EVALUATING OPEN SOURCE OPERATING SYSTEMS: **FEATURES, FLEXIBILITY, AND PERFORMANCE**

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Abstract

The operating system is the foundation of an enterprise's IT architecture. When evaluating open-source and proprietary OS solutions, more and more enterprises are recognizing the advantages of the easy access, continuous innovation, and flexibility that open source provides. For today's demanding enterprise, however, Sun's Solaris™ and OpenSolaris™ operating systems provide the ideal strategic platform. While open source offers distinct advantages, Solaris and OpenSolaris provide unmatched features, flexibility, performance, and reliability for the enterprise.

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Executive Summary

The operating system (OS), a collection of programs that serves as the interface between the hardware and the applications running on that hardware, can have a huge impact on how successfully enterprises meet their challenges. The OS manages all the other programs the enterprise uses as well as the allocation and use of hardware resources such as the CPU, memory, and hard disk drive. As a critical component of any IT solution, the choice of OS has both business and technical value for an enterprise.

Enterprises now have the option of choosing between open source and proprietary OS solutions. This white paper explores the advantages of open-source OS's and examines Sun's open-source Solaris and OpenSolaris OS's, which offer cross-platform capabilities and ground-breaking features to improve performance, availability, and scalability.

Why open source for operating systems?

Open-source OS's present a low-cost, secure, highly interoperable contrast to proprietary systems. The open-source model for OS development spurs innovation beyond the four walls of a company, in sharp contrast to the high-cost, high-maintenance, proprietary development approach behind systems like Microsoft Windows, AIX, or HP-UX. Open-source OS licensing costs can be significantly lower than their closed-source equivalents, especially for customers wanting a full-featured distribution on high-end systems. Additionally, open-source OS's that run on multiple platforms and work with a variety of applications from many sources make vendor lock-in less likely — and companies with special needs can customize specific open-source OS modules.

Solaris™ and OpenSolaris™ OS: Sun's Open-Source Operating Systems

The Solaris™ Operating System, the result of a $500-million plus investment in development by Sun, is a UNIX® technology-based operating system that is supported on more than 1,100 SPARC®- and x64/x86-based hardware platforms from top manufacturers, including systems from Sun, Dell, HP, and IBM. Because the Solaris OS is supported on both SPARC and x64 platforms, it provides a single environment that can extend from an organization's Web server to its database — which cannot be said of proprietary HP-UX and AIX systems. Sun also guarantees complete binary compatibility from release to release and source code compatibility from platform to platform, providing unmatched protection of customers' IT investments. In addition, thousands of open-source and ISV applications are available and supported for the Solaris OS, which has the largest server installed base of any commercial distribution of an open source-based operating system.

The Solaris OS provides unmatched reliability and performance, along with many features not available in any other OS. It also employs a conservative release approach, which — while of significant benefit to enterprise installations — can limit the speed with which new technologies are distributed. For this reason, Sun introduced the OpenSolaris™ OS release as an additional distribution model for Solaris technology that provides for releases every six months, delivered in a development and deployment environment familiar to users of open-source OS distributions based on GNU/Linux or BSD. With this model, developers and enterprises can take advantage of the latest Solaris innovations in a distribution that meets their needs.

Solaris and OpenSolaris technology releases are based on the same open-source code base. The OpenSolaris community is where the next generation of the Solaris OS is being built, and the OpenSolaris OS is where the latest results of these efforts can be found. Every three to five years, Sun delivers a major Solaris OS release and the company provides several updates to that release per year. When the next version of the Solaris OS is released, it will be almost identical to the most recent OpenSolaris release.

Solaris releases are especially attractive to customers basing their solution on third-party commercial enterprise applications, since more than 10,000 commercial applications are certified by their vendors to run on the Solaris 10 OS. OpenSolaris releases are particularly appealing to customers who are deploying applications using classic Web 2.0 infrastructure software such as Apache, MySQL™, Python, and other leading edge open-source technologies.

Here are some key points regarding Solaris and OpenSolaris:

- Both are available for download free of charge, and millions of Solaris licenses have been issued worldwide.
- All Sun products, including those that have open sourced their code bases, continue to undergo the stringent testing they always have before commercial distribution.
- Sun provides support options for OpenSolaris OS deployment, as well as expert assistance for developers. Support for the Solaris OS includes even more sophisticated levels of support for the most mission-critical applications.
- Source code for OpenSolaris projects is licensed under the very unrestrictive Common Developer and Distribution License (CDDL), an open-source license that takes the well-known Mozilla Public License (MPL) and makes it reusable without modification. This provides open-source protections and freedom while also making possible larger works for commercial purposes.
- The Web site opensolaris.org is where communities and projects are located.
- Universities worldwide have incorporated OpenSolaris technology into their kernel programming curriculum.
- Third-party software companies certify to the shipping version of the Solaris OS, which comes with full indemnification from Sun.

The Value of Open Source Communities in Developing Sun Operating Systems

Sun's Solaris OS was open sourced in 2005 as the OpenSolaris project at opensolaris.org, where a very active, worldwide community of developers collaborates on enhancements to the OS. An innovative technology recently developed by the OpenSolaris community is the Image Packaging System, which provides automated, easily customizable installation, updates, and fixes for a wide range of components; it's the most comprehensive packaging system of its kind. The Image Packaging System is also backwards-compatible with existing applications, which means that a company's previous investment in the Solaris packaging system is preserved.

Sun has hundreds of employees actively developing the Solaris OS, but also benefits from the participation of more than 180,000 community members working together to build the next generation of the operating system. Their Solaris knowledge and experience and their direct knowledge of what works and doesn't work in their environment is absolutely invaluable to the technology's development. The sharing of intellectual property between Sun and the open-source community is creating a larger, more diverse ecosystem of students, developers, system administrators, and users. Solaris customers are now able to get involved in the development of future versions, participate in or even initiate projects that help them in their own businesses, help Sun direct its massive R&D resources, and work with a growing community of developers (including those working for Sun) who can answer their OS questions.

Sun is unique in the industry in that it created a vibrant open-source community while providing commercial, 24/7 world-class support for an operating system that enterprises have been using for 20 years. As a result, Solaris is a high-performance OS that benefits from continuous innovation through Sun's $2 billion annual R&D budget, as well as contributions from the open-source community.

Key Features and Capabilities of Sun's Open-Source Solaris Operating Systems

Optimized performance

With a wealth of performance and price/performance world records set and reset since its release, the Solaris OS delivers indisputably high system performance. Its optimized IP network stack helps maximize the number of users/transactions per system, decrease response times, and increase customer satisfaction. And the innovative Dynamic Tracing (DTrace) tool makes it easy to safely analyze, debug, and optimize services on production systems in real-time. DTrace delivers always-there, real-time visibility of current program and operating system behavior on production systems without changing configurations, installing additional software, or interrupting current operations. DTrace also enables troubleshooting of system and application performance problems in hours or minutes instead of days.

Increased asset utilization

Sun developed OS-level Solaris Containers virtualization technology to provide light-weight, high-performance virtualization at the OS level for secure application isolation. Solaris Containers makes it possible for enterprises to safely consolidate multiple services onto fewer systems, making the best utilization of IT resources.

Higher application availability

Predictive Self Healing helps Sun systems and services maximize availability in the face of software and hardware faults and facilitates a simpler, more effective end-to-end experience for system administrators. The key elements of Predictive Self Healing — Solaris Fault Manager and Solaris Service Manager — are part of the Solaris 10 and OpenSolaris OS. Solaris Fault Manager automatically detects hardware errors and faults. Solaris Service Manager detects software failures and automatically restarts entire software services; recovery is automatic, in milliseconds rather than hours or days. The Solaris OS's memory-error detection and mitigation alone can reduce system downtime by 30% to 50% annually.

Simplified data management and increased data integrity

Solaris ZFS™ is Sun's next-generation file storage solution that's designed to meet the modern needs of a general purpose, host-based file system. The key benefits of Solaris ZFS are manageability, security and integrity, and immense scalability. For example, it automates and consolidates complicated storage management tasks, reducing overhead by 80% compared to traditional file management technologies. Enterprises do more with less by leveraging their existing storage infrastructure for greater efficiency. And Solaris ZFS technology also provides increased protection against data loss by detecting and correcting silent data corruption.

The early testing of ZFS software provides a good example of how effective community involvement can be in the development of open-source technologies. Very few, if any, enterprise customers would want to be the first to use this 1.0 file system, risking their mission-critical data in a production environment. The open-source development model provided an alternative: Months prior to the incorporation of ZFS in a commercial OS release, the OpenSolaris ZFS community allowed interested developers and deployers to compile the code under development, run it, and provide feedback to the project — all as part of a transparent, open process. Large numbers of people began using ZFS in test and even multi-terabyte production environments, and they gave the project valuable and candid information about what worked and what didn't and offered suggestions for additional operational features as well as for quality and performance improvements. After months of rigorous testing in environments not accessible in a traditional closed-source world, Solaris ZFS software was released as part of the Solaris OS. There was not only a significant amount of quality and feature improvements, but also pent-up demand for the product as people learned firsthand or through the reports of others about what made ZFS technology unique.

The Solaris OS continues to be recognized by many customers, press, analysts and many of Sun's competitors as the enterprise OS to beat. No other operating system has the same combination of innovation, openness, and cost-effectiveness, with a life cycle designed to address how businesses really work. None of Sun's competitors offer free licensing for their flagship OS, and no other OS can lay claim to a thriving customer and ISV ecosystem on the leading enterprise RISC and industry volume architectures. With a broad range of performance records, a 15-year history of scalability, the unique power of DTrace for optimization and troubleshooting, the uptime advantages of Predictive Self Healing, and the right background and vision for continued leadership in chip multi-threading, the Solaris OS provides high performance on all platforms it supports. For more information on the Solaris OS, got to sun.com/solaris or you can join the community at opensolaris.com.

Open Operating System Case Study

Reliant security creates streamlined, lower-cost retail security solution with Sun technology

Sun partner Reliant Security provides information security products and services that help merchants secure and protect the confidentiality and integrity of a client's information. The company's solutions are simple, inexpensive, and easy to deploy and manage. Most importantly, they help merchants comply with Payment Card Industry Data Security Standard (PCI) requirements.

For many retailers, PCI is an overwhelming security requirement, addressing encryption, system integrity, logging, intrusion detection, vulnerability scanning, wireless protection, configuration management, and system hardening. To meet these requirements, retailers often must deploy a complex mix of point solutions from various vendors. The cost to deploy and maintain these solutions can climb to the tens of thousands of dollars per store, and there is no guarantee that the solutions will be compatible — or reliable enough to ensure that confidential information won't be compromised.

Reliant's Managed PCI System (MPS) provides a full suite of security controls in a turnkey solution for merchants with distributed store or branch environments. Built on both Solaris 10 and the OpenSolaris Operating System, MPS provides a highly scalable virtualized platform. "With Sun, our approach is to take the best that's available from the open source community and provide the specific, programmatic software integration," says Richard Newman, co-founder and president of Reliant Security. "We make it all work together, package it, and virtualize it using an industrial-strength operating system and run it at the store environment on low-cost, off-the-shelf embedded systems hardware" including the Sun Fire™ T1000 server and the Sun Fire X2200 M2 servers.

Reliant originally developed its MPS on BSD Unix and then migrated to Solaris 10 and OpenSolaris. "We needed better virtualization than BSD provided, and Solaris 10 with Containers gave us the best balance between operating system virtualization and shared virtual resources," says Newman. "We also needed networking support and saw such strength in Sun's solutions. So, we turned to Crossbow, the OpenSolaris network virtualization project. It provided us with a very advanced, virtualized networking environment. It's exactly what we needed."

Although the company evaluated VMware, Reliant quickly realized that it was far too expensive to implement. “For this type of solution where we’re putting hundreds or thousands of boxes into retail stores, paying for a VMware license in each location made VMware cost-prohibitive,” says Newman. Because retailers operate on very thin margins, an open source solution — particularly when backed by a large company like Sun — is very compelling. For Reliant, the Solaris Operating System and Solaris Containers offered a better licensing model for putting low-cost boxes in multiple stores or branch locations.

Newman also says support and service were important factors in choosing the Sun platform for MPS. “The Sun name makes our customers feel very comfortable,” he says, adding that the level of support and service that Sun provides far exceeds that of other open-source vendors or the open-source community. “In the open-source community, you find individuals who are doing their own open-source work part-time, at home or at night. That’s not the same as having an organization like Sun truly standing behind it.” says Newman. “And from a hardware perspective, with Sun you have a close pairing of the strong open-source operating system in both Solaris 10 and OpenSolaris with hardware sets that come from one organization — no other vendor can provide that.”

A key deciding factor for Reliant Security’s customers is price. Because Reliant’s in-store management network appliance uses off-the-shelf components — with no custom hardware required — MPS is a dramatically lower cost solution than that of other vendors. “We have seen retailers that had to add three, four, five, or even 10 people to their existing support team to manage multiple solutions,” Newman says. Additionally, the small in-store footprint reduces retailers’ power and cooling costs.

Reliant Security plans to develop more security applications on the Sun platform. “With Sun, we get leading-edge virtualization from a well-established technology solution provider with a great pedigree,” says Newman. “Sun has strength and experience in security and in overall enterprise management. And it is able to bring both software and hardware solutions to the table from one organization.”

Solaris and Red Hat Enterprise Linux: A Brief Comparison

Red Hat Enterprise Linux (RHEL) is an open-source OS with a number of similarities to Solaris and OpenSolaris. This is not surprising, since Linux was crafted in emulation of the UNIX operating system, and the Solaris OS in particular has been considered by many experts to be the UNIX gold standard. In addition to both being open source, RHEL and the Solaris OS can be used in many of the same workloads, and their similar design philosophies, administrative models, and system interfaces as well as their support for many of the same platforms make it easy to move from one to the other as necessary.

But there are also important differences between Solaris and RHEL technologies. Solaris offers many business and technical advantages:

- Solaris runs on more hardware platforms.
- Solaris is supported by more applications.
- Solaris holds performance and price/performance world records that demonstrate its speed and scalability on a variety of systems.
- Solaris is supported by Sun, the company dedicated to UNIX for more than two decades.

In short, Solaris addresses more business needs at a lower cost than Red Hat Linux; this is what moved Mosaic co-author and Netscape founder Mark Andreessen to say: “Solaris is a better Linux than Linux.”

Top 5 differentiators

- **Security.** Solaris Trusted Extensions provides government-grade security in a standard commercial OS. Red Hat’s SE Linux requires a non-standard kernel and has no fine-grained security privileges.
- **Workload management.** Solaris Containers provides highly efficient virtualization at no additional charge. Red Hat requires costly add-on packages.
- **System observability and troubleshooting.** Solaris Dynamic Tracing (DTrace) delivers real-time visibility of program and operating system behavior. A similar feature from Red Hat has more limited functionality, cannot debug at the application level, and is not production-safe.
- **Fault detection and recovery.** Solaris Fault Manager automatically detects hardware errors and faults. Solaris Service Manager detects software failures and automatically restarts entire software services. RHEL has no such functionality.

- **Up-front and ongoing subscription costs.** Cost for licensing the Solaris OS is zero for commercial production applications on any supported system. Red Hat deployment requires an initial subscription; there is no "free" commercial distribution (i.e., there is no RHEL that third-party software vendors generally recognize as a supported platform).

The Solaris OS also offers a number of Linux interoperability features including:

- Seamless interoperability between Solaris and Linux-based systems
- Built-in binary and source code compatibility
- Easy portability with Java™ technology
- Sun Java Enterprise System software for standardized Java technology-based network services
- Integration of key open-source applications
- Free, high-quality porting tools
- Common desktop environment with Sun Java Desktop System desktops
- Designed for compliance with the Linux Standard Base (LSB) specification

Thinking of Deploying an Open-Source Operating System in Your Enterprise?

There are several steps you can take to help ensure your success with an open-source OS:

- Ensure that the open-source product you are considering has an established track record. Nobody wants to be the first customer for an OS. Everyone wants to know the platform already has an ecosystem around it and that it's ready for production-grade usage. If an operating system doesn't run on your hardware or doesn't run the leading-edge software you need, it's useless.
- Determine whether the OS is both maintainable and cost-effective. It's important to know whether the OS has a life-cycle around it or whether service runs out in two years, leaving the datacenter on its own. And can the OS can be managed efficiently or will it need to be replaced every year and require the retraining of staff?
- Ensure that the product has a substantial following and an active open-source community that supports it. Size and momentum are critical success factors for an open-source product to ensure it attracts ongoing maintenance and support.
- Be sure to acquire the product from an authorized source. Where source code is available, there is a possibility of sourcing products from unauthorized sources. For this reason, enterprises should acquire open-source products directly from a vendor that vouches for the technology or from the primary online repository for a particular product.
- Remember that many enterprises use a mixed environment so they can recognize the benefits of open source while leveraging their existing IT investments and expertise. Moving to open source need not be an "either/or" scenario. The beauty of open source is that it easily co-exists with current environments. New IT projects are a great way to get started with open source. Acquisition flexibility can result in a mix of open-source software, packaged software, and custom code.

How to get started with Sun's open-source operating systems

1. If they haven't already, ask your developers to download and experiment with:
    1. OpenSolaris, available at http://opensolaris.org/os/TryOpenSolaris/
    2. The Solaris 10 Operating System at http://www.sun.com/software/solaris/get.jsp
2. If either OpenSolaris or the Solaris 10 OS prove to be a good fit, you can easily migrate to Sun's fully supported commercial versions.

For more information on Sun's open-source operating system offerings, go to sun.com/solaris.

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