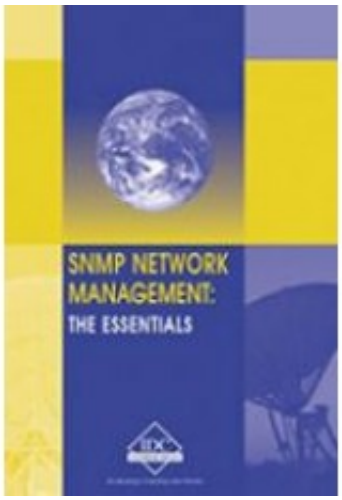
IDC Technologies - Books - 1031 Wellington Street
West Perth
WA 6005

Phone: +61 8 9321 1702 - Email: books@idc-online.com

SN-E - SNMP Network Management - The Essentials



Price: $65.95

Ex Tax: $59.95

Short Description

Network Management is about monitoring and managing multi-protocol networks using the SNMP Protocol. This manual reviews the SNMP Protocol structure, Network management applications, and query agents. There is a detailed discussion on identifying objects, MIBs and SNMP devices.

Description

Network Management is about monitoring and managing multi-protocol networks using the SNMP Protocol. This manual reviews the SNMP Protocol structure, Network management applications, and query agents. There is a detailed discussion on identifying objects, MIBs and SNMP devices.

Table of Contents

Download Chapter List

First Chapter

1. **Introduction to network management**

1

Introduction

Networks have become extremely widespread in today's world and are gaining importance with each passing day. If the networks are to function efficiently, they have to be monitored and managed. In this session, we will have a look at the concept of Network Management. Once we are familiar with Network Management, we dwell in to explore Distributed Network Management. The chapter also provides in-depth information about the Open System Interconnection (OSI) model.

Further on, in this chapter you will get introduced to Simple Network Management Protocol (SNMP) in terms of its evolution, model, functions and so on.

1.1 Need for network management

During the early 1980's, network deployment began to gain prominence tremendously. The reasons for this being that companies gradually appreciated the cost reduction and productivity enhancement as a result of network technology. No sooner were new network technologies launched; the companies expanded their existing networks by incorporating the new network technologies. In addition to the advantages offered by network technology, there were certain associated drawbacks. New network technologies were being launched on a regular basis. By the mid 1980's, a combination of a number of different network technologies was being used by the companies. In addition to this, another factor of concern for the companies was incompatibility of network technologies.

Owing to the problems associated with network expansion and incompatibility of network technologies, the routine network operation management and network growth planning was affected. This led to an overall effect on the productivity of the company, thereby hitting at the profits ultimately. This crisis had to be solved immediately. To solve the crisis, it called for an immediate requirement of automated network management incorporated over varied environments.

1.2 Network management

What is Network Management? A single line definition is not possible since it depends on the environs within which Network Management is being utilized. In the simplest of cases, *Network Management* refers to a network consultant who supervises network activity with the help of a protocol analyzer. This is one scenario. Another scenario might comprise of distributed databases, state of the art workstations capable of producing instantaneous graphical representations of changes in network topology and traffic.

Generally, it can be stated that Network Management is basically a type of service wherein a wide range of tools, devices and applications are utilized to aid network managers and other associated people for network maintenance and monitoring.

A network management system comprises of an assortment of network monitoring tools and control that is combined in the following manner: the crux of the system is a single operator interface comprising of easy to use commands that can accomplish the network management tasks. The advantage is that the need for separate equipment is minimal since the hardware and software requirements for the system are completely integrated into the user equipment itself.

1.3 Elements of network management architecture

The fundamental structure and the set of relationships utilized in a majority of network management architectures are identical. The functioning of the network management architecture is as follows. Network devices and computer systems run certain software that facilitates in sending alerts when problems are encountered. An example of one such problem is when the user determined threshold is exceeded. The management entities are programmed to react to these alerts in an appropriate manner. The entities are assigned certain actions like automatic system repair, event logging, and system shutdown.

Management entities can carry out polling end stations. Polling enables the entities to verify the values of variables. Polling can be user-initiated or automatic.

Figure 1.1 describes network management architecture. Agents that are present in the management devices provide response to both user-initiated and automatic polls. Agents are basically software modules that carry out the following tasks in the following sequence as mentioned below.

- Compiling the information about the managed devices in which they are present.
- Information storage in a management database.
- Providing the information to management entities within network management systems (NMSs) with the aid of a network management protocol.

Prominent among the network management protocols are ***Simple Network Management***

Protocol (SNMP) and ***Common Management Information Protocol (CMIP)***.

Figure 1.1 Network Management Architecture

1.4 Distributed network management

A distributed management system comprises of interoperable workstations positioned on LANs spread throughout the enterprise. The architecture used is hierarchical in nature and it comprises of the following elements.

- Distributed management stations have limited access for network

monitoring and control. This is defined by each department resource for which they serve.
- There is one central workstation having global access and the capacity to manage all the resources present in the network. In addition to this, it can also enhance the functioning of less enabled stations by monitoring and controlling their operation.

Distributed Network management offers certain advantages that are mentioned below:

- The biggest advantage offered is that of Scalability. When there is a requirement for a supplementary management capability, it can be achieved by easily setting up a workstation at the required location.
- There is a great reduction in the network management traffic overhead as a major portion of the traffic is restricted to the local environment.
- Since there are numerous networked stations present, there is no scope for single point of failure that is usually present in centralized schemes.

The concept that is stated above can be understood clearly with the help of a diagram as shown in Figure 1.2

Figure 1.2

Distributed Network Management

Figure 1.2 depicts the structure of a distributed network management system.

- The management clients (workstations, PCs) facilitate the user in providing access to management services and information. In addition to this, they also provide a graphical user interface that is user friendly. On the basis of access privileges, one or more management servers can be accessed by a client workstation.
- The management servers form the crux of the system. Each server comprises of a collection of management applications and a management

information base. They comprise of common management data models and route management information.

If you observe Figure 1.2 closely, it is easily evident that is highly scalable and flexible. When extra resources are added to the distributed network, each resource is provided with agent software.

1.5 Open systems interconnection (OSI) model

OSI is the short form for **Open System Interconnection**. The OSI model is represented graphically as shown in Figure 1.3.

The OSI model is created by International Standards Organization (ISO) and it is a seven-layered model. For every layer, there is a well defined input and an output. In addition to this, every layer has a well defined function that it carries out to facilitate efficient data communication in a network.

Figure 1.3

OSI Model

- **Physical layer:**The primary function of the Physical layer is transmission of raw bits over a communication channel. The major task during the design is that when a 1 bit is sent from one side, it should be received on the other side as a 1 bit itself and not as a 0. A wide array of questions need to be answered here like the volts needed to represent a 0 bit and a 1 bit, the bit life in microseconds, whether transmission can be bi-directional.
- **Data link layer:** To understand the functions of the Data Link layer, let us first familiarize ourselves with the term ‘frame’. ***A frame can be defined as a structured data packet.***The main function of the Data Link layer is transferring frames from one computer to another. After sending the

frame, it waits for an acknowledgement.

- **Network layer:** The network layer controls the Subnet operation. An important aspect of Network Layer is determining routes for packets to be transmitted from source to destination. If the number of packets being transmitted is too many in number, it leads to packet congestion, thereby resulting in bottlenecks. It is the responsibility of the network layer to ensure that the packet flow is smooth.
- **Transport layer:**The Transport layer accepts data from the Session layer. The data is split up into smaller units, if required, and then passed onto the network layer. It is the duty of the transport layer to ensure that the data is received accurately at the other end.

Generally**,** for every transport connection required by the Session layer, a distinct network connection is created by the Transport layer. In situations wherein greater throughput is required by the transport connection, multiple network connections are created by the transport layer. Alternatively, if the creation and maintenance of a network connection is costly, a number of transport connections are combined into a single network connection.

- **Session layer:** The main function of the Session layer is to facilitate users on different machines to start up a connection. Using a session, a user can log in to a remote time-sharing system. It is also used for file transfer operation between two machines. Token Management is another task that Session layer oversees.

Token Management: Whenever a task has to be performed, it might happen that the two sides involved might try to accomplish the same task simultaneously. To manage this situation, the session layer distributes tokens that can be exchanged. The side containing the token is given the priority to carry out the task.

- **Presentation layer:** The layers that we have discussed above are

concerned with whether the bits are being transmitted properly, controlling traffic congestion, ensuring that the received bit stream is identical to the transmitted bit stream and so on. The major task of the Presentation layer is to check the accuracy of the information transmitted in terms of the syntax and the semantics.

To make things clear, let us consider an example. The items that are usually exchanged in programs are dates, names of people, billing statements and so on. As per their data type, these items are represented as integers, floating point numbers, character strings. They might also be represented as a data structure, which in turn comprises of other items. The representation of the data types varies for different computers. Due to the variation, it will not be possible for two computers to communicate. To ensure that the communication takes place, the data structures that will be exchanged are defined in an abstract way. It is now the responsibility of the Presentation Layer to manage the abstract data structures. It converts the abstract data structures to the network standard representation from the representation used inside the computer

Data compression is another task carried out by the Presentation layer.

Data compression refers to sending data using fewer bits.

- **Application layer:** The Application Layer is the uppermost layer of the OSI model. . In this level, the applications directly access network services. This layer epitomizes the services that support applications like access to the database, electronic mail, file transfer.

1.6 SNMP history

In the beginning of this chapter, you have seen how network deployment gained

prominence and then the concept of network management came into existence. But as the number of individual networks grew in size, and even though there were network managers present, it became a daunting task to solve the network management problems. Thus, a small group of experts would not suffice. To tackle this problem, it called for a consistent protocol that would be easy to use and could be implemented by the network management people.

Simple gateway monitoring protocol (SGMP) provided the breakthrough in offering network management tools. It did not prove to be a general-purpose network management tool since the method it followed to monitor gateways was very simple. Since, SGMP did not prove to be too beneficial, there were three more protocols that came into the picture. They were: **Simple Network Management Protocol (SNMP)**, **High-Level Entity Management System (HEMS)** and **CMIP over TCP/IP (CMOT)**. It was a prerequisite that the OSI model should be utilized in implementing a network management system. Hence, SNMP was ultimately chosen for monitoring networks.

1.7 Introduction to SNMP

As the name indicates, Simple Network Management Protocol (SNMP) is a protocol using which a user can manage a network by supervising the events occurring in the network.

SNMP was designed in mid 1980’s to solve the communication problems that arose when two communicating devices implemented different network technologies. It was introduced with the notion that it can be used as a standby respite until a better option is developed and is available. That eventually did not happen and SNMP is still the preferred protocol for network management

In spite of the emergence of new technologies, SNMP is still being used widely around the world. The major reason for its wide acceptance and utilization is that its design is extremely simple. As a result of this, its implementation on a large network is simple since it can be set up easily. Secondly, due to simplicity in its design structure, the users can easily program the variables that they want to

scrutinize. The variable will comprise of the following information: title of the variable, the variable data type, and variable value and whether the variable is read-only or read-write.

Another advantage of SNMP is that it provides ample scope for any improvisations over it. Owing to this, it can be used to adhere to user applications that expand day by day.

1.8 SNMP components

An SNMP managed network comprises of the following components: management station, management agents, management information base, and network management protocol.

We shall now have a look at each of these in detail.

- **Management station:** It is a device, which acts as an interface between the network manager and the network management system. A management station is typically a stand-alone device that serves as the interface for the human network manager into the network management system. The station must be equipped with management applications, an interface for the human network manager, capability to transmit the network manager's commands by use of the network management protocol, and a database of information extracted from the Mobs.
- **Management agent:** The network devices like bridges, hubs, hosts are the Management Agents. They are monitored by the management station and can also communicate with it.

Whenever there is a request from the management station for information or action to be preformed, the management agent responds to it by executing the action on its self as ordered by the management station. Sometimes, it might send messages to the station without actually being asked for the same.

- **Management information base (MIB)**: The resources in the network are

represented as objects so that they can be efficiently managed. Management Information Base refers to that collection of objects. It functions as an assortment of access points at the agent to aid the management station.

- **Network management protocol or simple network management protocol:**

It is capable of performing the following tasks.

Get: Facilitates the management station in retrieving the object value at the agent.

Set: Facilitates the management station in setting the object value at the agent.

Trap: Facilitates the agent to inform the management station the occurrence of important events

1.9 SNMP model

Figure 1.4

SNMP Model