programing Language to customize some of the features application suit for the organization requirement. The developers have been explored and get closed with the Open Source Application Nagios Core such as method and class because this function will be used in the next stage enhancement of coding development. C Programming Language consists of the following parts: preprocessor commands, functions, variables and statements expression.[8] All the method is used to developed NMS and for other modules in NMSS, developers used MySql and PhP to integrate all the data collection into an accurate and efficient database application. 4 modules GUI and Features of NMSS as per below:

i. Outline of Network Monitoring System (NMS) as shown as figure 3.
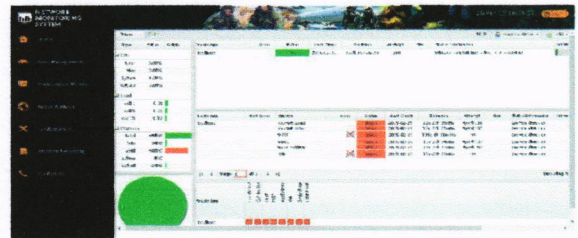

Figure 3: Main Interface

ii. Outline of Helpdesk

Once a user has successfully login into the Helpdesk system, the user will be routed to the Dashboard page (as illustrated in Figure 4) that opens up the Dashboard page of the Helpdesk system.
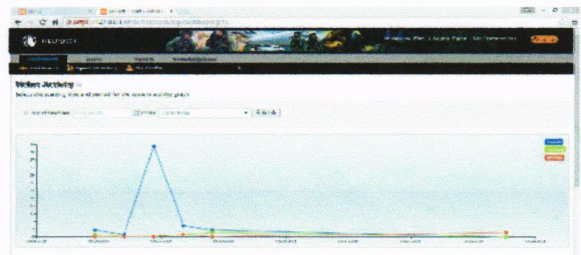

Figure 4: Dashboard Helpdesk

iii. Outline of Asset Management

Once a user has successfully login into the Asset Management system, the user will be routed to the Dashboard page (as illustrated in Figure 5) that opens up the Dashboard page of the Asset Management System.

Figure 5: Asset Management

iv. Outline of Patch Management

Patch Management System-Administrator is to managing update all application under NCO UC2 on server. This site can be access from web address. Shown As figure 6.
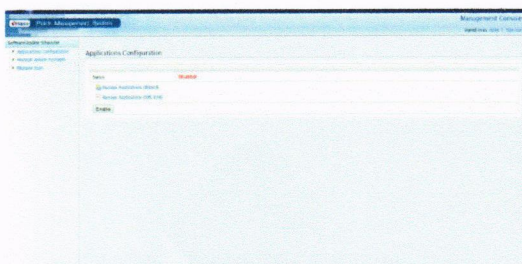

Figure 6: PMS Main Application Configuration

2. Testing tools

This section describes several testing procedures and mechanism applied to NMSS in order to evaluate the performance of Network Monitoring System (NMS) module. The evaluation and testing parameter has been carried out to evaluate the functionality of the chosen applications. Successful testing tools and evaluation methods identified from this experimental work will be used in the last stage of the research work where bandwidth utilization testing of video conferencing will be carried out. Our final objective is to check and monitor any bandwidth issues such as network bottleneck in terms of bandwidth utilization.

i. Evaluation And Testing Parameter

This procedure is required to test and rectify the overall system functionality aligned with our organization Standard Operation Procedure (SOP). On this procedure we are focusing only on the functionality of Network Monitoring System (NMS). The testing has been carried out at Network Operation Centre (NOC). The testing takes several hours to ensure that the data collected are accurate and reliable. The

analysis was concluded after the result has been captured. The objectives of this stage of testing are to ensure all the system are running successfully according to the goals when based on the network implementation and testing phases.

Other method of testing's have also been carried out accordingly using this NMS operation in 5 different selected areas which are Kuala Lumpur, Selangor, Kuantan, Perak and Johor. Procedures of testing have been carried by analyzed the parameter at the selected devices of mantis at interface Eth0 and details criteria are as per below:

a. Test ping and packet loss interface
b. Test SNMP
c. Test Memory of equipment

ii. Testing On Bandwidth Utilization Of Video conferencing

The testing has been carried out at 12 different places all over Malaysia. Kuantan site has been selected to measure the bandwidth utilization for the video conferencing which currently has a bandwidth of 4Mbps. The available bandwidth is based on the Local Area Network (LAN) and Wide Area Network (WAN) connection. Performance testing has been carried out for 4 hours during peak time to ensure that the data collected are accurate and reliable. The data obtained has been recorded and the results generated have been captured.
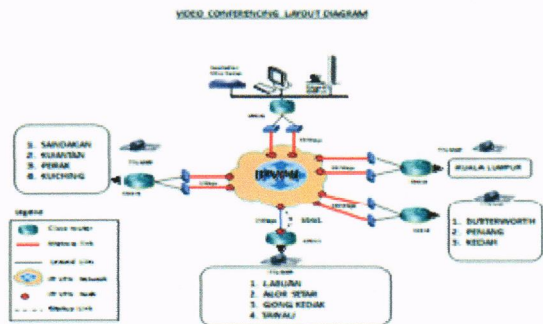

Figure 7: Layout Diagram of 12 Sites Involved On Video Conferencing Test

This testing has been carried out to focus at Kuantan site when all 12 sites at same time switch on their video Conferencing. Application Network Monitoring System (NMS) has been used to monitor the performance and utilization of bandwidth and data interface traffic at the main interface Eth0 of the Mantis Equipment as shown in figure 8 .
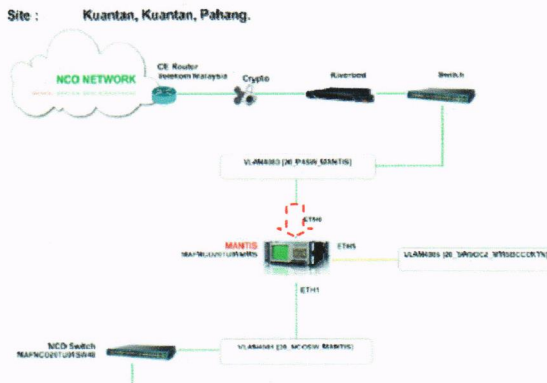
Figure 8: Layout Diagram Site at Kuantan at Main Interface Eth0

III. RESULT

1. Result on selected parameters from the conducted testing is shown in figure 9.
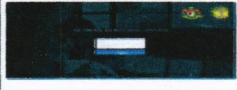

Figure 9: Shown the table result parameter of testing parameter

2. Results from the 5 selected places that have been carried out using specific test parameters are presented. All the data result from the NMS at involved site on this test procedure is shown the application can ping successfully with no data packet loss. The status of the SNMP also shown in good stage and finally all the memory of the equipment are indicated in a good condition as shown as figure 10.
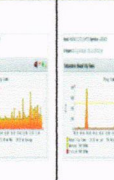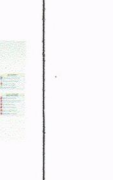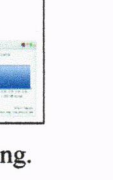

Figure 10: Shown the table result parameter of testing.

3. Data result of bandwidth utilization on video conferencing.

Figure 11: Data Result Interface Traffic From NMS

Mantis equipment will be operated effectively at 55.19ms and Average latency and 2% Average Packet Loss. As shown as figure 11 are the summary usage of overall bandwidth utilization average of 3Mbps (50% max of total bandwidth) interface of Riverbed equipment.

Figure 12: Data Usage Bandwidth At interface Riverbed Equipment

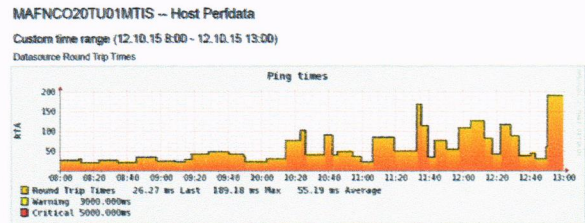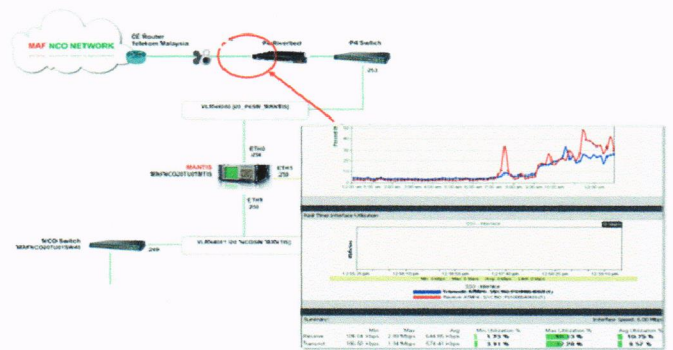Observation of summary of data graph from the NMS:

- Total bandwidth at Kuantan currently is 4Mbps.
- Total usage of bandwidth has been shared with data application, voice and video conferencing.
- The usage of Riverbed equipment at is functioned as Network Optimizer for segregation Quality of Service (QoS) of Data, Voice and Video Conferencing.
- Total Usage of bandwidth on the testing period of time was average 3Mbps.

IV. CONCLUSION

This project is to develop tools and procedures that will be used to monitor the network utilization performance for Local Area Network and Wide Area Network based on IP range which called Network Monitoring Support System (NMSS). Currently, it is running in Network Operation center (NOC) at a secured place. This device application is using by open source operating system and also compatible with Windows operating system.

On video conferencing test procedure, it can be concluded the NMS application has been very useful and effective to determine and rectify the usage of bandwidth at Kuantan site. When the usage of bandwidth indicates its maximum utilization, the Riverbed equipment can be used to give the priority of tuning the Quality of Service (Qos) for the video conferencing utilization. [9]

It can be concluded that this tool application is successfully function and completed within the dateline, some of the testing using Standard Operation Procedure running accordingly and smoothly without any error and collision.

From the analysis, it can be concluded that NMSS is better than using standalone application that develop by previous developers. However, those previous system applications are monitoring based on standalone IP range and windows OS only but in the NMSS, developers used the application based on open source OS and can running at all various Operating System.

V. RECOMMENDATION

There are several items that needed to be considered after completing this testing procedure, which is involving the minimum access of the network which control by other developer and contractor. However several recommendations can be implemented in order to NMSS performs more effective and reliable in our organization.

It is practical to measure network performance on a specific segment of IP addresses in a network at the initial stage of network monitoring process. This project has only been dedicated for specific IP Addresses thus not covering all areas in the whole network. Once suitable testing tools and procedures have been identified, the Developers should further monitor other areas in the network to evaluate overall network performance.

Also, it is recommended that the monitoring and testing tools for other network such as Satellite Communication are embedded into a single monitoring system for more efficient and cost effective management system.

Furthermore, the functionality of the NMSS needs to be expanded to perform more advance tasks such as a Quality of Service (QoS) level monitoring. The performance and utilization of performed by the Riverbed Equipment was not included by the developers. Hence, further development of the applications can be enhanced and extended by monitoring Quality of Service (QoS) on bandwidth utilization.

The bandwidth capacity at the Kuantan site is recommended to be increased up to 6Mbps to avoid any interruption of network services especially during peak hours or adding new site in future.

ACKNOWLEDGMENT

REFERENCES

[1] A SURVEY OF NETWORK PERFORMANCE TOOLS FOR COMPUTER NETWORK CLASSES S. Zeadally E. Yaprak1 Y. Li X. Che Department of Computer Science Wayne State University Detroit, MI 48202 pp 5-8, 2009.

[2] Network management performance analysis and scalability tests: SNMP vs. CORBA Gu, Q.; Marshall, A. Network Operations and Management Symposium, 2004. NOMS 2004. IEEE/IFIP Year: 2004, Volume: 1.

[3] THE INNOVATION JOURNAL: THE PUBLIC SECTOR INNOVATION JOURNAL, VOLUME 16(1), ARTICLE 3 2002

[4] SNMP and Beyond: A Survey of Network Performance Monitoring Tools. By Paul Moceri, paul.moceri@gmail.com. Pp 19-23, 20012.

[5] STRUCTURING AND MODULARIZING THE NETWORK WITH CISCO ENTERPRISE ARCHITECTURE. BY DIANE TEARE. SAMPLE CHAPTER IS PROVIDED COURTESY OF CISCO PRESS., JUN 12, 2008.

[6] http://www.slac.stanford.edu/xorg/nmtf/nmtf-tools.html. Network Monitoring Tools Les Cottrell, SLAC. Last Update: April 16, 2015

[7] https://www.nagios.org/documentation/ Last Update Okt 2015.

[8] https://en.wikipedia.org/wiki/C/programming_language

[9] www.chip.pl/ext_scr/pk/riverbed/SolutionBriefRiverbedQoS1.pd