DEVELOPMENT OF NETWORK CONGESTED ALERT SYSTEM (NetCAS)

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Abstract

As the power of computer network increased, the potential problems on the existing network are often seen to expand. There are many factors that do affect the performance of the network such as the security embedded on it, Quality of Service (QOS) used and also technology applied. One of the network QOS concern is congestion. It may happen due to security attack on network, inadequate network capacity or may be network physical problem. It seems impossible for a network administrator to monitor the network all the time. Therefore, a system called *Network Congested Alert System* (NetCAS) is developed to ease the burden of network administrator in monitoring the network traffic. NetCAS has the capability in identifying which resource has problem using *ping* method. Once detected, NetCAS able to notify the network administration automatically through Short Messaging Service (SMS) technology.

Keywords: Network security, Quality of Service, congestion control.

1. Introduction

The world becomes more sophisticated where everything can be accessed easily, precisely and perfectly in a very fast time using super powerful network communication. Computer Networking is the global infrastructure for the 21st century where Internet is widely being used in communication, business, education, medical and others field. Consequently, the Internet is become very important in our life as the daily businesses is also much depend on the online services.

High demand of Internet drives to the higher demand of network bandwidth. Insufficient bandwidth or memory will cause congestion to the network and degrades the network performance. Therefore, network administrator is needed to monitor the traffic of network in order to ensure all the reliability of data transmitted.

At UTHM, software called Multi Router Traffic Grapher (MRTG) is used to monitor and measured the traffic load and network usage on campus network. But then, the network administrator has to check every single graph in every minute or hour to ensure that the network usage is not exceeding the critical phase of the line capability. If the network usage is exceeding its limit, network administrator has to check and recover that problem. During at this stage the network is already down.

To convalesce the network, the administrator will filter out all the streaming videos, certain websites that are not really useful to surf in working hours and use a huge bandwidth, and also image with large size. The network administrator also can either stop or allow the network flow. Stopping the network traffic usually will resolve the congestion over the network by control list access or terminate the source.

To avoid from the network being congested, there a few choices to be deal with. First is increased network bandwidth by using huge media capacity. The second one is by applying congestion control mechanism. Generally this mechanism is divided into 2 categories: open loop congestion control (prevention technique) and close loop congestion control (removal technique). These mechanisms are mainly about applying policy into network [1].

However, how do if the system is congested then. It will be more vulnerable if it happens after working hour or when the network administrator is not around. So do this research is all about. A system called *Network Congested Alert System* (NetCAS) is developed to help the network administrator increased the working efficiency in monitoring the network. It is intelligent enough to detect congested link or resource and do inform network administrator immediately for quick remedy action.

The rest of the paper is organized as follows. The next section is discussing about the related work due to this research. Followed by discussion regarding the relation of congestion control and quality of service (QoS). The paper also wills discuss the methodology and design of the system. At the end the paper is conclude with the conclusion.

2. Related works

There are several open-source and commercial network monitoring tools. The most closely related to NetCAS are ANEMOS [2], *PingER* [3] and the *Network Weather Service* [4].

An *Autonomous NEtwork MOnitoring System* (ANEMOS) [2] is a tool that allows network operators and end-users to schedule, perform, and analyze active measurements on several network paths through a Web-based GUI. The measurements can be performed with "off-the-shelf" tools, such as Ping. The current prototype measures end-to-end available bandwidth with *Pathload*, and round-trip delays and losses with a UDP-based configurable variation of Ping. *PingER* [3] is a tool uses *Ping* to measure RTTs and loss rates to hundreds of hosts around the world. *PingER* provides performance information and long-term trends about many different geographical areas of the Internet. The *Network Weather Service* [4] is a distributed system that periodically monitors and dynamically forecasts the performance of various network and computational resources.

3. QoS and Congestion Control

With the ever-increasing reliance on network services, the smallest change in network usage can give visible impact on network performance and reliability. This has a direct impact on the ability to conduct key business functions and on the cost of maintaining network services.

Networks interconnect hosts using a variety of network devices, including host network adapters, routers, switches, and hubs. Each of these contains network interfaces. The interfaces interconnect the various devices via cables and fibers. Network devices generally use a combination of hardware and software to forward traffic from one interface to another. Each interface can send and receive traffic at a finite rate. If the rate at which traffic is directed to an interface exceeds the rate at which the interface can forward the traffic onward, then congestion occurs.

According to [5], congestion management has three aspects: *prevention, avoidance, recovery.* Congestion prevention involves designing and building a network that minimizes the probability of being congested. Congestion recovery is action taken by the network after performance degradation is detected to limit the effects of congestion. Congestion avoidance is an important tool for improving the performance and Quality of Service (QoS) of the Internet [6]. It depends on the action taken by the network before performance degradation occurs, to reduce the chance of congestion.

Network QoS refers to the ability of the network to handle network traffic such that it meets the service needs of certain applications. This requires fundamental traffic handling mechanisms in the network, the ability to identify traffic that is entitled to these mechanisms and the ability to control these mechanisms. Different applications have different requirements regarding the handling of their traffic in the network. These requirements are expressed using the QoS-related parameters; bandwidths, latency, jitter and lost.

In [7], the authors suggest that user has to have the option of paying for different range of QoS. These different prices named congestion pricing the user has to pay extra for a higher QoS, even though performance in an unloaded network may a little bit differ with the service level. Author in [8] suggest quite similar scheme called Dynamic Pricing scheme. The Dynamic Pricing scheme charges are depends on the network load; it can be very high when congestion occurs, vice versa. This will encourage users to use resources more efficient.

Multipath routing technique is suggested by [9] in order to improve TCP reordering robustness. The multipath routing not only does balance the load over wired networks, but also it provides better performance in congestion and capacity over mobile ad-hoc networks. While [10] proposed a drop based congestion control mechanism using fuzzy technique approach specially designed for the Differentiated Services (DS) networks. A drop based congestion controller only first control/drop the admission for packets with the lowest service precedence at a core node of the DS networks. It also applied for those who have a higher service precedence to ensure a good performance for some certain criteria. Learning techniques using simple feed forward neural network introduced by [11] is also a proposed technique used to predict the network congestion problems before it start impacting the performance of services. It predicts the suspected source for the congestion.

4. Methodology of NetCAS

It is important to understand the methodology used in the project that contribute to the development of the project. The methodology is emphasizing on the development of network congest alerting system The methodology of this project divided into three main phases which are accumulation of information, constructing hardware circuits and developing software programming. These phases are carried out systematically in order to come out with a stable system.

Figure 1 shows the block diagram of the NetCAS. The system is developed using Visual Basic 6.0. The system is intelligent enough to detect network congested by using a ping method. Ping method is actually a manual method to check either the certain server is congested or not by typing the Internet Protocol (IP) address of the server.

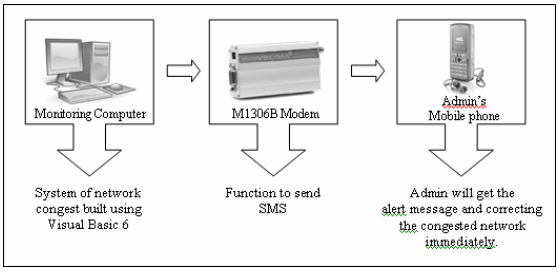

Figure 1. Block diagram of the NetCAS

A database is developed in the NetCAS consisting of a full list of IP address for servers and resource in assured Local Area Network. Then NetCAS will 'ping' all these IP address every second and immediately send alert SMS to admin once it detect congestion on that resource. If something happen such as reply buffer was too small, destination network/host/port was unreachable, hardware error occurred, packet was too big or may be request timed out it will be detected by the system. NetCAS will process this information and pass command using HyperTerminal code to send SMS to network administrator via modem. The SMS is send by using local mobile telephone services such as MAXIS, CELCOM and DIGI.

5. System Design

The interface and system of NetCAS is developed using Visual Basic 6.0. Rather than that it was being combining with HyperTerminal as a tool for communication using modem.

NetCAS has a Login form in such a way to protect its confidentiality. This form is the first form to be complete by network administrator for authentication and running the NetCAS system as well. Figure 2 shows the login form for NetCAS.

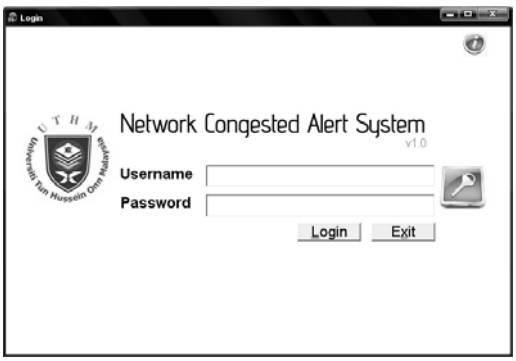

Figure 2. Login form of NetCAS

Then, the available COM ports and the GSM modem are checked. Network admin has to select the right COM port before this system can be used. The process and status list can be seen on the system display. Figure 3 shows the checking form of NetCAS.

Once the Start button is clicked at the Checking Form, the NetCAS will automatically ping the server's IP addresses. The system will also check the request time out of that IP, the byte size and display the problem detected. Figure 4 show the display box during processing time.

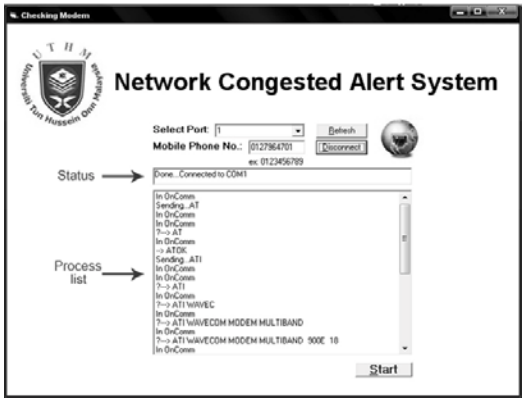

Figure 3. Checking Form of NetCAS

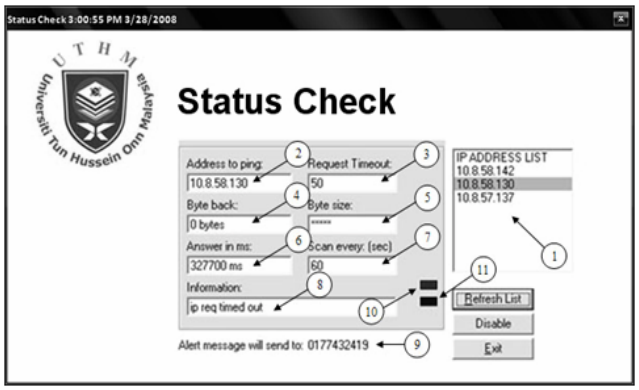

Figure 4. Status Check Form

Listed below are the description numbers in Figure 4:

1 – This is the list of IP addresses to ping. The highlighted IP address is the congested server during the test.

2 – The current IP address that being pinged is shown here.

3 – A timeout in millisecond to wait for each reply.

4 – This indicates the byte that response after the system ping its IP address. System will send an alert message when the byte gets 0 bytes which mean no response from server or server is congested.

5 – The size of byte that response after the system ping its IP address.

6 – An answer of round-trip time to the host, giving some indication of how 'far away' that host is which is measured in millisecond.

7 – User can set how frequent in a second for a program to ping back the first IP address [12] after all IP addresses has been ping. Then, alert message will be sent for the first IP congested loop. However, the next message will not be sent if the IP has been repaired in the first loop.

8 – The description of current pinging IP addresses [13].

9 – The alert message will be sent to the number displayed from the Checking Form [14].

10 – An action shape to show the current pinging IP address status. It will show in green of color if the current pinging IP address is in good condition or shown as 'IP success' in Information box. The color green will turn to red if the status of IP address is other than 'IP success' to indicate there is a problem in that IP address.

11 – A warning for each IP address that has been pinged by changing its color from black to red.

When the NetCAS detecting problem occurred in network, an alert message is automatically sent to network administrator's mobile phone and its display is as shown in Figure 5.

Figure 5. Alert message received at network administrator's hand phone

6. Conclusion

NetCAS is developed using a concept of IP address pinging method through a command prompt in normal computer. The system will automatically ping the listed IP address. As a result, it will increase the job efficiency of network administrator hence scratch down the time detecting network problem. Currently the system now is on second stage where NetCAS can accept remote command from network administrator to solve the problem. Thus NetCAS can automatically repair the network congested once it has been detected.

7. References

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