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Network Management Overview

THE ROLE OF NETWORK MANAGEMENT IN STRUCTURED NETWORK ENVIRONMENTS

As corporate networks continue to grow in size and complexity, to what extent do IS professionals protect and manage their investments? Surprisingly, administrators of many large networks risk daily exposure to catastrophe.

With the advent and standardization of SNMP (Simple Network Management Protocol), network professionals can better understand and control their day-to-day network operations. This helps them identify and correct potential problems before they occur.

Network management has experienced explosive growth over the last several years and is becoming a fundamental part of the network infrastructure as IS professionals recognize its benefits.

COMPAQ

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NETWORK MANAGEMENT OVERVIEW

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NETWORK MANAGEMENT DEFINED

Network management is a set of tools and processes that enables you to control, monitor, and troubleshoot your network. Some tools control the logical network, which can include servers, user accounts and resources. This paper discusses management of the physical network, comprised of repeaters, switches, routers, cable plants, and network interface controllers. Problems such as repeater and switch failure, intermittent cable operation, and incorrect controller settings occur in the physical layer of the network.

Management of the physical network can be divided into two areas: proactive and reactive tools. Proactive tools help you anticipate and prevent problems. Reactive tools help you identify and solve problems once they occur.

PROACTIVE NETWORK MANAGEMENT

Proactive network management is the most important aspect of network management. It involves actively searching the network for faults and monitoring the network's performance and error statistics, even though problems may not have occurred. Like radar, proactive network management informs you of the changing conditions in your environment, and alerts you to serious problems on the horizon.

As your network grows, management software enables you to monitor network traffic and configure the network infrastructure accordingly. For example, you can use a network management application to maintain or increase performance by isolating segments that communicate infrequently.

Scenario

As a network administrator, you need to increase performance in the network by segmenting groups of users that do not need to communicate directly. How do you determine which users to put on each segment?

Too frequently, network managers are forced to make an educated guess, implementing a solution that may not work for all users. A network management application provides a tool to monitor the traffic flow as well as implement the new segmentation scheme.

Segmenting the network increases the overall performance of the network by isolating traffic on each segment. A router or bridge installed between the segments enables users to communicate between segments when necessary. As the network continues to grow in size and complexity, you can use segmentation to maintain a smooth-running, structured network environment.

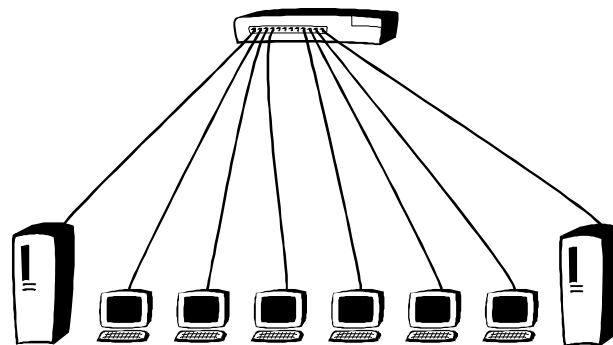


Figure 1 - A flat unsegmented network

Figure 1 shows eight nodes in a flat, unsegmented LAN. Each node's transmission affects the overall available bandwidth, and therefore performance. The repeater in the diagram can be segmented (divided into smaller, isolated networks). However, without the benefit of management software, it is difficult, if not impossible, to determine how best to segment the repeater.

Figure 2 shows a managed, segmented LAN in which network management now plays a major role. The network has been segmented into two smaller segments. Connecting the segments is a router or bridge, enabling clients on one side to connect to devices on the other side if needed.

Network management is essential when planning for problem avoidance. You can configure a repeater's redundancy capability to anticipate cable, controller or port problems. For example, if the repeater detects a port failure, it automatically switches to a backup port and notifies the management software of the error. This helps ensure uninterrupted operation of the network.

Network management allows you to employ many proactive features that may already be built into your network devices. Port intrusion security, VLAN, IP/IPX auto-discovery, and RMON support are just a few features waiting for a network management application to put them to use.

REACTIVE NETWORK MANAGEMENT

Once a problem is detected, how quickly can you identify the problem and implement a solution? Without the proper tools, small problems can often go undetected until they become major problems. How will you address these situations?

Scenario

A network user calls to inform you that his computer can no longer communicate with any of the servers on the network. This type of problem frequently occurs on LANs of all sizes and configurations. You could spend literally days troubleshooting the problem. Where do you start?

- See if the user still has access to the servers and the servers are operational.
- Check the repeater for port problems or see if the repeater has been reconfigured.
- Determine if there is a problem with the network software or drivers on the user's computer.
- See if there is a problem with the network interface card.
- See if the user's cable is properly connected and is not faulty.

A network management application provides a quick diagnosis that leads you to a solution. Rather than your having to check each possibility by hand, a network management application would allow you to check potential problem areas without leaving your desk.

One by one, you eliminate each lead until you discover the problem. You may even be able to resolve the problem using the network management application itself.

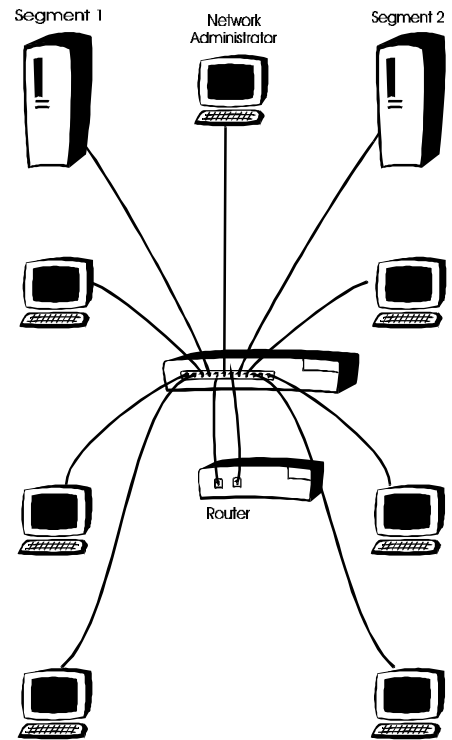


Figure 2 - The example network after segmenting the repeater with network management software

THE CENTRALIZED MANAGEMENT APPROACH

Most network management applications are designed around the concept of "centralized management." Rather than managing repeaters and switches via serial management ports, a technique which is acceptable for only for small networks in concentrated areas, centralized management allows you to manage all of your devices from a single location on the network.

For large networks, and networks that cover wider geographical areas (wide area networks, or WANs), the cost of time and travel required to manage the network becomes increasingly prohibitive, making centralized management vastly preferable to localized serial-port management. In a centrally managed network, you can manage devices that are hundreds, or even thousands of miles away without leaving your office, letting you focus on the problem.

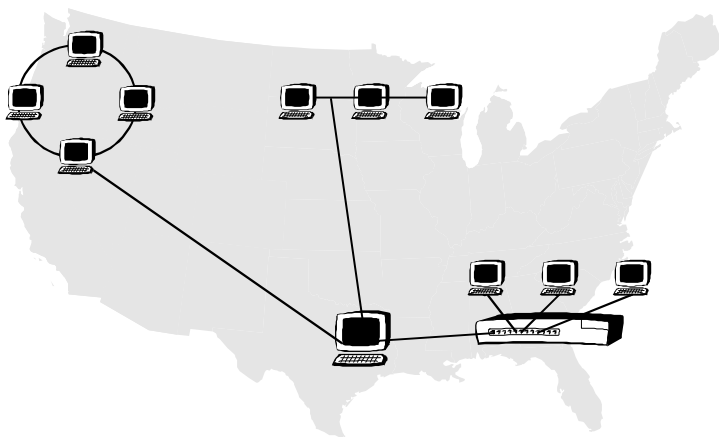


Figure 3 - A WAN managed at a central point (large PC represents the management station)

THE DISTRIBUTED MANAGEMENT APPROACH

In large, enterprise networks, even the centralized approach has its shortcomings. Trying to manage a network consisting of thousands of nodes from a single location requires massive computing power and generates a substantial amount of network traffic.

In these environments, a distributed management system prevails. Distributed management places the responsibility of gathering statistics at the segment level. Network administrators at various sites become responsible for managing and gathering statistics from smaller network segments or domains, buildings, or large departments.

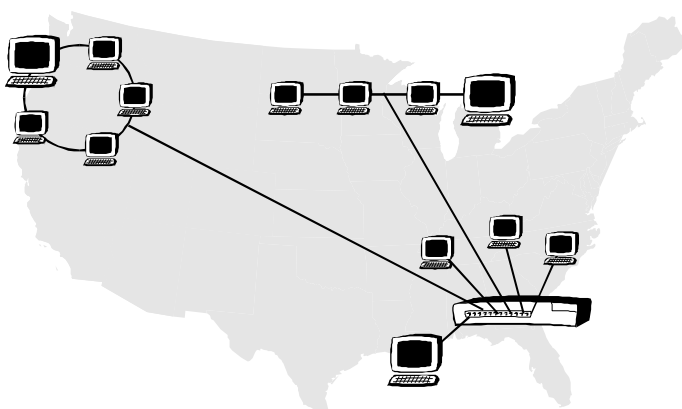


Figure 4 - A WAN managed on a segment basis (large PC represents the management station)

NETWORK MANAGEMENT OVERVIEW (cont'd)

In this manner, network management traffic is isolated to each segment. A central manager can then collect management data (performance, errors, configuration, etc.) from the segment or domain managers when necessary, providing a total picture of the network environment without generating excessive management-related traffic.

THE COST OF NETWORK MANAGEMENT

How do you justify the cost of the hardware, software, and training required to implement a network management system? Although most network management solutions may seem expensive, the lack of network management can be even more costly. Ask yourself the following questions:

What happens when my network fails?

Network failure significantly reduces productivity and revenue. When your network goes down, work ceases, paralyzing mission-critical operations - and you are responsible for reacting to and resolving the situation.

How much does downtime cost?

When a network or a segment crashes, every minute of downtime results in lost revenue and productivity. Each year, as we rely more on computers in our daily business, losses from network downtime increase dramatically. Figure 5 shows the estimated cost of downtime from network failure.

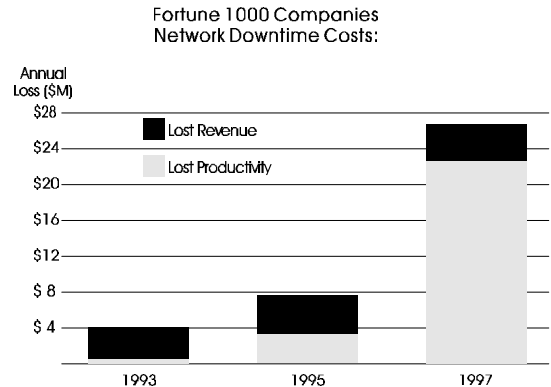


Figure 5 - Source: Infonetics Research, Inc.

Why not just hire additional support personnel?

Infonetics Research studies show that, as corporate management allocates funds to expand the information system, they are not allocating proportional funding for the staff required to support the system.

Therefore, as budgets tighten, network professionals will turn to management tools to maximize the productivity of smaller support staffs. Figure 6 illustrates the gap between network management budgets and LAN segment growth.

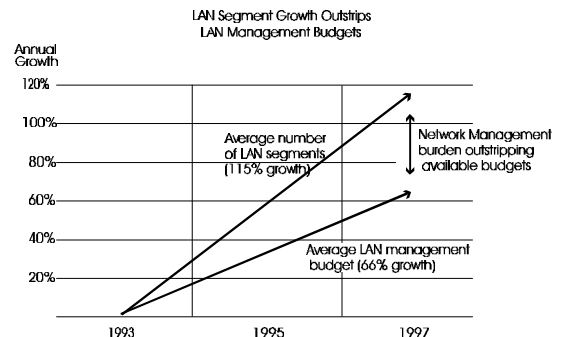


Figure 6 - Source: Infonetics Research, Inc.

THE NETWORK MANAGEMENT DIVIDEND

So what does network management really mean to your business, and what kind of return on your investment can you expect?

Each time a network management application prevents a failure, detects and solves a potential problem, or increases performance, you have gained a network management "dividend." These dividends translates into money in the form of time and resources.

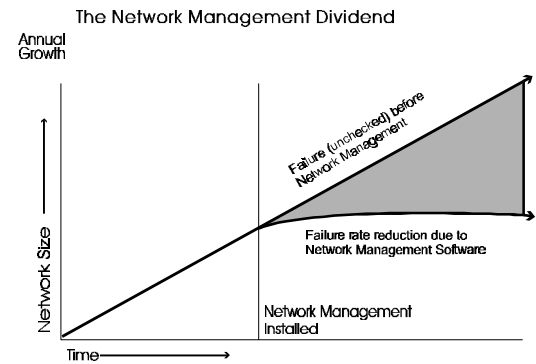


Figure 7 - Impact of Network Management

HOW NETWORK MANAGEMENT WORKS

Network management employs a standard called Simple Network Management Protocol (SNMP). SNMP consists of two important components: agents and managers. An agent is software or firmware included with a network device, such as a repeater or router. The agent monitors a device's operation, but does nothing else unless it detects an error or is polled for information. Software agents can be installed on PCs to report information such as available hard disk space, memory usage and which applications are loaded.

A manager is a sophisticated software application that collects and processes information from many agents. It polls certain agents for information at regular intervals or only when requested.

The manager/agent relationship is similar to an office administrator and employees. The administrator may occasionally ask an employee, "How is your report coming along?" to which the employee might respond, "It's finished."

Ideally, each employee answers favorably. Occasionally, the administrator may find that one or two employees may not have completed the work or were not present to answer the question. The administrator records these occurrences as faults and reports them to a higher authority. In both cases, the employee (agent) waits for the administrator (manager) to initiate the conversation (polling).

As another example, an employee might call the administrator to say that he cannot find the information necessary to complete his report. In this situation, the employee (agent) initiates the conversation by reporting a problem (trap) before the administrator (manager) makes an inquiry. The relationship of the manager and agents is illustrated in Figure 8.

A device's agent is typically accessed using a management information base (MIB). A MIB contains device-specific information that helps the management software work with an agent.

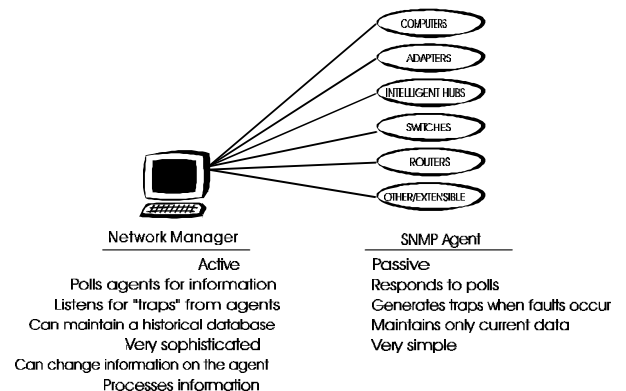


Figure 8 - The Manager/Agent Relationship

Typically, when you add a device to a network, you must load the device's MIB into the management software to manage the device.

MANAGEMENT TOOLS

MIB Browsers

SNMP-manageable devices which support MIBII and standard RFCs can be managed via a utility called a MIB Browser. A MIB browser allows network administrators to examine and configure a device's MIB. Many MIB browsers have the ability to compile vendor specific (proprietary) MIB extensions, also known as enterprise MIBs, thus providing further access to vendor specific extensions. A MIB database can consist of literally hundreds of elements, arranged in hierarchical order. You can navigate through the various levels to locate the information you need to manage a device.

Virtually any SMNP device can be managed using a standard MIB. Devices that offer special proprietary features can be managed using the vendor's proprietary MIB.

Graphical Interfaces

Most operations are greatly simplified by using a graphical representation of the device you want to manage, by isolating the user from complex MIB groups. Unlike a MIB browser, performing most functions requires only a few clicks of a mouse button.

NETWORK MANAGEMENT PLATFORMS

In recent years, the network industry has agreed on standard management platforms. For small to medium networks, Novell NetWare Management System (NMS) and HP OpenView for MS-Windows have become the de-facto standards. In larger, UNIX-based networks, HP OpenView, SunNet Manager, and IBM NetView/6000 have become the management platforms of choice.

These management platforms perform most of the network management functions IS professionals need, but they do not provide direct support for networking devices. Instead, each platform provides a set of application program interfaces (APIs) to which vendors can attach "snap-in" management applications designed specifically for the vendor's devices.

HOW COMPAQ ADDRESSES NETWORK MANAGEMENT

As network management becomes a key component of large networks, it also becomes a greater requirement for Compaq customers. Compaq is committed to including strong manageability features in all of its hardware product lines.

When Compaq acquired NetWorth, Inc. and Thomas-Conrad Corporation in late 1995 forming the Compaq Networking Products Division, the need for comprehensive network management coverage became critical. Compaq addressed this need with Compaq Netelligent Management Software.

Compaq Netelligent Management Software

Designed to operate under Microsoft Windows NT and Windows 95, Netelligent Management Software provides network management and configuration features for manageable Netelligent products.

Netelligent Management Software provides management information and control through an intuitive graphical interface designed specifically for your Netelligent product. In most cases, little experience with network management is needed to configure Compaq Netelligent managed networking devices.

A user-customized graphical topology map depicts the layout of your network, which can include network devices, WAN access-points and connections to each device. Simply drag and drop device icons and connect them to various LANs and WANs.

Device icons are polled regularly to determine if they are available on the network. Active devices are highlighted in green, devices that fail to respond are highlighted in red. This gives you an immediate "at-a-glance" status of your network.

Double-clicking on a Compaq Netelligent device icon automatically reads its current configuration and LED status, and displays a graphical depiction of the device on the screen. The device can now be configured using simple point and click operations.

The Netelligent Management Software guided configuration wizard enables users to deploy the Netelligent 8500 Communications Platform with ease. Combined with extensive on-line help, the guided configuration makes the normally difficult task of configuring a router easy.

Users are prompted through various screens such as interface configuration, IP addressing and routing, LAN and WAN protocols and SNMP traps. Once the configuration is complete, the configuration is set on the device and saved to a file for later use.

Netelligent Management Software is composed of two parts: the foundation and product management modules (PMMs). The foundation software is the main portion of the software,

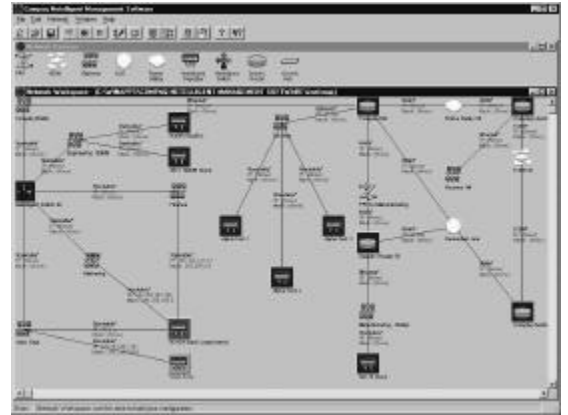


Figure 9 - The Netelligent Management Software topology map

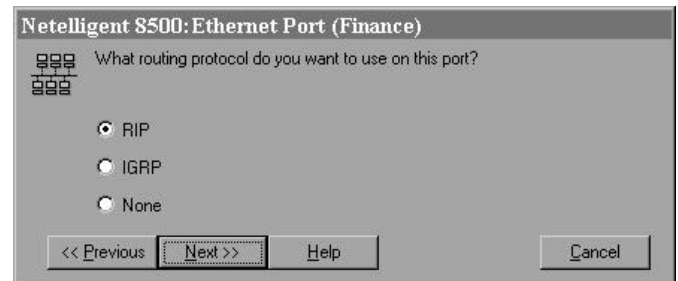


Figure 10 - Guided Configuration Screens

NETWORK MANAGEMENT OVERVIEW *(cont'd)*

encompassing the map, alarms, and MIB browsers. PMMs are product specific modules that add support for Netelligent repeater, switch, and router products.

NETWORK MANAGEMENT OVERVIEW (cont'd)

Netelligent Management Software and Compaq Insight Manager are included at no charge with all Compaq manageable repeaters, switches, and routers, and are available from the Compaq FTP and World Wide Web sites (www.compaq.com).

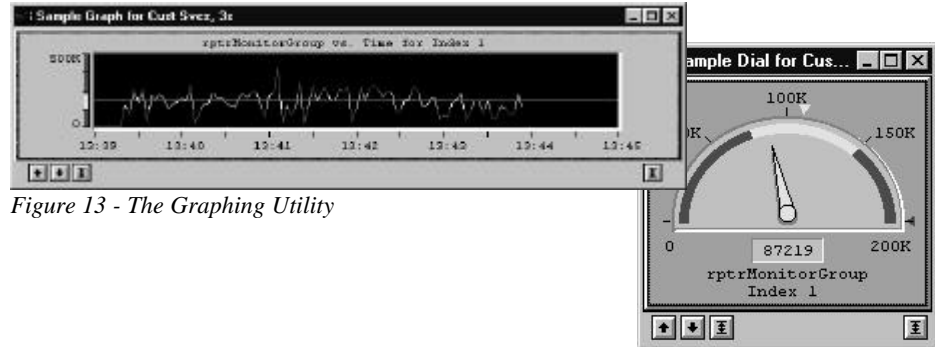


Figure 13 - The Graphing Utility

STATEMENT OF DIRECTION

In addition to Netelligent Management Software, Compaq is actively and aggressively investigating ways to improve its network management offerings. First, Compaq will continue to improve and enhance Netelligent Management Software. Second, Compaq is pursuing development of open platform management solutions. In addition, Compaq, in cooperation with other industry leaders, is driving an effort to standardize Web-based network management.

Netelligent Management Software

Future versions of Netelligent Management Software will include support for RMON, VLAN, auto-discovery, and other advanced network management features. As new Compaq networking devices are introduced, support for these devices will be added to Netelligent Management Software and made available at no charge. This is consistent with Compaq's established history of strong management solutions.

Open Platform Solutions

Compaq is investigating customer requirements for support for open platform management solutions, such as HP OpenView, SunNet Manager, IBM NetView/6000, and Novell ManageWise. These platforms offer a wide array of management solutions for Windows and UNIX users, and are considered the industry standard applications for medium to large networks.

Compaq understands the need to protect the investment of customers who have installed expensive network management platforms. Compaq is working to deliver application support for manageable Netelligent products in the leading open management platform environment. Currently, Compaq MIBs can be used in these applications (see MIB Browser section, page 8) to manage all Compaq networking products.

The Internet Management Initiative

BMC Software, Cisco, Compaq, Intel and Microsoft along with support from over 60 other software vendors together proposed an industry standards effort that will allow administrators to use any Web browser to manage disparate systems, networks, and applications. The intent of the Web-Based Enterprise Management effort is to enable the development of tools that reduce the complexity and costs of enterprise management.

The Web-Based Enterprise Management standards effort is open to the entire hardware, software, OEM and internetworking community. The effort is designed to integrate existing standards – such as the Desktop Management Interface (DMI) for desktops and servers, the Simple Network

NETWORK MANAGEMENT OVERVIEW *(cont'd)*

Management Protocol (SNMP) for networks, and the HyperText Transfer Protocol (HTTP) for communication over the Internet – into an architecture that can be managed using any Web browser.

The initial proponents of this industry-wide effort will cooperate on developing the resulting standards. Previous industry attempts at integrating enterprise management have resulted in a variety of frameworks and incompatible management protocols and data models, making it difficult to integrate management solutions in customers' enterprise environments.

To achieve this integration and meet customer needs, the inherent benefits of Internet technologies must be leveraged through Web-based management standards. This effort provides the foundation for developing these industry standards.

By implementing a solution using the Web-based Enterprise Management standards, information technology managers will gain an integrated low-cost management solution that spans their systems, networks and applications, while preserving their investments in existing management investments, standards and protocols.

Components of the Web-based Enterprise Management Standards Effort

The effort outlined today is based on existing industry standards. Structured and unstructured data can be presented by a variety of methods, including SNMP, HTML, and DMI, as well as new methods being defined within the standards organizations to support SNMP over HTTP.

Additionally, the effort promotes the use of two new management-related technologies to provide data modeling, manipulation, and communication capabilities, recently outlined at a meeting of the Internet Engineering Task Force (IETF):

- HyperMedia Management Schema (HMMS), an extensible data model representing the managed environment.
- HyperMedia Management Protocol (HMMP), a communication protocol embodying HMMS, run over HTTP.

The HyperMedia Management Protocol has been presented to the IETF and is currently under discussion. This schema will be defined, maintained and evolved by the Desktop Management Task Force (DMTF), pending its approval. The schema will be maintained on a public Web site using specially constructed tools to ensure consistency and longevity of the data model.

A portable C++ implementation of a HyperMedia Object Manager (HMOM) will also be created and made freely available. HMOM will manage elements as objects, integrating management data and coordinating control through a variety of management protocols and interfaces (such as SNMP, DMI, etc.) through Web-based consoles and other management applications. The specification for HMOM and the portable C++ implementation will be placed in the public domain.

For more information on the components comprising the Web-Based Enterprise Management effort, please refer to the effort's Web site at <http://www.wbem.freerange.com>.

SUMMARY

Network management is an excellent and essential investment in the future of your network. It can quickly pay for itself by increasing your company's productivity by reducing or eliminating network downtime. It empowers you with control and oversight of your network operations, preventing you from becoming a victim of network problems that could have been avoided. Compaq offers a complete family of network management applications that provide complete control over your Compaq Netelligent repeaters, switches and routers, maintaining your investment in networking hardware.