- Configuration files are not line based, but a sequence of lines with key words forming a ‘stanza’ (a single configuration unit). This makes manipulation with text based tools like awk and sed more difficult
- The admin framework has very long menu paths. For instance, to add a journalled filesystem involves traversing six menus and a scrolling list

Without SMIT, just give up and go home. Learning the many new commands which deal with the database and stanza format of files outweighs any benefits these mechanisms may have. By and large a UNIX literate person can come along to an unfamiliar UNIX box and generally figure things out. AIX is very different, meaning lots of training for system administrators and difficulty in making a heterogeneous network of systems administrable.

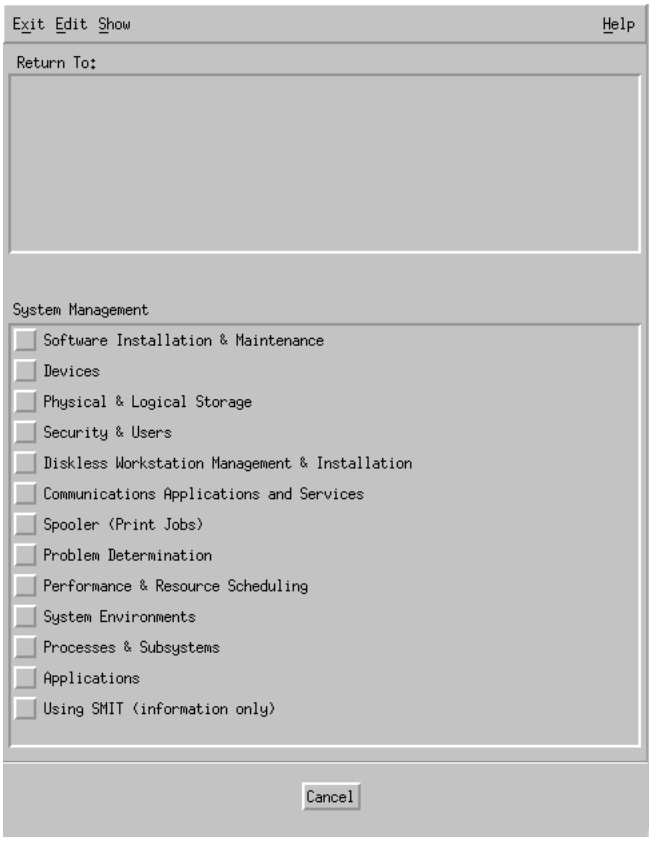
Solaris Admintool

For the sake of completeness, the diagram below shows the top level of the Solaris Administration utility called “admintool”

Figure 1-5 The Solaris “admintool”

- Comprehensive system management tool called “SMIT”

Figure 1-4 The AIX “SMIT” tool

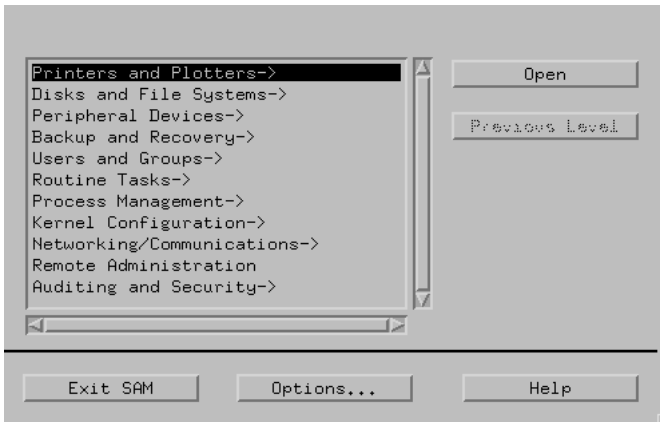


Some of the lesser known things about AIX are

- Installation is particularly cumbersome. A standard install with patches takes 6.5 hours (around 3.5 hours without patches)
- There is no way to boot single user. Instead, an administrator must boot into maintenance mode from an install media such as floppy disk. The lack of an interactive boot PROM makes alternate OS testing hard.
- The administration framework is intrusive - it maintains OS state in a database, so the “common” configuration files can become out of sync making use of the SMIT admin tool or an IBM specific command (which updates the database as well as system files) mandatory

(Graphical User Interface, or GUI). The GUI version is basically an implementation of the CUI on a graphics display. It does not provide anything other than menus, buttons and forms.

Figure 1-3 The HP-UX "SAM" tool



Certain key facilities, such as NIS and software management are lacking from the administration tool. A CUI is provided for software management but not as part of SAM.

Overview of IBM

The IBM systems used were an RS6000/560 (a desk side server) and an RS6000/320 (a client workstation). Both systems run AIX 3.2.5, primarily System V with BSD additions. The OS has evolved a long way since it had anything to do with System V. AIX is dynamically loadable and is largely dynamically configured.

The OS is consistent across all hardware. All systems are binary compatible and have the same feature set. Some of the good features in AIX are

- Logical Volume Manager - for concatenation/stripping and mirroring
- Journalled filesystem

HP-UX Laser ROM has the least visually appealing presentation, the text is difficult to read and diagrams hard to see. The search algorithm often produces zero hits or hits in virtually every document, making searches hard. The documentation does not provide the same level of technical detail as with AIX and Solaris. On the plus side the documentation CD includes details of many add on products, and references to every HP publication and product.

Introduction to HP and IBM

Overview of HP

The HP systems used were a HP 9000/847 (a rack-mount server system), and a HP 9000/710 (client workstation). Both systems run HP-UX 9.0, a mix of System V Release 2 and BSD 4.2. The system uses a system V release 2 init (without the run-state directories of System V Release 3.2), but it has the BSD fast file system.

Whilst the underlying mechanisms within HP-UX are the same on either system, the 700s and 800s have many different “add-ons”. 800s have a logical volume manager (akin to Online Disk Suite), and access control lists (ACLs). 700s have software disk stripping (SDS), and a swap implementation similar to Solaris “swapfs”. The 800 additions are mainly “server-centric”; the 700 additions “client-centric”.

There are additional fundamental differences in implementation of common services. For instance the “mmap” library routine is present on both systems but is implemented differently. The 800 series mmap will not successfully map a shared file at a system chosen address (i.e. address 0), but it will map the file privately. These anomalies do not occur on the 700 series machines.

This aside, the HP systems provide largely the same application binary compatible OS with a consistent management interface called “SAM”. SAM runs as either a Character User Interface (CUI) or as an X application

right network access. With AIX and HP-UX the administrator has to do extra work to achieve the same effect which is time consuming and error prone.

- Use of the "automounter" enables the Operator to develop a central file in which specific system details for each user/machine are stored, so that the Operator no longer needs to edit local system files when setting up a user's environment. The system looks to the central file for the parameters that it needs for system set-up for the user. The automounter is configured by default on Solaris, whereas integration of automounter with HP-UX and AIX involves editing NIS configuration files (shell scripts and Makefiles respectively). Because automounter is required on every client system, the administrative overhead for HP-UX and AIX increases linearly with system count.
- Unlike the HP-UX and AIX counterparts, the Solaris admintool will automatically update automount maps. Again this reduces the amount of work the administrator needs to do compared with HP-UX and AIX.
- Solaris admintool allows you to define a security policy for its use, and to define the group of authorized users with a particular access level. Neither HP-UX nor AIX have a secure remote administration facility. This is particularly important where systems are geographically remote.
- Sun NIS+ provides the only secure, inter-networked, remotely administrable name service. The only name service available with HP-UX and AIX is NIS, which does not provide these benefits.

A note on Documentation

All three vendors provide some kind of on-line hypertext documentation, as well as the standard on-line UNIX man pages. It is difficult to argue in favour of one system over another because each has its good and bad points. In general, though the Sun answerbook was easy to use and more often than not a search produced a list of relevant rather than irrelevant documents. The two main advantages answerbook has over AIX 'Info Browser' and HP-UX 'Laser ROM' is that the indexes can be placed on disk by the install mechanism making searches quick, and what you see on the screen exactly matches what you see in hard copy.

The worst part about the AIX documentation is that the man pages are on the CD. This make searches painfully slow. Otherwise the documentation is good and complete. Much of the documentation is task oriented which makes some tasks easier.

- The Solaris Jumpstart mechanism can be used to automatically add timed backup entries to clients crontabs either at installation time, or later on. Client Backups on Suns can be configured remotely at install time, simplifying the install process and reducing administrative overhead. Neither HP-UX nor AIX have this facility
- Sun Online Disk Suite (ODS) enables the spanning of logical volumes across physical devices, for example when managing a large 50 GB Oracle raw database file. This is impossible with the AIX and HP-UX volume management software.
- Sun ODS “hot spare pools” reduce the administrative overhead of volume management and improve system reliability. This is because a spare disk can be added to a system which will instantaneously and automatically be used to replace a failed one, without operator intervention. The data becomes available to end users once it is written onto the spare disk. HP-UX and AIX LVM have no hot spare pools, only hot plug capability. When a disk fails with hot plugs, the operator must respond to a warning and physically replace the failed disk, increasing the time during which data is unavailable and decreasing operator productivity
- AIX and HP-UX(800) Logical Volume Manager (LVM) have no real stripping, since the smallest stripe size is 2MB. On HP-UX(800) this stripping has to be implemented by splitting the disk into bits and arranging them manually
- Some HP-UX and AIX LVM operations are hard or impossible because of the way mirroring, concatenation and stripping are linked together
- The administrator has very little control over HP-UX and AIX LVM--for example, use of mirroring to provide on-line backups is hard to implement using the HP-UX or AIX volume management software. Using Sun ODS, one can easily turn on and off a mirrored disk so that a back-up can occur while maintaining a consistent image.

Users and Security

- Solaris admintool is integrated with both NIS and NIS+ name services, so all user and group operations are automatically seen across the whole network. As a result, local organizations can maintain their own lists of users and sub-groups that are seen throughout the network. They have an easy to use tool to quickly update them with personnel changes, so that potential security breaches are minimized and end-users efficiently get the

system to system, to reconfigure, etc. The ability to tightly control system access from the physical terminals is in which something many mainframe sites are interested

- Third party disk and tape devices are more easily integrated into Solaris, demonstrating our commitment to Open Systems and non-proprietary interfaces. Solaris loads SCSI disk parameters from the disk, and tape parameters can be configured via a configuration file, providing easier integration of third party devices. The Operator simply loads the third-party-supplied software interface and peripheral device and the peripheral becomes available without time-consuming setting of Solaris parameters, often without rebooting
- Swap space is used to hold pages that do not fit in the RAM. Solaris Swapfs allows systems to run without a swap device. Swap space can use either disk partitians or arbitrary files (whether local or mounted form the network). Swap files and partitions can be added on-line at any time, and they can also be deleted--the system automatically moves data out of the swap file so that the file can be removed or reused. And, adding extra RAM reduces the required swap size. Competitor's systems require that one reserves space in swap for all RAM, so that when RAM is added, swap space must also be added, which can be a waste of resources. If swap space is not added, RAM utilization and system performance is negatively affected. Swapfs also makes temporary space (tmpfs) more manageable
- The standard Solaris printer subsystem provides built in data conversion, a single printer interface program parameterized by the terminfo database and control over user access to printers, providing better facilities and easier administration than its AIX or HP-UX equivalents--adding remote printers, moving printers, and access control are all specific areas where Solaris offers better management control

System Availability

With mission critical systems, availability is key and so interruption to service should be kept to a minimum. Interruption can occur from inability to access the system or an application (for instance because files are being backed up), and not just from a failure

Basic Configuration

Once a system has been installed, there are often a small number of tasks required to tailor it to a given environment. Solaris Jumpstart helps reduce the number of tasks by allowing many to be performed at install time. Again this reduces the chance of error and improves productivity.

- Software packages (e.g., compilers, Wabi...) and patches can be added to Solaris at install or post-install without operator intervention
- Sun utilizes the widely used SVR4-standard software package format for OS and add-on products, leading to a lower learning curve and to commonality of install between Sun and many other sw vendors' install processes. (HP and IBM are formats are proprietary)
- The Sun GUI package administration tool (swmtool) is more sophisticated and easier to use than the HP or IBM alternatives
- Solaris has a completely dynamic kernel which eliminates the need for the majority of kernel tuning--tables in the system grow and shrink as needs change, and configuration parameters are read from a file at boot time so that a time-consuming kernel rebuild is not required

System Services

Solaris 2 has many system level facilities which effectively eliminate some of the most complex administrative tasks. It is also much more feature rich than either AIX or HP-UX. These features are not just fancy bells and whistles, but yield tangible benefits

- The Solaris kernel has dynamically loadable and unloadable subsystems. Device drivers, file systems, and other components of the kernel are only loaded into RAM if they are in use and RAM is needed. Once add-on card hardware has been installed, the associated device driver can be added and configured without rebooting. SCSI disks and tapes and their associated drivers can be added to an existing SCSI bus without rebooting. This reduces the service interrupts to users, easing the scheduling of new peripheral additions by the Operator
- Solaris has flexible serial device control, allowing multiple devices to be configured simultaneously. The Sun serial device mechanisms are easier to set-up, reconfigure and disable, providing greater physical system security. Terminals and modems are subsequently easier to move from

Figure 1-2 represents the total time taken to install a single server and a ten client network. Each bar has a shaded portion which indicates the basic server install time, and an unshaded section which indicates the total network configuration time plus the time to install ten clients using the network.

Refer to Chapter 2, “Installation” on page 11, for more information.

Key Points

Installation

Most administrators do not relish installing a system precisely because it is so time consuming, monotonous and error prone. The task of installing ten systems could be viewed as ten times worse. The Solaris install mechanisms stand out from the competition because, not only is a single system install easy, but the job does not get exponentially more difficult as more systems need to be installed. The Solaris Jumpstart features not only improve life for administrators they also make them much more productive.

- Sun installation is quicker than HP or IBM - up to twice as fast as HP and eight times as fast as IBM
- Sun has a one stop installation policy, where questions regarding system customization are asked at the start, so that the install can proceed without continuous operator intervention (unlike HP and IBM) leading to significantly increased Operator productivity. In fact, a stand-alone Sun installation can be hands-free
- A vanilla Sun installation is ‘network ready’--all of the daemons and configuration files for a full networked environment are set up automatically during the install process. With the HP and IBM installations, one needs to hand edit files to enable the same functionality, a tedious task that must be repeated for every workstation and server on the network.
- The software installed on a Sun system can be tailored based upon system attributes such as disk space and memory size. As a result, network-based installs can be cloned and performed automatically without operator intervention, even with diverse client system configurations. HP and IBM installs cannot be cloned. IBM cannot even boot from a network device.
- Solaris can be tailored post-install without operator intervention, so that automounter maps, patches or Sun add-on products can be automatically added to each networked system as required

Figure 1-1 Comparison of single system installation (actual)

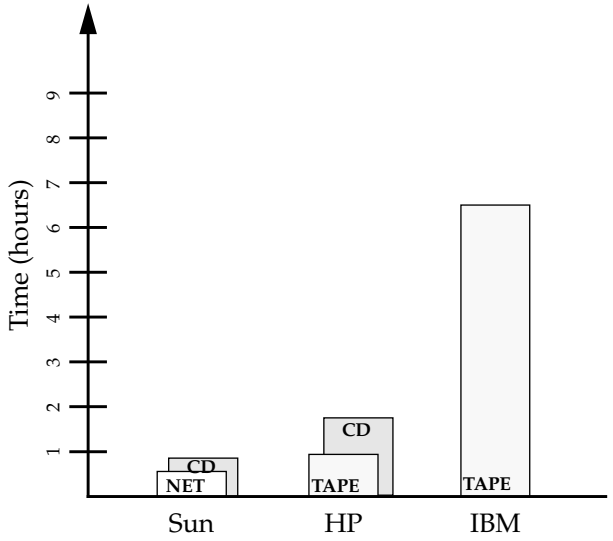
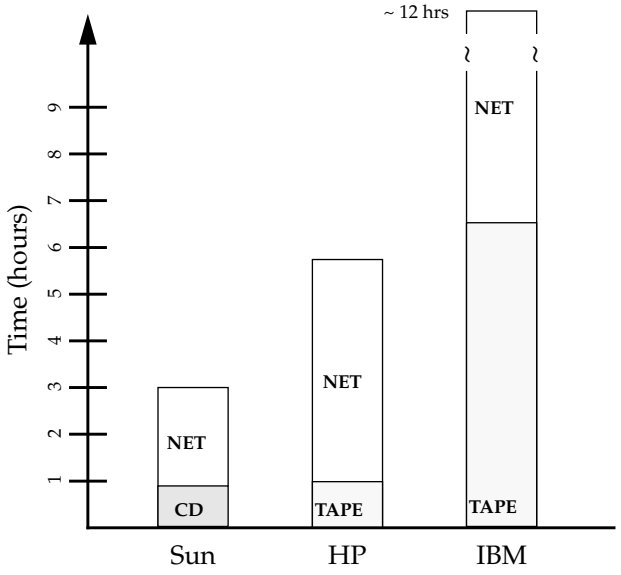


Figure 1-2 Comparison of a server and ten client network installation (calculated)



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The Sun Advantage

The Sun technologies which facilitate easy network integration such as Jumpstart, ONC+, and Admintool should be used to our competitive advantage. In particular,

- Jumpstart makes installation of a Sun network significantly easier, less error prone and quicker than the competition. This considerably improves administrator productivity.
- Sun client systems become replaceable, reproducible units which can easily be swapped out in case of failure, thereby reducing the amount of down-time to a minimum
- Many administration tasks, like backup, software distribution and auditing can be administered centrally using Jumpstart. This can allow an administrator to do the task once rather than many times, once for each machine.
- Admintool provides the only secure, distributed administration framework. Where administrators are not always centrally located or where security is an issue this can be used to Sun advantage
- NIS+ provides the only secure, inter-networked, remotely administrable name service.

As a simple example, the diagrams illustrates how much quicker installing a single Sun system and a network of systems is versus HP and IBM.

Figure 1-1 illustrates various methods of installing the systems. Each bar in the graph represents one installation method and an approximate time.

- Sun system net install takes about 20-25 minutes, CD takes about 45 minutes with CDplus or about 1 hour with an ordinary CD. Tape install is not shown as Solaris 2 cannot be installed from tape
- HP-UX (HPs UNIX) tape install takes about 55 minutes, or 1 hour 50 minutes from CD. Net install is not shown - it takes about 1 hour 30 minutes
- AIX (IBMs UNIX) tape install takes 6 hours 30 minutes for a full install. This includes around 40 minutes to install a base OS without networking. Installing the remainder of the OS including networking takes about 3 hours. The resulting system had problems with networking which were overcome by applying patches on the install tape, but this took a further 2 hours 45 minutes - a total time of about 6 hours 30 minutes!

Introduction 1

This document compares the system administration and management of a network of Sun, HP and IBM systems. The underlying theme in the following chapters is that Sun is easier to administer in a distributed, inter-networked environment than either HP or IBM. It may be surprising to some that Solaris is also often easier to administer in a stand-alone environment.

The key factor which leads to this conclusion is the integration of network services into Suns installation and administration frameworks.

How to use this document

Use this first chapter as a quick reference. It contains an overview of the other chapters, giving the key advantages of Sun in a distributed, inter-networked environment. It also contains an introduction to the HP and IBM systems, and a high level overview of their operating systems from a largely administrative perspective.

The remaining chapters cover the key points in detail and provides supporting information as to how these conclusions are drawn. Appendix A contains notes from the exercise of comparing the systems. It includes the details of the procedures which were tested on all systems, and an overview of how a systems administrator would perform each task.

How This Document Is Organized

Chapter 1, "Introduction," provides a high level overview of the document

Chapter 2, "Installation," describes the installation of a server, configuration of networking software, the setup of a network install server, and a client installation

Chapter 3, "Basic System Configuration," covers additional configuration tasks that would typically be done before a system was brought on line

Chapter 4, "System Services," describes the addition of peripheral devices, the configuration of file systems and virtual memory, and the management of printers

Chapter 5, "System Availability and Monitoring," discusses aspects of system management concerned with maintaining system service, for instance, backup and recovery and volume management

Chapter 6, "Users and Security," details the management of users and security features such as auditing

Chapter 7, "Summary," provides a quick reference summary of the previous chapters and the conclusions which can be drawn from the comparison exercise

Appendix A, "Raw Data," contains the notes made during the comparison of the systems including all the tasks performed and expected of a system administrator. This should be used if clarification or further details are required which are not available in the main body of the document

Glossary is a list of words and phrases found in this book and their definitions.

Preface

Managing Networked Systems compares Sun, HP and IBM from the standpoint of an administrator of a network of systems. It shows that Sun systems are easier to administer in a networked environment than either HP or IBM. It discusses a collection of administration tasks, describing first in brief and then in detail where Sun has an advantage over our competition.

The contents of each chapter is drawn from notes made during the comparison exercise, which are duplicated in an Appendix should more detail be required.

Intended Audience

This document is intended to assist in combating and preempting competition from HP and IBM. As such, it should prove useful reading if you are involved in a sale against one or both of these vendors.

The introduction covers all the material in summary form which is useful if you have little time to spare. Additionally, the final chapter provides a summary for quick reference.

Figures

Contents

Managing Networked Systems

A Comparison of the Sun, HP, and IBM Facilities for Administering Networks of Systems

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Part No.: 8xx-xxxx-xx
Revision X, September 1994