Use of Network Performance Management Tools to Increase Productivity

Seth Okyere Dankwa, Daparti Subba Rao

Abstract- Research has shown that there is a substantial lost in productivity anytime the performance of computer network becomes suspect. The resultant financial effect of supplementary bandwidth investment presents a daunting picture. Performance issues are very crucial in computer networks, for example when many computers are interconnected, complex interactions arise with unforeseen consequences. This complexity leads to degradation of performance if the system is not managed properly. The research explores the use of performance management aspect of the network management to maximize efficiency and productivity in computer network. It also tries to find out the features of performance management, examines current solutions to performance management features, investigate about techniques adopted to achieve quality of service and then attempts to recommend an appropriate performance approach to a medium sized company. The research is expected to reveal that performance management concept is one of the most efficient and effective network management approaches which ensures automated and preventive maintenance, thus relieving the network managers of doing manual investigation to find out many problems that the network might create. The research outcome enhances network availability to users, remote and automated monitoring to network administrators and then increase productivity to cooperate bodies.

Keywords: Throughput, Response Time, Availability, Protocol Analyzer, Multi Router Traffic Grapher (MRTG).

I. INTRODUCTION

This study is meant to address congestion that occurs as results of running of different applications in computer networks which leads to performance related issues in most organisations in general and the Internet in particular. Performance issues are very crucial in computer networks, for example when many computers are interconnected with different application running on them, complex interactions arise with unforeseen consequences. This complexity leads to degradation of performance if the system is not managed properly. There is also degradation of performance when imbalances in structural resources, the Central Processing Unit cannot handle the inbound packet quickly enough, thus some will get lost. The lost packets in an attempt to be retransmitted, add delay and bandwidth wastage, and generally cause a reduction in performance. Another problem associated with performance that happens with time – critical application like video and audio is jitter (Tanenbaum, 2003).Subramanian (2000) describes Network performance as nebulous term and defines performance management as management of traffic (data) which involves data monitoring, problem isolation, performance tuning, analysis of statistical data for trends recognition and resource planning.

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According to a technical paper published by Packeteer Company (www.packeteer.com), administering application performance on an Internet link can be quite demanding. There is a drop in productivity and end-user frustration increases when performance becomes unpredictable, slow and inconsistent. IDC affirmed that a typical large United States enterprise spends $26,626,600 annually on Wide Area Network circuits. Fig 1.1 depicts one of such organisation's top applications running across the Wide Area Network and the percentage of bandwidth consumption for each of the applications.

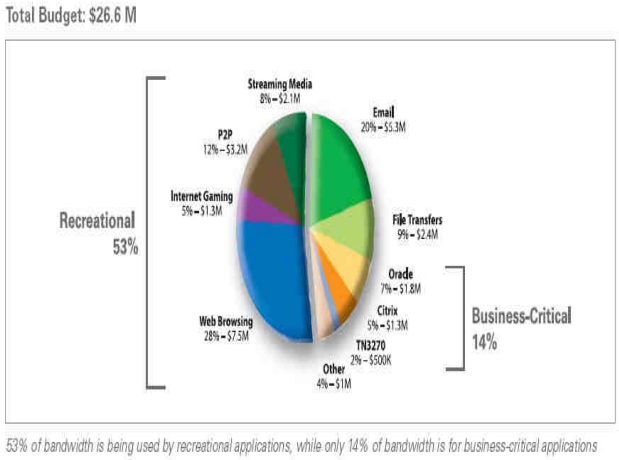

Fig. 1.1. Distribution of bandwidth consumption per applicatication Before bandwidth increase

SOURCE: www.packeteer.com

As could be imagined, getting more bandwidth has always been the common response to the problem of too much traffic. The Fig 1.2 depicts the increase in bandwidth by the organisation.

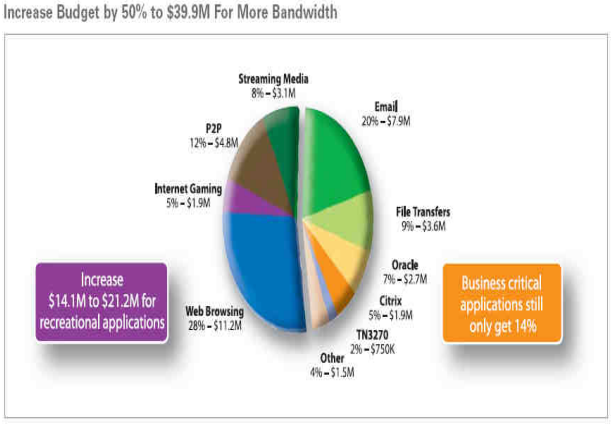

Fig. 1.2. Distribution Of Bandwidth Consumption Per Applicatication After Bandwidth Ncrease

SOURCE: www.packeteer.com

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It could be inferred from the Fig 1.2 that the increase in bandwidth has not changed the percentage for the business - critical applications. Since more bandwidth is not the solution, then network managers need more visibility and control to find a solution.

A. problem statement

The Internet in general and computer network in particular is a global infrastructure for information exchange that has transformed the social, economic, and political aspects of our lives. One of the most crucial building blocks of the computer network is a mechanism for resource sharing and management of the performance of the network. When end-hosts access a certain resource (such as a webpage from CNN, a video on YouTube, etc.,) on the Internet, it is important to ensure that they do not overwhelm network elements (such as routers) and are able to efficiently utilize network resources, and achieve fairness in some agreed-upon sense. IT managers and network administrators are working full time to manage data centres, provide new applications and also respond to help desk requests more than ever, yet performance of most network is flaw. There is a need for mechanism to monitor the entire network and troubleshoot problems wherever they are occurring, quickly and efficiently, so that business and other essential IT operations run smoothly.

B. General and Specific Objective

The general objective of the research is to contribute to the general body of knowledge in the area of computer network performance to enhance productivity at workplaces in general and computer network in particular.

To achieve the general objectives, the research addressed the following specific objectives:

- To explore current network management tools available.
- To employ the current network management tool to maximised efficiency and productivity.
- To deploy protocol analyser with remote monitoring software to manage network performance.
- Propose an efficient and effective performance management tool which pulls packets information at all the layers remotely for analysis and resolution of network problems.

C. Significance of Study

The results of this research study will categorically benefit all stakeholders of Computer Network facilities. Users will enjoy more network availability as identification of network problems and troubleshooting become easy. Queue build ups on links are going to be reduced to nearly zero. Productivity at most organisations will increase as more organisations deploy their commercial activities on the computer network. Social network activities on computer network will be enhanced. More software vendors will go into designing delay sensitive applications. The future high speed network envisage by all to manage triple play look bright. With protocol analysers more packets can be managed on the network remotely, hence reducing workload on system administrators.

D. Limitation

All studies have inherent limitations and delimitations. Limitations refer to limiting conditions or restrictive weaknesses. The research uses primary data for it analysis, this call for generation of the data. In studies of computer networks, it is highly expensive if not impossible to deploy real devices for experiments. The experiment is conducted over Local Area Network or Wide Area Network which are owned by organisations and are used for commercial purpose. Getting permission to use them for experiment is sometimes difficult. Internet connectivity is sometimes unreliable.

E. Delimitation

There are several means of handling computer network performance. Some of these are, over provisioning which is increasing capacities of devices attached to the network. This means is very expensive. Another means of ensuring network performance is to employ security approach. This method can also limit the availability of the network. Using congestion control protocols is also another means but these protocols are found at the upper layers of the TCP/IP model leaving the lower layer unattended to. The study is delimited to performance management practices. These include the use of status monitoring tools, traffic monitoring tools, route monitoring tools and protocol analyser which take care of all the protocols in the layered network.

II. METHODOLOGY

F. Research Design and Method

The researcher used Descriptive method. According to Glass and Hopkins (1984), Descriptive research can be either quantitative or qualitative. Descriptive research involves gathering data that describe events and then organize, tabulate and chart them. It often uses visual aids such as graphs and charts to aid the reader in understanding the data distribution. The researcher in this case used protocol analyser and other network management tools to pull data from the nodes within the network, analysed and depict them in a tabular or chart form.

G. Research Format

The researcher adopted experimental research approach. The experiment is a situation in which a researcher attempts to objectively observe phenomena which are made to occur in a strictly controlled situation where one or more variables are varied and the others are held constant.

H. Key Assumptions

The main assumption is that packet drop within the network indicates that the network is congested. This work is also based on the assumption that the status of the packet reflects the state of the network.

I. Research Technique

The researcher adopted network management tools to come out with the results of the research. The rationale for the choice is as follow: Network management tools are easy to come by. Some are software inbuilt in operating systems and others are hardware device. The following network

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management tools were used: Protocol Analyser, Route Monitoring Tool, Traffic Monitoring Tool, Status Monitoring Tool and Multi Router Traffic Grapher (MRTG). The protocol analyser which is the only hardware devise among the monitoring tool is used as a remote monitoring analyser. Data are collected using RMON probe and transmitted as SNMP traffic, the analysis is based on standard parameters like Throughput, Response Time, Availability and Threshold Setting which affect network performance. The Throughput is measured by transmission media capacity or bandwidth, average traffic load, peak load and channel error rate at a particular points in the network. The Response Time is a measure of time between user and server, application availability and burst frame rate and it depicts the rate at which the requested data arrives at the user station (Feldmier, 1997). Leinwand and Conroy (1996) elucidate availability as the percentage of time taken for the accessibility of the network for use and operational and is often measured as mean time between failure. Threshold is set on average utilisation, error rate and overall throughput. For an example, a point at which a certain device processor utilisation affects network performance is 90 percent of the total capacity. The threshold of this device could be set at 80 percent, thus allowing for examination of the network as a performance problem is occurring. Thresholds help to locate and fix a problem that affects network performance.

III. RESULT

In this section we present deployment of performance management tools result that briefly depict how computer network are managed to ensure availability which enhances effective usage of the network.

TABLE: 3.1 Status Monitoring Tools.

Name	Operating System	Description
Ifconfig	UNIX	Obtains and configures networking interface parameters and status.
Ping	UNIX/Windows	Checks the status of node/host
nslookup	UNIX Windows NT	Looks up DNS for name IP address translation.

SOURCE: from the research

TABLE: 3.2 Traffic Monitoring Tools

Name	Operating System	Description
ping	UNIX Window	Used for measuring round trip packet loss
bing	UNIX	Measures point-to-point bandwidth of a link.
etherfind	UNIX	Inspects Ethernet packets
snoop	UNIX	Captures and inspects network packets
tcpdump	UNIX	Dumps traffic on a network
getethers	UNIX	Acquires all host addresses of an Ethernet LAN segment.
iptrace	UNIX	Measures performance of gateways

SOURCE: from the research

TABLE: 3.3 Route Monitoring Tools

Name	Operating System	Description
netstat	UNIX	Displays the contents of various network related data structure.
arp/rarp	UNIX, Windows95/NT	Displays and modifies the Internet to Ethernet address translation tables.
traceroute/tracert	UNIX/Windows	Trace route to a destination with routing delays.

SOURCE: from the research

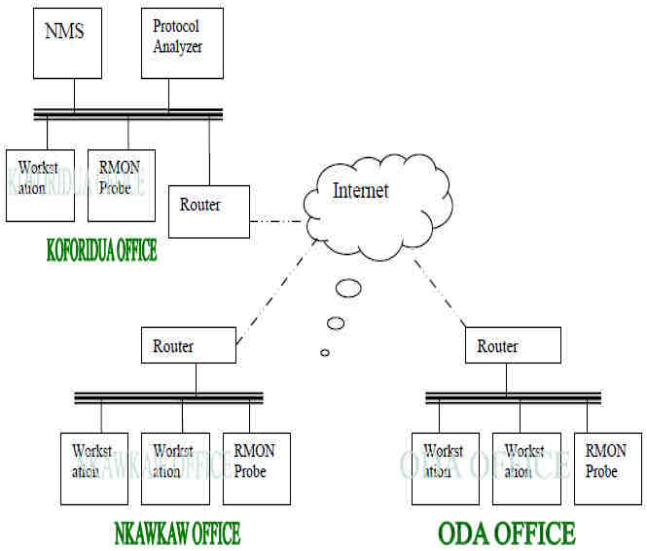

Fig: 3.1 Protocol Analyser Deployment In Success Trust Microfinance

SOURCE: from the research

The diagram above shows Network Management System Architecture that the researcher used as a performance management approach for Success Trust Microfinance Limited, Koforidua. Devices used are computers, routers, RMON Probes, Protocol Analyzer and a computer with SNMP as the Network Management Station (NMS) on it. There are three key components in this Architecture worth noting. These are:

- Managed device
- Agent - Software which runs on managed devices
- Network management station (NMS) - software which runs on the manager.

A *managed device* is a network node that implements an SNMP interface that allows unidirectional (read-only) or bidirectional (read and write) access to node-specific information. Managed devices exchange node-specific information with the NMSs. The managed devices can be any type of device, including, but not limited to, routers, access servers,

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switches, bridges, hubs, IP telephones, IP video cameras, computer hosts, and printers. An *agent* is a network-management software module that resides on a managed device. An agent has local knowledge of management information and translates that information to or from an SNMP-specific form. A *network management station* (NMS) executes applications that monitor and control managed devices. NMSs provide the bulk of the processing and memory resources required for network management. One or more NMSs may exist on any managed network. Below is a collection of screenshots from the protocol analyzer.

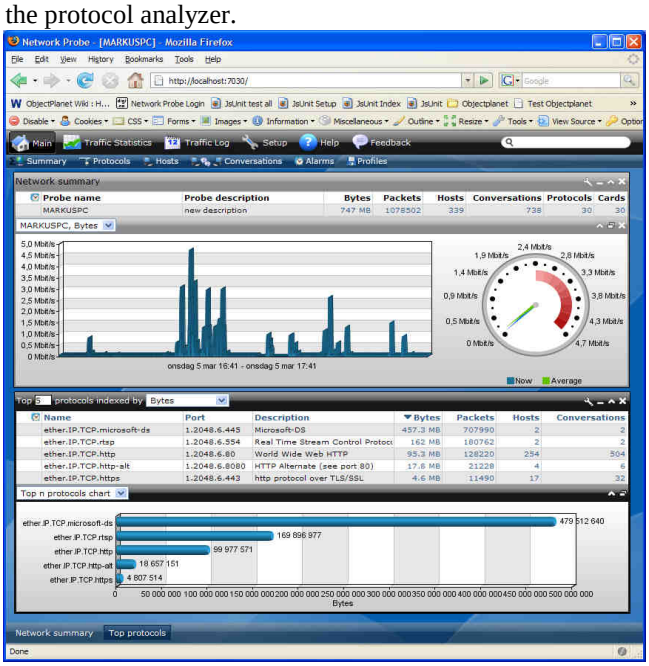

Fig: 3.2 Main Screen

SOURCE: from the research

The main interface displays the network summary, and with easy access to the most active protocols, hosts, talkers, listeners, and conversations. Using the top menu you can switch between the different parts of the application; the main screen, detailed live network statistics, logged historical traffic statistics, setup, and help.

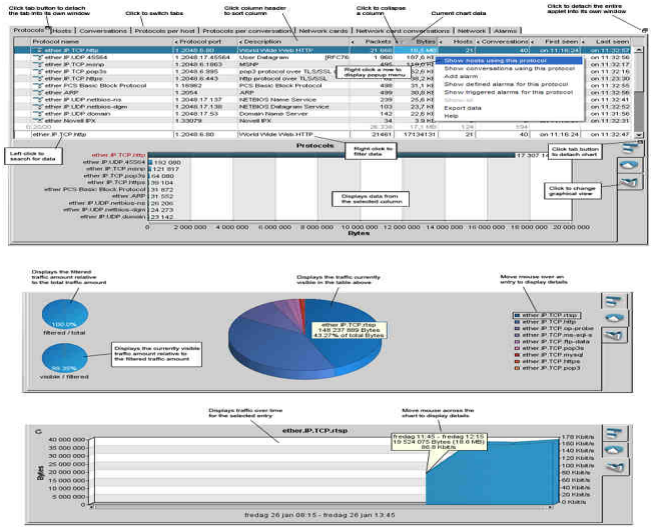

Fig: 3.3 Statistical application overview

SOURCE: from the research

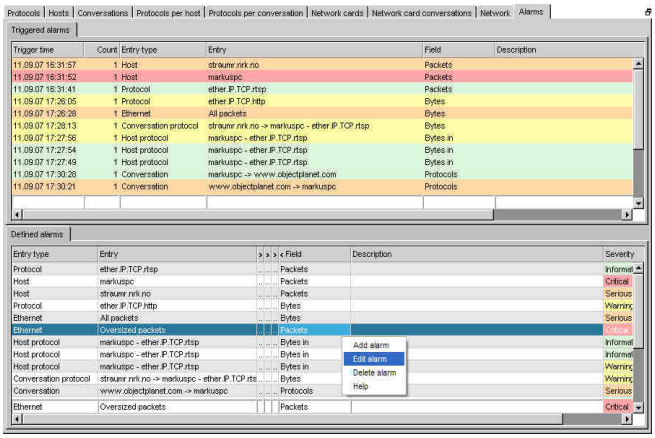

Fig: 3.4 Alarms

SOURCE: from the research

This screen shows the display from the alarm tab, where all the defined and triggered alarms are displayed. It can easily be viewed, edited and deleted both defined and triggered alarms using the alarms tab.

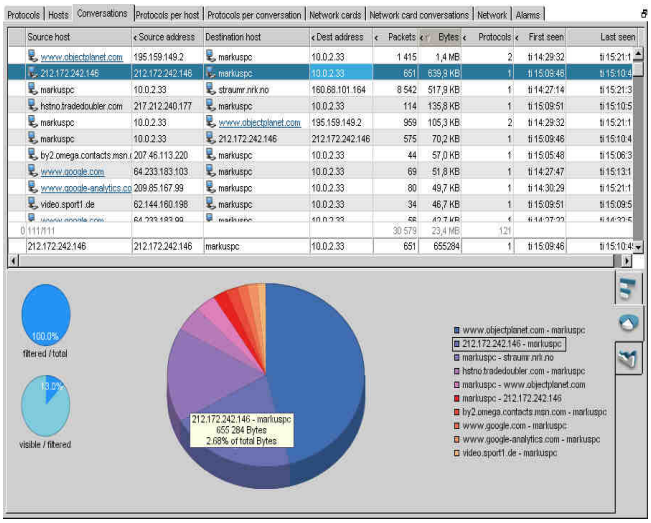

Fig: 3.5 Conversation

SOURCE: from the research

This screen depicts the display from the conversations tab which lists all the conversations taking place on your network along with their detailed traffic statistics. Selection of the pie chart option mirrors the data listed in the table.

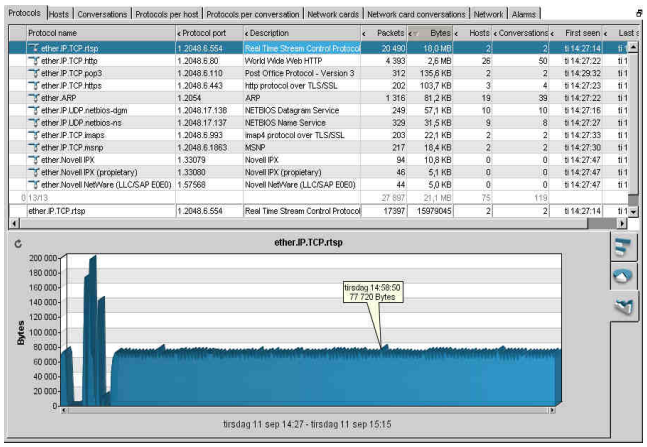

Fig: 3.6 Protocols

SOURCE: from the research

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This screen shows the display from the protocols tab where all the protocols and their traffic details are displayed. The researcher selected the througput chart and the pop3 protocol and the traffic for this protocol over time is displayed.

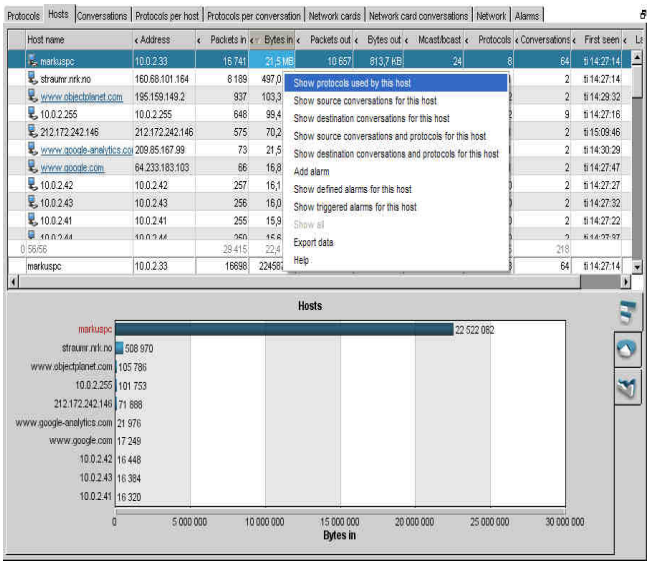

Fig: 3.7 Hosts

SOURCE: from the research

The screen above shows the display from the hosts tab where all the hosts and their traffic details are displayed. The default chart is selected which mirrors the data in the table as a bar chart. The researcher has right-clicked the first entry and is about to drill down and show all the protocols used by the selected host.

IV. DISCUSSION

Subramanian (2000) describes Network performance as nebulous term and defines performance management as management of traffic (data) which involves data monitoring, problem isolation, performance tuning, analysis of statistical data for trends recognition and resource planning. The current essential performance management tools explored by the researcher are either part of operating systems or available as add-on applications that support in obtaining network parameters or diagnosing network problems. The popular ones are categorised under route monitoring, traffic monitoring, and status monitoring as depicted in tables and figures at the result section of the research. The protocol analyser as shown in figures 3.1,3.2,3.3,3.4,3.5,3.6 and 3.7 is a remote monitoring analyser that collects data using RMON probe. Gathered data are pre-analysed by the RMON and transmitted as SNMP traffic. The result of data gathered are used to perform diagnostic problems and network management functions such as load monitoring, capacity planning, traffic reroute planning and traffic congestion.

V. CONCLUSION

The research has revealed that performance management concept is one of the most efficient and effective network management approaches which ensure automated and preventive maintenance, thus relieving the network manager of doing manual investigation to find out many problems that the network might create. Example is setting up of thresholds, collection and analysis of statistical data of packet transmission for recognising trends and resource planning. Capacity planning could be implemented through information from protocol analyser on the network. Performance management technique as mentioned and deployed in the research like traffic shaping and buffering could also be used to improve quality of service required by video and audio.

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Mr. Seth Okyere - Dankwa is a Network Engineer with more than 10 and 4 years working experience in industry and teaching respectively. I hold Masters degree in Network Systems from University of Sunderland in UK and currently pursuing Phd in Information Technology at Open University in Malaysia. I currently lecture at Department of Computer Science at Koforidua Polytechnic in Ghana.

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