Network Topology Discovey Using SNMP

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Abstract—— In this paper we discuss the method to find out topology of the network using SNMP protocol. We are trying to develop a client server Application where client sends a request for topology server to Discover the topology. Connection between nodes will be found out using SNMP MIBs stored in the nodes. Using Routing Table Address forwarding table and Spanning Tree and IPNettoMediaNet Address tables the connectivity will be found out by tracing these tables
Keywords-component; SNMP**,** ***Managed nodes, NMS, MIB.***

I. INTRODUCTION

Network topology is the study of the arrangement of links and nodes in a network and the interconnections among the nodes. We can categorize it as a physical network topology, where peers are connected to ports on devices via transmission link or a logical network topology, in which a network is divided into logical segments through subnets. Network discovery can also be categorized as Internet or backbone discovery and the local area network (LAN) or an organizational-level network such as autonomous system discovery[1].

An inexperienced network administrator joining an organization faces many difficulties due to the unavailability of a discovery tool, which otherwise would show the topology classification (based on types of devices and subnets) and layout of the networks.

Even for a Network management system keeping track of devices and their connectivity details, without having a proper method of visually presenting them becomes a difficult task.Our work concentrates on organizational level or LAN topological discovery. SNMP is a network management protocol which helps to get information about managed nodes in the network in a secured way[4].

This paper summarises about Network topology discovery using SNMP Protocol. In the next section AIM of the paper is been discussed and it also gives the abstract design of the system to be designed. IIIrd section gives the detailed design approach followed to design the system. And in last section we will see Implementation details.

II. THE AIM OF PROJECT AND AN OVERVIEW OF THE DESIGN

This section explains the main aim of our project and gives an overview of the entire design of our project. The aim of this project is to develop a framework which represents topology of the network, using SNMP protocol. Information about every node will be collected using MIBs and this information will be processed. Connectivity will be represented using a UI framework which can graphically represent the connectivity among the nodes.

Initially we start with identifying the Active devices in the network. SNMP request messages will be sent to get connectivity and other device related information which is stored in MIBs. This Information will process to and connectivity among different layers of the network will be found out. Connectivity among Routers, Router and Switch and connectivity among the switches and connectivity between Switches and nodes will be calculated, finally End to end Host connectivity will be calculated using Spanning Tree Information stored in bridges. Following Figure Shows the abstract view of the system.

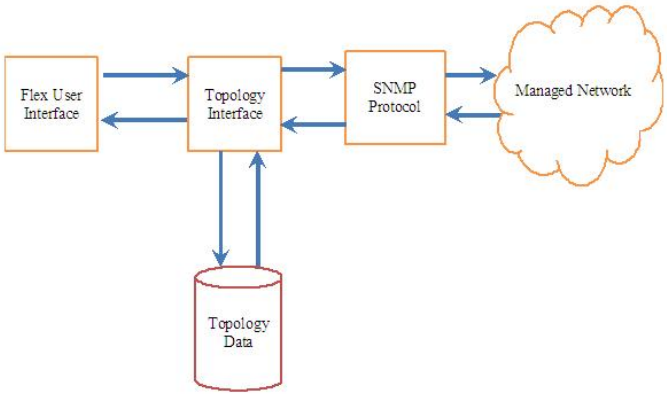


Fig1: abstract view of the system.

III. THE WORKING OF THE DESIGN MODULES

This section explains in detail the working of each module in this project. The system is modelled as a client-server Application. Where Server is following are the different modules that will perform the required functionality in order to complete the discovery process.

A. Topology Discovery Server

This is the module which collects information from other clients and performs required processing. Once the processing is done it retains the topology Information which can be presented on the UI at the end. This server module is containing following modules.

B. Topology Discovery Module

IN this module SNMP MIBs will be collected to find out the Physical, Logical and End Host Connectivity among the devices. Collected Information will be processed .Active devices in the network will be found out type of the device will be found using sysService MIB stored in managed nodes. Using Address forwarding table and Spanning tree Tables the connectivity among the nodes will be found out.

C. JMS Module

This module mainly helps for client and server communication. Both client and server should communicate with each other using java Messaging Service .The topology manager requests Information stored in the client. Management Information will be transmitted using Java Messaging Service.

D. Client Module(Managed node)

This module provides the information requested by topology manager. The information about the managed nodes will be stored in the form of SNMP MIBs. This Information will be transmitted using SNMP request reply messages.

IV. THE COMPLETE DESIGN OF THE SYSTEM

This section explains the detailed design of the system. Once the server module is started, the application first tries to find out possible IP range to be calculated. For all Network IPs that needs to be managed we are trying to find out Active device IPs, by sending SNMP request messages. SNMP request messages will be encapsulate in a PDU. Nodes which are replying to request messages will be considered as Active devices and connectivity among these devices will be found. To find out the device type of the Active Device SysService MIB stored in the managed node will be accessed and the it will be converted to a Binary string[10]. Based on the parity of the string type of the device will be decide.

Once the Information about all the devices collected, the next step is to find out the connectivity among these devices. Discovery process initially starts with router. For a router we will find out the next hop. The processed will be recursively continued for every next hop in the router table entry. If for a node if there is no next hop then that node will be considered as switch. To find out the connectivity with switches addressForwording table data will be collected which is stored in MIB. The destination entry for address forwarding and the port at which the packets will be sent will be taken into account to find out the connectivity among switches. To find out the end host connectivity. The spanning tree Information stored in the table will be collected. Since the spanning tree contains shortest possible distance between nodes. this Information will be processed to get the connectivity between end hosts in the network. JMS module plays a very important role while exchanging the network data. Both client and server will be communicated using this service to exchange the Information. The discovered topology will be represented in terms of java objects. These objects will be converted to castor objects. Castor objects are compatible with UI designing tool .Flex Builder will be used to design the UI framework.

Given below is the Data Flow Diagram of this project.

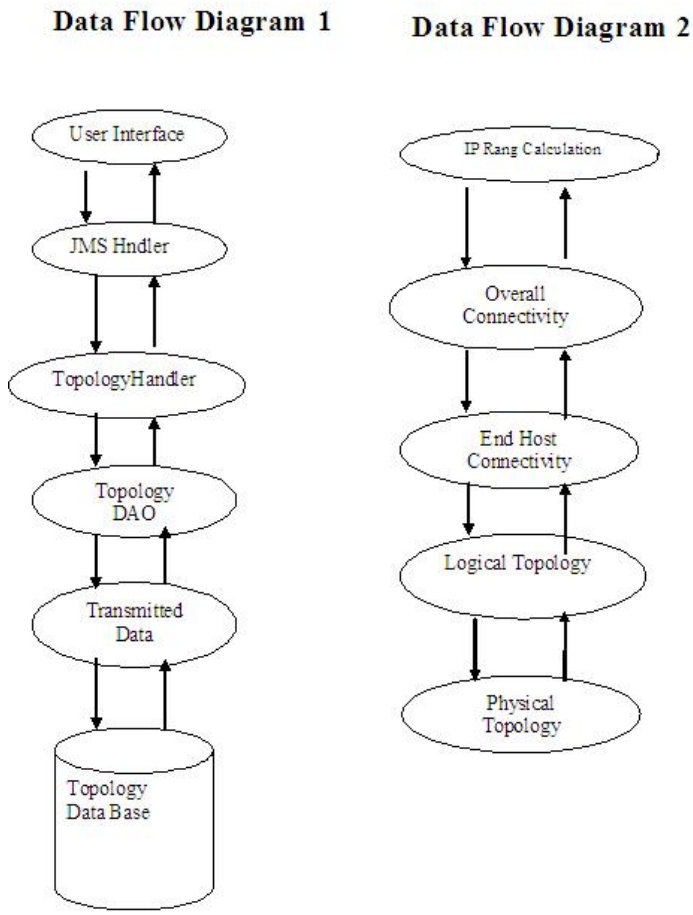
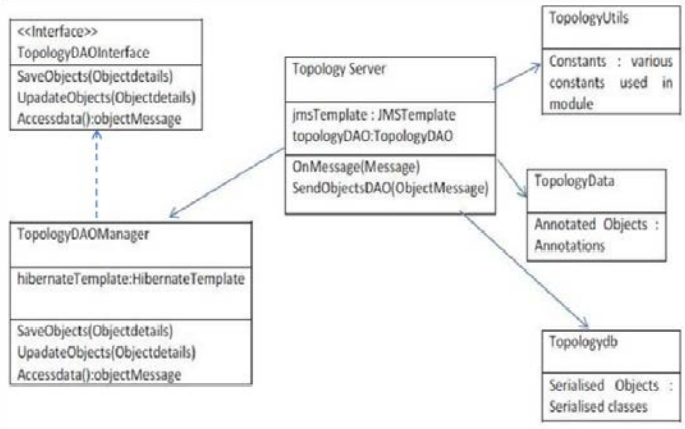


Fig 2: represents simple Flow diagram among modules

The system will be designed using JAVA environment for performing back end operations and Flex builder for providing User Interface hence following diagram shows Simple class diagrams for server module.



V. Implementation

This Application is developed as a Client – Server Application using (Java Messaging Service) JMS Service. To increase the number of users that uses the system. And the System can be used in network based Application. Client Sends Request for Topology Discovery to Topology Discovery Server. After Discovering Server Returns the Results to server.

Programming language used –Java which eases the large application development.

ActiveMQ is a JMS container used for client server communication.SNMP4j library is used for performing protocol operations.Net-SNMP is a SNMP agent should be installed in all network

nodes in order to collect information. The application is developed in eclipse IDE. Which contains large set of applications which eases complex application development time and effort .the project id implemented and experimented in a LAN environment?

Hence every module of project is designed using a class following diagram represents a simple class diagram which represents the server module. One of the class diagram I shown in the design section.
For implementation of this project we have considered following network elements. One router, two CISCO switches and two hosts. The results will be captured at different levels of connection.
The input to the system is Subnet mask. Using the subnet mask value we try to find out the range of devices needs to be managed. Once the range of IPs is found out we send SNMP request message to every IP in the IP Range list. IPs which reply to request message will be considered as Active IP .Every Active IP will be stored in Active IP list. And for every Active IP in the list we send the SNMP request for accessing Sysservice MIB. This MIB returns a string.which after conversion to a binary string will give Device type of the node. The device type will be updated for every IP in the Active IP list. Once the device type is calculated. Routing table will be fetched from every router. Using the routing table next hop will be calculated. Next hop is either a router or a switch to which the router is connected and transmits packets. The routing table will be recursively requested to all the next hops. For every next hop router present in the routing table other routers will be calculated. if there is no next hop present for a node in the routing table then that node will be considered as a switch and it will be added to a switch list. Hence using the information present in the routing table we calculate the router to router connectivity and router to switch connectivity.
The server Application first tried to find out the connectivity between routers and then between Switches and later the connectivity between hosts. SNMP MIBs are accessed by sending PDU request messages and based on the received information Details will be calculated. Once the connectivity among routers and switch is completed next we try to find out Connectivity among switches. For every switch in the switch list we request a SNMP MIB representing a address forwarding table. In address forwarding table every switch will have MAC address of destination node to which data needs to be sent. Hence for every node in the address forwarding table we find the Physical address of destination node. Using IPnetToMediaNet Table we will find out the IP address corresponding to a Physical address. if the IP address represents a switch then the procedure of finding address forwarding table continues recursively. The connectivity of switches will along with the ports through which they are connected will be stored in connectivity list.

After the connectivity of switches is found out finally we need to find out the connectivity of host systems. Very less effort is been done in order find out this layer connectivity. We use the spanning tree protocol to find out the connectivity of host node with switches since every switch contains spanning tree in order to route packets to all the hosts without following a loop. Hence a SNMP request message will be sent to access Spanning tree information. For every host in the active IP range we check entry in the spanning tree table. This procedure continues starting from root bride. Every host will be checked for all the switches and once the host is found out in the spanning tree entry of a switch then using port table and interface table we try to find out the port number through which the host is connected to the switch. Connectivity among switch and host will be stored in switch to host list. Overall connectivity among all nodes in the network will be found out using router to router connectivity list switch to switch and switch to host connectivity list. Hence the overall topology of network is discovered

VI. CONCLUSION AND FUTURE WORK

In this paper we have proposed the design of a Network topology Discovery framework, which represents the connectivity among the nodes in the network. This system provides a good assistance to a network administrator in order to manage the network. This system can be Integrated with a NMS (Network Management System) in order to perform other network related functionalities like fault management. main constraint of this system is that every node in the network should be installed with SNMP agent and also most of the recent network elements will be having SNMP agent as a in built software. We also use security measures so that only authorized user can access the information. The security is achieved by using the enclosing community name as a string in SNMP PDU. Hence this system provides a wide range of applications and also reduces the complexity involved in a Network Management System.

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