

NP Config SNMP Administrator's Guide

Optional Feature

DOCUMENT HISTORY

Revision/Issue	Date Issued	Part Number
Revision A/Issue 2	January 1998	2700-1391-01
Issue 1	November 1999	2700-1391-B1

Contents ©Copyright 2002, Mitel Networks Corporation

Distributed Courtesy of



**8777 E. Via De Ventura Suite #340
Scottsdale, Arizona 85258**

**Main: (480) 998-9500
Fax: (480) 718-7355**

<http://www.legacyvoicemail.com>

**Support: support@legacyvoicemail.com
Sales: sales@legacyvoicemail.com
General: info@legacyvoicemail.com**

About This Manual

This manual is about NP Config SNMP, the Simple Network Management Protocol (SNMP) agent for the NuPoint Messenger™ server. An SNMP agent is software on a networked device that allows an SNMP-based management station to inspect or change management information on that device. The device and management station communicate across a TCP/IP network (or SLIP/PPP phone line).

Who Should Read This Manual?

This manual is for administrators who must configure and maintain NP Config SNMP on a NuPoint Messenger server. The manual is also for management station operators who must retrieve or modify NuPoint Messenger server management information. This manual assumes readers are familiar with SNMP and client-server computing. It also assumes readers are familiar with NuPoint Messenger server configuration and operating characteristics.

What's In This Manual?

Chapters contained in this manual are:

Chapter 1 — Information: An orientation to what NP Config SNMP is and how it is used.

Chapter 2 — Installing NP Config SNMP: Instructions for installing NP Config SNMP files on the NuPoint Messenger server.

Chapter 3 — Using NP Config SNMP: Information on using NP Config SNMP from the perspective of the management station operator.

Chapter 4 — Handling SNMP Queries (Gets) and Sets: Information on requests to retrieve or modify NuPoint Messenger server management information.

Chapter 5 — Handling SNMP Traps: Information on SNMP event messages (traps) sent to the management station.

Appendix A — Reference Sources: A list of related Internet specifications and SNMP background information.

Appendix B — More About Standard MIB Support: Information on NuPoint Messenger server support of standard MIB modules.

Glossary — Definitions of key terms used in this manual.

What Related Documents Are Available?

For detailed reference on NuPoint Messenger server configuration and operating characteristics, refer to the following:

- *Installation and Service Manual*
- *Reference and Configuration Manual*
- *Error Log Messages Manual*

For manuals related to NP Config SNMP, refer to the following:

- *NP Config Administrator's Guide*
- *NP Config MIB Reference Manual*

1 Introduction

This chapter describes what NP Config SNMP is and how it relates to other elements of SNMP-based network management. It also describes NP Config SNMP components and operation.

What Is NP Config SNMP?

NP Config SNMP is the Simple Network Management Protocol (SNMP) agent for the NuPoint Messenger server. An SNMP agent is software on a networked device that allows a management station to manage the device across a TCP/IP network or SLIP/PPP phone line (SNMP messages are exchanged via a datagram mechanism; TCP/IP and SLIP/PPP protocol groups support datagrams).

The SNMP agent responds to management station requests to retrieve or modify information on the device. The agent can also send the management station unsolicited event messages called traps.

Terms and Concepts

The following terms and concepts are used throughout this manual. Be sure to understand this information before attempting to install or use NP Config SNMP.

SNMP Standards

SNMP is a set of standards for multivendor network management. The standards specify a means by which management information on networked devices is retrieved or modified. Management information includes configuration, operating, and status parameters. SNMP defines three key network management elements: the SNMP manager, the SNMP agent, and the management information base (MIB).

SNMP Manager

The SNMP manager is a software program running on the management station (Figure 1-1). The management station typically is a PC equipped with a network management platform, such as HP OpenView®. The platform consists of a GUI and underlying software support for the manager.

Figure 1-1 SNMP-Based Management Elements

A management station may have different managers installed, each performing a separate task. Generally speaking, there is a separate manager for each type of managed device (router, voice processing system, and so forth).

SNMP Agent

The SNMP agent is a software program running on a networked device. The agent responds to manager requests to inspect or change management information on the device. The agent also can send managers unsolicited event messages that contain management information. The manager can indicate which events it wants to monitor.

Typically, management information is not centrally stored on a device (for example, in a database). The agent collects the information, as needed, from applications running on the device.

SNMP MIBs

A MIB is a specification that defines management information. The MIB identifies each type of management information and provides a formal data description of each. The data descriptions are in a format based on Abstract Syntax Notation One (ASN.1). The data descriptions allow managers and the agent to exchange data in a format understood by each. The exchange is done through SNMP messages.

A device may have one or more MIBs associated with it. Typically, the separate MIBs are called MIB modules. Each MIB module defines management information of a separate type. A MIB module that defines management information that is vendor-specific (proprietary) is called a private MIB module. A MIB module that defines management information that is not vendor-specific is called a standard MIB module.

MIB support is specified by the device vendor; that is, the vendor makes clear which management information is located on a device, and which MIB modules define that information.

MIB modules are contained in ASCII files that are loaded at the management station. The vendor provides private MIB modules. Standard MIB modules typically are downloaded from the Internet. After the MIB files are loaded, the data descriptions contained in the files are available to any manager running on that station.

Note: The MIB files need not be loaded at the device, because MIB support is integrated with agent software.

Collectively, the MIB modules for all devices can be viewed as a global MIB (Figure 1-2). The global MIB represents all information that can be managed on the Internet. However, at any time, a given management station has just a subset of the global MIB loaded (the subset that applies to

devices the station manages).

Management information for the NuPoint Messenger server is defined in two private and two standard MIB modules. The two private MIB modules are called VM-MIB and SS7-MIB. VM-MIB defines general status and configuration information. SS7-MIB defines information related to Signaling System 7. VM-MIB and SS7-MIB are bundled in NP Config MIB.

The standard MIB modules are MIB-2 and DS1-MIB. MIB-2 defines information related to TCP/IP connectivity. DS1-MIB defines information related to digital trunk connectivity.

Figure 1-2 Global MIB and MIB Modules

NP Config SNMP Components

NP Config SNMP is a NuPoint Messenger server optional feature software product. It consists of two configuration files and binary executable files. The executables implement the SNMP agent in a distributed fashion: the agent is split into a main agent and five subagents (Figure 1-3).

Figure 1-3 NP Config SNMP Architecture

Each subagent provides access to a separate group of NuPoint Messenger server management information. The management information is divided according to MIB module. For example, one subagent supports information defined in MIB-2. A second subagent supports information in the DS1-MIB. Other subagents support parts of NP Config MIB (VM-MIB, SS7-MIB, and traps). Trap information is actually defined in VM-MIB, but a separate trap subagent is required to implement trap-handling.

The subagents collect management information from programs running on all hosts of the NuPoint Messenger server. The programs may be applications, device drivers, diagnostic programs, and troubleshooting tools. Each of these programs has a direct interface to the subagent collecting the information.

The manager(s) communicate with subagents through the main agent. The main agent and subagents might be located on separate hosts, as noted in Chapter 2, "Installing NP Config SNMP."

NP Config SNMP Operation

SNMP views management information as MIB variables. SNMP operations retrieve or modify the values of MIB variables. Table 1-1 lists the five types of SNMP operations supported by NP Config SNMP.

Note: NP Config SNMP is based on SNMP version 1 (SNMPv1).

Table 1-1 SNMP Operations	
Operation	Description
get	Requests to retrieve a MIB variable via the agent.
get-next	Requests to retrieve the next MIB variable from a sequence of like variables (contained in a MIB table).

set	Requests to alter a MIB variable via the agent.
get-response	Replies to a manager with the requested information.
trap	Sends MIB variables to the management station in the form of an unsolicited event message.

Note: The request and response operations occur in pairs; that is, each request is followed by an SNMP response. The trap operation is one-way. There is no response for a trap.

NP Config SNMP operation involves processing SNMP request-response pairs and traps. Following paragraphs provide a brief overview. For additional details, see Chapters 4 and 5.

A manager sends SNMP get and set requests to the NP Config SNMP main agent. The main agent passes each request to the appropriate subagent (the subagent responsible for the MIB variable operand of that request). After validating the received data, the subagent performs the requested task.

Whether the task succeeds or fails, the subagent sends an SNMP get response back to the main agent. The main agent forwards the get-response back to the manager.

Note: A get response is used to respond to both the get request and set request operations (there is no set-response). This minimizes the number of SNMP operations, making implementations easier. For a set request, the get-response returns the information set by the set request.

A separate subagent handles traps. Events recorded by NuPoint Messenger server programs are forwarded to the trap subagent. The trap subagent encapsulates event information into SNMP traps and forwards them to the main agent. The main agent sends the traps to registered management stations.

Note: To receive traps from NP Config SNMP, the IP address of a management station must be noted in the NP Config SNMP configuration (CONFIG) file. This is called registering the management station.

2 Installing NP Config SNMP

NP Config SNMP is a NuPoint Messenger server optional feature software product. This chapter describes how to install NP Config SNMP and how to configure it to send traps to specified (registered) network management stations.

Before You Begin

The NP Config SNMP optional feature software contains NP Config SNMP binary files and an ASCII configuration file (Table 2-1).

File	Description
CONFIG	ASCII configuration file.
NOV	Binary file that stores system information.
snmpmagt	Binary file that is executable for main agent

snmpmib2agt	Binary file that is executable for MIB-2 subagent.
snmpss7agt	Binary file that is executable for SS7 subagent.
snmptrapagt	Binary file that is executable for trap subagent.
snmpt1agt	Binary file that is executable for DS1 subagent.
snmpvmagt1	Binary file that is executable for VM subagent on host 1.
snmpvmagt2	Binary file that is executable for VM subagent on host 2.
snmpvmagt3	Binary file that is executable for VM subagent on host 3.
snmpvmagt4	Binary file that is executable for VM subagent on host 4.

The CONFIG file stores IP addresses of registered management stations. The NOV file stores system information, including location, system name, and a system contact (administrator name). Each of the remaining binary files is an executable that implements a subagent or part of a subagent.

For example, the VM subagent requires four executables: snmpvmagt1, snmpvmagt2, snmpvmagt3, snmpvmagt4. Each provides access to management information on a separate NuPoint Messenger server module (host): snmpvmagt1 provides access to information on module 1, snmpvmagt2 provides access to module2, and so on.

Before attempting to load NP Config SNMP files, do the following:

- Check that necessary hardware for NP Config SNMP is installed at the NuPoint Messenger server. This includes Ethernet card(s), and — if SS7 is used — the SS7 and E-1 cards.
- Check that the NuPoint Messenger server network connections are configured correctly and are operational.

Loading NP Config SNMP Files

To install NP Config SNMP, follow the procedure to add an optional feature in your *Installation and Service* manual, chapter 3.

At the beginning of the installation procedure, NP Config SNMP files are loaded in the following QNX directory:

```
usr/vm/bin
```

Following installation, required NP Config SNMP processes are activated automatically. To verify that processes are activated, enter the following at the QNX prompt:

```
sin -Psnmp
```

A display appears, listing active NP Config SNMP processes on the host to which the console is connected. For example:

```
SID PID PROGRAM PRI STATE BLK CODE DATA
0 052//1/*vm/bin/snmpmagt 8r RECV 858 139k 188k
0 862//1/*bin/snmptrapagt 4r RECV 0 32k 61k
0 874//1/*bin/snmpmib2agt 4r RECV 1294 69k 49k
0 889//1/*vm/bin/snmpt1agt 4r RECV 1345 65k 32k
0 923//1/*vm/bin/snmpvmagt1 4r RECV 1464 77k 40k
0 1304//1/*bin/snmptrapagt 4r RECV 1365 32k 61k
```

As shown, processes running on this host implement the main agent, the trap subagent, the MIB-

2 and DS1 subagents, and the host 1 portion of the VM subagent (the console is connected to host 1).

Note: Two snmptrapagt processes implement the trap subagent. This parent-child process pair gives the trap subagent capacity for two receive channels; one to accept event indications and the second to receive instructions from the main agent.

You can check processes running on other hosts. To view processes on host 4, for example, enter the following at the QNX prompt:

```
on -f4 sin -Psnmp
```

A display such as the following appears:

```
SID PID PROGRAM PRI STATE BLK CODE DATA
0 579//1/*bin/snmpvmagt4 4r RECV 700 77k 40k
```

As shown, the only NP Config SNMP process running is the host 4 portion of the VM subagent.

Table 2-2 summarizes the location of executing NP Config SNMP processes.

Table 2-2 Location of NP Config SNMP Processes	
Process	Executes On
snmpmagt	Host that contains Ethernet card.
snmpmib2agt	Host that contains Ethernet card.
snmpss7agt	Host that contains SS7 card.
snmptrapagt	Host that contains Ethernet card.
snmpt1agt	Host that contains Ethernet card.
snmpvmagt1	Host 1.
snmpvmagt2	Host 2.
snmpvmagt3	Host 3.
snmpvmagt4	Host 4.

You might wish to install two SNMP agents. In that case, you install two Ethernet cards in the NuPoint Messenger server and establish two sets of NP Config SNMP processes at installation time (done interactively, through the installation procedure). To verify that two separate groups of processes have been activated, enter the following at the QNX prompt:

```
sin -Psnmp args
```

The resulting display includes the IP address associated with each process.

Registering Management Stations

After installing NP Config SNMP, you must specify management stations to which NP Config SNMP can send traps. This process is called registering the management stations. You register management stations offline with the SNMP Resource Configuration Manager.

At the NuPoint Messenger server console, reach the SNMP Resource Configuration Manager through the NuPoint Voice Configuration Main Menu. From the Main Menu, the pathway is: S>O>D. The following menu appears:

SNMP CONFIGURATION MENU

- (I) Modify ip addresses for the trap manager's workstation
- (C) Modify card/slot mapping
- (X) Exit

To register management stations, select (I). The following menu appears:

MODIFY IP ADDRESSES

- (A) Add manager's workstation's ipaddress
- (R) Remove manager's workstation's ipaddress
- (D) Display ip addresses
- (L) Load modified ip addresses
- (X) Exit

Add (A) or remove (R) IP addresses, as necessary, until all desired management stations are registered

Mapping Cards to Slots

After installing NP Config SNMP, you must map the slot numbers of system and telephony cards in the NuPoint Messenger server. This allows the NuPoint Messenger server to notify management stations of card locations (done automatically when the SNMP agent communicates with managers running on those management stations).

You map cards to slots offline using the SNMP Resource Configuration Manager. At the NuPoint Messenger server console, reach the SNMP Resource Configuration Manager through the NuPoint Voice Configuration Main Menu. From the Main Menu, the pathway is S>O>D. The SNMP Configuration Menu appears (see the previous subsection, "Registering Management Stations.")

At the SNMP Configuration Menu, select (C). The following menu appears:

MODIFY CARD/SLOT MAPPING

- (M) Set Module Number
- (N) Set Module Type
- (A) Add Card
- (R) Remove Card
- (D) Display Card Layout
- (X) Exit

Add entries, as necessary, to map each NuPoint Messenger server card to its module and slot number.

Loading MIB Files

To use NP Config SNMP, you also must load NuPoint Messenger server MIB modules at the management station(s) to which the server is under management. As described previously, management information for the NuPoint Messenger server is defined in two private and two standard MIB modules. The two private MIB modules are called VM-MIB and SS7-MIB. The standard MIB modules are called MIB-2 (RFC 1213) and DS1-MIB (RFC 1406).

The VM-MIB and SS7-MIB modules are bundled with NP Config SNMP. You load the modules in the appropriate MIB directory on the management station. For the location of that directory, refer to documents supplied with the management station.

The standard MIB modules are available on the Internet or might already be installed on the management station.

Note: The MIB modules need not be loaded at the NuPoint Messenger server, because MIB support is integrated with NP Config SNMP agent software.

3 Using NP Config SNMP

This chapter introduces NuPoint Messenger server MIB variables and gives tips on developing a network management strategy based on those variables.

MIB Variables

NuPoint Messenger server management information is available as MIB variables. The name of each variable and syntax of its value are defined in MIB modules supported by the NuPoint Messenger server. The modules are either standard (defined in Internet RFCs) or private (defined for NuPoint Messenger). The NuPoint Messenger server supports the following four MIB modules:

- VM-MIB (private)
- SS7-MIB (private)
- MIB-2 (standard)
- DS1-MIB (standard)

Note: The NuPoint Messenger server supports only a subset of the two standard MIB modules. For details, see Appendix B, "More About Standard MIB Support."

In SNMP terms, MIB modules define items called objects rather than MIB variables. Objects are SNMP abstractions that help to organize the global MIB and to locate all information contained in it. Each object has a name, syntax, and position relative to other objects. Each MIB variable can be regarded as a specific instance of an object; that is, a MIB variable has associated with it an object name and a specific value.

To operate NP Config SNMP, each of the four MIB modules must be installed on workstations that manage NP Config SNMP. Most management stations have a specific directory set aside for this. Keep in mind the directory might contain MIB modules for other devices as well as the NuPoint Messenger server (other devices managed by that station).

In operation, the management station typically also maintains a database called the MIB database. MIB modules, whole or in part, are loaded from the MIB directory into the database as needed. The process of adding MIB modules to the MIB database is sometimes called compiling MIBs.

Using NP Config SNMP involves processing the values of MIB variables. The processing is initiated at management stations (except for traps, which are initiated at the NuPoint Messenger server). The mechanisms underlying the processing are the five SNMP messages: get request, get-next request, set request, get response, and trap.

Browsing the MIB Database

Each management station allows you to view the content of its MIB database. Typically, this is called browsing the MIB database, or browsing manageable objects. Browsing lets you see what objects are available at a managed device and how they are organized.

MIB browsers display individual objects within the context of the global MIB. The hierarchy of the global MIB is like an inverted tree, with a root at the top and groups of objects extending from the root like branches on a tree (Figure 3-1). The intermediate objects on each branch represent group names (each identifies the portion of the branch that follows). The terminal objects represent types of management information. Terminal objects are sometimes called leaves on the tree or atomic objects (atomic, because they cannot be subdivided further into other objects).

Figure 3-1 Global MIB Hierarchy

Note: In most SNMP documents, both the intermediate and terminal objects are simply called objects. This is somewhat confusing, because only terminal (atomic) objects represent types of management information. Intermediate objects simply name groups or subgroups of management information located at a lower level.

Within the global MIB, you can locate MIB modules using object names as signposts. Each MIB module is located down a separate branch from the root. For purposes of simple textual display, branch locations are often given as pathways. For example, following is one way to show the pathway leading to NuPoint Messenger private MIB modules. In this display, sideways carats (>) represent lines between objects.

```
root>iso(1)>org(3)>dod(6)>internet(1)>private(4)>enterprises(1)>Centigram(1096)>
    series6cs(1)>
```

Each object is labeled with its formal name and numeric identifier. The name is established through standards set by the Internet Engineering Task Force (IETF). The numeric identifier is an object identifier (OID) based on a numbering scheme devised by the IETF.

Beneath the series6cs vertex, the pathway forks into two branches. The two branches make up the two private MIB modules supported by the NuPoint Messenger server: VM-MIB and SS7-MIB. Figure 3-2 shows the tree structure of each of those branches. The figure stops at the level just above atomic objects (which are not shown).

In Figure 3-2, each indentation represents a lower object level. For example, ctrap, vmsystem, and vmhost are subgroups immediately below the vm-mib group (itself a subgroup of series6cs). Similarly, vmgeneral, vmsysdisk, and so forth, are subgroups under vmsystem.

The atomic objects are not shown, because they are too numerous to list and describe in this manual. However, you can view the atomic objects (individual types of management information) using the MIB browser on a management station.

```
vm-mib(1)                                ss7-mib(2)
    ctrap(1)                               ss7info(1)
        trapCommon(1)                     isup(2)
        trapFilter(2)                       vmmtp(3)
    vmsystem(2)
        vmsysgeneral(1)
        vmsysdisk(2)
```

```

vmsys SCSI(3)
vmsys net(4)
vmsys extra(5)
vmhost(3)
  localhost(1)
  localhost(2)
  localhost(3)
  localhost(4)

```

Figure 3-2 VM-MIB and SS7-MIB Branches of OID Tree

Private MIB Modules

Following is a general description of the two private MIB modules supported by the NuPoint Messenger server. The description is limited to all groups of the VM-MIB and SS7-MIB modules (it does not include atomic objects).

VM-MIB Module

The VM-MIB module defines basic management information for NuPoint Messenger servers. It specifies the NuPoint Messenger server modules (hosts) under management, the hardware and software characteristics of those hosts, and the content of event messages coming from the hosts (via traps).

The VM-MIB module consists of three groups, which themselves are divided into subgroups. The three upper-level groups are:

- **ctrap**: Defines information on traps.
- **vmsystem**: Defines information on basic system configuration.
- **vmhost**: Defines information specific to each host.

Table 3-1 lists and describes the contents of ctrap, vmsystem, and vmhost.

Table 3-1 VM-MIB Contents	
Object	Description
ctrap	(Information on traps.)
trapCommon	Defines how events are reported.
trapFilter	Defines which events are reported and from what hosts.
vmsystem	(Information on basic configuration.)
vmsysgeneral	Defines information on basic system configuration.
vmsysdisk	Defines information on system disks.

vmsysscsi	Defines information on SCSI disks.
vmsysnet	Defines information on network connections.
vmsysestra	Defines information on extra-cost features.
vmhost	(Information specific to each host.)
localhost1	Defines detailed information on host 1.
localhost2	Defines detailed information on host 2.
localhost3	Defines detailed information on host 3.
localhost4	Defines detailed information on host 4.

SS7-MIB Module

The SS7-MIB module defines basic information for an SS7 integration on a NuPoint Messenger server. It specifies object types that represent basic integration parameters, ISDN User Part (ISUP) parameters, and Message Transfer Part (MTP) parameters. The SS7-MIB module has three groups:

- ss7info: Defines information on basic SS7 configuration.
- isup: Defines information on SS& ISUP configuration.
- vmmtp: Defines information on SS7 MTP configuration.

Note: Again, use your management station MIB browser to access a list and description of each atomic object within the VM-MIB and SS7-MIB modules.

Planning Management Strategy

NuPoint Messenger server network management strategy has three key dependencies: the capability of the management station, the number and type of NuPoint Messenger servers to be managed, and the goals of the management team. These dependencies make it difficult to be specific about planning management strategy. However, it is possible to give some general tips.

Management Station Capability

The first step in planning management strategy is to thoroughly understand the capability of the management station(s). That ensures no time is wasted in management plans that cannot be implemented.

Management stations vary in the amount of support provided for SNMP operations. Most allow simple MIB queries, provide a trap-handling mechanism, and provide a means to display alarms triggered by traps. However, the support for these features varies. For example, full-service

management platforms such as HP OpenView provide controls to set alarm thresholds and execute automated polling of MIB variables. Other management platforms do not.

Device Characteristics

The next step in planning management strategy is to thoroughly understand the device(s) to be managed. Where are they located? How are they configured? How are they expected to be used? What event indications are expected?

With regard to events, determine the severity of events expected and the priority for reporting those events. Are the events critical, major, minor, or informational? Should they initiate alarms at the management station(s)?

Many NuPoint Messenger server characteristics can be viewed as manageable resources that allow you to set alarm thresholds. For example, the management station can monitor disk storage capacity. A threshold can be set on that MIB variable to trigger an alarm when the disk has approached, for example, 65% capacity.

In short, decide which MIB variables to monitor and at what frequency and against what thresholds.

Management Goals

After the management team understands the capacity of the management stations(s) and device(s) to be managed, the team can set some goals. The goals can be stated in terms of metrics. For example, the team can try to keep the frequency of disk capacity alarms under a minimum amount per hours of NuPoint Messenger server usage.

The team's goals can balance the level of NuPoint Messenger server management with user needs and management organization resources.

4 Handling MIB Queries (Gets) and Sets

This chapter provides additional information on retrieving and modifying MIB variables through SNMP get and set requests. Management stations issue get and set requests to, respectively, query or set MIB variables via the agent.

What Are Get and Set Requests?

SNMP defines a way to communicate with and control networked devices. Managers can query devices for management information. Managers also can modify some information on devices. The SNMP commands that initiate these operations are get requests (for queries) and set requests (for changes). A get response follows each of these requests. There is no set response, keeping SNMP operations to a minimum.

The operands and results of request-response operations are MIB variables. A MIB variable is a specific instance of a type of management information on the managed device. In MIB terms, read-write variables are variables that can be queried and set. Read-only variables can be

queried only.

Get and Set Processing at the Management Station

Figure 4-1 shows the methodology of SNMP gets and sets at the management station. First, the user (operator) loads the appropriate MIB modules from MIB device files. The process of loading the modules into a database on the management station is called compiling the MIB. The database tells the manager(s) what MIB variables are available to query.

Next the operator issues the get or set request. This causes the manager to transmit the request to the agent. After the request is processed, the agent returns management information to the management station. The information is reported or stored for later analysis.

In addition to manual queries, most management stations allow operators to configure automatic polling of selected variables. Automatic polling allows management stations to automatically retrieve the values of selected variables at regular intervals.

Operators can specify one or more threshold values on a number of MIB variables, along with a severity level for each. Whenever a retrieved instance crosses the pre-specified threshold, an event occurs of the specified severity. This triggers an alarm on the management station, and it might trigger event-handling software to take corrective action.

Figure 4-1 SNMP Get and Set Methodology

Get and Set Processing at the Voice Mail Server

The get requests issued at the management station reach the NP Config SNMP main agent in the NuPoint Messenger server (Figure 4-2). The main agent passes each request to the appropriate subagent. For example, if the request relates to a MIB-2 variable, the request passes to the MIB-2 subagent; if the request relates to an SS7-MIB variable, the request passes to the SS7-MIB subagent.

The subagent communicates the request to the appropriate process (executing program) on the NuPoint Messenger server. The process retrieves the requested management information from memory and passes it back to the subagent. Communication between subagent and NuPoint Messenger server processes is via QNX Send() and Reply() commands.

Upon receiving the reply with management information, the subagent constructs an SNMP response and forwards it to the main agent. The main agent passes the get response back to the management station.

Set requests are processed in a similar fashion, except the process on the NuPoint Messenger server writes to memory before reading from it. The set value is thus confirmed to the management station in the get response returned by NP Config SNMP.

Currently, only a limited number of NuPoint Messenger server MIB variables are read-write; in other words, it is possible to use the set command on only a select group of NuPoint Messenger server management information. Specifically, the types of management information that can be modified on the NuPoint Messenger server are trap filters. Trap filters are described in Chapter 5, "Handling Traps."

Figure 4-2 NP Config SNMP MIB Query (Get) and Set Processing

Note: For additional information on SNMP get and set processing from a management station perspective, refer to documentation supplied with the management station.

5 Handling Traps

This chapter focuses on the exchange of event information between NP Config SNMP and management stations. The exchange is done through SNMP traps. A trap is a one-way mechanism by which the management station is informed of an abnormal event at the voice mail server. The event might be informational or might indicate a degradation in operating condition.

What Are Traps?

SNMP defines a way to inform remote managers of abnormal events at networked devices. The SNMP command that performs this operation is a trap. The trap has two purposes: to report the occurrence of the event, and to provide values of management information related to the event. Because a trap is a one-way mechanism, no response is returned by the managers. The agent cannot assume a trap was received.

It is important to distinguish between an event indication, trap, and alarm. The three are interrelated and often confused. An event indication is initiated at the networked device by software that has an interface with the agent (as described later). A trap is initiated at the device in order to pass information about the event indication to the management station. After receiving the trap, the management station might or might not issue an alarm. To summarize, the sequence and point of origin of these three actions is:

event indication (device)>trap (device)> alarm (management station)

Note: In NuPoint Messenger server terms, event indications are usually called error messages. However, in keeping with SNMP conventions, this document calls error messages event indications. Also, some voice mail server software generates local alarms (at the voice mail server). These alarms are not the result of traps and are not related to NP Config SNMP.

Trap Processing at the Management Station

Figure 5-1 shows the methodology of traps at the management station. The user (operator) typically provides the station with trap-handling instructions. When the station receives a trap, it processes the trap according to those instructions. Typically, the management station logs the trap and registers an alarm.

Figure 5-1 SNMP Trap Methodology

An alarm might be an audible warning, or it might be a graphics display (for example, change in the color of a map icon). The management station also can forward the alarm to another management station.

Setting Trap Filters

Management stations can manage dozens or even hundreds of devices. Each device might have the capacity to send traps. To prevent being flooded by traps, the management station must limit the number of traps received. This is done by filtering traps at each device. Filtering is the process of establishing criteria by which the device sends traps.

NP Config SNMP provides four trap filters (Table 5-1). The filters are defined in the VM-MIB module of NP Config MIB. The operator of the management station controls the filters by doing a set request on those variables.

Note: The subsystemFilter is for internal use only.

Table 5-1 NP Config SNMP Trap Filters	
Filter	Description
moduleIDFilter	Limits traps to events generated at particular NuPoint Messenger server modules.
subsystemFilter	(For internal use only.)
messagetypeFilter	Limits traps to events of a particular type.
severityFilter	Limits traps to events of a particular severity.

Table 5-2 lists possible values for the severityFilter. NP Config SNMP supports six levels of event severity, corresponding to alarm levels defined by most management station vendors. You can use the MIB browser on your management station to view the possible values of all other NP Config SNMP trap filters.

Table 5-2 Event Severity Levels	
Level	Description
Normal	The device is up and working correctly.
Critical	The device is down or in a critical state.
Major	The device Mzhas problems that result in degradation of operation.
Minor	The device is in a degraded state, but no critical condition is reported.
Warning	The device has a potential problem, but no degradation is reported.
Informational	Returns information about the device.

Setting Alarm Threshold

The operator of the management station can set alarm threshold. Alarm threshold determines the circumstances under which an alarm is triggered at the management station. If the threshold value is crossed (in either a positive or a negative direction, depending on the definition of the threshold), the alarm is triggered.

Trap Processing at the NuPoint Messenger Server

Traps originate as event indications from NuPoint Messenger server processes executing in any module (Figure 5-2). Each process uses the ErrorLog() function to send its event indications to the err_log process in that module. The err_log process puts the indication into the trap and log

queues for that module.

Upon command by the NuPoint Messenger server operator, a process called the log recorder requests contents of the log queue and can print those contents to the console, a file, or a serial port.

On a periodic basis, the trap subagent requests the contents of the trap queue. After the trap queue is passed to the trap subagent, the trap subagent filters out event indications per trap filters set from the management station. The trap subagent then encapsulates the remaining event indications into traps. The traps are sent to the main agent, and the main agent forwards the traps to all registered management stations.

The developers of NuPoint Messenger server processes determine the conditions that trigger event indications. The developers also determine the content of the event indications, within constraints of the event indication format.

All event indication content reaches registered management stations intact. In other words, the NP Config SNMP main agent and the trap subagent do not strip away information contained in the original event indication.

The interpretation of event indications at the management station is the responsibility of manager(s) running on that station. As a result, developers who create those managers must be aware of the format passed by `ErrorLog()`.

Figure 5-2 NP Config SNMP Trap Processing

Appendix A - References

This appendix lists reference information that can be useful in understanding and applying NP Config SNMP.

Background Information

Many texts provide background information on SNMP-based network management. Following is a small cross-section:

- S. Feit. *SNMP: A Guide to Network Management*, McGraw-Hill, New York, NY, 1995. ISBN 0-07-020359-8.
- M. Rose, K. McCloghrie. *How to Manage Your Network Using SNMP: The Network Management Practicum*, Prentice Hall, Englewood Cliffs, NJ, 1995. ISBN 0-13-141517-4.
- W. Stallings. *SNMP, SNMPv2 and RMON: Practical Network Management (Second Edition)*, Addison-Wesley, Reading, Massachusetts, 1996. ISBN 0-201-63479-1.
- A. Leinwand, K. Fang Conroy. *Network Management: A Practical Perspective*, Addison-Wesley, Reading, MA, 1996. ISBN 0-201-60999-1.
- D.Perkins, E. McGinnis. *Understanding SNMP MIBs*, Prentice Hall, Upper Saddle River, NJ, 1997. ISBN 0-13-437708-7.

Requests for Comments

SNMP standards are documented in Internet Engineering Task Force (IETF) Requests for Comments (RFCs). The following RFCs relate to NP Config SNMP architecture and contents.

- RFC 1213. K. McCloghrie, M. Rose, "Management Information Base for Network Management of TCP/IP-based Internets: dMIB-II," 1991.
- RFC 1406. F. Baker, J. Watt. "Definitions of Managed Objects for the DS1 and E1 Interface Types, DS1/E1-MIB," 1993.
- RFC 1157. J. Case, M. Fedor, M. Schoffstall, J. Davin. "A Simple Network Management Protocol (SNMP)," 1990.
- RFC 1212. M. Rose, K. McCloghrie, "Concise MIB Definitions," 1991.

Note: RFCs are available on the World Wide Web. For information on locating and obtaining RFCs, check the IETF Web page:

<http://www.ietf.org>

Appendix B - More About Standard MIB Support

This appendix provides additional information on NuPoint Messenger server support of MIB-2 and DS1-MIB modules.

MIB-2 Support

MIB-2 defines a core set of management information related to a TCP/IP network connection. Some or all of MIB-2 is supported by all SNMP-capable devices. The MIB-2 specification is documented in RFC 1213.

The NuPoint Messenger server supports all of MIB-2, with the following exceptions:

- Object ifSpeed of the interface table is not supported
- Object ifSpecific of the interface table is not supported.
- Object ipRoutingDiscards of the ip table is not supported.
- Object ipAdEntReasmMaxSie of the imAddrTable is not supported.
- EGP Group is not supported.

Note: Objects that are not supported show "0" when they are viewed through a management station MIB browser.

DS1-MIB Support

The DS1-MIB defines management information related to DS1 digital trunk interfaces, including T1 and E1. The DS1-MIB specification is documented in RFC 1406.

The DS1-MIB has three groups: DS1 Near End Group, DS1 Far End Group, and DS1 Fractional

Group. The NuPoint Messenger server supports only portions of the DS1 Near End Group (no parts of the DS1 Far End Group and DS1 Fractional Group are supported).

The DS1 Near End Group has four tables: DS1 Configuration Table, DS1 Current Table, DS1 Interval Table, and DS1 Total Table. The NuPoint Messenger server supports only portions of the DS1 Configuration Table and DS1 Total Table (no parts of the DS1 Current Table and DS1 Interval Table are supported).

The NuPoint Messenger server supports the DS1 Configuration Table and DS1 Total Table with the following exceptions:

- Object dsx1Fdl of the dsx1ConfigTable is not supported.
- Values dsx1E1-MF and dsx1E1-CRC are not supported in the object dsx1LineType of dsx1ConfigTable.
- Only value dsx1SendNoCode is supported in the object dsx1SendCode of the dsx1ConfigTable.
- Only value dsx1NoLoop is supported in the object dsx1LoopbackConfig of dsx1ConfigTable.
- Value bitOriented is not supported in the object dsx1SignalMode of the dsx1ConfigTable.
- Value throughTiming is not supported in the dsx1TransmitClockSource of dsx1ConfigTable.
- Objects dsx1TotalSESSs, dsx1TotalSEFSs, dsx1TotalBESs, dsx1TotalDMs, and dsx1TotalLCVs of dsx1TotalTable are not supported.

Note: Objects that are not supported show "0" when they are viewed through a management station MIB browser.

Glossary

Abstract Syntax Notation One (ASN.1)

A formal language used to define syntax. In the case of SNMP, ASN.1 defines syntax of objects.

ACCESS

An element of OBJECT-TYPE that defines the way in which a variable of that object type can be accessed.

agent

In SNMP terms, software running on a network device that responds to a manager's request to inspect or change management information.

alarm

A graphic or audible signal that an event was indicated.

atomic object

A leaf on the OID MIB tree (a MIB object type that cannot be resolved into another object type). Each atomic object represents a type of management information.

client-server computing

Computing that is divided between activities requested by an end user or program (client) and resource responses (server) to the activities requests.

datagram

A packet that carries information across a network without need for a connection between source and target devices.

E-1

The CEPT digital telephony format devised by the CCITT that carries data at the rate of 2.048 Mbps (DS-1 level). E-1 can be compared to, but is not the same as, the North American T-1.

error

In NuPoint Messenger server terms, an event that is reported in the error log. Some events are routine and others cause degradation or loss of system performance.

event

In SNMP terms, a routine or abnormal condition reported to the management station. From the perspective of the NuPoint Messenger server, events are called errors.

filter

In SNMP terms, a mechanism that suppresses traps for particular devices.

Get

SNMP message that requests to retrieve a MIB variable via the agent.

Get Next

SNMP message that requests to retrieve the next MIB variable from a sequence of like variables (contained in a MIB table).

Get Response

SNMP message that replies to a manager request with the requested information.

global MIB

The union of MIB modules for all Internet devices. The global MIB represents all management

information that can be accessed through the Internet.

host

See module.

HP OpenView

HP's network management platform. Software that includes a GUI and underlying support for network managers.

IETF

Standards setting body for the Internet. Standards are published in Requests for Comments (RFCs).

Internet Engineering Task Force. See IETF

IP address

A network-level address assigned to each system in a TCP/IP network. It is 4-bytes long; for example, 192.215.15.46.

management information base (MIB)

See MIB.

manager

Software that runs on a management station and makes requests to a managed device via the SNMP agent for the device. The manager also can receive unsolicited event messages from the agent.

map

A graphical and hierarchial presentation of a network and its systems on a management station.

MIB

A specification that defines management information. The MIB allows software running on an SNMP-based management station to monitor or control devices across a TCP/IP network.

MIB database

A database for MIB modules on a management station.

MIB module

All or part of the MIB for a particular device. The union of all MIB modules for all devices is called the global MIB.

MIB-2

Standard MIB module that defines management information for TCP/IP connectivity. Also called RFC1213-MIB.

module

An individual processor (CPU) and attached components on a NuPoint Messenger server. The server can have between one and four modules. Also called a host.

NP Config MIB

MIB modules for the NuPoint Messenger server.

NP Config SNMP

SNMP agent for the NuPoint Messenger server.

NuPoint Messenger server -

Voice mail/fax processing system.

NuPoint Voice™

Basic software that provides voice processing capability to the NuPoint Messenger server.

object

A type or class of management information on an SNMP-capable device. Also called an object type.

object identifier (OID) -

See OID.

object type

See object.

OBJECT-TYPE

ASN.1 construct that gives the name of an object.

OID

unique identifier of an object within a MIB. A sequence of numbers separated by periods. The sequence defines the location of an object in the tree-structured MIB of which it is a part.

Point-to-Point Protocol (PPP). See PPP

PPP

Protocol that allows transfer of IP packets across a phone line. Similar to but not the same as SLIP.

private MIB module

MIB module that contains definitions of enterprise-specific management information.

RFC 1213 -

IETF document that specifies the MIB-2 standard.

RFC 1406 -

IETF document that specifies the DS1-MIB standard.

Serial Line Internet Protocol. See SLIP

Set -

SNMP command that requests to change a MIB variable via the agent.

severity -

Measure of the seriousness of a NuPoint Messenger server event. The following levels are defined (listed in decreasing order of seriousness): critical, major, minor, warning, informational, normal.

Simple Network Management Protocol (SNMP)

A set of standards for multivendor network management. SNMP specifies a means by which management information is defined.

Signaling System 7. See SS7

SLIP

Protocol that allows transfer of IP packets across a phone line. Similar to but not the same as PPP.

SNMPv1

SNMP version 1. First and most widely-used version of SNMP standards. Adopted in 1989. Superseded by SNMPv2.

SS7

A common-channel signaling protocol that communicates, on a dedicated circuit or channel, call setup, teardown, routing, origination, destination, and other control or status information pertinent to a call.

standard MIB module

MIB module that contains definitions of management information that has become an Internet standard. For example, MIB-2 or DS-1 MIB.

STATUS -

ASN.1 construct that

subagent -

In NP Config SNMP terms, a process or processes responsible for a particular kind of NuPoint Messenger server management information. The subagent communicates with a network manager through the NP Config SNMP main agent.

SYNTAX -

An ASN.1 construct that gives the syntax for an object type.

T-1

The North American telephony format that is similar to but not the same as E-1.

TCP/IP

Set of protocols for multivendor networking. Used extensively for the Internet. Includes UDP and IP protocols for connectionless delivery of datagrams.

threshold

Low or high limit for a value of a type of management information. If the value exceeds this limit, an alarm is triggered at the management station.

Transmission Control Protocol/Internet Protocol. See TCP/IP

trap

SNMP message that transfers event indication from agent to management station.

trap handling

The processing of traps.

UDP/IP

Set of protocols for connectionless delivery of datagrams.

User Datagram Protocol/Internet Protocol. See UDP/IP

variable

Specific instance of a type of management information. A variable has associated with it an object name and value.

voice processing

Generic term for any equipment that can handle voice messages from callers.