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Ethernet Network Bandwidth And Traffic Density Management: Knowledge Management Concept

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***Abstract*— Knowledge Management (KM) is a vital factor to address issues intersected with process, people and technology. The study necessitates employing KM practices to address network bandwidth abuse and congestion. The paper analyze traffic managers (Bandwidth Meter - BWM and Website Zapper) in the conceptual view of KM using Electronic Library, College of Engineering, Afe Babalola University, Ado-Ekiti, Nigeria as a case study. This was achieved through use of existing network with 32 Local Area Networked (LAN) systems and software traffic managers to reveal knowledge sharing due to data traffic. BWMeter was deployed to determine the maximum limit (per hour) of traffic accommodated before congestion. The network was monitored at capacity of 600MB to trigger end user's alert and reduces data speed limit to 2.5KBS, so that the internet can be surfed with ease and with a reasonable response time. Website Zapper was also installed on the LAN systems to block web access to sites that are non educative and which occupies and floods the bandwidth of the network such as pornographic sites, gambling site and online movie sites. The study adopted knowledge management concept to establish knowledge sharing (data traffic) in the College of Engineering, Afe Babalola University, Ado-Ekiti, Nigeria.**

Keywords—Bandwidth Meter; Ethernet; Knowledge Management; Traffic Density; Website Zapper

1. INTRODUCTION

Knowledge management is the deliberate and systematic coordination of an organization's people, technology, processes, and organizational structure in order to add value through reuse and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continued organizational learning [1]. Application of Knowledge Management is paramount in managing traffic density. Traffic Managers are software that monitors, record, displays and saves all traffic going out and coming into a network. With this Knowledge Management System, the difficulty faced in the network like congestion and also a sluggish network, is controlled and managed. As internet is growing exponentially
with ever-increasing web pages, full length movies, software applications, and online games, the need for an effective network traffic management. It is known that traffic density in Ethernet network application has faced the major challenges in computer networking particularly internet bandwidth etc. Analysis on dynamic density indicates that the trend could be traceable to effect of changing between the communicating parties on how the data that is to be exchanged or transmitted is to be coded. This follows that management devices could be the possible criteria which is concerned with making sure that systems integrity is maintained, continuously monitoring the status of the applications, reduce traffic configurations, overload and plan for future growth and maintenance of the network applications [2]. It became necessary to note that the concept of management of traffic density appropriate to guarantee full use (optimization), and establishment of interface that would require linking the various software to detect the specific type of traffic to allow free-flow movement in the network appliances. In contrast, transmission which is the propagation of data or information from one point to another is a critical part of any communication system. This however must be managed since the resources available may not be enough for all intending users of the system. Proper synchronization requires that signals arrive at certain periods and at certain intensity that constitute a meaning that is shared among the communicating devices on relevant intersections, define traffic situations that can be recognised through communicating devices and have identical remedies by making sure it automatically applies certain control measures. Thus, the amazing growth of traffic density on network application has resulted to the urgent need to effectively and efficiently manage the trend to combat operation in controlling the traffic to be as zero tolerance for error detection and correction and could be able to retransmit segments of data that have been

corrupted or lost in transmission to be saved and also to have a congested-free network as possible [3].
Furthermore, every user perceives the network differently and has a different set of expectations from the network. The network is not simply a physical media for information transfer. In a larger sense, the network is primarily a shared resource. When a resource such as a folder or printer is shared, access privileges and permissions are assigned to establish a policy for sharing. The policy based network access paradigm derives from the same principle. KM transforms the network into a managed resource. Centralized policy management and stateful network interface provisioning are powerful strategies to regulate networks and control traffic load for performance, efficiency and security. The rapidly emerging multimedia applications market in today's dynamic workplace has introduced serious challenges to network bandwidth on local area networks. A strategy to regulate and control the network resource efficiently is mission-critical for enterprise networks. A network bandwidth is a vital resource worthy of conservation. Managing the network efficiently often defers the need to upgrade the network and reduces costs. The 90's were a decade of abundance, as low-cost memory and faster processors promoted rapid sales of PCs to businesses and homes. As that trend curve flattens and budgets tighten, value-added services, performance enhancements and system optimizations become dominant factors with consumers. Judicious use of existing capacity and infrastructure provides better return on investment.

II. TRAFFIC MANAGERS INTEGRATION IN ETHERNET NETWORK APPLICATION

Research on previous work shows that most of the tools used for managing traffic density like PRTG, Network Sniffer, JitBit e.t.c are not compatible with all versions of windows [4]. In this work we used a software analyzer known as Bandwidth Meter which is compatible with all versions of Windows Operating System to manage traffic density in network application [5]. The unique features which supersedes its counterparts include:

· Graphical and numerical display of bandwidth
· User definable filters for measuring bandwidth
· User definable graphs to visualize bandwidth
· Can monitor all network interfaces / adapters
· Can monitor and display all traffic on the network
· Traffic control, access control and speed limits
· Creates daily, weekly, monthly and yearly statistics
· Shows statistics of other computers running BWMeter
· Alerts and notifications
· Statistics can be exported / imported
· Easy installation and configuration with default options
· Supports LAN, WAN, VPN, ADSL, xDSL, Modem, Dial-Up, etc.
· Can run as a Service (Windows 2000, XP, and 2003 only)

Web Site Zapper was also used to control Web access to sites and it is also compatible with all web browsers [6].
The importance of traffic density management to the effective use of available bandwidth of the transmission media of any network cannot be over emphasized. In the College of Engineering, Afe Babalola University Ado-Ekiti, the E-Library has increased the performance of students academically in terms of research works and also made work easier, faster for both students, academic and non-academic staff. For these reasons and many more there is the need to efficiently manage traffic density in network applications to enable the objectives of setting them up realized.

A. Network Traffic Density

Network traffic is data in a network. In computer networks, the data is encapsulated in traffic (packets). Traffic density is the amount of traffic that travels in a network or the concentration of traffic in a transmission link in relation to the bandwidth. A lot of people say that if a company says you have X amount of bandwidth, say 512 Kbs up/down, the company should allocate that amount for each customer, and not punish you for using the full amount. The problem with this view is that it is supremely wasteful. It's like you and your neighbour each having a private road from home to work. The vast majority of the time, both roads will be empty and just taking up space. A much better solution is a common road that everyone shares. Network traffic is like cars on that road. The important part here is that an individual doesn't really care who else is on the road, so long as he can get from point A to point B in a fast and efficient manner. As more and more cars appear, the road becomes more congested, and it becomes harder to use the road to full effect. In the past, whenever this happened, ISPs would add more bandwidth to the system, essentially adding an extra lane to the road, spacing out the cars once again. (Unlike real roads, extra bandwidth is often the cheapest solution.) So why don't ISPs just continue adding bandwidth? The answer lies in the nature of BitTorrent, which is the major protocol used to transfer files these days [7].

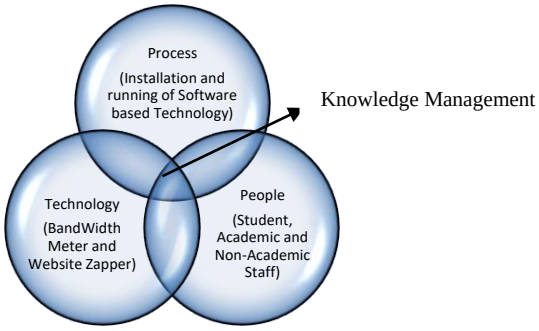

Fig. 1. Process, Technology and People

Application of Knowlwdge Management (KM) in the network will establish interaction between people (users of the network which includes students and staff), the process which is applied to support the technology and promote knowledge sharing as shown in Fig. 1.

B. Types of Network Traffic

Networks accommodate an increasingly complex set of data traffic. Identifying the type of traffic will help network administrators to facilitate the optimization of the network [8]. Various types of traffic are:

Table 1. Various Traffic Types, Example, Problem and Solution

Traffic Type	Example	Problem	Solution
Bursty Traffic	Downloads of FTP, graphic, video content	Consumes high bandwidth and Starves applications	Set constraint to limit access to bandwidth
Interactive Traffic	SSL transactions, IM, Telnet sessions	Susceptible to competition for bandwidth and results in poor response time	Prioritize over less essential traffic
Latency Sensitive Traffic	Streaming applications, Voice over IP, video conferencing	Susceptible to competition for bandwidth and results in poor response time	Set minimum and maximum bandwidth range based on priority
Non-Real Time Traffic	Email, batch processing applications	Consumes bandwidth during business hours	Schedule bandwidth during non-business hours

III. PROCESSES IDENTIFICATION AND TRAFFIC MANAGER IMPLEMENTATION

The software based tools employed in managing traffic density in network application in the conceptual view of knowledge management are Bandwidth Meter and Website Zapper.

The Process in Fig. 2 illustrates the technological approach to fuse the software based traffic managers (Bandwidth Meter and Website Zapper) into a network for knowledge implementation and sharing within the Ethernet Network. The top picture shows what surfing the network is like without traffic managers, it is always challlenging and slow as a result of congestion during the peak period where the users of the network (clients) are doing all sort of thing online from heavy downloads to uploads, online games, omline movies etc all of which congests the internet. This was addressed in the bottom picture where KM system was implemented to block uneducative sites and slow down heavy downloads and uploads to prevent the network from being bursty.

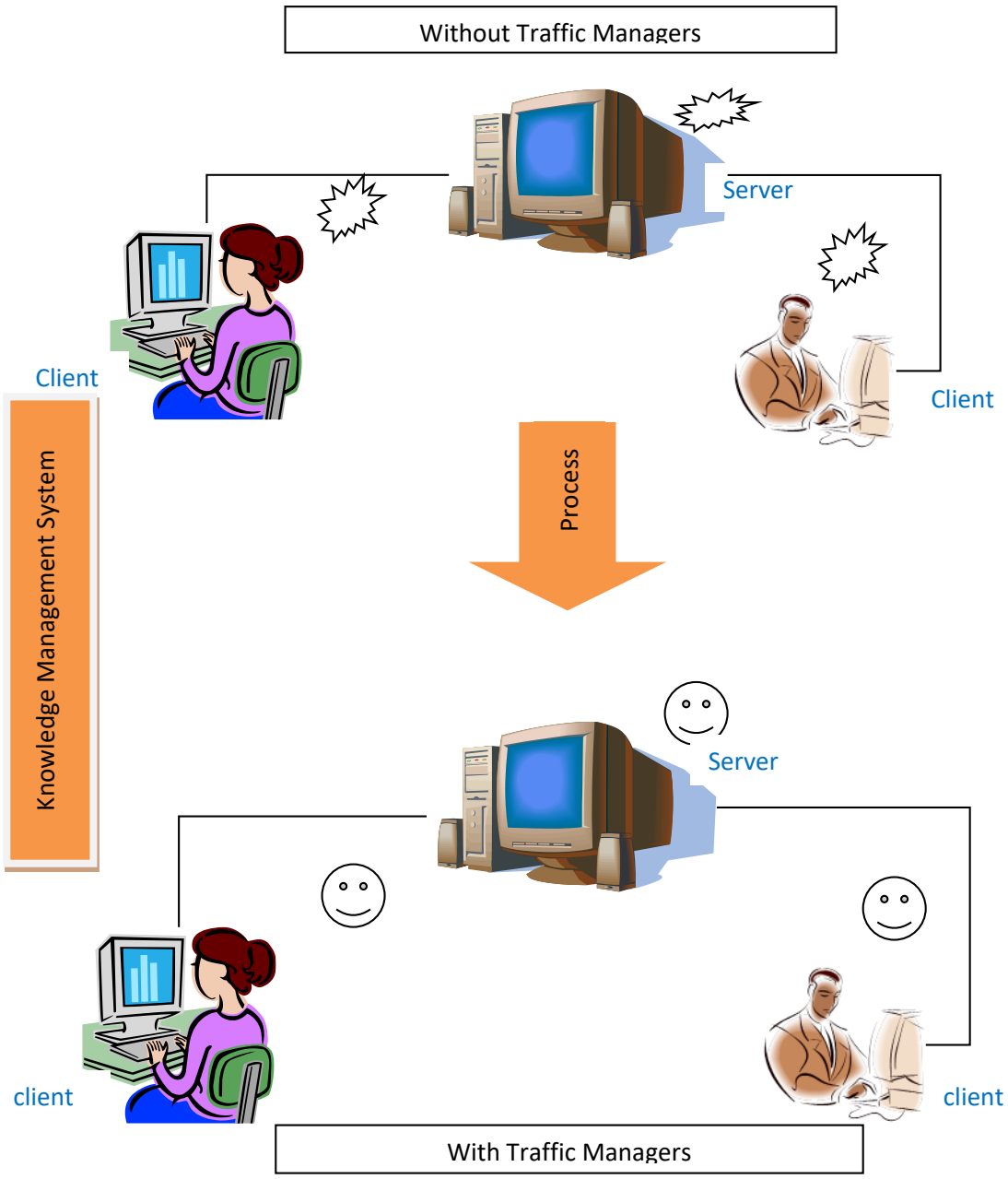

Fig. 2. Ethernet connected network showing effect of knowledge managerment system

A. BANDWIDTH METER

BWMeter is a powerful software employed to monitor, measure, display and control traffic to/from your computer on a network BWMeter is a powerful bandwidth meter, monitor and traffic controller, which measures, displays and controls all traffic to/from your computer or on your network. Unlike other products, it can analyze the data packets (where they come from, where they go, which port and protocol they use). This makes it possible to distinguish between local and internet traffic for example. BWMeter can also be used for traffic control by setting a speed limit for all kinds of connections or restricting access to certain internet sites. It creates statistics for all computers in your network, measuring and displaying all LAN traffic as well as download / upload from the internet. You can even define filters which show your transfer with certain internet addresses (e.g. to see how much data you download from your favorite news server). BWMeter is ideal for home users to get an overview of how much bandwidth they use, as well as small to large businesses, where one computer can control the traffic and maintain the statistics of downloaded / uploaded data of all computers in the network. The product is easy to configure and offers a rich set of options and features for beginners as well as experts and network administrators [5,9].

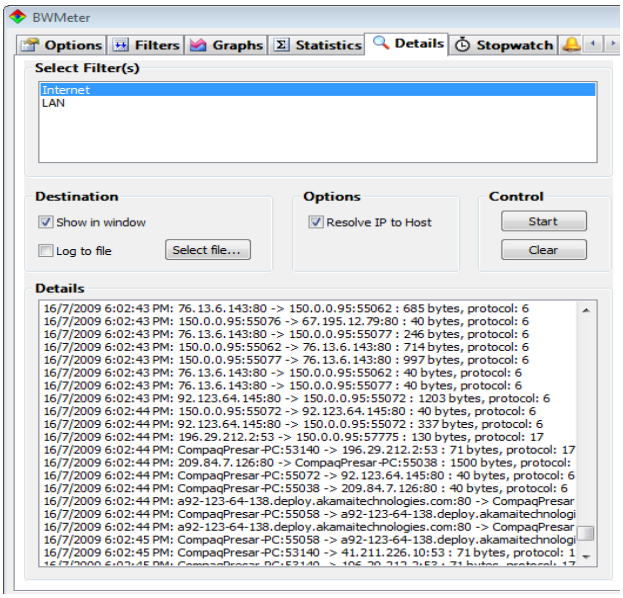

Fig. 3. Details menu of Bandwidth Meter

The details tab as shown in Figure 3 shows all network packets that are measured by the filters. It is intended as information for experienced users (e.g. to detect unwanted internet traffic). Recording each data packet is very time consuming so it takes a lot of CPU time and will slow down your network traffic if your computer is not fast enough. Therefore, it's recommended only to use the details view for special situations where it is needed.

Destination

The network packet details can be displayed in the list window and / or written to a log file. In the Destination group of options, you can choose where to send the details. The list window will display the last 512 packets. The log file doesn't have a restriction regarding the maximum size. It is only limited by the free space on your hard disk.

Options

Resolve IP to Host: If this option is selected, BWMeter will try to resolve IP addresses to host names for displaying details about network packets. E.g. "www.test.com" will be displayed instead of "208.48.34.132". This information will just be a hint and not always correct! BWMeter depends on the DNS servers of your system and these DNS servers do not always provide correct information.

Control

The control section includes a button to start recording the details. During recording, a red blinking indicator will be displayed. You can use the Clear button to clear the list window and the log file.

Details

Each line in the details list represents one data packet captured by the selected filter(s). The syntax is:
Time: Source:SPort -> Destination:DPort : x bytes, protocol: p
Time: date and time when the packet was captured.
Source: address or host computer where the packet comes from, SPort is the source port number.
Destination: address or host computer where the packet goes to
DPort: destination port number
x: length of the data packet in bytes and,
p: protocol number used.

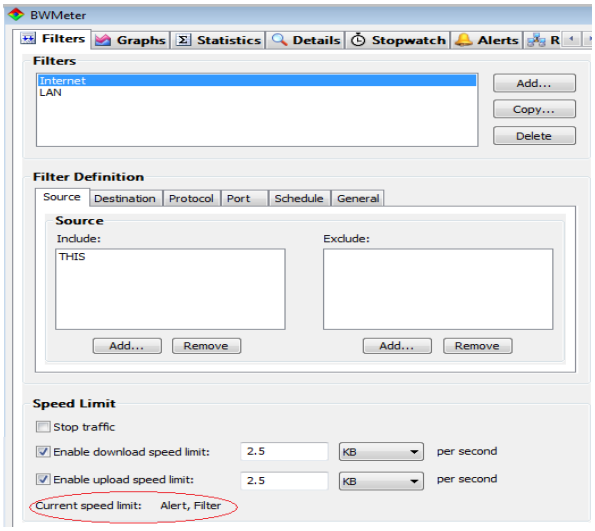

Fig. 4. Setting speed limit in Bandwidth Meter

This speed limit option as shown in Fig. 4 is very useful to restrict the traffic to a certain amount. , so that reading emails etc. will still be possible without exceeding the maximum allowed bandwidth. Or you can simply stop the traffic completely when the limit is reached.

B. Website Zapper

Furthermore a software program called Website Zapper was used in conjunction with BWMeter to control Web access, it closes Web browsers and is used to prevent students, employees or any person from going to undesirable sites, such as pornographic sites, gambling sites or sites where heavy applications such as movies, music, or games can be downloaded from all of which floods and congests the bandwidth of the network [10].
Website Zapper was also used to restrict web access by adding new site titles and/or URLs to your list, modify existing titles or URLs on your list, or delete titles or URLs from the list completely as shown in Fig. 5.

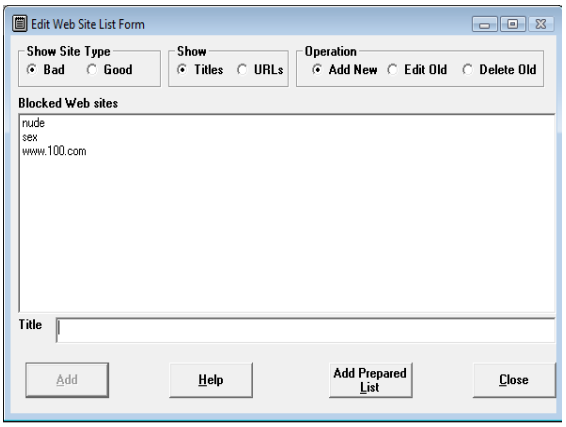

Fig. 5. Website Zapper Edit Form

IV. ANALYSIS

The transfer rate of traffics are high during the morning hours and average during the mid-day and low during sunset (evening hours). In the morning hours, the number of users on the network are few, traffic density is "low" and the speed is "high" resulting in a traffic state that is characterized as "free". In the afternoon when the number of users increases and sites containing interactive traffics are visited, traffic density is "not very high" and the speed is "medium" this results in a "crawling" traffic state. Towards sunset (evening) when the number of users is in its maximum, and sites where heavy downloads like movies, music, games etc. are done, activities involving voice conferencing, FTP graphics, streaming applications; all of which consumes high bandwidth and starves application which results in a traffic state characterized as "congested".

It was observed that in the morning hours when the traffic state is "free", the sum of the download and upload is within the range of 50MB-300MB within an hour, in the afternoon hours when the traffic state is "crawling", the sum of download and upload is within 350MB-550MB, and in the evening hours when the traffic state is "congested", the sum of download and upload is within 600MB-800MB.

BWMeter was set such that when the sum of download and upload reached 600MB the speed limit of the download + upload is reduced to 2.5KB/s so that normal surfing of the internet can be made without constraint as shown in Fig. 6. An alert will be triggered prompting the user of the LAN system of the adopted measure.

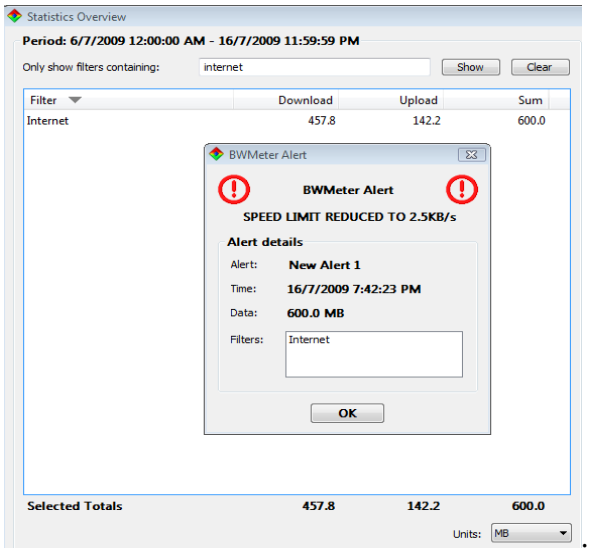

Fig. 6. Bandwidth Meter Alert

The second software as shown in Fig. 7 (Website Zapper) was configured to block access to sites where heavy unnecessary downloads are done as well as restrict access to sex, nude sites etc. whenever restricted sites are attempted to be accessed, the webpage is blocked and the screen pops-up an alert.

Fig. 7. Website Zapper Alert

When these changes were made and administered, whenever download & upload gets to 600MB per hour, the average transfer rate increases instead of decreasing as it used to. The average transfer rate is between 16-30KB/s which implies that the speed is "medium" and therefore the traffic state becomes "crawling" and the internet can be surfed without constraint.

V. CHALLENGES OF TRAFFIC MANAGERS AND KNOWLEDGE MANAGEMENT

The challenge of knowledge management in bandwidth and traffic density management in an Ethernet network.

a) Knowledge management system training**;** These software based systems can be complex to understand.

It is important that network administrator(s) are fully trained on how to implement and use these software based technology so that they collect and record the right data which will be needed to effectively manage the bandwidth and traffic density of the network.

b) Knowledge management system cost: It can be very expensive to install traffic mangers in a very big organization. Let's say that an organization has over 50 LAN systems and they want them to access the traffic in and out of the network from a centralized location (server). They will have to create a strong data base which will handle all the traffic density made by each client (user) in a minute.

VI. CONCLUSION

Knowledge management is the concept under which information is turned into actionable
knowledge and made available effortlessly in a usable form to the people who can apply it As in this paper it is applied to an Ethernet network application which collectively managed the traffic density. This means that even if additional bandwidth is added to the network and it is not properly managed then that is no solution. Based on the findings of this analysis, it was concluded that the best measure to take in managing traffic density in conceptual vie of knowledge management is setting a limit on the BWMeter (this limit should such that whenever it is exceeded, the traffic state is "congested"), so that when it gets to that point, the speed limit of the download/ upload that caused the congestion of the network is reduced to a limit so that the network will be less congested and usual surfing of the network can be possible with a reasonable response time.
In addition to this, Website Zapper was also adopted to restrict internet access to non-educative and pornographic site which are huge sources of traffic congestion.
With these measures adopted, the bandwidth of the transmission media was able to be used effectively.

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