# Design and Implementation of SNMP based Network Device Monitoring System

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*Abstract*---The network reliability and security is required for the promotion of business and internet development. This paper Design and Implementation of SNMP based Device Monitoring System in a network monitors the status of networking equipment, display various indicators of the network devices after failure which automatically gives alarm to network administrator.

*Keywords- SNMP; networking equipment; monitoring system*

## I. INTRODUCTION

The effective monitoring and management of network devices has become a problem to build the internal network of large and medium sized enterprises with the rapid development of computer network technology. The business quality is affected by network equipment, server and application performance status.

The enterprises suffer due to network device or server failure which affects normal services. So, it is necessary to design a real-time network devices monitoring system which provides network administrators ,a convenient way to view the status information of the network equipment to ensure normal and stable service.

## II. SNMP ARCHITECTURE

### A. SNMP structure model

Simple Network Management Protocol (SNMP)[1][2] architecture is divided into three parts: managed devices, SNMP manager and SNMP agent. The SNMP architecture is like  Figure 1.A managed device is one of the network nodes, sometime called network element, it can be router, switch and other equipment support SNMP protocol [1].
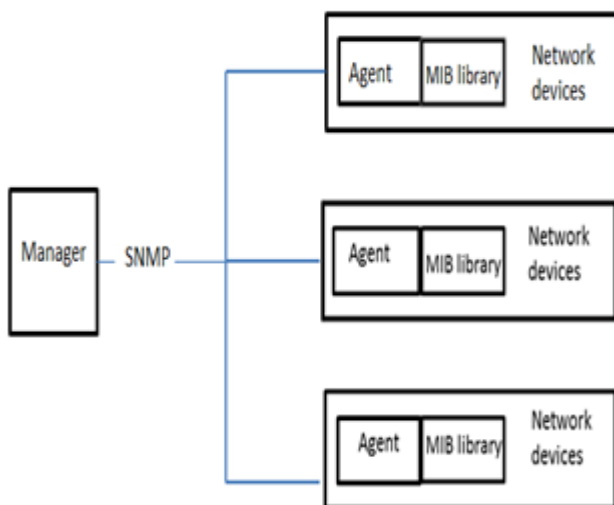


Figure 1: SNMP architecture

The network devices are managed by SNMP manager through  the  network  management  software.  The  network management software helps network administrators to manage network  devices.  Network  management  software  requires SNMP manager to regularly collect important information of the device [10]. The information collected will be used to determine the state of independent network equipment, part of the network or the entire network to ensure the state is normal. The SNMP manager regularly inquires the relevant equipment running status, configuration and performance information from  the network devices' agent.

The SNMP Agent is a network management software module that  resides  on  a  managed  device.  The  local  device management information is collected by SNMP agent and it translates that information into the form compatible with SNMP protocol [5].

### B. SNMP MIB

The way of managing network resources is the object to represent the particular aspect of the resource, the collection of  these  objects  form  the  Management  Information  Base (MIB) . Management station complete monitoring and control function through reading and set the value of the MIB objects. The backbone devices agents maintain a MIB to reflect on the node of managed resources status. Network management entity can monitor the node  by reading object value in the MIB, and can control the resources by modifying the value of the object [2].
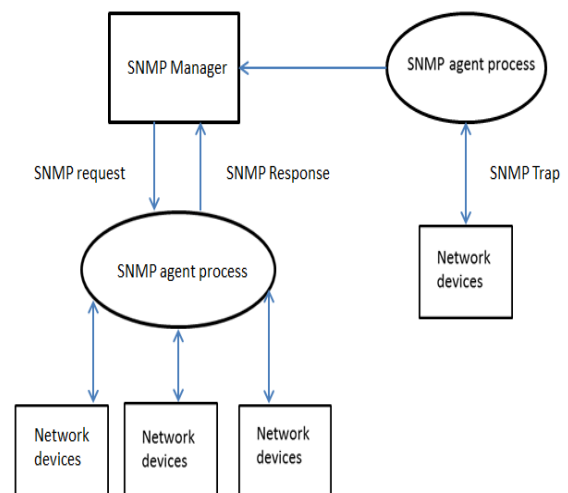
### C. SNMP polling algorithm



Figure 2: Packets transfer relationship between manager and agent

SNMP collects network device data information by using self-trapping polling method. Generally the network management workstation  collects  data  information  by  sending  the GetRequest and GetNextRequest packets polling managed devices' agent, Agents will response GetResponse message, this information display on the console through numeric or graphical representation which provides the working status of network devices, networks traffic analysis and management capabilities.  The  management  agent  can  also  produce  Trap

message to administrators reporting the major changes of MIB and other important events when managed devices appear abnormal state [7]. When a network device generates a self trap, the networks administrator can use the networks management station to query the status of the device, in order to get more information. Packets transfer relationship between manager and agent as shown in Figure 2.

## II. SYSTEM DESIGN

### A. System architecture

Based on SNMP network monitor system design of the network, the main goal is to realize the network topology management, network performance management, network event management, able to show in graphical representation form to show each management operation interface. The system has data collection layer, data processing layer and data application layer [6]. The first layer is the data collection layer. uses the SNMP protocol to communicate with the managed devices and collects the MIB information to ensure the integrity of the data collection; the second layer is the data processing layer, completes data calculation, storage, arrangement and organization; the third layer is the application layer for graphical interface, facing the administrator, the network topology display, network performance analysis results display, alarm events management operation and network event management and display. The function of the system module can be divided into two systems:

a) *Networks data communication system*, it is the basis and core of this system which solves the SNMP protocol, UDP protocol, IP protocol communication problem. The first and the second layers are the network data communication subsystem[4].

b) *User interface system*, The user interface system provides a friendly interface form for the user to use and provides all functions of the application by visible operational operator interface .The third layer is the user interface system. The overall system design is shown in Figure 3
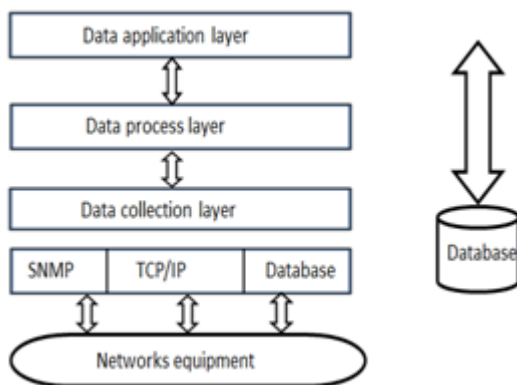


Figure 3.The overall system design

There are two main structural model of distributed systems: client/server (referred to as the C/S) model and browser/server (referred to as the B / S) model. The C/S model has higher security requirements, communication ability, relatively fixed location, small computer distribution;

The B/S model is suitable for wider ranged user, locations flexible, frequent changes in function, but safety and interactivity less demanding conditions. This paper proposes the system design, the application conditions to determine the various parts of the system based on C/S model or the B/S model. The SNMP protocol is executed by the C/S module

from the network device. In real time it reads the required data and stores the read data into the database. The user interface system adopts the B/S structure, the browser proposes data requirements to the Web Server according to the various requirements of the use.

### B. System functional description

#### a) Collect performance data on the managed devices

The collection of data about real-time status of managed devices on the network monitoring system is crucial. Through the server collects the network devices data which can be real-time monitoring data of network equipment state. The data collection module can collect real time data, display performance status of managed devices , also collect information on time and save it.

#### b) Performance information analysis processing

System is using formula analysis calculation for real time data to determine the utilization of the network, etc. Professional analysis tools can be used for network trend analysis of historical data. Historical data network operation status can be used to predict peak network usage, thus avoiding network saturation may bring low performance[3].

#### c) Alarm function

The abnormal performances of the system issues a warning. Before the user pays attention to warning, system can become active and find preventive network and the application may appear to problem places to help prevent performance down.

### C. Network data communication system design

The network data communication  system design has  two parts: data collection and data analysis. The data collection module is a critical part in the whole network device monitoring system and it is the first part of the network device monitoring process and the foundation of business processing, data storage and other follow-up links. No data collection, network device monitoring system will lose the sources of information. he importance of the data collected decision must be taken into account in the design of the module to achieve high real-time, high reliability, so that the accuracy of data collection, real-time,  high-key factors affect the performance monitoring system performance. The data analysis is a new collection of data for timely analysis and compare network performance thresholds set in the system[9].

### D. The user interface system design

In the design of the client browser-based system, the browser side program provides the functionality to authenticate users in order to ensure that only authorized users can view the device information. The browser side program provides the functionality to authenticate users. Users must authenticate before using the system. Through certification, they can see list of equipment within the scope of authorization. Each entry in the list is the hyperlink to get the query results when the user clicks on a link, the browser-side program will interact with the server-side program. The design difficulty lies in how to implement the program of browser-side communication with the server-side program, we establish Socket between them for communication. Since both programs are installed on the same computer, so we use the IP address of the loopback address (127.0.0.1) as Socket connection. Using the loopback address communication, data is not transmitted on the network; it can guarantee the security of communication. In addition, both

programs also need to specify a common port as the Socket connection port can be any one of the free high-end port (port number 1024) port[8].

## III. SYSTEM IMPLEMENTATION

In this paper, Based on the network equipment monitoring system using SNMP, the system has been run in a real environment, this system is deployed in a large IP network, capable of real-time monitoring of the entire network device status information. A network device data collection run results is like as Figure 4.
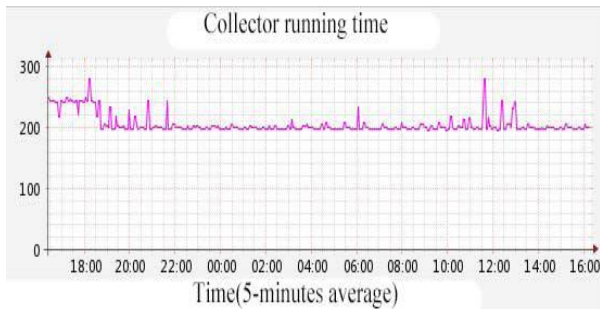


Figure 4: Collector running time

The CPU utilization is depicted in Figure 5 that the network devices monitoring system gathers a device CPU usage each period of the day.
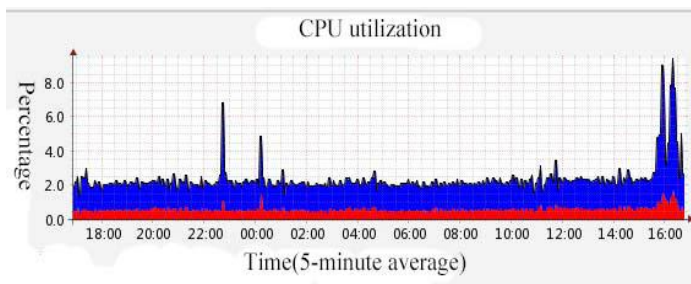


Figure 5: CPU utilization

Network monitoring system also can get the memory utilization of the network devices and the device network traffic areshown in Figure6 and Figure7.
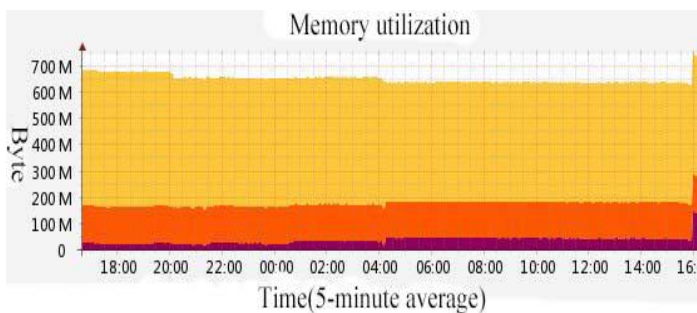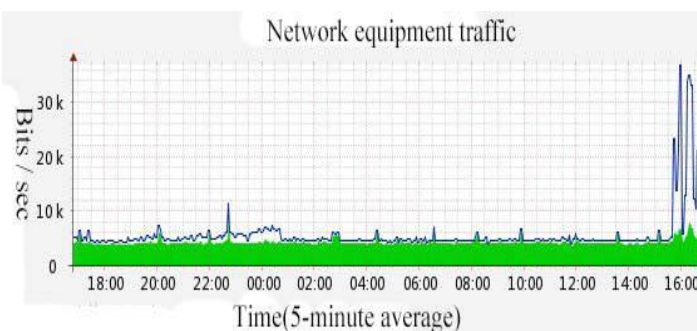


Figure 6: Memory utilization



Figure 7: Network equipment traffic

## CONCLUSION

This paper discusses the architecture based SNMP network monitoring system, the system successfully achieved most of the basic functions such as SNMP information collection module, data analysis module and so on. And through the Web server status information real-timedisplay, fault real-time warning, graphical reports display, custom functions.

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