



### Introduction

Sun's Solaris(tm) Operating Environment is designed to support the high-level infrastructure that today's successful organizations need. Because it is available, scalable, manageable and secure, the Solaris Operating Environment (Solaris OE) provides optimal support for the wide range of services necessary for both enterprise and Internet-based service-on-demand environments. The Solaris OE delivers the predictability of the datacenter with the agility of the Internet.

### Evolution of the OS

Today's explosive levels of growth — in terms of bandwidth, networks, and digital devices — are driving an even greater shift towards a services model of computing. The Services on Demand approach moves the burden of a computing infrastructure from end users and their PCs to the organizations that provide these services. Today, the operating system allocates resources, provides file and print services, APIs, commands, and utilities. But to truly deliver services on demand, operating environments need to evolve and move in two directions. Operating environments are extending more and more into the network and need to be managed at the network level. If the computer is really a network of elements (storage, network, compute, and software stacks sitting on those elements)

then you want an environment that can provision them. You want to be able to virtualize your environment for better utilization so you can allocate the resources making them available when you need them. The logical progression of the operating environment turns our original tagline "The network is the computer" on its head: now the computer is the network: a network of storage, network, compute and software elements all tied together.

The other direction of the OS is what sits on the client or the server. This is where the OS becomes a Services Platform. It wasn't long ago that the client server was state of the art. But we've changed the way we write applications. Why did we do this? It was because in the client-server model, the server side was a big monolithic wad of code that was difficult to scale. It was

inflexible and hard to change. So what we did was to begin to break the block of code into pieces.

The result was that the web server, the application server (for business logic and transactions) and the portal server (for aggregation and personalization) were split off. We then had a set of tiers to improve the scalability, availability and flexibility of the application. But it is the integration of these components that creates the platform that you need to be able to deliver services over the Internet efficiently.

What we found is that you need the functionality of the OS, with the middle-ware integrated, so you have everything that you need to run the application. As a Services Platform, the Solaris 9 OE delivers the key services required in your architecture.

Because it is scalable, available, manageable, and secure, the core Solaris Operating Environment provides optimal support for a wide range of services necessary to support both enterprise and Internet-based Services on Demand environments.

### **The 9 Cool Things about Solaris 9 OE**

Solaris 9 OE has more than 300 new features that are a direct result of Sun listening to the needs of customers. Sun has been able to put in all of these features into its operating environment, without sacrificing compatibility, because of another of Sun's unique strengths: the world's finest software integration process. For over a decade, Sun has refined the engineering process that allows the integration of new features, while at the same time, testing rigorously

for two key elements: overall performance and compatibility.

We've taken all these new features and categorized them into nine areas by how they meet infrastructure platform requirements of our customers. These categories are:

1. Sun ONE integration
2. Data management
3. Provisioning and change management
4. Server virtualization: Solaris Containers and Solaris 9 Resource Manager
5. Security everywhere
6. Clusters with SunPlex systems
7. Configuration management
8. Performance: increasing the lead
9. Compatibility: application, Linux and ISVs

### **The 9 Cool Things**

#### *1. Sun ONE Integration*

Sun[tm] Open Net Environment (Sun ONE) is Sun's standards-based software vision, architecture, platform, and expertise for building and deploying Services on Demand. As we enter into the era of Services on Demand, businesses are creating increasingly demanding new applications and services in Java and XML. To deliver true mission critical reliability, these new services require robust middle-ware components such as Java(tm) 2 Platform, Enterprise Edition (J2EE(tm)) applications servers and LDAP directory servers.

Historically, many middleware components have been sold and distributed as entirely distinct software products that must be purchased, installed and configured independently of the underlying operating environment. An increasing percentage of projects require these

higher level middleware services, and system administrators want the ability to quickly and inexpensively deploy robust, proven services platforms. They want to deploy application services easier, faster and cheaper than the way they are doing it today.

The inclusion of many new services and components in the Solaris software distribution enables Solaris OE users to have immediate access to the Sun ONE software stack for developing and deploying web services. This integratable stack (so called because, despite the fact it behaves as a fully-integrated stack of software, adherence to open standards allow nearly any product in the stack to be "swapped out" for a different product) enables developers to start development for Sun ONE immediately and helps sysadmins and architects get hands-on familiarity with the applications and tools that comprise the Sun ONE software stack.

Sun is integrating the the Sun(tm) ONE Application Server into the Solaris OE. Today Sun is offering the Sun ONE Application Server 6.5 for evaluation and development, and the next generation Sun ONE Application Server 7.0, Platform Edition will include a license for production use.

The Sun(tm) ONE Directory Server, which was co-packaged in Solaris 8 OE, is now fully integrated into the Solaris 9 OE and is the foundation for network identity. This creates a Lightweight Directory Access protocol (LDAP)-based environment for the storage of comprehensive information and asset management, including user names and attributes such as passwords, and group, project and task definitions. This server includes a license for 200,000 user

The Solaris 9 OE redefines the operating system as a services platform with the integration of key middleware products into the operating system. This modular, open integration saves customers money in software acquisition costs and significantly reduces the time to deploy and manage systems.

entries which can be expanded to millions of entries.

Sun also includes a comprehensive set of co-packaged software with the Solaris OE, providing interoperability and commonality across both Linux and Solaris environments. Some of the co-packaged products include:

- Sun(tm) ONE Portal Server
- Sun(tm) ONE Integration Server, EAI Edition
- Sun(tm) ONE Message Queue
- Sun(tm) ONE Studio development tools
- Companion software CD with leading libraries, commands, tools, and more
- StarOffice(tm) 6.0: Sun's full featured office suite
- Oracle9i Enterprise Edition server 30-day trial

For a complete list of software:

<http://sun/solaris/binaries/package.html>

By making an open stack based on industry standards the core of our products, Sun can integrate the best open systems software to build better solutions for our customers. For a complete list of

freeware included with the Solaris OE, visit <http://sun.com/solaris/freeware>.

## 2. Data Management

Data integrity is one of the foremost concerns of administrators, and the Solaris 9 Operating Environment now includes features to help manage the very data that gives a company its competitive edge.

Sun has made new investments in filesystem and volume management products to make sure databases work well on native UNIX file systems (UFS) and deliver the performance that you expect. UFS Concurrent Direct I/O and Solaris Volume Manager are both integrated into the Solaris 9 OE, leading to significant improvements in data management and decreased outages. These provide the ideal platform for database file systems. Both of these features are free; customers no longer need to spend a fortune to have a strong file system and data management solution/strategy.

Specific enhancements include the following:

### *Data Management through Solaris Volume Manager*

The first step in maintaining data integrity is to use reliable volume management software to link together multiple disk volumes - which themselves might be large disk arrays - into single, large, logical volumes. This capability, as well as software RAID, is integrated into the Solaris 9 Operating Environment as Solaris Volume Manager. The task of managing disk volumes is further simplified in the Solaris 9 Operating Environment with a new graphical user interface (GUI).

### *Soft Disk Partitions*

Using built-in Solaris Volume Manager software, up to 8,192 "soft" disk partitions can be created per disk volume, enabling each user in a shared environment to have a personal, private virtual disk. In addition to providing privacy, soft partitions create a barrier between users and make it easy to establish different backup policies for each partition. Soft disk partitions can be expanded as long as free disk space exists in the underlying partitions.

### *Snapshot Backups*

The Solaris 9 Operating Environment eliminates the need to take file systems offline for backups. Through UFS snapshots, a temporary copy of a file system can be created so that a consistent point-in-time image of the file system can be backed up to tape.

### *mkfs Performance*

Growth in database tables means growth in disk capacity, and for database management systems storing their tables in UFS, creating a file system structure on a large disk array can be a time-consuming operation. With improvements to the Solaris 9 `mkfs` command, a UFS can now be created 96 times faster than before.

### *3. Provisioning and Change Management*

As IT infrastructures grow increasingly large and complex, organizations must maximize efficiency. Deploying and re-deploying servers is a daily event. Today's companies must not only manage growth, but must also reduce risk through reducing complexity: from using fewer hardware and software components to using servers that can be repaired or upgraded with no downtime.

Sun makes deploying and changing software across the network much easier by enhancing the provisioning capabilities of Solaris itself, and creating a new product — that will be available separately — Sun(tm) Management Center Change Manager.

Solaris 9 OE includes tools that facilitate provisioning of an entire software stack (which includes OE, applications and content) on a single system. These tools include Solaris Flash (an extension to Web Start), Live Upgrade and Secure WAN boot.

Solaris Flash allows you to create a snapshot of the entire software stack (which includes OE, applications and content) that can be copied to another system. You can then rapidly install “flash archive” on one or many systems. Not only does this save significant time in the installation process (one of Sun's customer's

was able to reduce a 4-5 hour task of building the stack and copying it to other systems to only 20 minutes), it also reduces opportunities for configuration errors in the install process.

Sun Management Center Change Manager (Change Manager) extends the above features to allow for the provisioning of multiple systems. It leverages the intrinsic Solaris technologies to easily manage a “jukebox” full of flash archives; it supports multiple simultaneous installs, as well as auditing and management of configuration changes. So instead of installing or upgrading servers one at a time, you can use Change Manager to automate this process for hundreds of servers at a time, saving your IT staff many hours of repetitive work and providing scalability to your services.

Live Upgrade reduces planned downtime during the install process by allowing the upgrade to take place on a production system. It allows you to upgrade the operating system while the system is still running. If there is an upgrade problem, you can quickly fall back to the original boot environment. This eliminates the downtime associated with normal test and evaluation processes for the production environment.

Today's customers can boot off a local server, but customers want to take a piece of hardware, put it anywhere in the world and use the network to lay down the entire stack. Secure WAN Boot (coming in a Solaris 9 update) allows the user to securely boot and install a system across a public or private internet, rather than having to be physically present at potentially hard-to-access locations.

### *4. Server Virtualization*

#### *Solaris Containers and Solaris 9 Resource Manager*

Basing server utilization on peak load usage is very costly and inefficient to businesses. To address this problem, Sun has created the concept of Solaris Containers, of which a key component is Solaris(tm) 9 Resource Manager.

Solaris Containers are Sun's next advance in server virtualization, a concept which allows servers on the network to be flexibly partitioned into independent execution environments that provide isolation within the same server. The benefit of virtualization is that you can run multiple applications on a shared infrastructure, so that you can move headroom around based on service level requirements. To do this, you need to have multiple applications that share the same infrastructure but you also have to be able to isolate and contain them. There are three areas that need to be contained: the resources that are used (so they don't starve); security (so you have access only to the applications to which you are allowed access); and faults (so failure of one application doesn't affect other applications).

Partitioning is how you contain the above areas and is done on two levels: On the hardware level, it is done with domains. On the software level, Solaris Containers isolate software applications or services using flexible, software-defined boundaries. Solaris Containers provide an environment with fine grain, secure, dynamic server partitioning.

Note that the Solaris Container approach is being done in phases. Phase 1 is resource containment and is ready in

**Solaris 9 OE is built on open, Internet standards: the best investment protection. It is the only leading-edge Enterprise class OS that allows choice, is open and preserves customer's investments.**

Solaris 9 Resource Manager. The tool can allocate resources such as CPU, physical memory and I/O bandwidth within a single instance of the Solaris 9 OE.

This ensures high priority applications receive a pre-determined amount of resources to improve system utilization and aid capacity planning. Solaris 9 OE now IS the scheduler and is able to do timeshare and directed resource allocation. By managing service levels, the Solaris 9 Resource Manager enables system administrators to control and allocate major system resources such as CPU time, processes, virtual memory, connect time and logins.

### 5. Security Everywhere

Because Sun designed the Solaris Operating Environment with the belief that all systems should be networked, the Solaris OE has been built to securely interconnect with other systems and also to be better protected from the viruses and worms that plague software designed without security and networking in mind. These aspects of security - network and platform security - are critical whether building an enterprise network or providing services to millions of users over the Internet.

There are different dimensions to security, and a successful plan involves people, processes and product. The Solaris 9 OE contains features and tools that support effective security across all these dimensions. Some of the new features in Solaris 9 OE include:

- Solaris(tm) Secure Shell. Allows for strong authentication of both the client and server machines as well as userids. It provides a secure method for system access including a lightweight VPN.
- IPSec with Internet Key Exchange (IKE). These modules have been approved for export at 128-bit encryption. IPSec increases security between both servers and communication channels so that only authorized parties can communicate with them. IKE is used to set up and manage larger numbers of secure networks.
- SunScreen 3.2. High speed, stateful packet-filtering firewall that offers advanced features that protect a single system or an entire network of servers. Now included with the Solaris 9 OE at no extra charge.
- Kerberos v5 server. Improved single sign-on for applications and systems.
- Role-based access control (RBAC). Enables assigning rights to perform specific operations. Minimizes the

change that any user will go beyond their realm of expertise and inadvertently or intentionally make a change that results in a system failure.

### 6. Clusters with SunPlex Systems

With businesses operating globally, organizations no longer know when their customers might demand their services. The days of "planned downtime for maintenance" are long over; systems must now be designed to provide services at all times. Sun(tm) Cluster 3 is the foundation of the SunPlex environment and a key element in providing the highest level of availability.

The May 2002 update of Sun Cluster 3 gave customers immediate availability of the SunPlex environment with Solaris 9 OE. In addition to this, it also delivers optimized support for Oracle's RAC, with configurations of up to four nodes. Oracle's distributed Lock Manager takes advantage of Sun's Remote Shared Memory facility, providing the high performance and response time needed for true scalability and fast failover.

Security hardening has been dramatically increased for clustered software. Additional enhancements include: ease of upgrade from any prior Sun Cluster 3 release, continued support and enhancements for unique Sun features (such as the Agent Builder for rapid integration and deployment of new software into a clustered environment), and support for Dynamic Reconfiguration of clustered nodes.

### 7. Configuration Management

In any business, availability is critical. You can have all the best features, the strongest security, and the most powerful

systems in the world, but if the system is down, if the application isn't running, your performance rating is zero.

Robust hardware and software components are vital elements for continuous uptime, but at least as important are well-documented practices, and the knowledge base to deliver the correct highly-available system configurations.

Sun has made two significant investments in this area: Intelligent configuration services and more comprehensive facilities for system administrators to maintain their operating environment. Under configuration services, Sun has improved the facilities that software providers can use to integrate their products with the Solaris OE. The Solaris 9 registry offers a single consistent view of all software installed on the system, whether it's Solaris elements, Sun ONE components, 3rd-party products or customer-developed applications. This improves system integrity by making sure package interdependencies are checked and documented. The Solaris 9 registry builds on the existing Solaris package integration facilities, such as Web Start for ease of installation, using the de facto standard interfaces customers are familiar with in other environments.

Configuring for availability involves more than product features — it's also important to have the right processes in place and have the knowledge available for optimum performance and reliability. Sun has compiled a database that documents our cumulative product and operational knowledge of best and worst practices. We can use that database to compare to a customer's specific configuration and application needs; we can then make recommendations as to how to best

**The logical progression of the operating environment turns our original tagline “The network is the computer” on its head: now the computer is the network: a network of storage, network, compute and software elements all tied together.**

configure systems and infrastructure for best availability. This creates a RAS profile, which can be used and updated by our customers in partnership with their Sun account team. To supplement this, we have a comprehensive set of best practices documents on our Sun Blueprints(tm) portal, as well as our award-winning BigAdmin(SM) portal, Sun's sysadmin-focused location for information on Solaris system management.

Patch management is a fact of life for any system administrator. The Solaris Operating Environment is well regarded in the industry for its extremely high quality, and continues to deliver measurable improvements in quality with each release. As availability, security, and reliability have become more critical to the success of an organization, the focus of many IT professionals is changing from a reactive to a more proactive approach to patch management. Keeping systems up to date on current patches avoids needlessly leaving them exposed to integrity risks that are mitigated by available patches. However, patch management can be very time consuming.

With that in mind Sun introduced Solaris Patch Manager to make it easier and less time consuming for sysadmins to perform this critical task. Solaris Patch Manager simplifies patch management by automatically identifying the patches currently installed, identifying recommended patches based on the system configuration and downloading the necessary patches. Solaris Patch Manager also verifies the digital signature of patches, resolves any patch dependencies and determines the correct install order for patches, all in an automated fashion. Installing and removing patches on single or multiple machines is now faster and easier than ever before, thereby improving system availability and driving down the time and cost of administration.

#### ***8. Performance: Increasing the Lead***

Companies offering Web-based services have lost control over how many customers might visit their sites — and successful companies are the ones which can grow to support millions of customers almost overnight. The Solaris 9 OE is the third major release of a complete 64-bit

computing environment tuned for Sun's line of highly scalable 64-bit servers. Increasing the performance and scalability of the Solaris OE serves to instantly improve the price/performance and, hence, the return on investment for Sun systems.

Some of the new scalability features in Solaris 9 include:

- **Threading library improvements.** Significantly improve the scalability and performance of multi-threaded applications including Java-based applications.
- **Multiple page size support.** Improves virtual memory performance by allowing applications to use large page sizes, therefore improving resource efficiency and reducing overhead.
- **Remote Shared Memory API (RSMAPI).** Allows cluster-aware applications to be architected to significantly reduce the time required to respond to events in a clustered configuration.
- **Network Cache and Accelerator (NCA).** Increases web server performance by maintaining an in-kernel cache of web pages accessed during HTTP requests.
- **mkfs Performance.** Reduces the length of time, in some cases from hours to minutes, needed to create UFS file systems with large numbers of entries (files).

### 9. The Compatibility Story

Compatibility is one of the hallmarks of software developed for the Solaris Operating environment, and is a key feature enabling customers to move up the product line without ever having to port or re-compile their applications. Solaris OE offers complete binary compatibility by supporting a public Application Binary Interface (ABI) which guarantees that conforming applications will run on all Sun servers without modification - from desktop workstations to the 106-processor Sun Fire 15k server.

This tight coupling of Solaris software with Sun hardware, while maintaining broad compatibility with the UNIX(r)/Linux community makes Solaris the operating system of choice to deploy today's network-centric infrastructure where scalability, availability, manageability, and security cannot be compromised. The Solaris OE delivers built-in Linux compatibility and this compatibility is further enhanced in Solaris 9 OE. Linux compatibility features are built into the Solaris OE, including APIs, tools, utilities, and services. LinCAT, a Linux compatibility assurance toolkit, is available to run against source code to help port to the Solaris OE.

Reliance on open standards also offers asset protection, as Sun systems can be well integrated with the legacy systems that companies already have in place.

Sun's commitment to open standards is exemplified by our support of Internet standards, including the IETF and our sponsorship of the Java Community Process for Java programming languages. In fact, the Solaris OE supports software components including the Java(tm) 2 Platform, Standard Edition (J2SE(tm)) and the Java(tm) 2 Platform, Enterprise Edition (J2EE(tm)) environments and service-delivery platforms including Sun(tm) ONE Web Server, Sun ONE Application Server, and Sun ONE Portal Server. And because it is based on open standards, Sun invests its resources in creating superior implementations rather than vendor lock-in strategies. There are more than twelve thousand third-party applications running on the Solaris Operating Environment, giving customers greater choice.

### Conclusion

The Solaris 9 OE builds on the proven foundation of Sun's industry-leading platform, adding new features that meet the needs of today's most demanding IT professionals while continuing to provide full binary compatibility with prior releases. By minimizing planned and unplanned downtime, reducing the opportunity for administration errors, and simplifying troubleshooting, Solaris keeps mission-critical applications available and ensures high-speed, reliable access to data.