Modernize Your Data Center: Migrate from AIX to SUSE® Linux Enterprise Server

Executive Summary: Discover how migrating from AIX to SUSE® Linux Enterprise Server on your choice of server platform can result in significantly lower hardware and software licensing costs, improved interoperability with best-of-breed products and freedom from lock-in.
“Modern” data center infrastructures allow you to:

- Easily take advantage of new innovation
- Reduce data center costs by decreasing software licensing, maintenance and hardware acquisition costs
- Increase data center resource utilization by consolidating assets, implementing cloud computing and supporting application portability
- Improve workload performance and lower operating expenses by using newer, more powerful yet energy-efficient hardware
- Increase business agility by helping you address technology and market changes more rapidly
- Improve employee productivity by supporting strategies such as BYOD (bring your own device)
- Improve security and management by addressing any gaps caused by an ever-changing IT landscape
- Support a new wave of applications including new solutions for mobile devices, cloud computing, big data and social media

Where do you start? Perhaps the two most important areas to consider when modernizing your data center are implementing virtualization, choosing the “right” operating system/hardware server platforms and being creative about how to use cloud computing. Virtualization enables you to consolidate multiple workloads, often running on individual servers, onto significantly fewer virtualization host servers, reducing data center expenditures substantially. Virtualization also leads to flexible networks and enables you to move compute resources, whatever they are, to better respond to changes in demand. Without virtualization your speed in provisioning and de-provisioning resources is greatly constrained. Cloud computing enables you to reduce costs, manage peak load situations and increase business flexibility.

Selecting an operating system and hardware server platform for your data center has long-term consequences. The selection process must take into account not only features of both the operating system and the hardware platform on which it runs, but the ability of the platform to enable and support your future business requirements. It must also consider the initial acquisition and the ongoing maintenance and service costs based on projected reliability and the business impact of downtime.

Today, you can run almost all mission-critical, back-end database applications on Linux using POWER and AMD/Intel multi-core scale-up servers. You can do the same with IBM Power Systems servers running AIX. However, there may be a higher relative cost to do this with AIX, as well as limitations in innovation that you may have with a proprietary UNIX solution.

Besides the mainframe, the two primary choices for powering data centers are RISC/UNIX versus Linux on x86 or IBM Power Systems. Two leading platforms representing each category are AIX, which runs exclusively on Power Systems, and SUSE Linux Enterprise Server, which runs on both x86 and Power Systems server platforms. Let’s explore how they stack up in terms of the big picture as well as a feature/technology comparison.
AIX: Strong Enterprise OS, but Closed to Outside Innovation

Historically, IBM Power Systems running AIX have been a leading RISC/UNIX platform with exceptional RAS—reliability, availability, and serviceability. Its solid performance has made it a good choice for running back-end, mission-critical databases. In addition, IBM has continued to deliver innovation and software enhancements on AIX, more so than any other RISC/UNIX vendor, offering a roadmap that includes improvements in both RAS and performance. As a result, for some configurations applications on AIX may provide higher performance per core than competitive Linux distributions.

However, the market for applications running on UNIX operating systems including AIX has declined over the last several years. Companies with large data center investments in AIX (or other RISC/UNIX) platforms will ultimately face substantial barriers to ongoing, flexible modernization and huge challenges with respect to price/performance.

High costs. Many companies modernizing their data centers reduce data center costs by using new, lower cost hardware and virtualization for consolidating physical servers. Today, AIX-based solutions may not be cost-effective for some workloads when you consider software licensing for AIX, virtualization and cloud computing as well as the costs for the physical servers and server maintenance. IT organizations should always also consider the business costs of downtime for system failures and maintenance balanced with the IT costs of acquisition and support in making the decision to migrate.

Today, a SUSE Linux Enterprise Server subscription (Priority subscription) for x86, x86-64 or POWER processor-based servers is US$1,499 for up to two sockets. Because the pricing is the same across server platforms, customers have the flexibility to move licenses in the data center to meet changing requirements. SUSE Linux Enterprise Server may be a more cost-effective alternative for applications that do not require AIX capabilities such as Enterprise Pools, Live Partition Mobility or certain advanced security certifications.

Reduced ISV support for AIX. While IBM is a large ISV (Independent Software Vendor) with its own commercial software products running on AIX, some ISVs are dropping support for their applications on AIX due to insufficient demand. SUSE Linux Enterprise Server has more than 10,000 certified ISV applications. What’s more, almost all important business applications currently running on AIX, including those from IBM, SAP, Oracle and more, run on SUSE Linux Enterprise Server.

Lack of technology innovation. IBM and other large ISVs continue to develop solutions that run on AIX, but they also deliver innovative solutions on Linux along with smaller and emerging companies. Lack of AIX support from some ISVs limits your ability to take advantage of many of the open source innovations for virtualization, cloud computing and deployment capabilities such as Docker or Ceph that are important when modernizing your data center.

Lock-in for the platform. With reduced ISV support for the platform, migrating to or staying with AIX limits your ability to modernize your data center and effectively locks you in to IBM. This may result in high costs and inflexibility when evolving your data center environment. This is why several years ago IBM opened the POWER platform to support Linux and open source applications. SUSE Linux Enterprise Server was the first Linux distribution supported on Power Systems.

Migrating to SUSE Linux Enterprise Server: Innovation plus RAS at an Affordable Price

Fortunately, today Linux solutions, especially SUSE Linux Enterprise Server, eliminate the drawbacks of proprietary RISC/UNIX systems to help companies achieve the desired results of data center modernization:

RAS at an affordable price. The price, performance and reliability of industry-standard POWER and x86 servers running Linux have improved over the years to the point where today they can meet or exceed the capabilities requirements for today’s enterprise workloads. The RAS features currently available in POWER and x86 servers running Linux include improved inter-processor communication, higher interconnect bandwidth, machine check architecture recovery, double device correction and more. As a result, enterprises are migrating from AIX to Linux platforms running new, more affordable, multi-core servers such as the DL980 servers from HP (Intel x86), servers from Lenovo.
such as the System x3690 (AMD x86), servers from Dell such as PowerEdge M910 and R910 servers (Intel x86), and IBM servers such as the Power S812L, S822L and S824L (IBM POWER) servers running Linux. SUSE Linux Enterprise Server provides you with flexible choice in continually modernizing your data center to meet your business requirements.

It is difficult today to name a new technology for which Linux and open source are not at the center of innovation. Virtualization, cloud computing, big data, etc.—all of these technologies are important for modernizing your data center. Large ISVs such as IBM choose to embrace innovation from the open source community while maintaining support for applications on AIX to meet the needs of customers who require support for mixed environments.

SUSE Linux Enterprise Server versus AIX

The table below provides a detailed comparison of the features and technologies available in SUSE Linux Enterprise Server and AIX:

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<th>Technologies</th>
<th>SUSE Linux Enterprise Server</th>
<th>AIX</th>
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<tr>
<td>File system</td>
<td>Ships with several different file systems, including Btrfs, ext3 (default for SUSE Linux Enterprise Server), ext2, ReiserFS, XFS (open source version) and OCFS2. Each has advantages and disadvantages. A file system comparison table is located at: <a href="http://www.suse.com/products/server/technical-information">www.suse.com/products/server/technical-information</a></td>
<td>AIX comes bundled with multiple file system options, including journaled file system (JFS), extended JFS (JFS2), as well as Veritas VxFS. JFS and JFS2 are journaling file systems developed for AIX by IBM. An open source version of AIX’s JFS is available for Linux. Linux journaling file systems that compare to JFS include XFS, ext3, ext4 and ReiserFS.</td>
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<td>Predictive self-healing</td>
<td>Requires hardware support to be fully effective. SUSE is working with all major hardware vendors, especially IBM and Intel, to optimize integration of hardware and operating system in this area. Supports proactive notifications. Technologies such as MCELog help administrators with early warning about upcoming hardware issues that might impact the stability of the operating system and applications.</td>
<td>IBM has been a leader in this area for many years. IBM first developed Chipkill technology in the early 1990s, and it is integrated with AIX. It is a form of advanced error checking and correcting (ECC) computer memory technology that protects computer memory systems from any single memory chip failure as well as multi-bit errors from any portion of a single memory chip. Chipkill is sometimes combined with dynamic bit steering, so that if a chip fails, another spare memory chip is used to replace the failed chip.</td>
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<tr>
<td>Dynamic tracing framework</td>
<td>Ships with SystemTap, a scripting language and tool for dynamically instrumenting running production Linux operating systems.</td>
<td>AIX 7 provides dynamic tracing capability through probevue Dynamic Tracing, to simplify debugging system and application code.</td>
</tr>
<tr>
<td>Security/ certification</td>
<td>Meets Common Criteria Certification at Evaluation Assurance Level 4+ (EAL 4+).</td>
<td>Provides Trusted AIX. It enhances the security of AIX by providing for label-based-security capabilities within AIX. Trusted AIX consists of regular AIX with some additional packages and file sets. AIX 7 meets Common Criteria Certification at EAL 4+.</td>
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Technologies | SUSE Linux Enterprise Server | AIX
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**Virtualization** | Interoperable with leading open source and proprietary third-party hypervisors: | Workload partitions (WPARs) enable the creation of multiple virtual AIX environments inside a single AIX instance. Each WPAR can have a unique root, file system and security profile. | PowerVM is available as an option for AIX and is primarily used for server consolidation—moving multiple workloads to a single server. Its features include logical partitioning, micro partitioning, dynamic logical partitioning and live partition mobility. PowerVM can be used to create virtual host environments that support Linux and Windows guests. PowerVM is not shipped with SUSE Linux Enterprise Server but PowerVM and PowerKVM are supported at no additional cost. PowerVM and PowerKVM are two hypervisor options for SUSE Linux Enterprise Server. SUSE Linux Enterprise Server itself is a supported guest operating system in virtual environments created using KVM, Xen, VMware vSphere, Microsoft Hyper-V, Citrix XenServer and PowerVM. Linux Containers (below) is another supported virtualization technology. SUSE Linux Enterprise Server ships with Xen and KVM and can be used to create virtual host environments that support Linux and Windows guests. | Pricing for PowerVM includes the software licensing cost (starting at US$990 per core, the price per core depends on the edition and Power Systems server type) and the maintenance cost (starting at US$110 per system). |
**Containers** | Supports Linux Containers (LXC), an operating system-level virtualization method for running multiple isolated Linux systems (containers) on a single control host. LXC relies on the Linux kernel cgroups functionality that became available in version 2.6.24. In principle, Linux Containers and IBM's WPARs are similar. They are virtualization technologies at the application level, so they are “above” the operating system kernel. Unlike hypervisor-based virtualization, they do not add an additional software layer. | AIX supports Workload Partitions (WPARs), which are similar to Linux and Solaris Containers (see Virtualization above). AIX 7 includes built-in clustering capabilities called Cluster Aware AIX. It is available in AIX 7 Standard and Enterprise Editions. Cluster Aware AIX is primarily intended to provide the clustering infrastructure for PowerHA SystemMirror. PowerHA SystemMirror for AIX (formerly HACMP—High Availability Cluster Multiprocessing) is IBM’s solution for high availability clustering for AIX. PowerHA can run on up to 32 nodes on AIX and up to eight nodes on Linux. The cost of PowerHA SystemMirror for AIX provides another example of IBM’s relatively high licensing cost for software: US$3,500 per core for PowerHA Standard Edition for mid-sized Power Systems servers US$6,500 per core for PowerHA for large-sized Power Systems servers AIX supports additional clustering technologies: Veritas Cluster Services for AIX and LifeKeeper High Availability Clustering by SteelEye. | | continued on next page

1 Workload Partitioning (WPAR) in AIX 71: www.ibm.com/developerworks/aix/library/au-wparaix7/?ca=drs
2 Server virtualization with IBM PowerVM: www.ibm.com/systems/power/software/virtualization/
3 FPowerVM—The i Hypervisor Is Not Hidden Anymore: www.itjungle.com/th042808-story03.html

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## Technologies

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<tr>
<td>Hardware platforms supported</td>
<td>x86, x86-64, POWER, Itanium, IBM mainframe</td>
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### Cloud computing

Using SUSE OpenStack Cloud you can build and deploy private clouds within your firewall. SUSE OpenStack Cloud is based on the popular OpenStack, open source project, and is integrated with SUSE Manager and SUSE Studio to provide management and application development for SUSE OpenStack Cloud as well as other cloud platforms.

Various third-party cloud management tools, such as Aeolus and ConVirt, are also available to manage SUSE OpenStack Cloud-based private clouds. SUSE OpenStack Cloud interoperates with other cloud platforms built around OpenStack.

SUSE Linux Enterprise Server is available through over 50 public cloud providers, such as Amazon Web Services, Google Cloud Platform, and Microsoft Azure.

IBM has a number of cloud computing solutions on AIX for a variety of infrastructure needs: CloudBurst, a private cloud appliance; the IBM Smart Business Test and Development Service that runs on IBM Cloud; IBM Application Development Services for Cloud; IBM Smart Analytics Cloud; Smart Business Cloud; IBM Cloud Labs; PureSystems; IBM SmartCloud; and others.

IBM has expanded its CloudBurst family of private cloud appliances to include POWER7-based units running on POWER 750, etc. CloudBurst was initially x86 for IBM BladeCenter. CloudBurst is a “ready-to-go” solution that’s designed to provide resource monitoring, cost management, and services availability in a cloud.

The IBM Power Systems Solution Edition for Cloud helps speed up and simplify the deployment of a cloud with OpenStack-based cloud management software delivered on pre-built and pre-installed Power Systems servers.

IBM PurePower System is a converged cloud infrastructure for AIX and Linux workloads that integrate and optimize compute, storage, and networking resources.

IBM Cloud Manager with OpenStack for POWER provides a multi-platform cloud solution for IBM Power Systems servers.

### RAS

Combination of new multi-core, scale-up hardware married with SUSE Linux Enterprise Server compares favorably with AIX with respect to RAS.

AIX is still one of the leading UNIX platforms for RAS, and IBM continues to innovate to improve RAS.

RAS features added to AIX include active memory mirroring for the hypervisor, active memory expansion, first failure data capture, dynamic processor de-allocation and more.

### ISV enthusiasm

Increasingly, ISVs like SAP are using Linux as their development platform and porting to AIX based on customer demand.

10,000+ ISV applications are certified to run on SUSE Linux Enterprise Server.

In most cases, applications that run on SUSE Linux Enterprise Server on x86 servers will run on the latest generation of Power Systems servers in little endian mode, although some recompiling may be required, or porting or migrating applications to big endian mode.

AIX market share is declining in the operating system market. As a result, leading ISVs are selectively porting to AIX based on market demand, rather than by default.

Like many ISVs, IBM invests in open source solutions for solutions while continuing workload innovation on its AIX, IBM i and z/OS operating systems.

### High Performance Computing (HPC)

HPC business applications, referred to as “crossover” HPC applications, are preferred on SUSE Linux Enterprise Server. High-performance computer clusters running crossover applications are typically smaller than the supercomputers.

IBM is a leader among RISC/UNIX vendors in crossover HPC applications.

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Summary and Conclusion

The UNIX market is declining in favor of an open source Linux market that depends on an innovative community that collaborates on new solutions and standards. SUSE Linux Enterprise Server is an outstanding choice for organizations that are ready to migrate legacy AIX workloads to new and existing Power Systems servers, or to x86 servers. SUSE uses the same code base for both platforms, so you can be sure that you are getting the latest in Linux innovation and support regardless of your server selection.

With SUSE Linux Enterprise Server you get:

- **Interoperability with best-of-breed products used to modernize data centers, leveraging new technologies**
- **Lower licensing and maintenance costs**
- **Broad virtualization support across multiple server platforms**
- **Innovation and support from a wide spectrum of established and emerging ISVs**
- **No vendor lock-in**

SUSE Linux Enterprise Server solutions are designed for interoperability and support for mixed server and operating system environments, at an affordable cost. SUSE Linux Enterprise Server offers the innovation, performance and RAS necessary to support modern data centers in the face of new technologies such as cloud computing, big data, mobile devices and social media.

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<tr>
<td>Innovation</td>
<td>Linux is at the center of innovation for technologies used to modernize data centers. Open access to source code encourages innovation, as does a vibrant, growing community.</td>
<td>Many large ISVs developing enterprise software applications continue to support AIX. IBM has done a much better job keeping AIX competitive from a functionality point of view than Oracle and HP have with Oracle Solaris and HP-UX platforms, respectively.</td>
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<tr>
<td>Cost/performance</td>
<td>While it is generally true that SUSE Linux Enterprise Server subscriptions are much less than the cost of AIX licensing with yearly maintenance costs, SUSE does not recommend making platform selections based solely on operating system acquisition and maintenance costs. It is not possible in this short space to provide a meaningful comparison of cost/performance for SUSE Linux Enterprise Server and AIX systems. We recommend that you carry out a detailed cost/performance study for the applications and their requirements that you intend to host.</td>
<td>See column to the left.</td>
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<tr>
<td>Big data support</td>
<td>SUSE partners with a wide variety of big data technology partners such as Teradata, SAP (with SAP HANA), Cloudera, Hortonworks, HP, Revolution, InterSystems, MongoDB, MapR, Veristorm, WANdisco, and others. SUSE Linux Enterprise Server supports the open Hadoop framework for processing big data. SUSE also provides the SUSE Linux Enterprise High Availability Extension to run multiple clusters for big data processing.</td>
<td>Big data is a focused area for IBM. In the past few years, the company has invested heavily in big data analytics and processing and has dozens of partners such as SAP, SAS and recently acquired Veristorm. IBM features a number of big data offerings for AIX including InfoSphere Streams, InfoSphere BigInsights, IBM InfoSphere Warehouse, Cognos, SPSS, and DB2.</td>
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