

PETER BAER GALVIN

## Pete's all things Sun: comparing Solaris to RedHat Enterprise and AIX



Peter Baer Galvin is the chief technologist for Corporate Technologies, a premier systems integrator and VAR ([www.cptech.com](http://www.cptech.com)). Before that, Peter was the systems manager for Brown University's Computer Science Department. He has written articles and columns for many publications and is co-author of the *Operating Systems Concepts* and *Applied Operating Systems Concepts* textbooks. As a consultant and trainer, Peter teaches tutorials and gives talks on security and system administration worldwide. Peter blogs at <http://www.galvin.info> and twitters as "PeterGalvin."

[pbg@cptech.com](mailto:pbg@cptech.com)

**THESE ARE TRYING TIMES IN SOLARIS-**land. The Oracle purchase of Sun has caused many changes both within and outside of Sun. These changes have caused some soul-searching among the Solaris faithful. Should a system administrator with strong Solaris skills stay the course, or are there other operating systems worth learning? The decision criteria and results will be different for each system administrator, but in this column I hope to provide a little input to help those going down that path.

Based on a subjective view of the industry, I opine that, apart from Solaris, there are only three worthy contenders: Red Hat Enterprise Linux (and its identical twins, such as Oracle Unbreakable Linux), AIX, and Windows Server. In this column I discuss why those are the only choices, and start comparing the UNIX variants. The next column will contain a detailed comparison of the virtualization features of the contenders, as that is a full topic unto itself.

### Choices

There are certainly many operating systems, and many of those are "good." However, there are only some that a Solaris administrator would find interesting professionally. Those are the operating systems that could subsume, or at least co-exist with, Solaris in a datacenter. Such operating systems need to be scalable, reliable, secure, and powerful. For a sysadmin to bother devoting the time and intellectual effort to learning a new operating system, it must also have a future, both technologically and commercially. Based on that reasoning, many operating systems fail to make the cut. Linux certainly has a future, and meets the aforementioned datacenter qualifications. Red Hat Enterprise Linux (RHEL) is the leading commercial Linux in the USA, if not the world, so that version is included. AIX 7.1 is (surprisingly to me) feature rich, and runs on the excellent Power 7 CPU, making it a worthy contender. HP-UX is not included on my list, as its feature set has not kept pace, and the servers it runs on don't appear to be compelling enough for a site to switch from their Sun servers. Windows Server 2008 is certainly a valid choice, but a technical comparison between it and other operating systems is unlikely to cause anyone to switch toward or away from it. And

let's not forget Solaris, which in all likelihood will continue to be a leading datacenter operating system.

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## The Comparison

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This column is about choice, and which other operating systems are worth learning by a professional Solaris system administrator. Now that the field of contenders is narrowed to RHEL, AIX, and Solaris, how can they be compared? Operating systems have many aspects, and really all of these should be considered when trying to choose the “best” OS. What follows is a set of criteria, and an attempt to compare the operating systems and their abilities within that criteria. Some criteria are certainly objective, while others are necessarily subjective. I try to gather all of the important data together, and provide the details needed for analysis. What is not included is any sense of the importance of a given criterion, as that will vary by administrator and by site. That priority is what every admin will need to add to their decision process.

There are many base features that all operating systems share, and still more that all UNIX-based operating systems have. And while the details on those may vary, the net result is that there is little generally important differentiation. Of course, a small detail in some aspect of some operating system may be vitally important for a given use case, but that is impossible to include in a comparison such as this. In the discussions below, where features are on a par at the macro-level, I call them equivalent even though there might be differences of note.

Although no Solaris overview should be needed by the readers of this column, a quick overview of the other contenders would be worthwhile.

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## RHEL Overview

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RHEL is Red Hat's commercial Linux release. Linux, of course, runs on x86 and some other CPUs, and is commonly found on everything from embedded systems through mobile devices, desktops, and servers. It is certainly ubiquitous, and many datacenters run a mix of Windows, Linux, and their “core” operating system. RHEL requires a maintenance contract for support, and it is reasonably priced. However, some sites choose to run CentOS, the almost exact duplicate of the RHEL release but delayed somewhat and without the support program or the support expense. Of course, there are very many other Linux distributions (see [http://en.wikipedia.org/wiki/Comparison\\_of\\_Linux\\_distributions](http://en.wikipedia.org/wiki/Comparison_of_Linux_distributions) for a full list). Fedora is much like OpenSolaris used to be—a bleeding-edge distribution full of new features not yet included in the commercial and supported release. Oracle also has Oracle Enterprise Linux, which is essentially a fork of CentOS and much like RHEL except with lower-cost support via Oracle. ISV support of the various Linux distributions varies quite a lot, so be sure to check for availability of your applications.

As a side note, many sites start with CentOS on their journey to Linux, and sooner rather than later find themselves running Linux for core production use and still using CentOS. Should there be a problem at that point, the site is self-maintaining their releases and self-debugging any problems. If your site is running Linux for important production uses, consider whether self-maintenance or commercial support is the best course of action. It would be unfortunate to be in a situation where the administrators, IT managers, or business unit managers believe a facility is fully “supported” only to find that when there is a problem only some parts are completely covered.

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## AIX Overview

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While Linux is common, AIX is less so, and perhaps a bit of a mystery to many sites. The problem with AIX is that it has somewhat of a “weird UNIX, not very common, feature-poor” reputation. Until recently, that was certainly how I regarded it. And while it is true that AIX is slightly different from other UNIX versions and only runs on one kind of hardware, the Power CPU architecture from IBM (meaning that it is difficult to explore), AIX has evolved rapidly over the past few years.

A Power CPU-based system is needed for familiarity with AIX. Fortunately, AIX now runs on a large suite of systems, ranging from blades, through two-rack-unit (2RU) systems, and up to full-rack systems. A reasonably small investment would allow a datacenter to run AIX on Power for full testing. RHEL and SUSE, as well as AIX, are available on the Power CPU, which may be a consideration for some sites. Using Power’s virtualization features, all three OSes could be run on the same hardware, but that is a tale for the next column.

AIX itself now has a rich feature set, including parity with Solaris in some areas and even excelling it in others, as described in detail in the next section.

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## Features

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Comparing operating systems is difficult, probably thankless, and impossible to get absolutely right, as discussed above. Perhaps that’s why there is a dearth of OS comparisons, even from the vendors of the operating systems. However, in this section is a rich set of criteria and a best-effort explanation of what each of the contending operating systems has to offer in those areas. This comparison is based on the current commercial release of each operating system: Solaris 10 9/10, AIX 7.1, and RHEL 5.5. Where there are multiple flavors of the operating system, the most advanced version is included.

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## PLATFORMS

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Solaris is supported on x86 and SPARC CPUs, and has a hardware compatibility list (HCL) detailing which components are supported on x86 servers (<http://www.sun.com/bigadmin/hcl/>). Additionally, Dell and HP currently sell and support Solaris on some of their x86 products.

RHEL runs on x86, x86-64, Itanium, IBM Power, and IBM System Z servers. The full list of supported hardware is available at <https://hardware.redhat.com/>.

As stated above, AIX runs only on IBM Power CPU-based systems.

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## SCALABILITY AND PERFORMANCE

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The vendors publish supported scalability information, in terms of the raw ability to use CPUs and memory.

Solaris—256 cores of CPU, 4TB of main memory.

RHEL—32 cores on x86, 256 cores on Itanium 2, 64 cores on AMD x86-64, 128 cores on IBM Power, and 64 cores on IBM System Z. Main memory limits include 16GB on x86, 2TB on Itanium 2, 256GB on AMD x86-64, 256GB on IBM Power, and 1.5TB on IBM System Z.

AIX—256 cores of CPU, 8TB of main memory.

Comparing the actual performance of operating systems is more of a challenge, with benchmarks possibly the most reasonable approach. However, benchmarks are designed to measure hardware performance or application performance, not that of the host operating system. And of course benchmarks are imperfect, being part art, part science, and part vendor manipulation. To delve more into performance, suggested sites include [www.spec.org](http://www.spec.org) and [www.tpc.org](http://www.tpc.org). The SPECjbb2005, a measure of Java performance, is particularly interesting because it is modern, still being used, has many submissions, and seems well thought out. Having a look through the results of specific vendors, platforms, and configurations may go a long way toward comparing real-world performance of many systems and give a feel for operating system performance.

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## FILE SYSTEMS

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Solaris includes ZFS, as well as UFS and a variety of special-purpose operating systems. Subjectively, ZFS has no peers in current commercial file systems, but it is also the newest and has the shortest track record in terms of reliability, performance, and maintainability of the options.

RHEL has both ext3 and GFS file systems. Ext3 is journaled for reliability, but lacks other features such as snapshots, replication, deduplication, compression, and checksumming that are core to ZFS. GFS, or the Global File System, is a clustered file system that allows up to 16 Linux nodes to mount, read, and write the same files. As with ext3, it lacks the advanced features of ZFS, but ZFS is not a clustered file system, and a ZFS file system may only be mounted on one system at a time.

AIX features the JFS2 file system, which is similar to ext3 in that it includes journaling. It used to have compression (in JFS1) but, oddly, JFS2 does not. JFS2 includes snapshotting, even going beyond the ZFS feature by allowing “external” snapshots that can be mounted on other systems. However, there is no clone ability to make a snapshot read-write. Finally, it has encryption, which ZFS currently lacks. Features like ZFS deduplication and replication are missing. Also available with AIX is GPFS, IBM’s clustered file system. Although not included in Linux, there are Linux ports of GPFS available, allowing a file system to be shared between AIX and Linux. For more on GPFS see <http://www-03.ibm.com/systems/software/gpfs/>.

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## VIRTUALIZATION

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The virtualization features of these operating systems are extensive but quite variable. RHEL must do all of its virtualization in software, while Solaris and AIX can make use of specific hardware features of their platforms to provide other virtualization options. The next Pete’s All Things Sun column will focus on comparing the virtualization offerings of Solaris, RHEL, and AIX.

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## DEBUGGING

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Debugging was long a backwater of operating system features, until the Solaris introduction of DTrace moved it to the forefront. There are many claims and counterclaims about operating system debugging features and functions, mostly between the Linux and Solaris factions on sysadmin forums. I believe it is safe to say that Solaris has a very full-featured, integrated, and supported dynamic tracing and debugging system.

RHEL has SystemTap, which is now fully integrated and supported. In general, SystemTap is an improvement on strace and other Linux debugging tools but is not as comprehensive as DTrace.

AIX includes a features called ProbeVue, which looks very similar to DTrace. One could argue that IBM ported DTrace to AIX and called it ProbeVue, but that could also lead to a debate. ProbeVue does lack the aggregation functions of DTrace, as well as providing fewer probe points. If you are familiar with DTrace you might want to look at the chapter on ProbeVue in the AIX manual (<http://publib.boulder.ibm.com/infocenter/aix/v7r1/topic/com.ibm.aix.genprogc/doc/genprogc/genprogc.pdf>) and at the ProbeVue QuickSheet (<http://www.tablespace.net/quicksheet/vue-quicksheet.pdf>) to see how close it is to DTrace.

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## INSTALLATION AND ADMINISTRATION

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Generally, all three operating systems are designed not only to install from a set of media, but also to be bulk-installed over a network. Solaris has the JumpStart and Flash Archive methods. AIX has several facilities including “NIM” and “EZNIM,” as well as procedures involving the HMC (Hardware Management Console). AIX has the nice feature of being able to create bootable backup tapes that can be used for restoration. RHEL provides a “network install” feature that works similarly to JumpStart.

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## SECURITY

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Another area ripe for lively debate is security, and comparison is again complex. In general, all three of these operating systems include role-based access control (RBAC), which is a key to limiting users to just the privileges that they need to accomplish their goals and to avoid privilege escalation, where users or applications can gain more privileges than they are supposed to have. The US government provides security measurement criteria in the form of the “Common Criteria” guidelines and testing (<http://www.commoncriteriaportal.org/>). Such certification takes time and frequently applies to older versions of a given operating system. There are also many variations within the evaluation (specific hardware, for example) that make determining “what is more secure” difficult. In summary, all of these operating systems have a good rich set of security features, which, if used properly, can result in very secure deployments.

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## ISV SUPPORT

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Perhaps the most important comparison point for a given facility is whether or not an operating system runs all of the applications that the facility requires. If an operating system cannot run a needed application, then it is not an option. All three vendors provide ISV lists, but further study beyond the list is required. For example, when each ISV releases a new version of its software, how long does it take for that version to become available on the operating system in question? Another important aspect is patch availability and delay. How long after a patch is released by an ISV on one platform does it take for release on the other platforms? For example, Oracle used to release Oracle Database patches for Solaris SPARC and RHEL first, on the same day, and follow that with the Solaris 10 x86 patch weeks or months later. Recently they changed that policy and release Solaris 10 x86 patches with the first wave as well. Delays in patch releases can leave sites vulnerable to bugs that affect reliability, performance, and security. Be sure

to check your important applications against the ISV lists, and check with those ISVs to determine how they treat a given operating system before making any moves between platforms. Another important sanity check, at least for the most important applications, is to poll the application vendors to see which platforms they recommend, or at least are commonly run on. Being the only site to run a given application on a given platform can induce a very lonely feeling.

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## How to Make a Switch

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Even after all these considerations, there are many other factors to weigh when adding or replacing an operating system. Sysadmin knowledge is certainly in the forefront, as is the overall cost of such a project. All three of the considered vendors have programs available to help a site move to their products. Check their Web sites or with your favorite reseller for details. Training can include specific areas of interest, or comparison of the operating systems. For example, IBM has a four-day course designed for system administrators with knowledge of other UNIXes to quickly get them familiar and comfortable with the AIX way of performing the standard sysadmin tasks. Even with these aids, bringing in a new operating system or hardware platform can be a challenge. Certainly, migrating to a new platform should not be undertaken lightly and should be given due deliberation and planning.

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## Conclusion and Further Reading

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Computing history is full of waves of operating system growth and shrinkage. Although the operating system choices seem to be narrowing these days, it's possible that once again we will have an explosion of choices. In the meantime, it seems that there are few contenders for datacenter managers to use as their core platform. Certainly Solaris, RHEL, and AIX are at the top of my list, and this column should provide a starting point for exploration and evaluation. In the next issue, the comparison concludes with a detailed look at the virtualization features of these products.

There are many resources available to aid in learning these operating systems and in comparing them to their peers. For a data sheet on the features of AIX 7.1, see <ftp://public.dhe.ibm.com/common/ssi/ecm/en/pod03054usen/POD03054USEN.PDF>.

IBM has a portal containing information about migrating to Power and AIX from SPARC and Solaris: <http://www-03.ibm.com/systems/migratetoibm/sun/>. It also provides "Redbooks," or technical white papers, available on a wide variety of topics at <http://www.redbooks.ibm.com/>.

Solaris technical documents can be found at <http://www.oracle.com/technetwork/server-storage/solaris/documentation/index-jsp-135724.html>.

A RHEL data sheet is available at <http://www.redhat.com/f/pdf/rhel-55-datasheet.pdf>, while version comparison information can be found at <http://redhat.com/rhel/compare>.