

SCOadmin

SCO OpenServer Systems Management

An SCO Technical Strategy Paper

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Overview

The search for a universal systems management solution for the distributed computing environment continues to be an elusive goal. The challenge of incorporating diverse technologies into a unified architecture that supports an infinite set of business practices is unlikely to be solved soon, if ever. The Open Software Foundation's vision of a Distributed Management Environment (DME) collapsed under its own weight in the attempt to build an alliance of disparate network management and bleeding-edge object technology.

While the industry re-groups in its attempt to solve the distributed systems management problem, a more modest first step has been taken with the definition of a common set of management semantics based on object-oriented programming principles, giving solutions providers and management professionals the ability to describe the systems management environment with standard, implementation-independent terminology. Object-oriented terminology is providing a universal language for describing *managed resources* such as users, printers filesystems and Windows® desktops as objects representing management information. The X/Open Systems Management Working Group has defined a standard "reference model" for distributed systems management that incorporates this object-oriented approach.

Building on this standards-based model, SCO OpenServer™ Release 5 introduces a new generation of system administration features incorporating the new object-oriented view of distributed systems management. As a suite of highly-integrated graphical applications, "SCOadmin" raises the bar of base systems management functionality by providing core remote-enabled, management services that reflect the responsibilities of the Business Critical Server. In addition to providing traditional systems management capability, these new applications support an extensive set of new features that include distributed user account management via NIS, expanded printer job management, remote filesystem backup, RAID disk configuration as well as NetWare® printer and access management and support for selected portions of the SNMP-based Host Resource management information base.

SCOadmin expands the definition of "system administrator" by reducing the need for extensive training as well as the dependency on UNIX® system "gurus" to manage day-to-day operations. Simplified administration has been accomplished through the use of OSF/Motif® interfaces designed to present graphical views of well-defined management tasks. This "task view" is supported throughout the SCOadmin environment in a consistent, orchestrated manner. Training requirements are further reduced by the use of context-sensitive and point help.

Taking full advantage of the graphical SCO OpenServer desktop, SCOadmin management applications can be reorganized to reflect the assigned tasks of individuals with specific administrative roles. Extending the desktop with third party management solutions, as well as internally-developed administration utilities, is fully supported with SCOadmin desktop installation and configuration tools. Solution providers and administrators alike can take advantage of the native SCO OpenServer system OSF/Motif scripting language provided by the new, multi-platform SCO Visual Tcl™ technology used by SCO engineers to develop SCOadmin applications.

The use of an object-oriented "framework" enables SCOadmin applications to share common management services, including access to managed resources, management events, and logging services as well as the sharing of common functions such as requests for information on installed media devices. Reducing the reliance on "rlogin" or "telnet" for remote administration, framework-based SCOadmin applications provide authorized remote systems management of other SCO OpenServer environments with an eye on enhanced support of the Windows LAN environment in the near future.

As an application server, SCO OpenServer features powerful new capabilities with the development of a new SCOadmin "Software Manager," supporting the ability to push and pull software applications, updates and patches across the network. Current SCO Open Server Release 3.0 customers can perform upgrades of their systems from remote SCO OpenServer Release 5 sites. Software applications configured with the new "Software Storage Object" architecture can be remotely shared over the network, conserving the use of network disk space.

SCOadmin puts core enterprise systems management technology in the hands of SCO OpenServer customers today. With an eye on the near term, the SCOadmin framework provides a foundation for expanding SCO OpenServer management into the Enterprise management view as well as the Windows LAN environment.

Systems Management Today

The Race for the Best View

The steady migration to distributed computing has extended beyond the umbrella of traditional systems management services that were standard in classic host-centric environments. Finger-tip access to enterprise-wide asset and accounting information has proven to be an elusive goal for businesses attempting to view their desktop and server environments as a unified, manageable organization.

Falling short of this goal, distributed computing has become synonymous with resource and cost-intensive management solutions. There are a wide variety of management technologies well-tailored for only a portion of the larger management picture, poorly integrated to deliver a complete solution that seamlessly presents and controls the WAN and LAN user environments. In recent years the industry has seen a scrambling by a wide variety of interests and management backgrounds to attempt to solve the systems management problem, each with its own point-of-view.

Two major trends, representing both established and emerging technologies, shown in Figure 1, have begun to shape the direction of the enterprise management picture. Traditional standard network management protocols, the Internet's SNMP (Simple Network Management Protocol) and the ISO CMIP (Common Management Interface Protocol), are moving beyond their historic roles of managing the health of the network to taking on expanded responsibility for management of system-specific data, such as filesystems and system performance. Newly-emerging object technology represented by the Object Management Group's CORBA distributed object protocol have entered this domain as well, providing an alternative approach to the traditional network protocols. The converse perspective is represented by Windows PC technologies that are beginning to move up the management food chain, taking on the monitoring and management of department and larger LAN environments. The Data Management Interface (DMI) is the first industry standard specification targeted at making desktop management information accessible by the larger corporate management view.

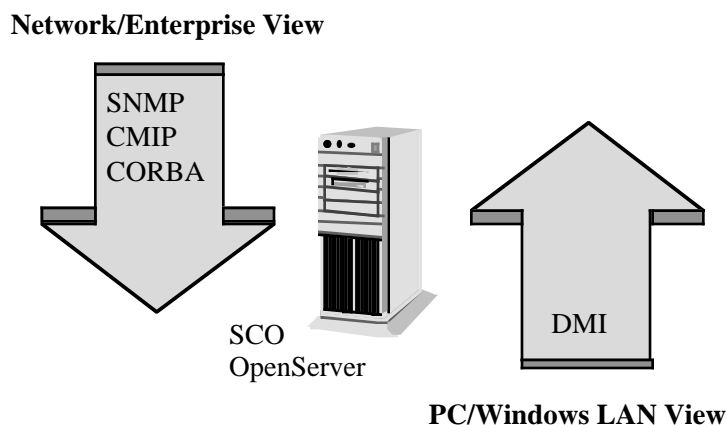


Figure 1 - Competing approaches to addressing systems management across the network.

The search for comprehensive distributed systems management is encumbered with a list of issues that, in part, explain why there is still much work to be done. Discussions about delivering systems management typically lead to commonly-asked questions, such as:

- ◆ Which wire protocol or RPC specification should the industry agree upon?
- ◆ When will the industry standardize on common definitions of managed resources?
- ◆ How will policy-based management fit into all of these management views?

The failure of the Open Software Foundation's Distributed Management Environment (DME) was based, in part, on the premature attempt to bring bleeding-edge and established technologies together, resulting in a lengthy integration effort that wallowed while the rest of the industry moved on in piece-wise fashion. By the time DME was "ready" its technologies were either out-of-date or never really ready for production-quality management.

The reality of the distributed systems management situation still reflects a recipe that integrates existing and very new technologies, all necessary to provide a solution that scales to address the need to integrate the many “micro-climates” found in distributed computing environments.

Objects and Systems Management

The promise of object-oriented technology appears to be an irresistible component in just about every approach to the evolving distributed management picture. Trends in distributed systems management standardization are dominated by the use of object-oriented principles (OOPs) to describe standard interfaces of resources that require management (e.g., users and filesystems). At first it may appear that the systems management area is simply reflecting the latest industry hot topic. However, there are distinct advantages to viewing systems management through the terminology and concepts of the object view.

The X/Open Systems Management Working Group (SysMan), where SCO represents the X/Open ISV Council and currently chairs the activities focused on a standard Backup and Restore API, has completely incorporated OOPs into its systems management “reference model,” shown in Figure 2, that identifies the components and their interfaces for enabling distributed systems management. SysMan has explained its rationale for using OOPs based on the following criteria:

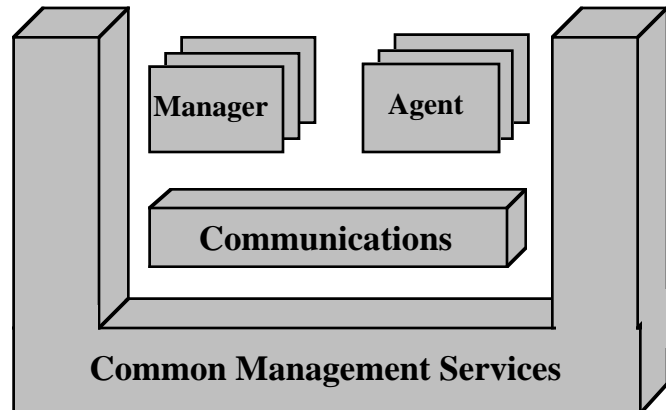


Figure 2 - X/Open Reference Model

Resources as Objects

By representing a filesystem, a user or a printer as an object, a consistent, universal model and set of semantics can be defined for the entire industry. This “layer of abstraction” allows definition work in systems management to move ahead while implementation details are worked out elsewhere.

Building on Existing Work

Subclassing of objects allows for building upon earlier object definitions. For example, a new type of device driver object can be subclassed from existing general device drivers with only the new features added on. In theory, if the industry decides on a base object for a user, then vendors can define their system-specific user attributes or extensions as subclassed from the industry-defined user object.

Hiding Implementation Details

Encapsulation of data allows for the “hiding” of how things are done. Thus a user object can be defined independently of whether it’s an SCO® UNIX® user or a PC user. This also provides a powerful story for how new systems management models can incorporate the management of “legacy” systems, such as mainframe hosts.

Message-based requests and responses

Making requests via “message passing” for services (e.g., “list the users on machine Y”) means that applications can be written independent of RPC technologies (e.g., ONC RPC or DCE RPC?). If a requested service is generic in nature, then message-based communication allows the network to determine which service is free to satisfy the request. (e.g., a network job scheduling service).

Synergy with related activities

This is more than a “because everybody’s doing it” rationale. The good news is that, in principle, if each standards body is using OOPs as a basis for their definition work, then the collective work becomes much easier to synchronize. X/Open SysMan has established a very tight liaison with the OMG®, for instance, in pursuit of synchronizing their mutual work.

Systems Management and CORBA

In 1993, X/Open SysMan reworked its reference model for distributed systems management to make sure that it could accommodate the OMG (Object Management Group) CORBA (Common Object Request Broker Architecture) architecture. Briefly, CORBA is an evolving standard specification that describes a standard interface and model for how “distributed objects” communicate with each other across a networked environment. An application on one platform (e.g., IBM® AIX™) can request services from objects residing on another platform (e.g., SCO OpenServer). CORBA defines how inter-communicating objects can be scattered over an organizational network. Although it is still too early to determine, it appears that CORBA-based distributed management tools could become the industry standard for distributed systems management. X/Open is current defining a set of management services, all based on the CORBA architecture.

Terminology

Although this paper attempts to minimize the use of object-oriented terminology, the fact of the matter is that these concepts are essential components of an industry-standard terminology used to describe the “things” that participate in systems management. Here are some key definitions to consider.

<i>Managed Resource</i>	A logical or physical thing that is managed or represents management information, such as a user, a print queue or a modem.
<i>Managed Object</i>	The object interface of a managed resource.
<i>Agent</i>	The software that coordinates activities (requests and responses for information or actions) of managed resources.
<i>Manager</i>	The application user interface that presents systems management tasks via a graphical dialog. A manager represents management information and gathers user input by issuing and receiving requests and responses from managed objects. A manager may make a request for information from multiple managed objects located on different machines (e.g., list of users on machines A, B and C).
<i>Framework</i>	The technology that “coordinates” the requests and responses between managers and managed objects.
<i>Management Services</i>	These are common services, such as event, security and scheduling services, that are commonly utilized by managers and agents. These services eliminate the need for each manager to provide its own set of services that are commonly required in systems management environments.

SCO OpenServer and the Enterprise View

Traditionally, SCO has tuned its SCO OpenServer operating environments to address the needs of the Small-to-Medium Business, Branch Automation and Replicated Systems markets. So why is the “Enterprise View” of systems management important to SCO?

In the role of a Business Critical Server, SCO systems commonly serve to link departmental environments into the larger management picture. Often these departments display the attributes of “branch automation” or “replicated sites” where each department in the environment is configured with similar software and hardware components. For many organizations, it is critical that these departmental nodes participate in the larger management infrastructure as organizations attempt to control costs by creating highly-responsive centralized trouble desks.

SCO OpenServer Release 5 introduces a new systems management technology, “SCOadmin,” that incorporates the evolving standards-based model for enterprise-wide systems management, largely based on the object-oriented principles discussed earlier. SCOadmin defines a management environment that will provide the foundation for future releases of SCO OpenServer systems to represent departmental management information, including the Windows desktop LAN environment, to the larger management picture.

SCOadmin is the next-generation successor to **sysadmsh**, the long-time character-based stalwart for SCO systems management. Sysadmsh represented a significant leap forward in base UNIX centralized systems management, moving system administrators from the command line to full-screen, single-entry management operations. Sysadmsh made system administration available to a larger audience by presenting management operations via a familiar, easy-to-use ring style menu interface complemented by on-line help.

The evolution of the Business Critical Server platform pushed sysadmsh to the limits of its original design philosophy. Adapting to an enormous range of server-based roles required a huge leap in flexibility, scalability and usability.. Furthermore, the emergence of SCO's Window's Friendly strategy introduced an entirely new set of management requirements focused on the LAN-based desktop environment. A new direction in OpenServer systems management was clearly required that would address this wide range of design challenges:

- ◆ Application interaction must be designed to expanded the definition of the SCO system administrator "user profile," allowing for a wider range of expertise and training experience. Inconsistent user interfaces placing the user in the vi editor or "rolling shell script" subprograms must be eliminated from day-to-day management tasks.
- ◆ Provide the ability to view large volumes of data in order to adapt to a dynamic, expanding organization characteristic of distributed computing environments.
- ◆ Software and system installation and distribution must allow administrators to take advantage of SCO OpenServer as an application server in the client-server environment.
- ◆ Extensibility must be "policy-free," allowing tools and solutions from administrators and third party products to be easily incorporated anywhere in the SCO OpenServer systems management environment.
- ◆ SCO OpenServer systems management environment must reflect established and evolving standards wherever possible in order to support "administrator portability" in a multi-platform environment.
- ◆ The new systems management architecture must establish a base platform designed to accommodate a growing management role of Windows desktop LAN environment. Accessibility to non-SCO network services, such as NetWare printing and NIS must be enhanced.

SCOadmin: Core Systems Management Redefined



SCO OpenServer Release 5 introduces a highly-integrated set of core systems management technologies designed to take SCO customers into the future of distributed systems management *today*. This new environment, called “SCOadmin,” represents the *raising of the bar* of core systems management features and functionality for the server market.

A Suite of Graphical Management Applications

SCO OpenServer systems management provides a suite of graphical management applications, called *Managers*, featuring carefully-crafted management tasks targeted at significantly boosting the productivity of system administrators performing daily administrative activities. Built with the exciting new SCO Visual Tcl language, each SCOadmin application supports both OSF/Motif and “character Motif” interfaces. Incorporated into the SCO OpenServer graphical desktop as a toolshed object, the SCOadmin environment features boundless desktop configurability.

Remote Systems Management

As core technology, SCO OpenServer will come “out of the box” enabled for remote management, replacing “sneak net” and time-consuming remote login utilities with simple point and click access to managed resources. The new SCOadmin “framework” provides selected management applications with the ability to remotely administer SCO OpenServer clients on the network.

Client-Server Software Management

SCO OpenServer introduces a new approach to software installation and configuration, providing administrators with the ability to optimize their client-server environment. A new software packaging architecture supports the ability to share, install and distribute software components across the network.

Standards-based Systems Management

The SCOadmin architecture incorporates the object-oriented concepts of the X/Open Systems Management Reference Model for distributed systems management. Its communication protocol and managed object definition language are based on existing ISO (International Standards Organization) standards.



A Foundation for Windows Management

By supporting the object-oriented concepts of the X/Open Systems Management Reference Model, the SCOadmin architecture will be able to easily incorporate management of the Windows desktop environment via the Desktop Management Interface (DMI) in future releases of its Windows Friendly™ SCO OpenServer product family.

A Survey of SCOadmin Features

Motif and “Character Motif” management applications	<p>SCOadmin is a collection of Motif-based applications referred to as “Managers.”¹ Appendix A contains a detailed list of SCOadmin managers and their features. Rather than wade through an extensive set of administrative menu options, administrators invoke only the application that suits their purpose. The SCOadmin managers interfaces were developed with the new SCO Visual Tcl scripting language, giving each application the ability to display Motif dialogs in both X/Motif and curses-based character environments. By incorporating a common set of SCO Visual Tcl libraries, all SCOadmin managers support:</p> <ul style="list-style-type: none">• context sensitive help• point-help¹
Task-based Management	<p>Each SCOadmin management application is designed to lead the administrator through a set of easy-to-follow, well-defined tasks, such as “add a remote printer” or “mount a filesystem.” For the occasional task requiring expert knowledge, expanded control capability is supported “deeper” in pulldown menus.</p>
Graphical View of Managed Resources	<p>Graphical “Object Browsers,” familiar to anyone who has used the Microsoft Windows file manager, provides configurable views of managed resources, such as printers, users, file systems and software components. These browsers allow SCOadmin managers to accommodate a huge amount of data that can be “rolled up” or expanded as necessary.</p>
Remote Management	<p>SCOadmin management applications share a common set of services provided by an environment commonly referred to as a <i>framework</i>. SCOadmin management applications that use the full capabilities of the SCOadmin framework are “remote-enabled” allowing for node-to-node remote management of other SCO OpenServer systems and their resources. Within an SCO environment, the need to rlogin or telnet to another machine in order to add a local user has been eliminated. The SCOadmin applications that are remote-capable include:</p> <ul style="list-style-type: none">• Software Manager• Account Manager• Backup Manager• Printer Manager (See Figure 3 below)• FileSystem Manager• SNMP Agent Manager
A highly extensible administration environment	<p>By virtue of incorporating an application-based view of systems management, the SCOadmin environment is highly extensible. Easy-to-use SCOadmin utilities are provided for installing in-house or third party applications wherever appropriate into the SCOadmin desktop hierarchy.</p>
Management Application Launcher	<p>SCOadmin takes full advantage of the graphical SCO OpenServer Desktop environment in order to organize systems management tasks as a highly-configurable hierarchy of management folders and applications. For those not using the desktop, management applications can be launched via command line or a Motif SCOadmin launcher utility. In the character environment, the same launcher utility is displayed with the “Character Motif” look and feel. (See Figure 4 below)</p>

¹ The terms “Manager” and “Application” are used interchangeably throughout the remainder of this document.



Figure 3 - SCOadmin Printer Manager

Common Services via the SCOadmin Framework

Along with the remote management service, the SCOadmin framework supports a set of services that are commonly available to all management applications, including:

- logging service,
- events,
- error handling,
- object registration,
- database service and
- internationalization service.

Network-based software installation with software sharing and version control

The new Software Manager, formerly known as custom, implements the *Software Storage Object, or SSO*, architecture developed to enable the sharing and distribution of software and software components across the network. Full products or sharable files like large binaries can be pushed or pulled from server to desktop. This flexible new architecture also enables the Software Manger to provide full version control capabilities, including the tracking of software patches.

SNMP-based Systems Management Information

In addition to supporting SNMP MIB-II, SCO OpenServer system includes support for selected portions of the Host Resources MIB (as defined by RFC 1514), the first systems management-specific SNMP Management Information Base to emerge from the IETF (the organization that develops standards for the management of the Internet). By supporting the HR MIB, any SNMP management station will be able to retrieve system-specific information, such as CPU utilization, filesystem names and media device lists, from any SCO OpenServer Enterprise or Desktop system on the network.

NIS and Novell® NetWare® Support

SCOadmin supports the ability to create distributed users and groups via NIS. Printer management supports remote NetWare Printer servers, while the FileSystem Manager can mount remote NetWare filesystems. New SCOadmin management applications support the monitoring of performance, services, and connections with NetWare servers as well as control access, login/logout and password changes.

New management application functions

New management interfaces, not previously available under sysadmsh, include:

- Virtual Disk Manager
- NetWare Managers and Monitors
- Automatic Node Pinging
- Print Job Manager
- SNMP Agent (Configuration) Manager

The plug-and-play flexibility of the SCOadmin framework will enable SCO and SCO customers to easily add new functionality without re-compilation of the entire SCOadmin environment.

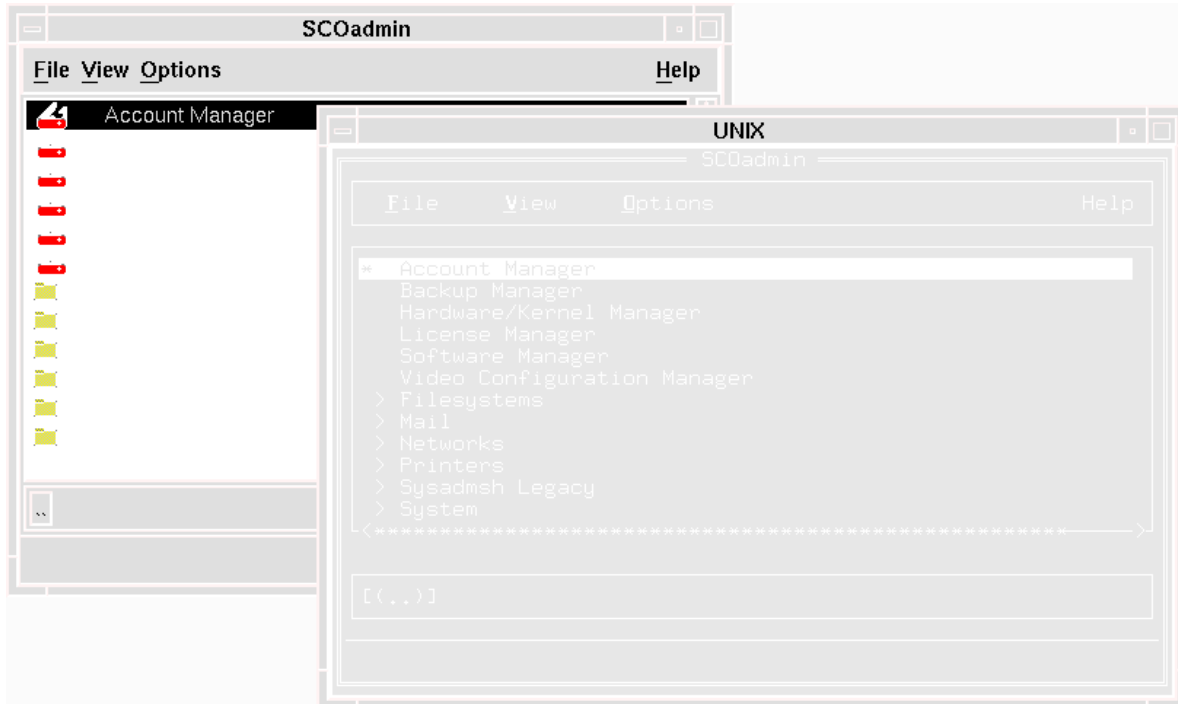


Figure 4 - Graphical and Character Desktops Launchers

Benefits of SCOadmin

By designing SCOadmin to implement a common framework of graphical management applications based on evolving systems management standards, SCO customers will realize the following benefits:

Improved Usability,
Reduced Training
Costs

SCOadmin applications are all written to the same industry-standard interface technology: OSF/Motif 1.2. Combining a consistent user interface design with a task-oriented organization of screen elements (for both X and character environments!) as well as finger-tip, context-sensitive help, substantially reduces the level of expertise required to perform common administrative tasks.

Consistent with
Industry Trends

SCOadmin was implemented to reflect the current industry trends within systems management standards-building activities. As a result, SCO customers will be able to leverage their SCO OpenServer systems management knowledge to become familiar with the new, cross-platform model for enterprise distributed systems management.

The object interface language used by SCO to define managed resources, such as user, printer and filesystem, is an industry standard language (discussed below). As

A consistent view of management data	standards-defining groups like the POSIX® 1387 Systems Administration committee develop new object definitions for different resources, SCO can easily plug these definitions into the SCOadmin environment.
Improved flexibility, configuration and extensibility	<p>The sharing of framework services, such as logging and events, gives SCOadmin applications the ability to present the user with a consistent view of management data. For example, device information is displayed in the same manner no matter which SCOadmin application the user is executing. Also, the same “definition language” for objects representing managed resources creates a level of consistency between how data is accessed and manipulated by each management application. Management applications share data through common functions rather than each defining its own method.</p> <p>By taking advantage of graphical SCO OpenServer desktop support for a hierarchical, icon-based view of management applications, the organization of SCOadmin applications is easily configurable. For instance, a user who is only interested in running the SCOadmin Print Job Manager may elect to move the icon from the SCOadmin printer folder to their main desktop for convenience. Also, administration folders may be created and customized in-house to contain only those applications that represent management tasks for which an individual administrator is assigned and authorized.</p> <p>SCOadmin’s extensibility, via the use of the “scoadmin” line command utility, enables system administrators to install their in-house developed scripts or applications so that they may appear as though they were shipped with the original SCOadmin environment. <i>Provided as SCO OpenServer core technology, the SCO Visual Tcl language enables administrators with the ability to script Motif and character utilities on top of existing UNIX commands.</i></p>

For Software and Hardware Developers and System Integrators

Ease of extensibility	Third party products are easy to install under SCOadmin. Even if the product has not been crafted to be SCOadmin-aware, the local administrator can use the <i>scoadmin</i> utility to migrate the application icon to appear in the appropriate section of the SCOadmin toolshed.
Ease of Motif Migration (without leaving character terminals behind)	The SCO Visual Tcl technology was engineered to meet the needs of systems management, supporting legacy character terminal support as an essential feature. Developers and Integrators can easily migrate their existing shell scripts and small tools from a character-only interface to Motif with parallel support for the character environment.
A complete development environment for management tools	SCO Visual Tcl and the SCOadmin framework services provide a complete scripting development environment for creating remote-capable graphical management applications for the SCO OpenServer environment. The SCOadmin framework also supports C and C++ interfaces when development is augmented with the SCO OpenServer Development System.
Easy integration of installation and configuration scripts.	With the SCO OpenServer system, the SCO Visual Tcl language becomes a base technology. As a result, installation and configuration scripts can be written to use full Motif and Character Motif interfaces, making them appear consistent (and easier to use) with the SCOadmin environment.

Enhanced Software Management

SCO OpenServer Release 5 has been greatly enhanced to deliver as many benefits of client-server-based distributed computing as possible. OpenServer provides superior application server functionality thanks to an entirely new architecture focused at enabling the distribution of software and pieces of software around the network.

The new SSO (Software Storage Object) architecture structures software as cohesive sets of related objects. The software that is “SCO OpenServer” itself has been reconfigured to support the SSO model. Although this reorganization may be transparent to the average user, anyone invoking the new Software Manager will see the immediate benefit of this new model. The Software Manager object browser, shown above in Figure 5, reveals the hierarchical nature of SCO OpenServer software components utilizing the SSO architecture. The administrator can use the object browser to “drill down” into this hierarchy in order to view different products and the components and products of which they are composed. For more on the SSO architecture, see “The SSO Architecture” chapter further on in this paper.

The combination of the new Software Manager, a complete re-write of the old Custom utility, and the SSO architecture provide the basis for a new set of software distribution features:

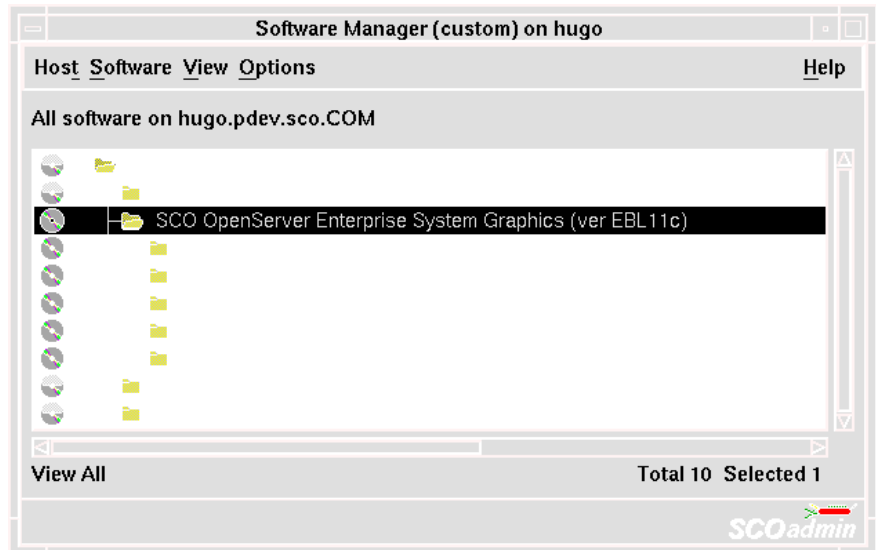


Figure 5 - Software Manager and the view of Software Storage Objects

Remote Installation and Software Management

Software Manager supports the ability to install software from OpenServer systems to SCO client machines over the network. Key variations of installation types include:

- ◆ Install from a device located on a remote machine.
- ◆ Remotely update an SCO OpenServer 3.0 target to Release 5 from an SCO OpenServer Release 5.
- ◆ Push or Pull full software products, or selected software components, between SCO OpenServer targets. Indicate software components, such as re-usable binaries, that are available for **export** to remote clients.

Software on remote machines can also be remotely managed using the standard “Open Host” menu item.

Software Sharing

Software Manager makes it possible to export sharable software resources, such as large binaries, across the network. Administrators now have the ability to “tune” their network configurations for optimal load balancing of installed software. This feature addresses the needs of supporting remote **diskless clients**.

Version and Patch Support

Thanks to the SSO architecture, for the first time, administrators can now track

- ◆ **software patches**, including the ability to add and *rollback* selected

versions, and

- ◆ **multiple versions** of software products, providing the ability to install, for example, two versions of the same application side-by-side on the same side, giving administrators the ability to perform extensive testing of new software without requiring a separate physical environment.

Software Verification

Software Manager offers the ability to check installed software components for corruption or other problems, including detection of *broken symbolic links* or modified configuration files. Replacing the old “perms” files, the new Software Manager database stores a vastly-expanded set of software, software component and file attributes.

Software Manager is also backward-compatible with the huge installed based of existing Custom format applications.

Setting the Stage for Distributed Systems Management

SCOadmin, via its incorporation of the X/Open Systems Management Reference Model and adherence to related standards, both existing and evolving, will eventually position SCO OpenServer systems as inherently “plug and play” components in the larger management scenario of the distributed computing environment.

SCO has been able to establish this foundation by actively tracking, participating in and, in some case, leading standards efforts in order to understand which activities are in the interests of SCO customers, which activities might become dead-ends and which activities are the threads that are likely to dominate distributed systems management interfaces in the near future. Recent SCO activities have included:

POSIX Users/Group Management

SCO chairs the POSIX 1387.3 working group that is developing the standard description of the user and group objects and commands. The interface definition used as a basis for these objects are based on the SCOadmin user and group object definitions. As a result, SCO is in a position to become the first UNIX vendor to provide industry-standard user and group objects as part of its core operating environment technology.

X/Open Systems Management Working Group

For four years, SCO has represented the ISV Council in the X/Open Systems Management working group. SCO has actively recruited ISVs to become even more involved and has seen the balance of representation within this working group move from 90% system vendors to a virtual even-split of system vendors and ISVs.

The Technology Behind SCOadmin

The design principles behind the new SCOadmin technologies were driven by the overall goal to make SCO OpenServer systems easy to manage within the client/server environment. The high level requirements that drove the selection of SCOadmin technologies were:

- Improve **usability** OpenServer systems

in order to make the management of SCO available to a wider profile of system administrator user, reducing the previous level of training required. A derivative of this requirement was to improve the dynamic **extensibility** of the management environment as well, allowing SCOadmin to adapt to the administrator's individual role and responsibility.

- Enable **remote management**

of the LAN environment, defined as one to 1000 users. Reduce the need for "sneaker net". Incorporate systems management **standards**, wherever they exist, into all levels of SCOadmin design and functionality.

Figure 5 illustrates the four key design and technology methods that were selected to implement the bulk of these SCOadmin requirements.

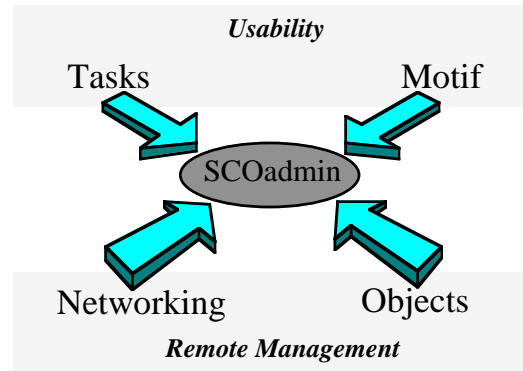


Figure 6 - Views of the SCOadmin design strategy

Management Application Development Strategy

Each SCOadmin manager represents a great deal of design, technical evaluation and human factors test feedback. This section reviews the design strategies used to implement the design and role of each SCOadmin application.

Integration with the SCO OpenServer Desktop

SCOadmin management functions are organized as management applications and are referred to as "Managers" using the X/Open terminology. Each manager takes its place within the hierarchical tree of folders and managers supported by the SCO OpenServer Desktop toolshed, illustrated in Figure 7. This approach provides administrators with an extremely flexible environment that can be manipulated via drag & drop of the SCOadmin manager icons to create a convenient desktop of management functionality that reflects the administrator's management responsibilities.

The view of management applications as highly mobile desktop objects creates an infinitely extensible architecture that eliminates a great deal of hardwired "policy" that previously enforced how management functions were organized. Now local administrators and third party management solutions providers can install their applications anywhere within the SCOadmin desktop environment. The utility "scoadmin" provides a wide range of functions, including the installation of applications into the SCOadmin desktop hierarchy without having to learn how to edit desktop object files. The attainable effect is that these contributed applications look as though they

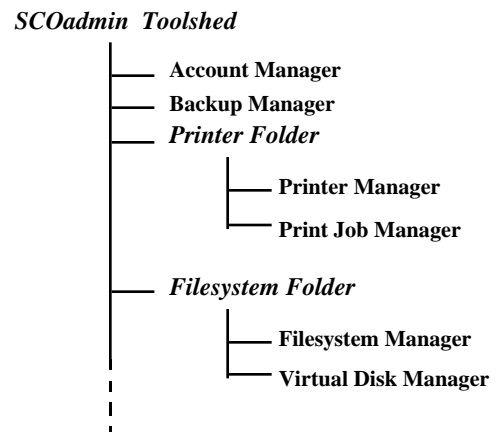


Figure 7 - Hierarchical organization of SCOadmin management applications

shipped with the base operating system.

Tasks and Usability

By virtue of implementing the SCOadmin user interface using the OSF/Motif look and feel, a huge usability improvement is realized for a number of reasons:

1. Administrator training is reduced to learning how to interact through one interface look and feel.
2. The potential for entering invalid values are reduced by the use of Motif widgets such as spin buttons, push buttons and other widgets that list only valid options. In addition to reducing the opportunity for “pilot error”, users are able to accomplish management functions more quickly and reduce dependency on documentation.
3. Motif widgets, used as object browsers where graphical pixmaps are embedded with a list widget, can represent large amounts of management data, and its state. Object browsers are key to enabling SCOadmin applications with the ability to adapt to growing network environments.
4. Because context-sensitive help via SCOHelp is built into the Motif environment, finger-tip information is instantly available, avoiding the need to thumb through manuals.

Delivering truly improved usability for systems administrators, however, takes more than just adding a graphical user interface technology.

Administrative Tasks

Systems Management is characterized by administrators carrying out daily tasks, such as

- ◆ “add a printer”
- ◆ “export a remote filesystem”
- ◆ “change a user’s default shell”

These are examples of tasks which typically incorporate a number of documentable steps required to complete the process. One of the key decisions behind the development of SCOadmin was to design the user interface (and the supporting functionality) to reflect the most common tasks carried out by system administrators. There are a number of benefits to taking this approach:

1. Users don’t have to have a book alongside to figure out “where to go next” to complete each step of a task. Documentation is greatly reduced by not having to point out each step.
2. Interfaces can display (and hide) controls based on required levels of expertise.
3. Task descriptions reinforce a consistent user interface design process.

In order to identify the tasks that SCOadmin would support, SCO Engineering established a team of representatives from training, support, and engineering departments, as well as a newly-established human factors department, to identify, prioritize and chronicle a database of tasks that were based on their experience as administrators, as trainers and as people who support administrators on a daily basis. Predictably, the list was extensive, so SCO applied the 80-20 rule:

☛ Implement the top 20% tasks that represent the tasks that administrators carry out 80% of the time.

In order to make SCOadmin as comprehensive as possible, the points of control that were not incorporated into the implemented tasks are made available as options within appropriate nested sections of pulldown menus and pop-up forms of each management application.

From the database of administration tasks, engineers used a “task template” to turn the task description into the design of a user interface component. The task template identified:

- ◆ A short and long description of the task
- ◆ the steps required to carry out the task
- ◆ the managed resources (e.g., /etc/passwd, lpadmin) required or affected by the task

Remote Administration

SCOadmin management applications support the notion of “one-to-one” remote management. Management actions are carried out on a per-node basis. A contrasting approach is “one-to-many” management where one action can be applied to one or more nodes or resources simultaneously. The latter approach has been popularized by products such as the Tivoli System’s TME management environment. One-to-many is ideal for large enterprise environments supporting 1000’s of network nodes and resources. The technology to deliver enterprise-scale functionality is being delivered by key ISVs with whom SCO is working to make available on the SCO OpenServer platform. Although the SCOadmin framework is capable of supporting one-to-many functionality, the goal for SCOadmin was to administer the needs of the department-size LANs with 1 to 1000 users.

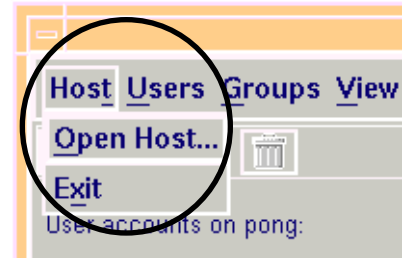


Figure 8 - Remote management access button

A derivative benefit of this design approach is that the one-to-one view maps extremely well to the character interfaces. Character-based users realize the same benefits of remote management as their X/Motif-based counterparts.

SCO Visual Tcl Technology

In order to meet the unique development needs of graphical-based systems management, SCO developed a scripting-based OSF/Motif (version 1.2) interface development language called SCO Visual Tcl. The SCO Visual Tcl architecture supports simultaneous rendering of the Motif look and feel for X and character environments, as well as the Windows look and feel through the use of the Wintif™ library. The cornerstone features of SCO Visual Tcl that supported the development (and runtime environment) of SCOadmin are:

Character Terminal Support	Character displays are still the dominant environment of system administrators. This includes administrators who commonly operate from remote sites, such as home, over modem lines. From a single script, SCO Visual Tcl provides X/Motif or “Character Motif” rendering, as previously shown in Figure 3. OpenServer administrators can execute all SCOadmin applications from their character terminal, their X terminal or from their PC terminal emulator at home.
Easy access to Motif Development	SCOadmin was developed by engineers who are experts in the area of systems management and installation technology. In order to enable these engineers to provide Motif-based applications, the SCO Visual Tcl language was designed to greatly reduce the learning curve for Motif development.
Rapid Development	As an interpreted scripting language, SCO Visual Tcl technology makes it possible to develop interfaces in a manner of minutes. SCOadmin gave the SCO Human Factors department the flexibility it needed to quickly gain user reaction and offer alternative screen designs.

As core SCO OpenServer technology, SCO Visual Tcl development is available to all SCO OpenServer users, making it possible for system administrators and power users to extend SCOadmin and other SCO OpenServer graphical environments. SCO Visual Tcl is also available for support of the large customer base of Open Desktop® Release 3.0 environments.

SCO is moving rapidly to make SCO Visual Tcl programming accessible to the developer and system administrator community-at-large. The SCO Visual Tcl 1.0 technology is being ported to popular RISC-based platforms in 1995 as a freely-available technology. SCO believes that this strategy will encourage the SCO Visual Tcl language as a defacto industry standard as the Motif scripting language of choice.

Framework and Common Services

The most exciting component of SCOadmin is the “lightweight framework” that incorporates an object-oriented architecture that allows for a level of functional integration that is just not possible in conventional run-time environments. This framework is a direct mapping of the X/Open® systems management reference model discussed earlier in this paper (see Figure 9 below).

The components of this framework include:

Managers

Managers are the graphical dialogs that collect and display data about users, filesystems and other managed resources.

OSAs

Defined by SCO, OSAs or Object Service Agents, represent the functional role of manipulating a managed resource, such as /etc/password or the printer subsystem.

Communication Service

The communication service conveys requests and responses between Managers and OSAs to create the illusion of a single application at work. It is the communication service that provides SCOadmin applications the ability to provide remote management, insulating the Manager from needing to know if it is dealing with a local OSA or an OSA located on a machine in another department.

Management Services

Logging, object database storage, security, internationalization and naming (identifying and locating OSAs) are examples of common services provided by the SCOadmin framework.

There are many benefits to framework-based design and development. For instance,

- ◆ Providing an OSA view of management data creates a common view of management data (or data modeling) that can be shared by any Manager using the framework. This also encourages a consistent look and feel of common tasks, such as asking for a list of supported physical devices.
- ◆ Management applications are simpler to develop. Because so many essential services are publicly available, the developer can focus on new functionality and take advantage of the existing functionality for free.
- ◆ Development of the management dialogs (i.e. Managers) can move quickly without being held back by the development of the functional side (OSAs). This feature provided SCO's Human Factors department with the time to review interface designs while the functional portion was still under development.

The SCOadmin framework is available to anyone who would like to take advantage of its features and functionality. However, the use of the OSA agents is discouraged with the first release of SCOadmin due to the nature of object definitions. Although developers are free to incorporate OSAs into their application, they should do so with the understanding that, given the changing nature of industry definitions of management objects, the OSA definitions may change as well.

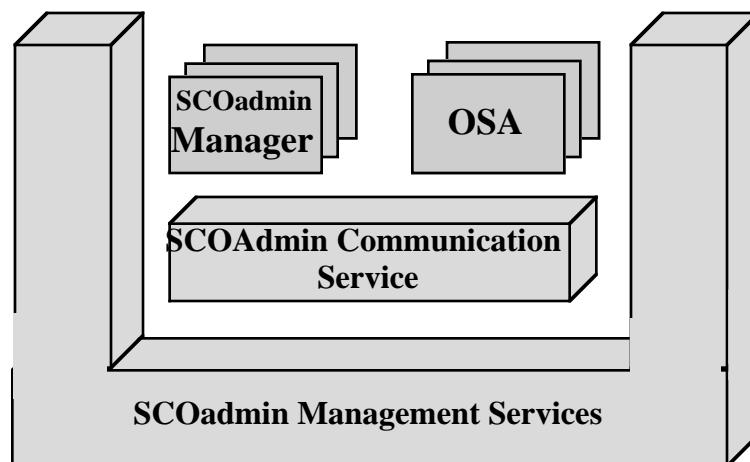


Figure 9 - SCOadmin Support of the X/Open Reference Model

The SCOadmin Protocol and Communication Service

Figure 10 illustrates how the framework facilitates the message-passing of requests and responses between managers and OSAs.

Object Call API

The language used by Managers to request services from OSAs, and by OSAs to send responses to Managers, is referred to as the *object call API*. This API is the programming interface that sits on top of the SCOadmin communication protocol language, BMIP. BMIP is based on ISO CMIP (Common Management Interface Protocol). CMIP is an object-oriented language that was specifically designed to carry out management operations.

Connection Layer

All requests and responses made through the object call API are delivered via the *connection layer*. The connection layer is designed to be transport layer independent, meaning that the SCOadmin framework, over time, can be migrated to take advantage of a DCE or ONC RPC environment.

The SCO OpenServer version of SCOadmin utilizes named pipes for local negotiation and TCP/IP sockets, via rcmd, for remote operation. Security is based on the use of user equivalency configuration (via the rhost mechanism). **NOTE:** Combined with the Kerberos-enabled SCO Network Utilities contained in the SCO Distributed Services product group, SCOadmin remote management made to support authorization and authentication capabilities featured in the SCO Security Manager, also a product component of SCO Distributed Services package.

Language Bindings

By providing an architecture that physically separates the Manager and OSA components of an application, SCOadmin makes it possible to choose the appropriate language binding depending on your design objectives. The 3 bindings that are supported are:

- ◆ C
- ◆ C++
- ◆ SCO Visual Tcl (scripting)

It is possible to write a Manager in C/Motif and the OSA in C++, for example. For SCOadmin, SCO Visual Tcl technology provided the performance needed to address the needs of most of the Managers and OSAs, though some of the OSAs were written in C (primarily for security reasons).

GDMO, Object Definitions and CORBA migration

Complementing the BMIP protocol is the specification language used to define the objects represented by the SCOadmin OSAs. The language, referred to as GDMO (Guidelines to the Definition of Managed Objects) is also an ISO standard for defining an object's interface (i.e. what the object represents and what it can do). The benefits of using GDMO to define all of the SCOadmin OSAs are:

1. SCOadmin OSAs will eventually be able to provide management information in a multi-platform environment since they use an industry-standard interface definition language, and
2. they will be easy to migrate to the CORBA environment, which is a potential target for the eventual evolution of the SCOadmin framework. X/Open and others are currently defining how GDMO objects will be mapped to CORBA objects.

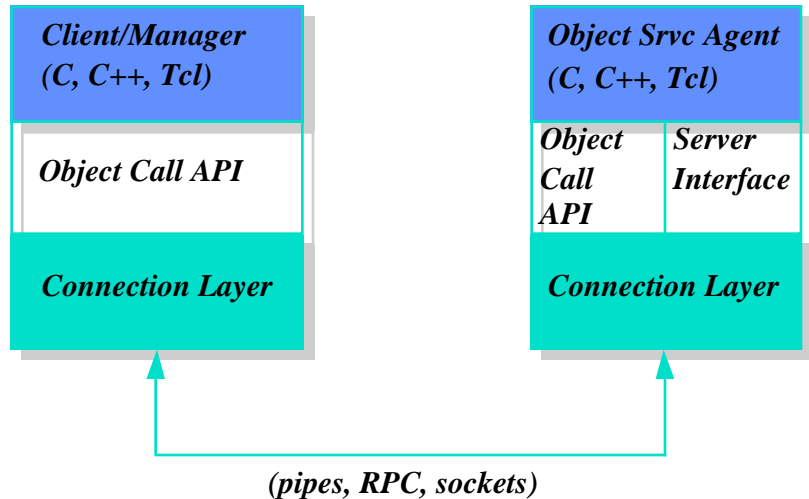


Figure 10 - How Managers and OSAs communicate

The SSO Architecture

SCOadmin defines a new architecture that gives Software Manager the ability to provide many of its new features. Software Manager now views software as collections of objects, or *Software Storage Objects*. The SSO architecture provides the kind of flexible product package structure required to, for example, distribute “pieces” of applications across a network, or address the tough issues of patch and version control.

Software Manager will, of course, continue to support the huge base of existing applications built on the old Custom/Fixperm format. Applications that are re-engineered to the SSO distribution format using the new **CDMT** (Custom Distribution Mastering Toolkit) that ships with the SCO OpenServer Development System, will be able to provide customers with far more control over their products.

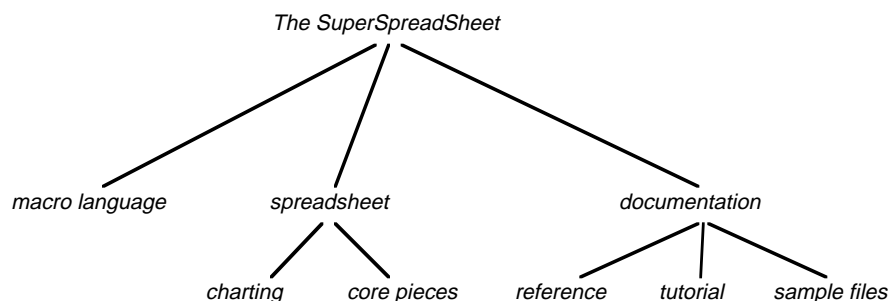


Figure 11 - Hypothetical composition of a general business application

Software products may be viewed as a collection of hierarchically-related components, as illustrated in figure 11. The components in this view have been broken into the following general categories:

- Products** the basic unit of software which is sold or distributed
- Parcel** Provided for convenience, it's often useful to divide a product into sub-products. For SCO OpenServer, for example, there are the Graphics and Connectivity parcels.
- Components** A basic unit of software at the development and support level. It should always consist of a single set of functionality, like the spreadsheet's macro language or its documentation.
- Packages** A set of files that a system administrator will want to operate on as a unit; for instance, the tutorial files that are shipped with the spreadsheet program.

The SSO architecture builds on this view by representing these components, and the files they are composed of, as “software storage” objects with attributes (e.g., private, shared, version, type) that give the Software Manager the ability to support its extended set of features. For example, an object that represents the spreadsheet main executable binary may be designated as a public and sharable, and therefore can be exported to network clients by the Software Manager.

Currently, this architecture and its features are available only in the SCO OpenServer environment. SCO is working with other system vendors through the POSIX process to encourage standards definition work that incorporates as much of the SSO model as possible.

SNMP Host Resource MIB

For the last ten years, SNMP has been the predominant protocol for the management of TCP/IP-based networks. Until recently, the management information that SNMP dealt with focused exclusively on “network elements,” such as router cards, transmission throughput and other components and characteristics that are key to the health of the network infrastructure.

In late 1993, the Internet Engineering Task Force (IETF), which oversees the management of the Internet and establishes standards for the TCP/IP environment, finally agreed on a MIB definition that specifically targets the management of computer systems on the network. A MIB, or Management Information Base, is a logical collection

of management data points that usually represents a particular management domain, such as routers or network cards. A substantial portion of the Host Resource (HR) MIB, defined in RFC 1514, has been implemented for SCO OpenServer Release 5, making SCO OpenServer the most manageable out-of-the-box UNIX system for the SNMP environment.

As reviewed in the *Distributed Systems Management* SCO Technical Strategy Paper, the HR MIB provides management information regarding:

- ◆ CPU Performance and Utilization
- ◆ Devices
- ◆ Filesystems
- ◆ Software Asset and Utilization

Two technologies, SMUX and the SCOadmin framework, made it possible to provide fast-turnaround support for the HR MIB. SMUX is the extensible SNMP agent technology provided in SCO OpenServer that supports the ability to “plug in” additional MIBs as “peers” into the SCO environment. Much of the functionality that provides the management information required by the HR MIB is accessed through the SCOadmin framework and the appropriate OSAs.

SNMP management stations, making queries from any place on the network, will now be able to monitor system-specific information from SCO OpenServer systems. For example, an administrator will be able to use an SNMP query to determine the names of files systems that are mounted on a remote SCO OpenServer node. As with many SNMP MIBs, it should be noted that the Host Resource MIB supports primarily “read-only” information, and is therefore most useful for monitoring purposes.

The SCO OpenServer Systems Management Roadmap

SCOadmin for SCO OpenServer Release 5 sets the stage for expanding the management capabilities and scalability by SCO OpenServer servers of the distributed environment. By incorporating industry standards for systems management, SCOadmin provides the basis for

- ◆ improving management of SCO systems in the networked environment, and
- ◆ providing management of LAN-based Windows PCs.

Addressing these goals will position SCO OpenServer environments as the ideal Business Critical Servers for intergrating enterprise and desktop systems management functionality into a single management view.

What's Next for SCOadmin

In the near term, SCOadmin will be expanded to provide new functionality in the following areas:

Management of the Windows Environment

SCO's charter, as part of its Windows Friendly strategy, is to provide the best server-based management of the Windows environment available. A key component to this strategy is to provide support for the DMTF's Desktop Management Interface (DMI). DMI makes it possible for SCO to move ahead with standards-based management tools to administer and monitor the unique environment of the PC. The SCOadmin architecture supports the DMI model of representing DMI-instrumented Windows PCs as objects, making it possible for SCO to generate OSAs that represent Windows resources as managed objects. One of the major benefits of this approach is that administrators will be provided with a high level of integrated management information, irrespective of whether its origin is the UNIX platform or specific to the Window's environment.

Windows-based Management

SCO believes that Windows PC environments will become the most prevalent system administration console of the future thanks to the falling costs of owning PC hardware. In line with that view, the SCO Visual Tcl architecture will be enhanced with the ability to support a native Windows display engine as well as the capability to distributed widget-rendering commands over the network. This technology will enable administrators to perform graphical SCOadmin management tasks over a low-bandwidth environment from their Windows PC, including over dial-up modem lines.

Expanded graphical application coverage

The predominant set of day-to-day management functions have been provided with a graphical interface, Some areas of system administration remain as character-based tools, although they are easily accessible through the same SCOadmin desktop hierarchical environment. SCO will continue to extend graphical interfaces coverage to these remaining areas with subsequent SCO OpenServer releases.

Improved security features

SCOadmin for SCO OpenServer systems utilizes the TCP/IP rhost mechanism to provide access control to management applications in the networked environment. SCOadmin will be enhanced to take advantage of security features made available by the SCO Distributed Services product., allowing for full kerberos-based authorization and authentication capability.

Exposing object definitions for Third Party development

As discussed earlier, the SCOadmin object definitions will evolve over time, which is to be expected of new interface specifications. With subsequent releases of SCOadmin, the SCO platform will document these interfaces as they will become more stable and are adapted to industry-standard definitions as they become available.

Expanded use of framework services

As chronicled in Appendix A, not all of the SCOadmin management applications have incorporated remote management support. These applications will be reworked to take advantage of this feature of the SCOadmin

framework over time. By incorporating the “Open Host” option in the “File” pulldown menu as a standard approach to selecting remote management, there should be little to no impact to the design of existing applications as they are migrated to support this feature.

Long Term, Major Technology Directions

DCE Integration

In addition to the security features offered by the SCO Distributed Services product line, SCOadmin could potentially be enhanced to take advantage of DCE naming and location capabilities. X.500 naming would provide an improved mechanism for locating OSAs located on SCO machines in a DCE cell environment. Thanks to the transport-independent design of the SCOadmin framework, this feature can be implemented with little impact to existing SCOadmin management applications.

X/Open Management Services

The X/Open Systems Management Working Group is currently defining a set of standard object services for the distributed management environment. SCO will incorporate those services, where appropriate, as they reach maturity. These services include collection (of resources) management, scheduling and management policy control

CORBA Migration

The CORBA model for distributed objects appears to be the primary platform for future distributed systems management. X/Open is basing all of its management services definition work on this assumption. SCO has long believed that CORBA may become the distributed object architecture of choice for distributed management applications. SCO has made the possible migration to a CORBA-based management framework by

1. basing the SCOadmin architecture on the X/Open reference model for systems management,
2. using the industry-standard GDMO template for defining managed objects, and
3. employing an object call API that reflects the CORBA object invocation mechanism.

SCOadmin was developed to provide standards-based systems management from the base system view; migrating upwards to complement the same trends that are occurring in the distributed management area. This provides SCO with a model for “instrumenting” SCO server and desktop resources to be able to participate in the managed environment. It also means that administrators can view distributed management and local systems management as part of the same conceptual model.

Third Party Solutions

SCO will continue to work with strategic partners to provide third party management solutions on the SCO platform, including SNMP and CORBA-based technology.

Appendix A - SCAdmin Manager Features

This appendix contains highlighted features, focusing primarily on the improvements over sysadmsh, including brand new functionality. In the table below, "New Application" refers to a collection of features not found in previous versions of sysadmsh. "Remote-Enabled" refers to SCAdmin applications that use the framework remote management service, except where noted.

	Motif Interface	New Application	Remote-Enabled
Account Manager	✓		✓
Audit Manager			
Backup Manager	✓		✓
Cron Manager			
Desktop Launcher	✓	✓	
Event Log Manager	✓	✓	
FileSystem Manager	✓		✓
Initial Systems Load (formerly IQM)			
Internationalization Settings Manager	✓	✓	
Hardware/Kernel Manager	✓	✓	
HP Network Print Services Manager		✓	
HP Network Printer Manager		✓	
License Manager	✓	✓	
MMDF Administration	✓	✓	
MOTD Manager			
NetWare Managers & Monitors	✓	✓	✓ _v
Network Configuration Manager	✓		✓ _v
Node Check Manager	✓	✓	
Printer Manager	✓		✓
Print Job Manager	✓	✓	
Reports Manager	✓	✓	
Security Profile Manager	✓		
Software Manager (Custom)	✓		✓
SNMP Agent Manager	✓	✓	✓
System Defaults Manager	✓		
System Logs Manager	✓	✓	
System Shutdown Manager	✓		
System Startup Manager	✓		
System Time Manager	✓		
Terminal Manager			
User Command Line Interface		✓	✓
User Equivalence Manager	✓	✓	
Video Configuration	✓		
Virtual Disk Manager	✓	✓	

v - denotes remote via means other than the SCAdmin Framework

Account Manager

- ◆ NIS distributed user account management.
- ◆ List of all the existing users/groups is always displayed. Icons in the main list provide instant feedback on the status of each user account.
- ◆ Management of system wide data in the defaults files for user account and group creation is new with Account Manager.
- ◆ Consistent menu driven interface providing a dialog box for adding user accounts and groups.

- ◆ Improved organization of user administration tasks.

Audit Manager

- ◆ Enable and disable system auditing.
- ◆ Specify collection rules for auditing, including directories where audit data should be kept, types of events that should be audited, users and groups who should be audited.
- ◆ Generate system audit reports. View, create and modify report templates.
- ◆ Backup audit session files. Delete or restore audit session files from backup media.

Backup Manager

- ◆ Main window listing of all filesystems available to be backed up, including:
 - when the next backup is due, and at what level
 - when the last backup was done
 - if a backup is overdue.
- ◆ Run unscheduled backup.
- ◆ View contents of a backup.
- ◆ View the backup history for a filesystem.
- ◆ List of scheduled remote filesystems giving the user the choice of what to backup and when.
- ◆ Simplification of backup scheduling including easy method of creating backup schedules for particular filesystems or for modifying the system default schedule.
- ◆ Ability to view and save on-line backup filelists.
- ◆ Simplified file and filesystem restores. Restoration of a scheduled backup will provide list of required backup volumes to restore to a user specified date.
- ◆ Point and Pick lists of files to restore files or directories from either backup filelists stored on-line or read from backup media.
- ◆ Ability to backup remote filesystems
 - to the local machine's devices.
 - to their own remote devices.
- ◆ List of backup devices that are currently accessible to the machine using the new SCO OpenServer Device Query Interface.

Cron Manager

- ◆ Set default authorizations for regularly scheduled or delayed jobs.
- ◆ Authorize users to create scheduled or delayed jobs.
- ◆ Modify the environment for delayed or batch jobs.

Event Log Manager

- ◆ Monitor SCOadmin events as they are generated.
- ◆ View administration-related events currently logged and not logged, such as
 - errors
 - warnings
 - attribute changes (e.g., the renaming of a printer)

- object creations (e.g., the addition of a new user)
- deletions.
- ◆ Indicate events to log.
- ◆ Indicate events to ignore.

FileSystem Manager

- ◆ Provides a full view of the status of every filesystem known to the system.
- ◆ Configurable timer to refresh the status display periodically.
- ◆ Detects filesystem type automatically.
- ◆ Provides consistent interface to manage all supported filesystem types on the SCO platform, including
 - UNIX Filesystems: HTFS, S51K, AFS, EAFS, DTFS, HighSierra, ISO9660, Rockridge,
 - Remote Filesystems: NFS®, NetWare (Status available for LAN Manager Client only).
- ◆ Allows finer control (than sysadmsh) when mounting a filesystem.
- ◆ Mount and unmount filesystems with a single mouse click.
- ◆ Simple user interface for exporting NFS filesystems.

HP Print Services Manager

- ◆ Installs HP Printer Manager software.

HP Printer Manager

- ◆ Setup HP print services.
- ◆ Configuration of bootp and HP printer (similar to X-Terminal boot issues).
- ◆ Add and remove remote HP printers.

Initial Systems Load (formerly IQM)

- ◆ Extensive usability improvements.
- ◆ Required floppies reduced to only one.
- ◆ Reduced human interaction time.
- ◆ More ways to configure filesystems.
- ◆ More installation pathways to choose from (in addition to simple and custom).
- ◆ Automatic detection of network cards on set of ISA buses, and all on non-ISA buses.
- ◆ Feedback (% installed) meters during installation.

Internationalization Settings Manager

- ◆ Controls the locale settings of an SCO OpenServer system and for each user.
- ◆ Set the internal system codeset.
- ◆ Set device character mapping.
- ◆ Create a character mapping table.

License Manager

- ◆ View-at-a-glance product license and registration information.
- ◆ Register installed products.
- ◆ License additional users, additional CPUs.
- ◆ Remove licenses.
- ◆ Filtered viewing of license and registration information.

MMDF Administration

MMDF Configuration Manager

- ◆ mkdev MMDF functionality.
- ◆ Pseudo-account alias management.
- ◆ Mail folder location selection.
- ◆ Selection for nameservice.

MMDF Alias Administration Manager

- ◆ Allows creation, removal, modification of system aliases.
- ◆ Allows creation, removal, modification of mailing lists.
- ◆ Allows user alias maintenance.
- ◆ Subscription of a user to list of aliases.
- ◆ Retirement of a user.
- ◆ Unsubscribe from all lists & aliases.
- ◆ Disposition of user's system mailbox.

MMDF Host Administration Manager

- ◆ Allows viewing hosts according to criteria.
- ◆ Allows adding hosts.
- ◆ Allows moving hosts from one channel to another.
- ◆ Automatic address selection, where possible.

MMDF Advanced Administration Folder

- ◆ MMDF Channel Administration Manager.
- ◆ MMDF Domain Administration Manager.
- ◆ MMDF Table Administration Manager.

MOTD Manager

- ◆ Simple editor interface into the Message of the Day file.

NetWare Manager and Monitors

NetWare Monitors:

- ◆ Dynamic monitoring of RIP, SAP, and NVT protocols.
- ◆ All monitors provide a configurable display refresh interval which allows real-time activity monitoring.
- ◆ RIP monitor shows the routes to all known IPX™ networks and hosts.
- ◆ SAP monitor shows all services advertised on the network.
- ◆ NVT monitor shows all current connections to the NVT server.
- ◆ Local Users monitor shows all users connected to native NetWare servers.

NetWare Managers:

- ◆ NetWare Access Manager allows fine control over NetWare server accesses:
 - ◆ login, logout, password changes, and viewing a server's resources such as available space on its volumes, UNIX printers attached to its printers, users logged in, etc.
- ◆ NetWare Login Manager provides logins to one or more NetWare servers simultaneously.
- ◆ NetWare Logout Manager provides logouts from one or more NetWare servers simultaneously.
- ◆ NetWare Password Manager provides the ability to change a NetWare password on one or more servers simultaneously.
- ◆ NetWare NVT Login Manager provides the ability to remotely login to one or more selected NVT servers.

Network Configuration (“netconfig”)

- ◆ Simplified graphical user interface which is intuitive and easier to use.
- ◆ Integrated with the SCOadmin facility.
- ◆ Consistent look and feel across the entire set of drivers.
- ◆ Detailed adapter card selection, with transparent card-to-driver mapping.
- ◆ New option to view the configuration information of protocols and drivers.
- ◆ Advanced driver options in graphical screens, e.g., MAC address, frame size, source routing options, boot ROM, MP options, etc.
- ◆ Automatic detection for PCI, EISA, and MicroChannel® adapters & many ISA cards.
- ◆ One-step process for many ISA cards; options transparently programmed to hardware as needed, eliminating the need for separate commands.
- ◆ Context sensitive on-line help, accessible separately from the SCO documentation reader.
- ◆ Complete flexibility of stack-card associations.
- ◆ Third party network drivers and networking products plug into the graphical interface.

Node Check Manager

- ◆ Automated pinging of selected servers/desktops at regular intervals.
- ◆ Ability to ping both TCP/IP and IPX/SPX servers.
- ◆ Options for indicating alert type:
 - pop-up alert
 - mail or user-defined action script.

- ◆ Configurable time interval between ping sessions.
- ◆ Historical downtime information.

Print Job Manager

- ◆ Point and pick, multi-select visual display of pending jobs including printer, user, status
- ◆ Filters for job selection: user, job destination, all jobs
- ◆ Automatic refresh of job list for dynamic status with user configurable time interval.
- ◆ Useful as a monitor of ongoing print activity and to determine when a given job has printed.
- ◆ Supports management of remote jobs.
- ◆ Incorporates printer classes transparently.
- ◆ Push button actions: cancel, hold, resume, promote, transfer.
- ◆ Available to all users, not just administrators.
- ◆ Desktop variant (via command line options) that includes printer status and print job submission interface.

Printer Manager

- ◆ Full featured graphical printer manager including lpd and NetWare remote printers and general administration on remote hosts.
- ◆ Includes all features previously available through sysadmsh plus more: remote printing, remote administration, NetWare support, X GUI.
- ◆ Extensive use of default values for minimal user input required.
- ◆ Provides point and pick lists for all pertinent data required for optional configuration: devices, models, terminfo printer types, user names, form and filter names etc.
- ◆ Includes rename and duplicate actions for local printers.
- ◆ Main screen provides point and pick list of all system printers including description, type indicator and easy double-click action for additional per-printer status
- ◆ Groups all three printer access controls on to one screen of toggles:
 - › enable/disable
 - › accept/reject
 - › accept/reject remote
- ◆ Groups all fault handling parameters for a printer on to one screen in a logically coherent user interface
- ◆ Provides push button control of local and lpd printer spooler (start, stop, status)
- ◆ Remote lpd printer support: add/remove/configure connections to remote UNIX printers including a graphical browser of printers on the remote host (other SCOadmin-based systems only).
- ◆ Non-graphical configuration of remote UNIX printers on any remote UNIX system that supports the lpd protocol.
- ◆ Automatic initial configuration of rlp services when first needed to export or import UNIX printers.
- ◆ NetWare support: add/remove/configure connections to remote NetWare printers including a graphical browser for print, file and queue servers.
- ◆ User-configurable toolbar for easy push button actions.

Reports Manager

- ◆ Monitor possible security problems with several reports, including

- › Account password status
- › Account summary
- › Terminal access and lock status
- › Login and account lock summary
- › Terminal login status
- › Account database consistency
- ◆ Print reports or save to a file

SCOadmin Desktop and Utility

- ◆ Hierarchical browser for launching SCOadmin applications (when not using the X.desktop™).
- ◆ Provides "desktop" support in the character environment.
- ◆ Command line options allow SCOadmin to start up at any level of the hierarchy, e.g., create a wrapper that launches SCOadmin exclusively for printer or filesystem clients alone
- ◆ Command line options to point at alternate hierarchies
- ◆ Direct command line invocation of SCOadmin clients without the graphical desktop including: minimal substring title matching and an option for list all available applications by title
- ◆ Full command line SCOadmin hierarchy maintenance for third party software
 - › install/removal and general maintenance including:
 - › create, replace, delete objects and entire hierarchy of objects
 - › sanity checking of object format with non-fatal warnings
 - › command line listing of objects, paths, titles
 - › verbose flags for full report of hierarchy manipulations
 - › flags to deal with alternate hierarchy roots e.g., personal and/or custom object hierarchies
 - › maintenance of index file that supports fast invocation searches

Security Profile Manager

- ◆ Set the system security profile to:
 - › Low
 - › Traditional
 - › Improved
 - › High

SNMP Agent Manager

- ◆ New graphical application for SNMP Agent Configuration.
- ◆ Ability to turn SNMP Agent off and on.
- ◆ Configure System Configuration, Peer, Traps, Community information.
- ◆ View statistical information (as supplied by snmpstat).
- ◆ Remotely configure SNMP Agent (via SCOadmin framework).

Software Manager (Custom)

- ◆ Verify installed software and system software.
- ◆ Examine attributes, files and installed patches.
- ◆ Perform Product updates.
- ◆ Support for installing, viewing, rollback of software patches.
- ◆ Install from remote machines.
- ◆ View available for network install

System Defaults Manager

- ◆ View and modify default values for system resources, such as
 - tar archive device list
 - idleout logout interval
 - location of root whois server
 - domain, netmask and broadcast address
 - system login parameters.

System Logs Manager

- ◆ Centralized administration of SCO OpenServer log files.
- ◆ Turn on "auto refresh" to view log entries as they are updated.
- ◆ Examine, clear or print logs.
- ◆ Monitor the size of logs.
- ◆ Select logs to read from a list.
- ◆ Add log file of interest.
- ◆ Clear out the contents of a log.
- ◆ Search for strings in a log.

System Shutdown Manager

- ◆ Shutdown the system.
- ◆ Change the grace period.
- ◆ Change the broadcast message, or read the message from a file.
- ◆ Indicate "automatic restart" behavior.
- ◆ Indicate confirmation request before shutting down.

System Startup Manager

- ◆ Modify system startup behavior to:
 - restart automatically when power is restored
 - automatically check and clean filesystems
 - Immediately go to multi-user during restart
 - Restart automatically after a system panic
- ◆ Indicate seconds before auto restart

- ◆ Set the default boot strong to be automatically loaded at the boot: prompt
- ◆ Restore system defaults
- ◆ Make changes to advanced startup parameters

System Time Manager

- ◆ View the dynamically-refreshed system time.
- ◆ Use spin buttons to change the system time during normal operation.
- ◆ Update the timezone.

Terminal Manager

- ◆ View, create, modify or delete an existing terminal entry.
- ◆ Lock a terminal. Clear locks on a terminal.
- ◆ Set defaults such as delay between login attempts or the time to complete successful logins.

User Command Line Interface

- ◆ Configurable templates for building definitions of reusable user types.
- ◆ Supports the same remote capabilities as the graphical Account Manager.
- ◆ A POSIX standards-based interface common across other platforms (e.g., SVR4™, Solaris®).
- ◆ Transparent NIS user/group administration for medium and large organizations.
- ◆ Batch user creation capabilities.

User Equivalence Manager

- ◆ Configure user rhost files.
- ◆ Add user equivalence between accounts on a remote host and an account on the local host.
- ◆ Delete previously configured equivalence.

Video Configuration

- ◆ Displays current configuration information, including: Video Monitor configuration
- ◆ Configuration format consistently displayed.

Virtual Disk Manager

- ◆ View the full list of all currently defined virtual disks (“vdisks”) on the system. Expandable view to show the details of each vdisk piece.
- ◆ Current state of each vdisk/piece is always shown; state information can be automatically refreshed in user-defined intervals. This information includes
 - „ when a piece gets disabled,
 - „ when the hot spare comes on line, and
 - „ when a vdisk goes off-line.

- ◆ Provides a map of physical disks, showing divisions, vdisk pieces and free areas, enabling easier determination of vdisk layout.
- ◆ Define vdisk partitions by using mouse to select disk free area, eliminating need to enter arcane numbers.
- ◆ Selection from list of valid choices eliminates chance for entering incorrect values that could put the system in a non-functional state. Automatically locates and highlights the first sensible location for a vdisk piece.
- ◆ Allows reconfiguration of an existing virtual disk, both at the vdisk level and at the piece level (e.g., for relocating a piece). The interface deals with all the complicated restrictions and only provides the valid choices.
- ◆ Makes mirroring root and swap a simple task, performing the myriad of configuration changes, including a kernel re-link.
- ◆ Allows monitoring of vdisk performance and run checks and repairs on the vdisks.