Intranet Mailing System

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Abstract - The Intranet Mailing System is applicable within an organization only. In this fast growing world where every qualified person is in urgent need of a job, they join places, working at odd times. The organization has shift times and it becomes difficult for an employee of the shift to communicate with another employee of a different shift. In these circumstances the Intranet Mailing System proves its worth; if the organization has an Intranet Mailing System facility available to all its employees then each employee can register himself/herself and send mails to any other registered employee and thus making the communication easier.

Index Terms- Intranet, System, Communication, Mailing

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1. Introduction

INTRANET is the generic term for a collection of private computer networks within an organization. An intranet uses network technologies as a tool to facilitate communication between people or work groups to improve the data sharing capability and overall knowledge base of an organization's employees.

A network that uses technologies of internet protocol to share any type of information within association or Business Company is called Intranet. This technology is used in the proposed system, the "Intranet Mailing System" to make the most out of this technology. This will somehow automate the information passing system.

2. Proposed system

As organization grows in size in terms of departments and functionalities, it requires a quick and efficient system to achieve instant communication b/w employees of same department or b/w departments. The proposed system "Intranet Mailing System" serves organization's needs in a consistent and transparent manner. It should cater the needs of information sharing. It allows the users to exchange their views thru mails and send electronic files thru attachments. It should have all traditional things such as sent items, inbox, drafts etc. The users are allows to send mails to multiple users using to, cc and bcc too. Thus the system caters spontaneous needs of the organization.

2.1 SNMP and Mail Monitoring MIB

Simple Network Management Protocol (SNMP) is a standard protocol suite for the Internet network management. Internet Engineering Task Force (IETF) first standardized the protocol and initiated SNMP-based management. The original targets for this effort were TCP/IP routers and hosts. However, the management architecture is inherently generic so that it can be used to manage various types of systems.

The SNMP network management model consists of the following elements [8, 9]. SNMP management defines two network entities, managing system and managed system, and the communication methods between two entities. Managing system contains one or more processing elements called management applications, shortly, managers. Manager performs management functions over managed nodes it controls. Each managed system has a processing entity called an agent which gathers various management information from the managed system. SNMP itself is a set of communication methods between manager and agent. The protocol defines three basic operations, GET, SET, and TRAP. The GET operation is initiated by a manager for retrieving management information from an agent. When the manager needs to change management information in managed systems, the manager performs the SET operation on the specified agents. The TRAP operation is an unsolicited communication from agents to managers. Agents send TRAP information to specified managers when managed system initiates any events.

Management information and events used in the SNMP management model should be clearly defined in

predetermined formats. The Structure of Management Information (SMI) [10] includes the model of management information and events, the allowed data types, and the rules for specifying management information and events. It sets the rules for how management information is described and stored. Management Information Base (MIB) [11] is a set of related management information, events, and implementation compliance requirements following SMI rules. A MIB represents a collection of managed objects and each managed object can be managed remotely by managing MIB information via SNMP operations. MIB information is written in the subset of Abstract Syntax Notation ONE (ASN.1) [14]. When a networked system is to be managed by SNMP, the first thing to do is to define MIB for the system.

There are many SNMP MIB modules developed by IETF working group for various kinds of network elements such as bridges, routers, hubs, printers, workstations, Internet service systems, etc. The MIB modules are standardized and published in RFC documents. In order to identify each MIB module SNMP uses object identifier (OID) found in ASN.1. OID values are organized in a tree structure so that each OID value is assigned to the unique object. This scheme is created by the ISO and ITU-T and SNMP MIB modules are located in a subtree of the OID tree.

RFC 2249 [13] defines MIB for monitoring of Internet/Intranet mail server systems. It extends the basic Network Services Monitoring MIB defined in RFC 2248 [12] to allow monitoring of Message Transfer Agents (MTAs). MTA is a more general term representing the mail server system. RFC 2249 has OID, 1.3.6.1.2.1.28 which is located in SNMP MIB modules. **Figure** 1 shows the location of MTA MIB in the OID tree structure.

Internet/Intranet mail server management system presented in this paper is based on the RFC 2249 MIB module. We have extended the Mail Monitoring MIB to handle SNMP TRAP operations. SNMP agent system has been developed to monitor the MIB information in mail server systems and SNMP manager functions are defined to have access to the MIB information from agents.
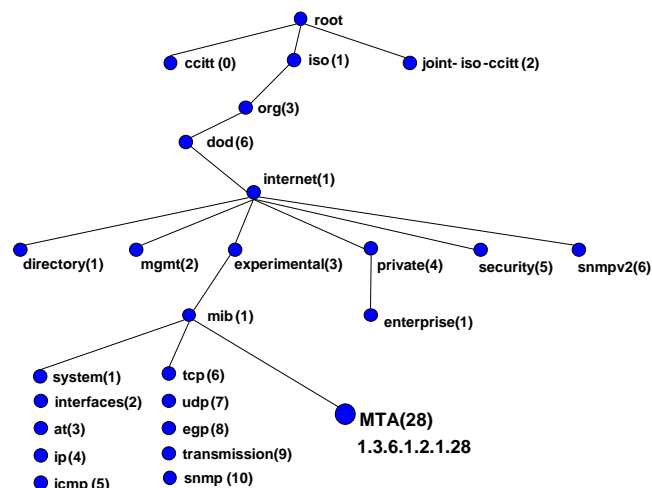

Figure 1. MTA MIB in the SNMP OID Tree

RFC 2249 Mail Monitoring MIB defines four tables. The first of these contains per-MTA information that is not specific to any particular part of MTA. The second breaks each MTA down into a collection of separate components called groups. The third table provides a means of correlating associations with specific groups within different MTAs. Finally, the fourth table provides a means of tracking any errors encountered during the operation of the MTA. The first two tables must be implemented to conform with this MIB; the last two are optional [13].

Since defining MIB for managed system is the first step in developing a management system, RFC 2249 is the key basis of our system design. In the following section, we describe how we have modified the Mail Monitoring MIB for designing our Web-based mail server management system.

3. System Design

Our Internet/Intranet mail server management system has three architectural parts: SNMP agent, SNMP manager, and Java-based management application. SNMP agent is a process running on the mail server system that is supposed to be managed by SNMP manager. SNMP agent process keeps track of management information in the mail server system and provides the information to the SNMP manager. SNMP manager is a process running on the managing system that controls SNMP managed systems by communicating with the SNMP agent process. Java-based management application is a Java applet running on the human manager's Web browser. Easy-to-use graphical user interfaces are provided by the applet application. Also, the management information is more understandable in Web-based management system comparing to proprietary text-based management systems.

The design goals of our system are as follows.

- Simple SNMP-based system management: There are various kinds of system management methods such as CMIP/CMIS, DMI, etc. However, SNMP is a lightweight, simple, and efficient management protocol among them. Also SNMP is widely used in many areas of management domains.

- Use of Web technology: Web-based technology provides a lot of benefits in system and service management. It enables developers to achieve easy, graphical, portable, and ubiquitous user interfaces. Management applications written in Java programming language can be run on many platforms without modifying the code. Both system development and maintenance costs can be reduced when the Web-based technology is deployed.

- Generic architecture for Internet/Intranet service management: We have designed our system not to be specific to any hardware and operating systems so that our system architecture can be used for developing any Internet/Intranet service management system. By replacing SNMP manager, SNMP agent, and related MIB information, any management system can be developed easily.

3.2. Design Architecture

The design architecture of our Internet/Intranet mail server management system is illustrated in **Figure** 3. For each Internet/Intranet mail server process (called Message Transfer Agent or MTA), an MTA agent process is assigned to monitor management information defined in RFC 2249 MTA MIB module. MTA manager process should be able to handle one or more of MTA agent processes by sending and receiving SNMP messages with each agent process. Web technologies are used between manager system and management applications running in Web browsers.

Management applications must be written in Java programming language so they can run on any Web browsers as Java applets. General Web servers are used for distributing the applet program, which has been stored in the applet storage, to Web browsers. Although **Figure** 3. shows Web server and MTA manager running in one system, the physical locations of Web server and MTA manager do not matter.

Management operations from human users are transferred to MTA manager which interacts with MTA agents using SNMP messages. Our design architecture is three-tier (i.e., user applications, middle layer manager, and agent) and highly flexible to be extended to manage other Internet/Intranet service systems.

4. Implementation

In this section, the implementation details of our Internet/Intranet mail server management system are presented.

We have chosen Java as the main programming language of our system modules. Java which is developed by Sun Microsystems is a simple, object-oriented, interpreted, robust, secure, architecture neutral, portable, multithreaded, and dynamic programming language [15]. The language originally designed for controlling consumer electronics is now widely used in developing Web-based applications. SNMP-based communication can be implemented easily by using Java. Java provides TCP/IP socket interfaces for such kinds of communication applications. However, there is much more efficient way of developing SNMP-based management system in Java. Java class package dedicated to SNMP communication is freely available from many organizations. AdventNet is one of such companies that provides SNMPv2c package written in Java [16]. It helps the developers of network management applications by simplifying SNMP interfaces. The library takes care of all the SNMP details underneath, so that programmers can concentrate on the implementation logic of management applications. Manager and agent modules for Internet/Intranet mail server management system are based on this SNMP package.

4.1 Implementation Architecture

The detailed implementation architecture of the proposed system is illustrated in **Figure** 3. Based on the design architecture presented in the previous section, we have realized the Web-based Internet/Intranet mail server management system. The implementation architecture is divided into three separate systems: Web browser, MTA manager system, and Internet/Intranet mail server system. MTA manager system includes Web server for downloading Java management applications. Internet/Intranet mail server system, which is to be managed via SNMP, contains MTA agent system and mail server process running in it.
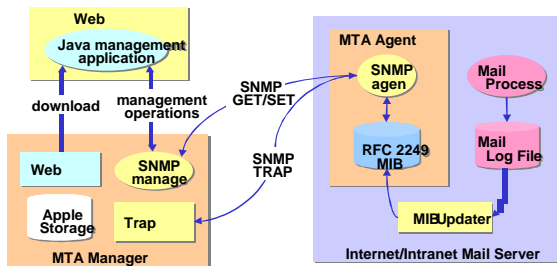
Figure 3. Implementation Architecture of Proposed Mail Server Management System

4.2 Mail Server System

Internet/Intranet mail server system is the management target system. There are mail server process, SNMP agent process, and MIB updater in the mail server system. Mail server process is a general mail server process for sending and receiving user messages via Internet or Intranet. In our system, send mail is chosen to be the managed mail server process because it is the most widely used mail server process in UNIX systems and is very flexible to be customized for management purposes. MTA agent system which includes SNMP agent process and RFC 2249 MIB module is responsible for agent parts of SNMP operations. The SNMP agent process answers SNMP SET and GET operations from SNMP manager and sends SNMP TRAP operation messages to SNMP manager.

The MIB module contains extended RFC 2249 MIB information for MTA process. In order to reflect status changes of mail server process to the MIB information, MIB updater process runs in background periodically. It reads the log files of send mail process, extracts appropriate management information from the log files, and stores the information in the MIB.

The SNMP agent is written in Java and the MIB updater is written in Perl programming language [18].

4.3. MTA Manager System

MTA manager system has several roles. It runs Web server for distributing Java-based management applications to Web browsers. The Web server is also used for showing static information pages in HTML. The manager system communicates with MTA agents via SNMP. It sends SNMP GET and SET operations to SNMP agent process and waits for SNMP TRAP messages from SNMP agent process.

Finally, it summarizes and analyses management information and reports the information to Java-based management applications.

Manager process consists of two different threads. SNMP manager is responsible for handling management operations from Java-based management applications. SNMP manager process sends SNMP GET or SET messages to the appropriate SNMP agent processes according to the management operations. Operation results or responses are manipulated by SNMP manager and transferred to Java-based management applications.

The TRAP server process is a kind of daemon process constantly waiting for SNMP TRAP messages from SNMP agent processes. The process listens on the TRAP port and keeps the TRAP messages in files. The files can be retrieved by SNMP manager process regularly and SNMP manager process reorganizes the information to be displayed by Java based management applications.

The Web server and MTA manager can be located on different computers. Since the Web server exists for distributing Java applet codes to Web browsers when requested by users, any Web server program can be installed for the purpose.

4.4. Java-based Management Application

Java-based management application is responsible for displaying management information for users using Web browsers and for obtaining user's management requests. The applications are stored in Web server initially, and downloaded via Hypertext Transfer Protocol (HTTP) [17] over Internet/Intranet. The application window is made of static HTML data, CGI scripts, and Java applets.

The user interface provides four different user views on mail server systems.

- Current status view: This view is the initial user interface for a mail server system. Human manager can view the system status in one window. The statistics are gathered by SNMP GET operations regularly. Also if TRAP condition occurs, the status colour turns to red to alert abnormal conditions in the mail server system.

- MIB browser view: This view is useful for browsing Mail Monitoring MIB information in the OID tree. Graphical layout is very user-friendly and easy-to-use.
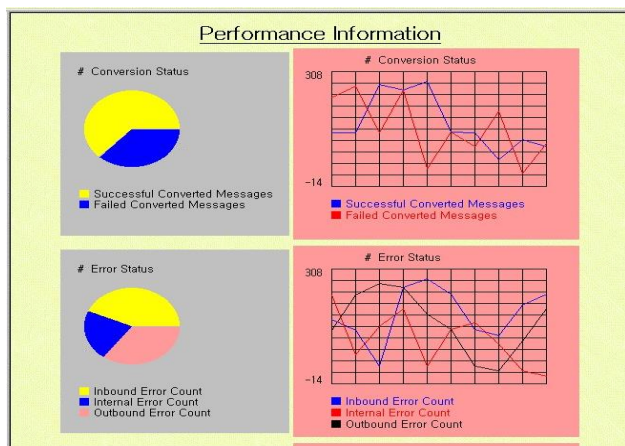
Figure 5. Performance View Window

- Performance view: This view (shown in **Figure** 5) illustrates statistical data of mail server system graphically, such as pie charts and history graphs. Pie charts can provide quantitative relations between management information, and history graphs can keep track of historical changes of statistical data.

- Trap condition view: This view controls trap condition parameters. Human user can increase or decrease TRAP condition threshold values in this view. TRAP condition history is also retrieved and analysed in this view.

5. Conclusion

In this paper, we have presented the design and implementation of a Web-based Internet/Intranet mail server management system. We have used and integrated SNMP and Web technologies in developing our system. The SNMP management framework enables developers to create management applications easily and efficiently. We have defined SNMP MIB module for monitoring mail server process and have designed SNMP manager and agent system which can handle SNMP MIB information. Web technology such as CGI and Java enables human users to learn and maintain management applications easily and cost-effectively. Our system has utilized both technologies so that Internet/Intranet mail server management could be highly efficient.

Though we have developed a management system for mail service only, our design and implementation architecture is general enough to be applied to manage any Internet/Intranet application service system. If SNMP MIB is re-designed for other Internet/Intranet service system and the related SNMP manager and agent processes are modified, any Internet/Intranet service management system can be developed easily without modifying our design and implementation architecture. Also if we can handle several service MIBs at the same time, an integrated Internet/Intranet service management system can be realized.

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