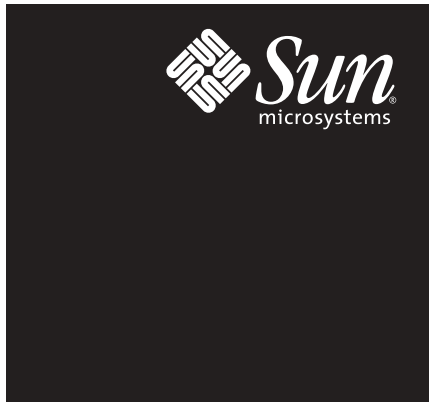
Using SAS IT Management Solutions

Effectively Managing IT Investments

October 2002



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Chapter 1

Executive Summary

With Internet computing and e-commerce now a part of everyday life, businesses are becoming increasingly dependent on the IT resources that support these highly critical applications. Corporate executives, financial managers, and business managers rely heavily on IT resources to provide daily business functions and are now responsible for IT operations and IT budgets. As the role of IT systems continues to grow, implementations are becoming more complex and costly to deploy and manage. To address these increasing costs, businesses are beginning to emphasize simplicity, consolidation, and return on investment for their IT systems and services.

Sun and SAS have come together to offer an end-to-end IT management solution leveraging the strength of the two industry leaders — one specializing in business intelligence and the other in network computing and systems management. In combination Sun and SAS deliver a tightly integrated, open, scalable, and flexible infrastructure for IT management that allows companies to leverage existing information assets and extract real value from their data sources. SAS IT Management Solutions include a complete suite of IT resource management and chargeback tools incorporating broad-based data management, analysis, and the comprehensive reporting capabilities for which SAS is well known. Sun provides the robust IT infrastructure of scalable servers, storage solutions, and resource management tools to help deliver high performance, maximum uptime, optimized resource utilization, and low total cost of ownership (TCO).

The combined IT management solution from Sun and SAS can help IT managers deliver:

- *Efficiency* — Effective planning and resource allocation, enabling cost-effective, highly available, and flexible services
- *Flexibility* — The ability to respond quickly to changes in the business environment
- *Profitability* — Accurate analysis of IT costs and charge back capabilities, enabling IT resources to be put to their best use

As complementary partners, Sun and SAS have a close working relationship that includes the cooperative exchange of technical innovations and ideas. Together, Sun and SAS engineers work to help ensure that SAS applications run optimally on the Solaris™ Operating Environment (Solaris OE). In addition, SAS is a charter member of the Sun Vendor Integration Program (SunVIP (SM) program), providing integrated support to help customers resolve problems quickly.

To manage the escalating demand and cost of IT resources, IT managers need tools to help them analyze and communicate resource usage, provide accurate chargeback information, effectively manage resources, and quickly allocate resources to meet changing demands. Unlike other solutions that are for IT only, Sun and SAS can help eliminate the void between the business and financial sides of the corporation.

Together, Sun and SAS can help corporations build a comprehensive IT management solution that offers low total cost of ownership and provides the efficiency and flexibility needed for future growth and increased profitability.

Chapter 2

Understanding IT Management Issues

The Environment

Today, more than ever, the success of businesses large and small depends on functionality provided by IT. Because of this escalating reliance, non-IT executives and managers are increasingly involved in financing IT services, either through best-guess estimates or actual chargeback accounting. In order for this model to be effective, IT managers need to accurately communicate usage and costs, and provide information for capacity planning and resource allocation. In effect, IT must now be managed as a zero-cost or profitable business within a business.

In this environment IT managers find themselves grappling with several underlying pressures:

- *Infrastructure* — The expanding complexity of quickly evolving technologies is frequently at odds with the drive to increase productivity. The irony is that technology intended to make life easier is not always easy to manage or control.
- *Delivery* — Application availability, customer satisfaction. In the form of service level agreements (SLAs), changing requirements, and the emergence of utility computing.
- *Cost efficiencies* — Accurate chargeback accounting enables better control of budgets and the ability to proactively manage TCO for IT services.

The Problems

IT executives encounter several problems when trying to deal with these pressures. The growing dependency of the business on IT resources is putting a great deal of strain on people resources and skills that have been severely limited by budget cuts and belt tightening. The increasing demand for 24 x 7, high performance application services produces a correlating increase in the cost of those services. In light of these problems, IT executives need to prove the value of IT to avoid the possibility of outsourcing services and potentially higher costs. One stumbling block to proving the value of IT is the inability to know if the budget is spent in the right areas because resources are not tied to business activities. Another is untimely and inaccurate information delivery used to support business goals and strategies.

At a lower level, *IT managers* are faced with additional challenges. The most critical of which is enabling a limited staff to manage larger numbers of incrementally complex IT resources. Increasing system performance, utilization, and availability can help improve efficiency, but the difficulty of managing and analyzing data from many sources, and the inability to identify meaningful exception reports makes this task nearly impossible. Another challenge, in support of the IT executive's need to prove the value of IT, is accurately analyzing, charging, reporting, and forecasting IT costs in a rapidly changing environment.

Requirements

In order to conquer these challenges, IT executives and managers need the ability to demonstrate and communicate the success and value of the IT organization by delivering services and resources efficiently and cost effectively. They need the capability to run as a profit center or zero-balance organization. And, they need the dexterity to acquire new hardware and software based on detailed utilization, SLA tracking, historic information, knowledge of upcoming business changes, intelligent forecasts, and capacity planning reports.

The Solution - Efficiency, Flexibility, and Profitability

Together, SAS IT Management Solutions and Sun's suite of management tools meet the requirements for solving these problems by delivering:

- Low TCO, investment protection, capacity planning, and improved service levels
- A comprehensive and cost-effective way to gain control of all IT resources
- The ability to turn data from many sources into the knowledge needed to forecast IT needs and make financial decisions
- Tools to manage technology complexity and improve productivity
- System resource management, including flexible resource allocation and high availability for systems and applications
- Service levels for systems, applications, and end-to-end services

Sun and SAS Management Process

The Sun and SAS IT management solution is a closed-loop management process, as shown in Figure 1, designed to improve efficiency, flexibility, and profitability by continually following the loop:

- *Collect* — Collecting the data using Sun management tools to gather data on performance, utilization, etc.,)
- *Analyze and Publish* — Analyzing performance/cost/return on assets and publishing this intelligence for use by appropriate users
- *Change* — Changing the execution environment using Sun resource management tools and flexible architectures to address the findings of the analysis
- *Plan* — For the future and unanticipated events

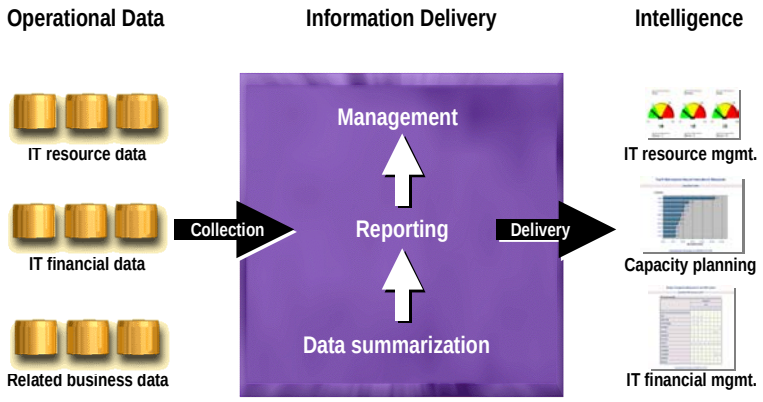
Figure 1: Sun and SAS Management Process

Chapter 3

Turning Data into Intelligence

SAS IT Management Solutions enable IT managers to manage the IT organization and infrastructure, evaluate and control costs, and make informed business decisions that directly impact the organization's bottom line. The SAS IT Management Solutions architecture, shown in Figure 2, provides facilities for collecting operational data, such as IT resource, financial, and other related business data into a central repository where it is summarized and used to generate meaningful reports.

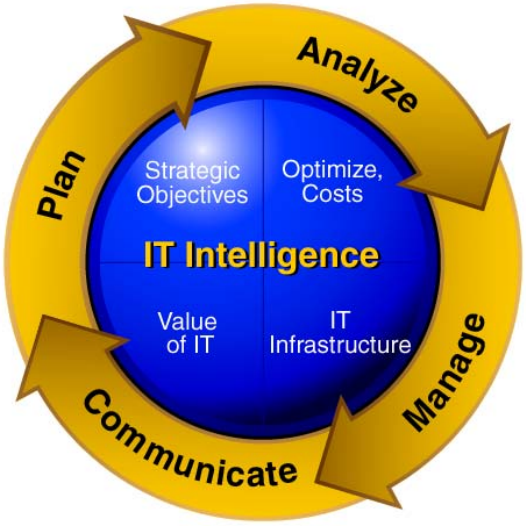
Figure 2: SAS IT Management Solutions Architecture



These reports can then be delivered via the Web to support IT operational functions such as resource management, capacity planning, and financial management.

SAS IT Management Solutions combine the capabilities of SAS IT Resource Management and SAS IT Charge Management to address IT utilization, resource and component availability, computer performance management, resource cost allocation, and chargeback. These tools can help leverage investments in existing operational systems by adding a layer of intelligence not found in any other IT management solution. With this new information, IT managers can implement an enterprise-wide closed-loop IT management *intelligence* flow as shown in Figure 3 and described below.

Figure 3: IT Management Intelligence Flow



- *Analyze* — Analyzing costs and resources to provide the right resources at the right time for an appropriate price.
- *Manage* — Employing historical usage trends to provide for future capacity requirements.
- *Communicate* — Effectively communicate the value of IT to the organization's bottom line.
- *Plan* — Aligning IT resources to the organization's strategic objectives.

SAS IT Resource Management

SAS IT Resource Management automates the process of collecting diverse data from applications and systems (including servers, networks, applications, database management systems, IT infrastructure, and IT staff activities) into a common warehouse structure. The data can then be used for analysis and reporting, providing the knowledge to efficiently manage IT resources across the entire enterprise, and the flexibility to respond quickly to changing environments. The warehouse can expand to provide additional functionality such as chargeback, company balanced scorecards, and activity-based costing. Whereas other IT solutions for consolidation and management are for IT only, SAS IT Resource Management can bridge the gap between IT and the business and financial sides of the corporation.

SAS IT Resource Management provides a simple GUI interface to present an enterprise view of the IT infrastructure, administer the data warehouse, and generate reports. The interface includes functions to create a data warehouse and import data, apply analytical functions, apply reporting interfaces, and distribute intelligence via the Web. These functions are also accessible programmatically via SAS code and are described in more detail in the following sections.

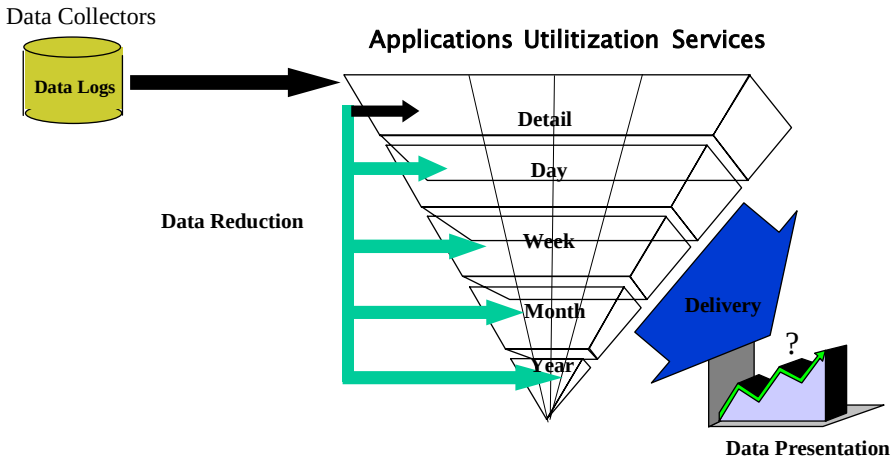
Enterprise View of IT Infrastructure

SAS IT Resource Management brings together utilization, availability, and performance information from each component of the IT infrastructure, including servers, mainframes, databases, applications, networks, Web hosts, security data sources, and more. This end-to-end view of the heterogeneous enterprise can help facilitate processes to tie operational goals to the organization in the areas of capacity management, IT financial management, service level management, computer performance, cost recovery, Web infrastructure, and IT strategy.

Historical Data Collection

SAS IT Resource Management assembles the data collected in day-to-day business and turns it into knowledge needed to forecast IT needs and make financial decisions. It allows data from any source with a date time stamp to be imported into the warehouse for analysis, making the warehouse easily extendable to support new data sources. SAS IT Resource Management stores data in detailed, weekly, monthly, and yearly views. Weekly, monthly, and yearly data stores are based on summaries and require incrementally less data storage, as depicted in Figure 4.

Figure 4: Historical Data Reduction



Some examples of possible input data sources are: databases, flat files, sar data, Web logs, NT server logs, UNIX® platform accounting records, and Telco equipment.

Decision Support and Trend Analysis

SAS IT Resource Management provides a wide range of analytical processing and reporting options through a suite of user-friendly interfaces accessible by all levels of the organization. These options enable decision makers to draw upon a consistent pool of information to generate automated standard or customized reports.

Data Modeling Techniques (Visualization)

A key differentiator of SAS IT Resource Management is the ability to interactively and dynamically evaluate data using statistically valid visualization methods. Data visualization allows correlations and interrelationships among data from single or multiple, disparate data sources to be examined with regard to one another. SAS IT Resource Management provides the data visualization techniques to help make business sense of IT data, including box mosaic, line, scatter, contour and rotating plots, histogram bar, and distribution, fit and multivariate analysis.

SAS IT Resource Management's powerful modeling facilities provide the ability to test relationship assumptions when potential relationships between data metrics are identified.

Information Publishing

SAS IT Resource Management includes a Web publishing facility for distributing static and dynamic (including drill down functionality) reports, such as production quality, billing, capacity planning, utilization, and service level exception reports via the Web. Reports can also be delivered to users via the Sun™ ONE Portal Server software.

The SAS solution increases effectiveness, flexibility and profitability of the IT organization by helping to provide:

- *Optimal operational system management* — Making processes more efficient and competitive by relating IT resources to services.
- *Optimal IT services management* — By managing seven key IT resources: servers, networks, applications, management software, infrastructure, databases, and staff activities.
- *Effective planning and resource allocation* — Collecting historical data and performing trend analysis in order to predict future IT growth.
- *Enhancements to existing IT investments* — Optimizing existing system resources without extensive re-engineering.
- *Accurate analysis of IT costs* — By developing business-focused IT cost models.

By effectively managing these functions, IT organizations can communicate services in easily understandable business terms and provide innovations and expertise to make IT a quantifiable asset to the organization.

With a common repository of IT measurement data, IT management possibilities are virtually limitless. Some examples of how customers are successfully using SAS IT Management Solutions to increase efficiency, flexibility, and profitability are:

- *Consolidating servers* — Measuring CPU utilization of applications to determine where consolidation can be applied to attain optimal resource utilization, lowering TCO.
- *Balancing loads* — System utilization reports can be used to balance application loads across multiple systems, increasing performance and availability of application services.
- *Forecasting* — Allowing flexible, just in time upgrades by monitoring trends over short and long periods of time and integrating non-IT metrics to plan for "peak" events.
- *Network consumption* — Eliminating bottlenecks and enabling department chargeback for usage.
- *SLA management* — Exception management using threshold values can help implement, maintain, and report upon service level agreements.
- *Security management* — Enabling off-line detection of security intrusions.

SAS IT Charge Management

SAS IT Charge Management provides chargeback data from diverse computing environments, coordinating IT cost and financial management information in one performance data warehouse. SAS IT Charge Management can help increase profitability by allocating costs to users throughout the organization to help zero-balance the cost of IT, to communicate the cost of IT, and to influence IT user behaviors.

SAS IT Charge Management is tightly integrated with SAS IT Resource Management, providing an enterprise solution for tracking and managing costs. It provides facilities to append billing data to the IT resource data warehouse such as: IT resource used, quantity used, user, time of use, units of use, rates of use, location of use, funding source for use, and invoice recipient.

The greatest benefit of sharing a single IT data warehouse for management and billing is that it allows IT charges to be fully auditable to the system log files used to create the billing reports. This capability enables IT to quickly respond to and resolve billing inquiries.

SAS IT Charge Management can be used in many ways to decrease TCO within the organization. One example is allocating IT resources to cost centers to help ensure optimized monetary margins. Another way is to employ variable usage rates to influence user behaviors, maximizing IT resource use.

A new use of the solution is in utility computing. The idea behind utility computing is to provide unlimited computing power and storage capacity that can be used and reallocated for any application and can be billed on a per-use basis. Utility computing will not only deliver equal access to computing resource, it can also help create new revenue streams for data centers and new application pricing models based on metered use. SAS IT Charge Management can supply the chargeback accounting functionality that is the core of utility computing. With SAS IT Charge Management and IT Resource Management, IT can implement utility computing models, delivering pay-per-use computing services when and where they are needed.

Reports from both SAS solutions can be delivered via the Sun ONE Portal Server software, providing:

- Security
- Access control (via LDAP/Portal)
- View customization (supports different input streams, SAS could be one or more of these streams)
- Delivery to different interfaces (wireless, browser, etc.,)

Access control within the Sun ONE Portal Server software can be used to manage accessibility of the various static and dynamic reports that are available. Some examples of using the Sun ONE Portal Server software in this manner are:

- CTO can view IT exception reports (uptime, etc.,)
- CFO can view expenses and activity costs
- CEO can view all of the reports
- System administrator can view the systems they are responsible for (uptime, etc.,)

Chapter 4

Intelligently Managing Sun Servers

Armed with analysis reports generated by SAS IT Resource Management, IT can employ this intelligence to better manage individual Sun systems (set alarms and thresholds), manage and provision resources to meet SLAs, and provide highly available services. The knowledge can also be used to plan mainframe migrations and server consolidation projects to further cut the costs of providing services. Healthy, available, and flexible systems, managed efficiently through automation can help increase the profitability of an organization. Sun offers a full suite of solutions for monitoring and managing systems and applications, as well as tools for automating change management, load balancing, and providing highly available application services.

In addition, output from many of these tools can be input into SAS IT Management Solutions. In the Sun and SAS management process, data from Sun tools is input into SAS IT Resource Management and analyzed. Sun tools are then used to affect changes indicated by SAS reports necessary to increase performance, utilization, or change. New data from the modified systems is then fed back into the SAS data warehouse, thus renewing the IT management process.

Efficiently Managing Systems

In today's quickly changing business environment, efficiently managed systems are a corner stone to success and profitability. Wasted resources, unexpected downtime, inflexible platforms, and complex administrative procedures can eat away at IT staff and budgetary resources.

Monitoring and adjusting CPU utilization and network bandwidth allocation enables application response time and service-level requirements to be met. In addition, trend analysis

can enable effective capacity planning and resource management. When systems operate at peak efficiency, administrators are better equipped to work more productively and make better decisions — factors that can mean the difference between merely surviving and thriving in an increasingly competitive marketplace. Using the intelligence gained from SAS IT Resource Management and IT Charge Management, and management tools from Sun, IT managers can concentrate on innovations that increase the value of IT and affect the bottom line.

Sun Management Center Software

Sun Management Center 3.0 software is designed to provide a powerful, easy-to-use single management point for all Sun servers and storage, independent of geographic location. System administrators can perform remote system configuration, performance monitoring, and isolate hardware and software faults through a single interface at any time, from anywhere on the network, improving administrator efficiency. Sun Management Center easily integrates with enterprise management frameworks, and provides a central facility for managing events and alarms, automated responses, and diagnostics, giving administrators the ability to manage systems and perform corrective actions without leaving the central office.

Sun Management Center software includes a variety of tools to help administrators proactively and automatically manage both common and complex administrative tasks, such as managing performance and data, and monitoring applications service levels. Tools include:

- *Health monitoring* — Incorporating a large body of administrator knowledge into an intelligent rules-based monitor for the system and applications giving suggested steps for problem resolution, resulting in simplified administration. Intelligence from SAS can be used to write new health monitoring rules to increase the efficiency and uptime of systems.
- *Physical viewer* — Displaying photo-realistic images of hardware components, enabling junior administrators to quickly determine which components to replace.
- *Logical viewer* — Presenting a tree hierarchy of managed hosts or domains, enabling administrators to quickly identify a component's exact location.
- *Real-time Performance Analysis* — Enabling administrators to isolate potential and existing bottlenecks. Data from this tool can be input into SAS for historical analysis, increasing performance and utilization.
- Event and Alarm Management — Supplying administrators with the information they need, when they need it. Knowledge from SAS can be used to set new thresholds and alarms.
- Automatic Discovery — Enabling fast inclusion of new systems into the Sun Management Center management framework. Data collected through this tool can be input into SAS for up-to-date inventory management.

Performance Reporting Manager

Performance Reporting Manager (PRM) is an add-on to Sun Management Center 3.0 software that enables the administrator to create reports detailing the status of their systems. Performance data is gathered by the history logging capability included with Sun Management Center software and used by PRM to generate performance reports. The reports can be generated at schedule times and viewed via a Web browser.

Examples of how PRM can be used to increase efficiency, flexibility, and profitability are:

- IT service managers can use reports on the availability of services and performance levels from the previous day to make sure they are maintaining SLAs. A unique feature of PRM allows the administrator to click on a spike in the report to see alarm data and/or processes that were running at that time, providing further information to help troubleshoot problems.
- PRM reports can be used as input into SAS for diagnostic and trend analysis, as well as for capacity planning and inventory analysis.
- PRM can generate a very detailed level of information on the demand and workload endured on an application service and the resource utilization of memory, CPU, and I/O by applications and service components. This data can be input into SAS for more detailed analysis to determine dynamic allocation of resources.

Sun StorEdge Enterprise Storage Manager Software

Sun StorEdge Enterprise Storage Manager (Sun StorEdge ESM) software is the industry's first WBEM/CIM-compliant open SAN management tool. WBEM/CIM (Web-Based Enterprise Management/ Common Information Model) is an open standard, extendable technology for managing heterogeneous devices and SAN environments, providing adaptability for support of future storage technologies. This new addition to the Sun StorEdge software family leverages the Storage ONE initiative of offering open, standards-based storage management solutions that lower TCO and improve application service levels by streamlining operational activities and simplifying the complexities associated with SAN management.

Sun StorEdge ESM software is designed to provide a centralized management platform consolidating core storage management services through a Web-based common view. It delivers a consolidated presentation of three major areas of storage management, helping increase uptime and improve service levels, and is the core platform for other Sun StorEdge software suites:

- *SAN topology management and reporting*
  An enterprise-to-enterprise visualization of the SAN infrastructure and a central point of access and control for servers and network storage devices, including storage arrays, fabric switches, and Fibre Channel HBAs. Data from the reporting functions can be used by SAS for trend analysis and capacity planning.
- *Device configuration management services*
  Auto discovery and scalable wizard-based configuration services for Sun StorEdge storage systems and third-party devices, from a single management console. Auto discovery data can be input into SAS for up-to-date inventory management and the configuration services can quickly make changes to support evolving environments.
- *Health monitoring and intelligent diagnostics management*
  Proactive health checking, fault isolation, and expert-based advice for possible remedies to problems. Intelligence from SAS can be used to extend this functionality to increase the performance and availability of SAN systems.

Sun StorEdge Resource Management Suite Software

Sun StorEdge Resource Management Suite software is a set of Web-based management applications designed to provide valuable knowledge about the storage infrastructure. It helps effectively manage, implement, and maximize SAN storage investments. Data from Sun StorEdge Resource Management Suite software can be input into SAS to help IT managers analyze the

entire enterprise infrastructure. The suite includes central management, reporting, and monitoring of storage resources with the following tools:

- *Capacity Reporter* — Automates the discovery, monitoring, alerting, and reporting of key storage resource statistics. These statistics can be input into SAS for more detailed analysis and report publishing. Information from SAS can then be used to increase the effectiveness of monitoring and alerting functions. It can also be used for chargeback accounting, enabling utility computing. Data from the discovery process can be input into SAS for inventory purposes.
- *Database Reporter* — Facilitates the discovery, analysis, and management of database storage environments.
- *File Reporter* — Generates detailed file-analysis storage reports. These reports could be input into SAS for trend analysis, monitor usage, or to detect security intrusion.
- *Global Reporter* — Provides a single management view of global storage resources.

Sun Storage Resource Management Suite software helps maximize storage network investments, increase operational effectiveness, and increase IT staff efficiency with the following features:

- Automated network storage discovery
- Historical data analysis and trending
- Facilitates charge back to users and groups
- Identifies appropriate resource allocation
- Consolidates global storage resources
- Support for data classification and migration projects

Flexibility

Constantly changing and growing business models, including utility computing require unrestrained flexibility. Sun servers and system management solutions give IT the flexibility to manage any system from any site, quickly reprovision systems to meet demands, freely allocate resources when and where they are needed, and install and upgrade software during normal working hours without incurring system down time. The ability to perform all of these functions effectively is the driving force behind delivering dependable mission-critical application services, increasing profitability, and lowering TCO.

Sun Fire Servers

Sun's new generation of Sun Fire servers are based on a strong foundation of technologies resulting from nearly two decades of innovation at Sun. The award-winning UltraSPARC® III processor used in Sun Fire servers includes a high performance design, higher clock frequency, reduced on-chip latencies, greater amounts of cache, and high levels of integration. Furthermore, it has been optimized for incorporation into scalable multi-processor systems such as the Sun Fire line of servers illustrated in Figure 5.

Figure 5: Sun Fire Server Family

To maintain service levels in today's frequently evolving environment, businesses must be able to add or reassign resources quickly. Sun systems provide a range of features designed to simplify system management and enable higher levels of resource utilization. Resources can be allocated to specific applications or shifted from one application to another using features such as Dynamic System Domains, Dynamic Reconfiguration, software-based resource containment in Solaris 9 Resource Manager software, and automated change management in Sun Management Center Change Manager.

Sun systems also include hot-swappable components that allow the addition of system resources without disrupting service. Upgrades can be performed on live systems using hot-swappable components with Sun's Dynamic Reconfiguration technology.

Dynamic System Domains

Dynamic System Domains are designed to provide high-level control over allocation of processors, memory and I/O devices to separate, electrically isolated domains on Sun's Sun Fire server product line. Solaris supports *dynamic* system domains, where system resources (processors, memory, and I/O devices) can be re-allocated from one domain to another on the fly or on a scheduled basis to rapidly adapt to changing workloads. For example, Dynamic System Domains might be used to support on-line transaction processing during the day, and long data warehouse queries at night. In addition, resource pools can be created to automatically replace failed components, adding resilience to all domains.

Dynamic System Domains are a key technology in supporting utility computing because they enable resources to be added to fully operational system domains, adjusting to increases in demand almost instantaneously.

Dynamic Reconfiguration

The ability to install or remove components while the system is operational, known as Dynamic Reconfiguration, is the enabling technology behind Dynamic System Domains.

User defined policies such as time of day or threshold in CPU activity (an optimization that can be obtained through SAS) can trigger a Dynamic Reconfiguration event. This can be implemented as an automated process that reallocates resources between domains, or as an alert to an operator who can manually initiate the reconfiguration. Sun Fire servers are the only non-mainframe solutions that allow on-line reconfiguration without rebooting the server.

In conjunction with Dynamic Reconfiguration in Sun Fire servers, Sun's Solaris Operating Environment offers similar capabilities for systems software. Solaris Live Upgrade and Dynamic Upgrade to Kernel allow key components of the operating system, including the kernel, to be upgraded while systems continue to run.

As workloads change rapidly over time, server capacities must inevitably be adjusted by adding and subtracting processors, memory, and I/O devices. With the knowledge gathered from SAS, these changes can be made more effectively. Likewise, when tools like Sun Management Center software suggest pro-active replacement of marginally performing components, server configurations must also be modified. The ability to update and reconfigure a server and its operating system without interrupting business processing is a key component in providing the flexibility necessary in efficiently managing IT resources.

Solaris 9 Resource Manager Software

The Solaris 9 Resource Manager software enables administrators to efficiently control system resources by creating *resource pools* that are reserved to be used exclusively by an application or set of applications. Using resource pools, isolated computing environments can be implemented to help ensure applications have access to a consistent set of resources regardless of the resource usage of the remainder of the system. With knowledge from SAS, these pools can be fine-tuned to effectively meet the needs of users while lowering costs. In addition, caps can be placed on resource usage, preventing workloads or users from over-consuming resources.

An important feature in Solaris 9 Resource Manager software is the Fair Share Scheduler. When there is contention for a resource, the Fair Share Scheduler helps ensure that each user or application receives its fair share of CPU allocation. If users and applications are consuming less than the CPU allotments designated to them, the Fair Share Scheduler allows other active users and applications to take advantage of the unused processing power. This feature helps protect key applications and fully utilize resources.

Sun Management Center Change Manager

Many of today's enterprises rely on horizontally scaled server farms to provide software services. It is common to see tens or even hundreds of replicated servers — each running an identical software configuration — that provide a set of services such as Web, e-mail, directory, caching, and other applications. The task of administering and provisioning a consistent software stack across this vast array of systems has been complex, time-consuming, labor-intensive, and error-prone until now.

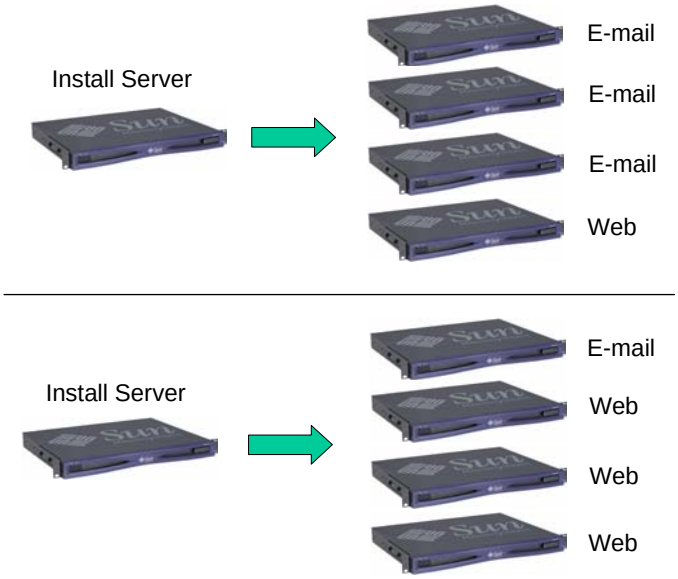
Many organizations have large numbers of servers all delivering the same services, but each requiring their own similar but unique software configuration. For example, a customer might provide Internet search services using 200 Sun servers, each one similarly configured, and each one loaded with similar software so that the entire server complex can support millions of customers.

Managing this number of servers can be costly in terms of administrator time without automated tools. Sun Management Center Change Manager makes it easier to manage large numbers of servers in any type of environment.

Sun Management Center Change Manager is designed to provide a fast and easy way to deploy software stacks securely to a single server or groups of servers using Solaris Flash archives, enabling formal IT procedures in a build-test-deploy-maintain model. The concept is simple. The administrator builds and tests a prototype server, captures the entire software stack (Solaris OE, middleware, applications, and configuration) as a single, integrated software image in a Solaris Flash archive, then uses the archive to install or update a single server or a group of servers. When information from SAS indicates that changes need to be made to large groups of servers, these changes can occur quickly and automatically.

Using intelligence from SAS and Sun Management Center Change Manager, systems can be instantly reprovisioned, giving IT the ability to immediately respond to changes in workloads in order to comply with SLAs. For example, an Internet Service Provider (ISP) can install servers to primarily e-mail services during one part of the business day, while a small number of servers provide Web hosting. Later in the day, as user demand for e-mail drops and Web hosting demand increases, the server farm can be reprovisioned so that more servers are reconfigured from e-mail servers to Web servers, as shown in Figure 6. Sun Management Center Change Manager allows the servers to be reprovisioned in a cascading fashion, so that both the e-mail and Web hosting services are never off-line and the same resources are used to support different functions at different times.

Figure 6: Reprovisioning Servers to Meet Changing Business Needs



Sun StorEdge Products

Sun offers a rich suite of software products to further enhance the performance and availability of the data that is the core of every business today. Combined with intelligence from SAS, IT managers can use these tools to help provide optimized, flexible, cost-effective, and highly available data solutions.

Sun StorEdge Traffic Manager Software

Sun StorEdge Traffic Manager software (Sun StorEdge TMS) is a client that manages devices that are accessed by a host through multiple paths. It includes multi-path configuration management, I/O load balancing across host bus adapters (HBAs), failover semantics for interconnect and controller failures, and single instance multipath devices. With Sun StorEdge TMS a multi-path device is represented as a single instance, rather than multiple instances for multiple devices.

Sun StorEdge TMS is designed to provide:

- Superior SAN-wide failover and load balancing, improving availability
- Simplified administration by reducing the complexity of growing storage resources

Intelligence from SAS can be used to fine-tune the storage traffic managed by Sun StorEdge TMS, as well as identify areas where load balancing might improve performance and application availability.

Sun StorEdge Availability Suite Software

Provides both local and remote point-in-time copy as well as remote mirroring. Point-in-time copy increases the availability of on-line data by taking snapshots of live data for decision support, backups, loading data warehouses, migrating data, or even for developing and testing applications using actual production data. Snapshots are instantly accessible and can be quickly re-synchronized. Remote mirroring enables customers to replicate disks between physically separated servers, in real time, to local sites or across the globe. Providing available applications, even during disasters, can help protect the profitability of the corporation.

Sun StorEdge Utilization Suite Software

Provides automated file management and intelligent restore and archive capabilities to maximize storage utilization and IT staff efficiency. The recovery and archive service acts as an extension to on-line storage. It automatically backs up work in progress and creates duplicate archived files and file systems. An entire file system can be restored in minutes with users gaining immediate access to critical files for quick recovery from unplanned downtime. Multiple distributed storage devices provide redundancy to reduce risk and improve availability.

Sun StorEdge Performance Suite Software

The Sun StorEdge Performance Suite software is a high-performance, massively scalable, shared file system service. It is intended to provide fast access to shared data, even when processing large files such as satellite pictures, magnetic resonance images (MRIs), check scans, or automotive designs. The software is designed to require less hardware, simplify and reduce the staff required for storage administration, and provide better data performance. The important features of this suite include:

- File sharing (multi-reader and multi-writer)
- Scalability (designed to 1 PB, tested to 8 TB)
- Policy-based administration
- Unparalleled performance — scales with file system
- Rapid recovery
- Integrated and sophisticated volume management
- Heterogeneous host support (with third-party APIs)

Chapter 5

Summary

IT executives and managers are faced with the challenge of delivering return on investment and proving the value of their IT services. With increasingly demanding customers (both internal and external), accountability for profitability, and the looming threat of outsourcing it is imperative that they implement a comprehensive, enterprise-wide solution to provide accountability and help improve return on investments.

Sun and SAS, each with more than 20 years of experience designing and building hardware and software solutions, have joined together to provide a tightly integrated, open, scalable, and flexible infrastructure for IT management that allows companies to leverage existing information assets and extract real value from their data sources. SAS IT Management Solutions' complete suite of IT resource management and chargeback tools and Sun's robust IT infrastructure of scalable servers, storage solutions, and resource management tools help deliver the efficiency, flexibility, and profitability necessary to help make IT a successful and profitable component in the organization.

For More Information

Table 1: Web links for Additional Information.

Web Site URL	Description
http://www.sun.com/solaris	Solaris Operating Environment
http://www.sun.com/servers	Sun Hardware Servers
http://www.sun.com/sunmanagementcenter	Sun Management Center Software
http://www.sun.com/storage	Sun Storage Solutions
http://www.sas.com/products/itsv/index.html	SAS IT Resource Management
http://www.sas.com/products/itchargemgr/index.html	SAS IT Charge Management

Sun Microsystems, Inc. 4150 Network Circle, Santa Clara, CA 95054 USA **Phone** 1-800-555-9786 or 1-800-555-9SUN **Web** sun.com

Sun Worldwide Sales Offices: Africa (North, West and Central) +33-13-067-4680, Argentina +5411-4317-5600, Australia +61-2-9844-5000, Austria +43-1-60563-0, Belgium +32-2-704-8000, Brazil +55-11-5187-2100, Canada +905-477-6745, Chile +56-2-3724500, Colombia +571-629-2323, Commonwealth of Independent States +7-502-935-8411, Czech Republic +420-2-3300-9311, Denmark +45 4556 5000, Egypt +202-570-9442, Estonia +372-6-308-900, Finland +358-9-525-561, France +33-134-03-00-00, Germany +49-89-46008-0, Greece +30-1-618-8111, Hungary +36-1-489-8900, Iceland +354-563-3010, India–Bangalore +91-80-2298989/2295454; New Delhi +91-11-6106000; Mumbai +91-22-697-8111, Ireland +353-1-8055-666, Israel +972-9-9710500, Italy +39-02-641511, Japan +81-3-5717-5000, Kazakhstan +7-3272-466774, Korea +822-2193-5114, Latvia +371-750-3700, Lithuania +370-729-8468, Luxembourg +352-49 11 33 1, Malaysia +603-21161888, Mexico +52-5-258-6100, The Netherlands +00-31-33-45-15-000, New Zealand–Auckland +64-9-976-6800; Wellington +64-4-462-0780, Norway +47 23 36 96 00, People's Republic of China–Beijing +86-10-6803-5588; Chengdu +86-28-619-9333; Guangzhou +86-20-8755-5900; Shanghai +86-21-6466-1228; Hong Kong +852-2202-6688, Poland +48-22-8747800, Portugal +351-21-4134000, Russia +7-502-935-8411, Singapore +65-6438-1888, Slovak Republic +421-2-4342-94-85, South Africa +27 11 256-6300, Spain +34-91-596-9900, Sweden +46-8-631-10-00, Switzerland–German 41-1-908-90-00; French 41-22-999-0444, Taiwan +886-2-8732-9933, Thailand +662-344-6888, Turkey +90-212-335-22-00, United Arab Emirates +9714-3366333, United Kingdom +44-1-276-20444, United States +1-800-555-9SUN or +1-650-960-1300, Venezuela +58-2-905-3800