MDNS Based Automatic Discovery Method In Optical NMS

Jie He,Yangan Zhang,Xueguang Yuan
State Key Laboratory of Information Photonics and Optical Communications
Beijing University of Posts and Telecommunications
Beijing, 100876,China

ABSTRACT

The optical network management system is very important for optical equipment monitoring and managing, the timeliness and accuracy are very critical parameters. Automatic discovery of network nodes is the embodiment of automation of network management system. However, most of the traditional automatic discovery method is based on the ICMP protocol, which is to ping all the IP addresses in local area network one by one, but it effects efficiency greatly consuming costing too much time. This paper proposes an automatic discovery method based on MDNS protocol in designed optical NMS, sending multicast message to all IP addresses in LAN, then the IP addresses with response are valid address. So in this way we can detect IP node and supported services more rapidly, brings about a vast improvement in the efficiency of optical network management system.

Keywords: *optical NMS, ICMP, MDNS, Automatic Discovery*

1. INTRODUCTION

Network management system[1] plays a very important role in equipment monitoring and management. The general network management system can be divided into four levels: monitoring and discovery layer, logic layer, data collection and analysis layer and user interface layer.

In the monitoring and discovery layer, the monitoring, management, and control function typically contain many concurrent tasks that must be performed during the NMS operation. This layer is responsible for the discovery of active network, the polling service and whether the device is out of order, as well as the interception or processing of asynchronous events from device, service or higher level distributed agent. This component can also perform operations driven by configuration logic, supply logic, workflow execution, or other custom logic from the NMS intermediate layer.

The logic layer provides personalized and distinctive feature collection for NMS. It also provides some common features, such as asset management, data collection and analysis. Role management and workflow management are also provided.

Data collection and analysis provide current and historical statistics about the managed devices and services. It also provides statistical analysis to reveal the performance of the network and sub-net, as well as the availability of equipment and services. The component also interacts with the workflow execution logic to handle customized workflows.

As for user interface layer, NMS can have a GUI interface, as well as an easy-to-customize Web based user interface. The report function resides on this layer, which can interact with UI to provide real-time reports in batch form.

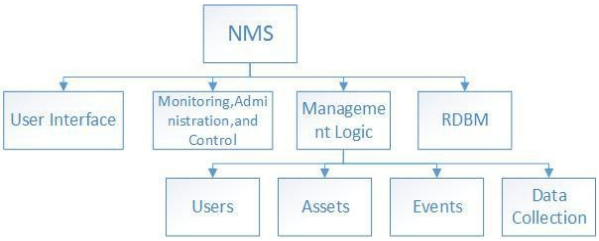

Fig. 1. The NMS architecture

In the network management system, an important procedure is to discover equipment and its supported services. The mainstream automatic discovery method is based on ICMP[2] protocol. This method uses the ping method for discovery. Ping method is one of the earliest and most widely used method in IP network, which mainly uses ICMP echo replied messages to determine whether the host can be reached. The method can also deduce the distance of node by calculating round-trip delay. In small groups, Ping method is cheaper. We can ping every IP address to determine whether it can be corresponded to[3]. But it takes much time to ping every IP address in network one by one. What's more, when sending ping message to inaccessible nodes, it will timeout after intervals set, which is usually 2 seconds. So in this case, using Ping method is quite inefficient, especially when sending ping message to a large number of pending IP addresses[4]. Due to the long detection period and large network load, it is not proper for real-time topological discovery.

For the reasons above, we put forward a new method for automatic discovery based on MDNS agreement. The launched experiments have proved that the method can greatly reduce the automatic discovery time of IP nodes and services.

2. THE DESIGN PRINCIPAL

MDNS[5],which is multicast DNS, uses 5353 ports. The multicast information appears when network does not have a DNS server. The small network without a regular DNS server can use MDNS to implement DNS in programming interfaces, packet formats and

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operational semantics. If MDNS service is opened, it helps a host broadcast messages to all the other hosts in the local area networks, such as "who am I", "what's my IP address". For example, if host A is connected into the LAN, it will open MDNS service and register the following information to the MDNS service: I provide FTP service, my IP is 192.168.1.101 and the port is 21. When the host B is connected into the LAN, it will request the MDNS service: I want to find a FTP server in LAN, then host B will ask other hosts through MDNS service in LAN. Finally, MDNS mechanism will detect that there is a host whose IP address is 192.168.1.101 and the port number is 21, which represents host A provides FTP services. In this way, host B knows the IP address and the port number of host A.

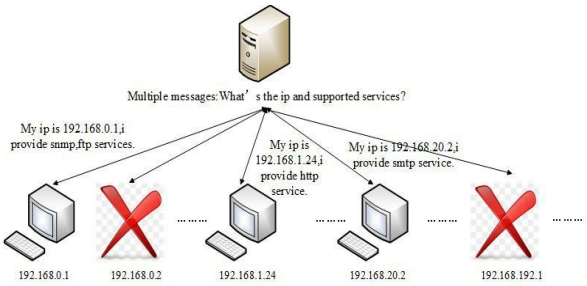

Fig. 2. MDNS protocal schematic diagram

MDNS based automatic discovery protocol[6] relies on JMNS library which uses java language, mainly related to ServiceListener, JmDNS, ServiceEvent, ServiceInfo class. MDNS protocol content for management-side server is transmitting multicast message and monitoring feedback message. Once the response message is received, it will be stored into the database and displayed on the front page. The agent monitors the multicast message all the time, which will reply messages as soon as multicast message is detected. The automatic discovery process based on MDNS is as follows. First, user clicks automatic discovery in the front interface. Then, management-side server sends multicast message to all the other hosts in LAN, which asks for the IP address and the supported services. The node responses the effective nodes. The NMS collects data, stores in the database and displays on the front-end interface. Next, the user is able to choose nodes to monitor. The framework of the MDNS based network management system is divided into three layers, including data layer, function layer and control layer. The main functions are polling, performance monitoring, fault monitoring, alarm, configuration management, user management, etc..

3. EXPERIMENTAL SETUP AND RESULTS

In order to verify whether the multicast way saves much more time than the point-to-point ping way, we decide to launch an experiment. The first step is to program for the point-to-point ping method and the MDNS protocol based method in automatic discovery. Then, in the same LAN, individual record the time of collecting all IP nodes and services. Perform the experiments ten times, carry out and analyze the results. The results are shown in the graph below.

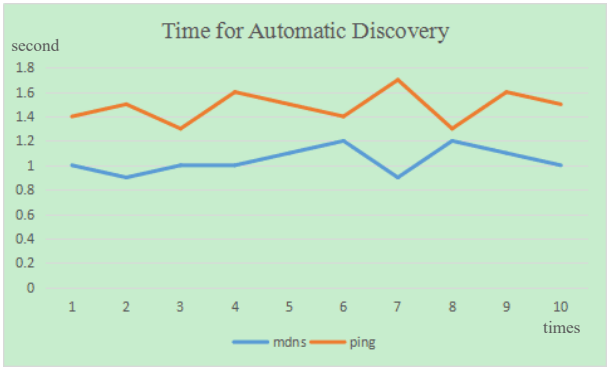

Fig. 3. Automatic discovery time graph

From this graph, we can find that the automatic discovery time based on MDNS multicast way is less than that of the traditional point-to-point Ping way every time. The average time of the former is 70.3% of the latter. Through the experimental verification, we can conclude that the efficiency of automatic discovery service based on MDNS protocol is much higher than that of Ping method using ICMP protocol.

4. CONCLUSION

This paper introduces the basic framework of network management system and the automatic discovery function, and also puts forward a new method based on MDNS protocol for automatic discovery.The performance of the method based on MDNS is evaluated with conventional ping method. The experimental results demonstrate that MDNS way indeed save much more time than the ping way in IP node and service automatic discovery, nearly saving 30% time.Thus,MDNS based automatic discovery method truly optimizes the discovery time and improves the NMS efficiency.

5.ACKNOWLEDGMENTS

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6.REFERENCES

[1] Cordray C, Link D, Chart R, et al. Self configuring network management system[J]. 2015.
[2] Raheja A, Singh A. Network Analysis of ICMP Ping Flood DoS Attack in WiMAX and Wireless LAN[J]. 2016.
[3] Lee D H, Jeon W. DETECTING THE PRESENCE OR ABSENCE OF A USER:, US20170025861[P]. 2017.
[4] Primerano D, Saparoff N W. Automated discovery and procurement of management information bases (MIBs):, US8914490[P]. 2014.
[5] Stolikj M, Cuijpers P J L, Lukkien J J, et al. Context based service discovery in unmanaged networks using

978-1-5386-3273-4/17/$31.00 ©2017 IEEE

mDNS/DNS-SD[C]// IEEE International Conference on Consumer Electronics. IEEE, 2016:163-165.

[6] Ishvarchandra F B. Communicating Service Denials Back to Client During MDNS Service Discovery:,US20150100700[P]. 2015.

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