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Bandwidth Monitoring Tools

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Abstract -***The word bandwidth is often used as a synonym for data transfer rate within computer network and it refers to the amount of data communication resources available or consumed. It is usually expressed in bits per second or multiples of it. In case of internet, the actual bandwidth provided for the data transfer is much less as compared to its theoretical value that is being claimed, hence making the data transfer much slower and of poor quality. To overcome this problem there is a need of continuous monitoring of the ISP's connectivity so that poor performance can be immediately reported. This can only be achieved by an automatic bandwidth monitoring tool with the ability to log the bandwidth usage all the time and generate the report as desired. The paper presents the details of the various available tools for the purpose as well as an in-house developed Bandwidth Monitoring Tool that performs the similar tasks with a user friendly interface.***

Keywords: ISP, ADSL, GUI, Bit-rate, SSL, NMS

1. Introduction

Bandwidth Monitoring Tool refers to an application program that analyses the network traffic, and generates a report about the amount of data flowing through the network or a particular part of it based upon its analysis. A Bandwidth Monitoring Tool can provide the users with real time network traffic and can be used by the network administrators to render quality service to their organizations.

2. Various bandwidth monitoring tools

2.1 IPerf

Iperf [3] is a popular open source network monitoring application with the ability to create TCP and UDP data streams and analyze the throughput of the network that is under observation.

Iperf facilitates its users with the ability to set various input parameters that are used to test a network, or for the purpose of optimization or tuning a network. Iperf is based upon client - server architecture, and measures the throughput between two terminals, either in half-duplex or full-duplex mode. It is designed to run over various platforms including Windows, UNIX and Linux.

- *UDP*: The software facilitates its users to specify the datagram size and provides the information about the datagram throughput along with the information about the lost packets when implemented for testing UDP capacity.
- *TCP*: Iperf analyses the turnout of the payload when implemented for testing the capacity of TCP. It uses 1024*1024 for megabytes and 1000*1000 for megabits.

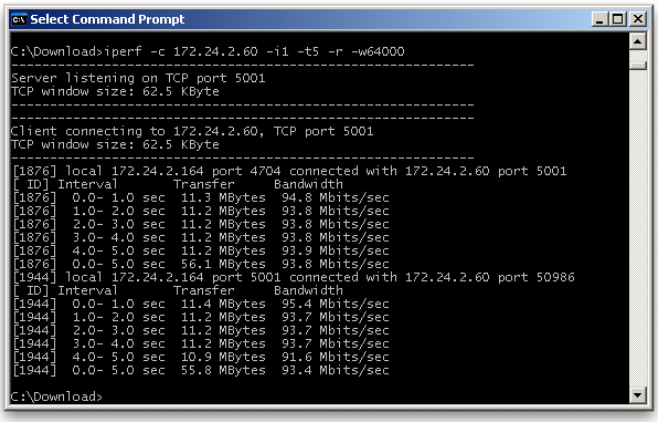

Fig.1 CLI of IPerf

2.2 BandwidthMonitor

Bandwidth Monitor [4] is a proprietary based network monitoring tool that has a free trial period of 30 days after which a certain fee has to be paid for further use of the software. The software measures the bandwidth usages through the stand alone system it's installed on. It provides with the real-time download and upload statistics in graphical, as well as numerical formats, records bandwidth usages, and also provides reports

on daily, weekly and monthly bandwidth consumption. It monitors all the available network connections including LAN network connection, Internet network connection, and VPN connection found on a system. It also provides some of the enhanced feature like speeds stopwatch, transfer rates recorder, and bandwidth usage notification along with the software supports running as a system service with the ability to monitor the system and generate the report automatically.

Bandwidth Monitor is compatible with most of the network connections including modem, ISDN, DSL, ADSL, cable modem, Ethernet cards, wireless, VPN, etc and can be used over a wide range of platforms including Windows 98, Windows Me, Windows NT 4.0, Windows 2000, Windows XP, Windows 2003, Windows Vista, and Windows 7.

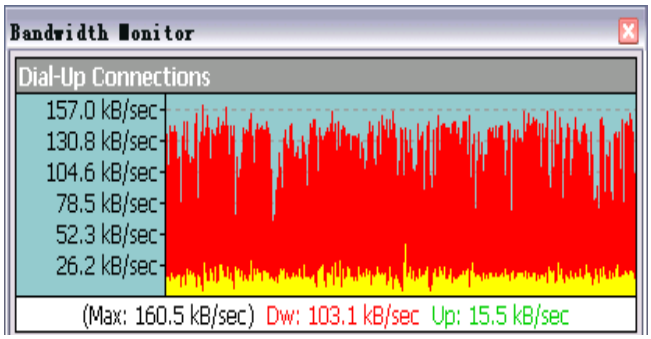

Fig.2 UI of Bandwidth Monitor

2.2.1 Working of Bandwidth monitor

- Bandwidth Monitor identifies the network connections available on computer on which it is installed and monitors the bandwidth over those connections
- Displays real-time download and upload statistics.
- It displays bandwidth usage reports on daily, weekly & monthly basis.
- The software notifies the user from crossing the bandwidth caps.

2.2.2 Features of bandwidth monitor

- Monitors Network bandwidth
- Monitors Internet and broadband bandwidth
- Displays Real-time network traffic numerically and graphically
- Supports **multiple** network connections at the same time
- Runs as a system service and automatically generates reports by analyzing the network traffic
- It provides Speed rates scale
- Supports most of the connections including modem, ISDN, DSL, ADSL, cable modem, wireless network cards, Ethernet cards, VPN, etc
- Scalable to a specific modem's download capabilities
- Displays results in either KB/sec (kilobytes per second) or kbps (kilobits per second)
- Provides **stopwatch** for Download and upload speeds
- Supports color and font customization
- Displays real-time network traffic graph in system tray
- Displays time in traffic graph
- Displays **average** download and upload in traffic graph
- Supports complete window configuration and view options
- Utilizes minimal system resources
- Supports Windows 98, Windows Me, Windows NT 4.0, Windows 2000, Windows XP, Windows 2003, Windows Vista, and Windows 7

2.3 Paessler Router Traffic Grapher (PRTG)

Paessler Router Traffic Grapher[5] is a network monitoring software for Microsoft Windows that has been developed by Paessler AG as a proprietary software that has a trial period of 30 days after which a certain license fee and annual software maintenance fee has to be paid. It has the ability to monitor bandwidth usage within a network and classify them using SNMP, Packet Sniffing and Net flow.

It collects and analyses various statistics from the designated machines, software, and devices.

PRTG supports almost all the devices over the network along with multiple protocols for collecting the data that includes

- SNMP[6] and WMI
- Packet Sniffing
- NetFlow, jFlow, and sFlow

It is compatible with a large number of windows based systems that includes: Windows 98, Windows Me, Windows NT 4.0, Windows 2000, Windows XP, Windows 2003, Windows Vista, and Windows 7

2.3.1 Working of PRTG

PRTG Network Monitor comprises of various parts that are divided into three main categories:

- System parts: It is installed on the system as a client.
- Control interfaces: It acts as middleware and controls and monitors the data flow.
- Basic administration interfaces: Used by administrator to monitor the devices.

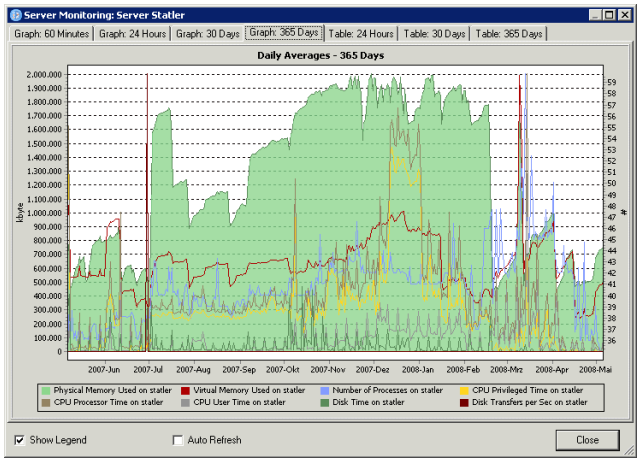

Fig.3 UI of PRTG

2.3.2 Features of PRTG

- It is a web browser based Interface with AJAX based web site
- HTML based interface for compatibility with older browsers and mobile devices (runs on IE 6/7/8, iPhone, Android, Blackberry)
- Provides the facility of viewing and monitoring data of other PRTG installations within single application.
- SSL-secured local and remote access that can be used simultaneously for More than 130 sensor types covering all aspects of network monitoring
- Upload time/Download time Monitoring
- Monitors Bandwidth using SNMP, WMI, NetFlow, sFlow, jFlow, Packet Sniffing
- Monitors Virtual Server
- SLA monitoring
- QoS Monitoring (e.g. when using VoIP)
- Monitors LAN, WAN, VPN, as well as Multiple Sites
- Supports IPv6
- Supports Agent-less monitoring that makes the monitoring possible even for deeper metrics
- Supports 9 notification technologies including Email sending, SMS/Pager, syslog and SNMP Trap, HTTP request, Event log entry, Play alarm sound files, Amazon SNS, any external technology that can be triggered using an EXE or batch file
- Provides system health alerts for up, down & critical
- Provides Threshold alerts (above/below x for y minutes)
- Multiple condition alerts (x and y are down)
- Supports Dependencies to avoid alarm floods
- Acknowledge Alarms (no more notifications for this alarm)
- Supports Alert Scheduling to avoid any low priority alerts at night.

- PRTG can monitor upto 20,000 sensors per installation.
- Paessler's proprietary database system is being optimized to facilitate data monitoring which is accessible through API.
- It is faster than SQL servers and consumes less CPU.
- Can store data for years for thousands of sensors
- Needs very less system resources so that even Netbook can monitor up to 1,500 sensors
- High loads are distributed using Multiple Probes
- SSL encryption based Multi site monitoring for probe and cluster connections

3. NET Monitor: An In-House Developed Bandwidth Monitoring Tool

NET Monitor is a GUI based software program developed in Visual Basic 6.0 by Abhishek Sinha[I] under Mr. Nishant Kumar [II] at Defence Scientific Information & Documentation Centre (DESIDOC), Defence Research and Development Organization, Delhi as a six weeks industrial training project. The main aim of the development of the software was to provide the organization with a permanent solution for monitoring the ISP's connection with the minimum utilization of resources, cost and manpower.

3.1 Working of NET Monitor

A network device stores and updates statistics counters. Using an optimal counter management algorithm minimizes required SRAM size and ensures correct line-rate operation for many counters.

Packet switches (that is, IP routers and ATM and Ethernet switches) maintain statistics for performance monitoring, network management, security, network tracing, and traffic engineering. Counters usually collect such statistics as the number of arrivals of a specific packet type or they count a particular event, such as when the network drops a packet. A packet's arrival can lead to the updating of several different statistics counters.

The number of statistics counters in a network device and their rate of update are often limited by memory technology. On-chip registers or SRAM (on- or off-chip) can hold a few counters. Often, a network device has to maintain many counters and therefore must store them in off-chip DRAM. But the large random access times of DRAMs make their use difficult when supporting high-bandwidth links. The time it takes to read, update, and write a single counter would be too long and worse still, each arriving packet can trigger the update of multiple counters. To alleviate these problems, we use a well known architecture for storing and updating statistics counters. This approach maintains smaller-size counters in fast (potentially on chip)

SRAM, while maintaining full-size counters in a large, slower DRAM. Our goal is to ensure that the system always correctly maintains counter values at line rate. An optimal counter management algorithm (CMA) minimizes the required SRAM size while ensuring correct line-rate operation for a large number of counters.

Many routers (and other equipment) are equipped with counters. With SNMP we read such a counter using the NET monitor, wait for five minutes, and then read the counter again. In normal circumstances the counter will increase by a certain amount. Network bandwidth is usually measured per second. By dividing the five-minute increase by 300 (the number of seconds in five minutes) we get the bandwidth. The monitoring software calculates the rate and displays it as an image. Real time measurement provides a historic view of the rate changing over time.

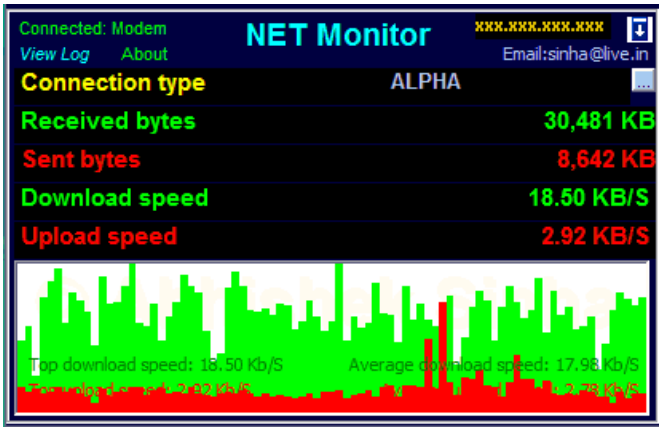

Fig.5 UI of NET Monitor

3.2 Features of NET Monitor

The developed system has the following advantages over the existing system:

1. Since it is in compiled form, hence no need of compiler to compile it.
2. It extremely small in size (i.e. 148 KB).
1. It doesn't require installation of any third party software for its functioning.
2. Automatically detects network connectivity status.
3. Automatically detects network connection type.
4. Monitors the download and upload speed of the network in real time.
5. Displays Average Download and Upload speed.
6. Displays Maximum download and Upload speed.
7. Logs the data automatically.
8. Numerical and graphical display of the monitored results.
9. Requires very less CPU and memory resources.
10. Provides accurate results

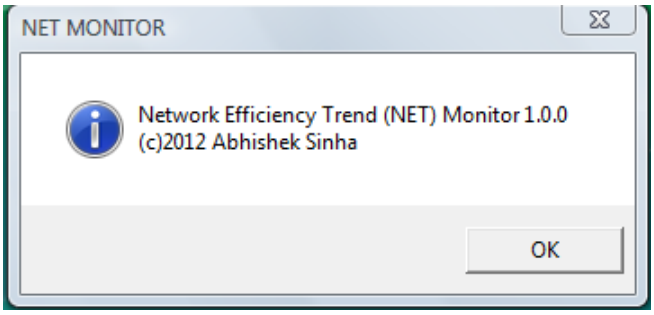

Fig 4 Information about NET Monitor

4. Conclusion

According to the analysis and reports generated by various bandwidth monitoring tools, PRTG and NET Monitor (Developed System) were found to be most user friendly and easy to configure with minimum utilization of the resources and also provided with the desired and accurate output.

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5. About Authors

Abhishek Sinha is a student of B.Tech in Computer Science and Engineering from Sri Sukhmani Institute of Engineering and Technology, Dera Bassi, Punjab. His research and scientific interests focus on data security in information systems and cryptology, especially methods of designing of cryptographic algorithms.

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