Subnet Broadcast Polling Algorithm of Network Management Based on SNMP

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***Abstract*—The current data collection of a network device in the network management system exists low real-time and long polling cycle, this paper proposes a subnet broadcast algorithm based on SNMP. The algorithm introduces the idea of Subnet division and broadcasting, when polling, the algorithm polled network devices by sending a SNMP data broadcast packet to each subnet, which reduced the polling packets, shortened the polling cycle and lightened the burden of management station, thus the proposed algorithm improves real-time and work efficiency for the large-scale network management system.**

Keywords-SNMP; network management; subnet broadcast

I. INTRODUCTION

With the rapid development of computer and communications technology, Network management technology has become an important frontier technology. SNMP-based Network Management System is one of the important network management technology researches; the data collection of traditional SNMP-based network management system obtains the information of the network devices by which the management station constantly send query packets to devices. It takes management station a lot of system resources to send these messages, then affecting it ability to work, existing long polling cycle and increasing additional network management traffic[1]. Therefore this paper designs an efficient polling algorithm, with low network communication cost; realize real-time better, work efficiency higher network devices data collection.

Network management system based on SNMP mainly makes the dispersed network devices to be centralized management, and the system consists of the management station, device agent, management information base and the SNMP protocol[2][6] composition. Management station implements the function of data collection, storage and analysis, data packets transmitted between the management station and the device agent just completes the data collection of interactive work. How to realize high efficiency data collection of the network management system is a difficult problem. The traditional data collection make management station to send a polling packet to every device for requesting management information, it waste of network resources and reduce the real-time.

This paper proposes a subnet broadcast algorithm based on SNMP. When the system is initialized, the network devices are divided into several parallel subnets according to their network topology. And the algorithm polls each subnet in sequence. Management station requests data collection by sending SNMP data broadcast packets to each subnet; the managed devices agent extracts the request information of the polling packets when they receive the broadcast. Then searches device information library and return the results to the management station

II. SUBNET BROADCAST POLLING ALGORITHM

A. Algorithm Description

Network management system contains a management station and many dispersed network devices, the structure of system shown like as Figure 1. Network management system monitors the network devices work state[3] by the management station collecting data information from the managed devices. The data collection usually has two methods: polling and self-trapping, reference [4] presented polling is the management station initiatively sending query packets to get devices current status; self-trapping is network devices send their failure information to the management station. Subnet broadcast polling is the management station sending a SNMP broadcast packets data to every subnet for collection requesting, the management station multithread accepts devices reply, comparing with the traditional polling for each device transmitting a packet way, this system can greatly reduce the number of management station polling packets and shorten the device polling cycle.

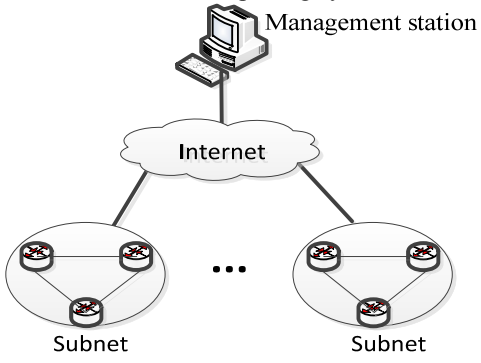

Figure 1. Network management system structure

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B. *Algorithm thought*

The management domain's network devices are likely to change[5] at any time, which can have newly added devices, because of the breakdown offline or administrator dismantled devices. In order to real-time obtain the working condition of all devices and their topology; device status can be divided into three types: the newly added, offline and online. According to the established polling list when the system is initialized[7][8], the management station sequentially sends a SNMP broadcast data collection packets to every subnet. The network devices which have received the request packets will extract packets' information. If the packet information contained this device's IP address, Community and others, the device agent should respond this packet and transmit information requested to the management station. If the packet didn't contain such information of the devices, the devices agent will give management station a new added devices response, at the same time, its IP address and other information will send to the management station. Comparing the devices response list and polling list, the management station get the information of the newly added and offline devices. The subnet broadcast polling algorithm structure is shown in Figure 2.

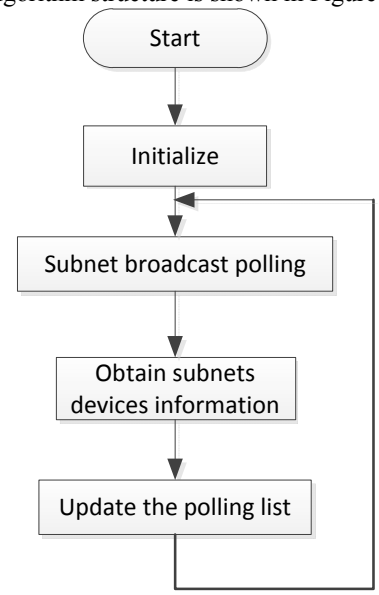

Figure 2. The subnet broadcast algorithm structure

III. ALGORITHM IMPLEMENTATION

A. *Initialization*

When management system is initialized, the network devices are divided into several subnets according to devices' IP address and network topology structure. Creating a polling list PList, used to store information such as the network devices' IP address, polling cycle, Community, a collection of data to be collected and subnet identifier; creating a response list RList to receive the response packet from management domain's network devices for that reply. Management domain's devices may change at any time, so the network management system need real-time update the polling list PList. At the same time it needs to create two lists: NList and OList, which are respectively applied for saving newly added and offline devices' information. The dynamic device list and its meaning as is shown in table I.

TABLE I. DEVICES LISTS AND THEIR MEANINGS

List Name	Meaning
PList	Polling device list
RList	Response device list
NList	newly added device list
OList	offline device list

B. *Subnet broadcast polling*

Before every polling start, Management station firstly loads the polling list PList. The polling process mainly consists of the following steps.

a) According to the PList subnet identifier, management station send a SNMP broadcast packet to every subnet for requesting data collection in order.

b) The subnet managed devices' agent receive and parse the SNMP broadcast messages. If the device's IP address is not included in the parsed data, the agent will put its IP address information to the management station; if the IP address is included,the agent will check the parsed data and the community with the IP address,then transmits the collecteddata to the management station after verification.

c) Management station receives the response information such as IP address from the network devices and puts them into the Rlist.

d) Check whether the subnet polling of PList has been completed. If no end continues to implement a) b) c) steps, if the end of turn step e).

e) At the end of whole PList list of polling, the management station need to detect whether there is offline or newly added devices in management domain, the newly added list: NList=RList-(RList∩PList), the offline list OList = PList-(PList ∩ RList), synchronous update NList list and OList list. If OList is not null, namely the polling list existes offline devices,the management station needs to retransmission SNMP data collection packets using parallel polling method. After the management station receive the devices' response message, it will remove them from OList;if some devices are still polling timeout,the management station will removed them from PList list, then update OList and PList.

f) The network management system puts the OList and NList information feedback to the administrator, the newly added devices require the administrator to manually add the device corresponding to the community and the collected data information needing by management station. At the same time, the devices in the NList according to theirs own IP address join in the subnet of the polling list PList. For offline devices OList, network management system notifies

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the administrator to check network connection and power state of the devices, If the devices are withdrawn from the management domain, the adminstrator will remove them from OList. The subnet broadcast polling operation is shown in Figure 3.

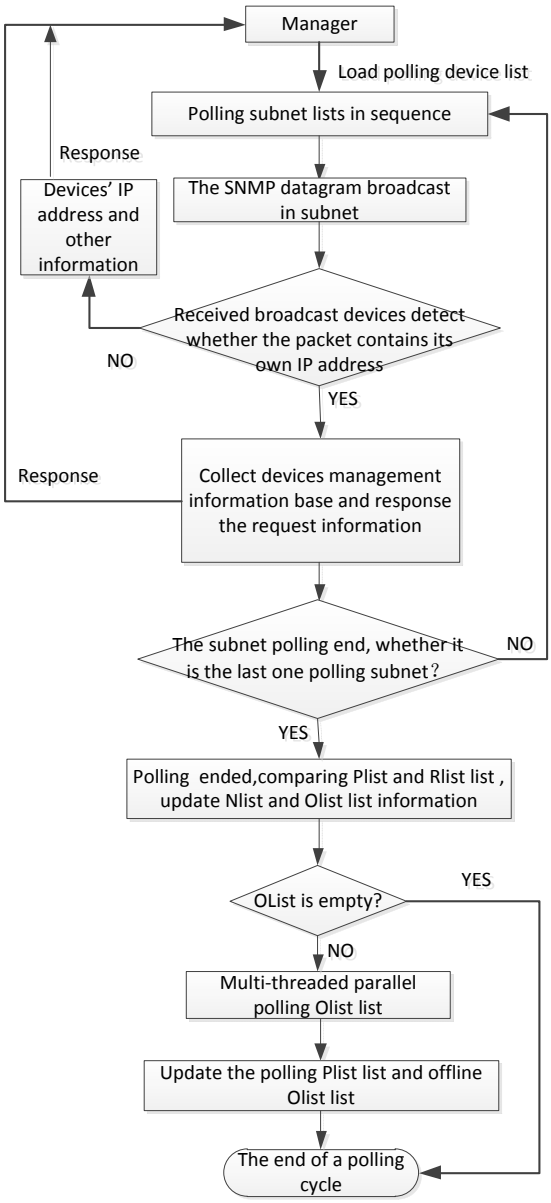

Figure 3. The subnet broadcast polling operation

IV. TESTING AND ANALYSIS

Network management system based on B/S structure is developed with PHP language in this paper, and has been run in the test environment; the system data collection module takes the proposed algorithm.

Test environment: 200 sets of devices are divided into five subnets according to the devices' IP address and network topology, each device supports SNMP protocol. It is implemented for management station to be replied to the traditional polling algorithm and the subnet broadcast polling algorithm. Our Test compare experience analysis and performance comparison of the proposed algorithm and the traditional polling algorithm.

Figure 4 is the comparison of the two algorithm's polling packet transmission rate. We respectively implement two different algorithms in the same test environment. We find that the traditional polling algorithm transmitting a polling packet to each device send a total of about 1600 packets, a polling cycle takes about 65 seconds, and polling data packet rate is about 25packets/s. However subnet broadcast polling algorithm takes the method of dividing subnet and broadcast polling devices, polling packet rate is about 6packets/s. Therefore, subnet broadcast polling comparing with the traditional polling algorithm; its polling data packets' number is greatly reduced.

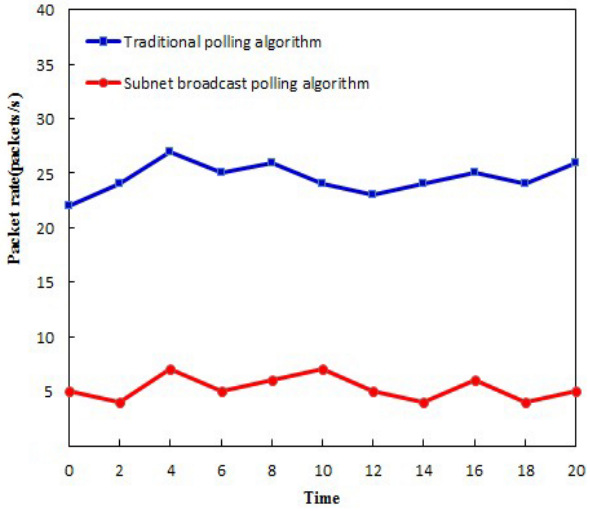

Figure 4. Comparison of polling data packet transmission rate

As shown in figure 5 is the comparison of two different algorithms' polling cycle in the case of the same number polling devices. Under the same network conditions, we find traditional polling algorithm cycle is about 65 ~ 75s, while subnet polling algorithm cycle is only 20 ~ 30s. This shows that the subnet broadcast polling algorithm can greatly shorten the polling cycle.in networks which need many management information, on case of busy polling for getting management information from network devices, the subnet broadcast polling is more efficient by smaller latency time.

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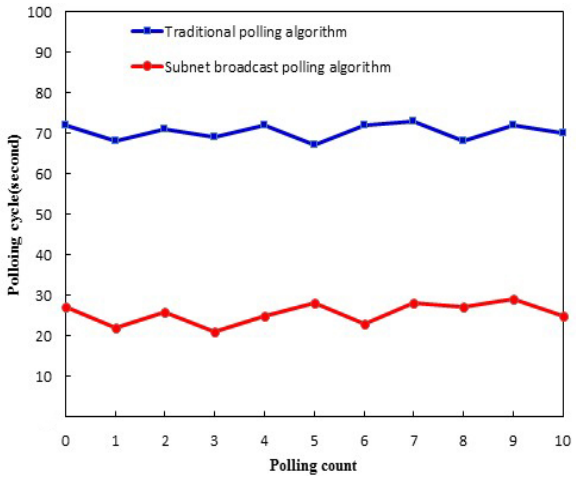

Figure 5. Polling cycle comparison

V. CONCLUSION

This paper proposes a subnet broadcast algorithm based on SNMP. The network devices are divided into a number of subnets. Between subnets take serial polling, the subnet internal takes SNMP broadcast to realize large-scale data collection, which solves the large-scale network with many network devices quantity and higher real-time polling. The proposed algorithm can find the changes of devices status such as newly added and offline devices. It also can effectively control the polling traffic. Test data collection module which takes the proposed algorithm in practical environments, the test results show that the proposed algorithm can improve real-time and work efficiency for the large-scale network management system.

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