

Optimizing Business Value for Midsized SAP Landscapes with IBM PowerLinux: Simpler by Design

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Executive Summary

Midsized businesses today face challenges from multiple quarters. Their suppliers and customers are mostly larger companies who are more demanding and require them to adopt stringent standards with fewer available resources. To remain competitive and tap into newer avenues for growth, it is critical for these midsized businesses to balance cost control and efficiency. As more midsized companies rely on IT and Business Applications to improve productivity; the uptime, efficiency, performance, and the resilience and reliability¹ of IT systems supporting business critical applications such as SAP, is ever more crucial. Another key challenge for midsized businesses is achieving energy efficiencies in their data centers² to deliver best application performance and yet optimize floor space.

In this mid-market segment, with close to 10% of the CRM market share³, SAP is aggressively making substantial product, channel and marketing investments⁴, especially in the SAP Business All-In-One Suite and for the mobile and cloud market⁵. For SAP customers, there is huge potential⁶ for cost-savings through consolidation in mission critical SAP⁷ landscapes provided their needs for SAP performance, reliability, availability and resilience are met.

Driven by cost considerations, increasingly midsized companies are adopting Linux and virtualization for their SAP landscapes, only to find that the perceived lower Total Acquisition Costs (TCA) of x86 based Linux solutions for SAP actually result in much higher Total Cost of Ownership (TCO) as these configurations scale up. Hidden operational costs in energy consumption, Reliability, Availability, Serviceability (RAS) and complexity dominate the TCO.

At x86 price points or better, IBM offers the PowerLinux Solution Edition for SAP Applications for midsized SAP ERP workloads (250-500 users) supported by PowerVM virtualization and the IBM DB2 database. This configuration is delivered, integrated, and supported by IBM Business Partners. IBM has positioned this PowerLinux solution to address this market gap between entry-level x86-based Linux servers and Power Systems used in the enterprise market.

With current mid-market trends, we believe IBM is well positioned to address this definite market need. This IBM PowerLinux solution and IBM's approach to help customers deploy or migrate their midsized SAP landscapes easily to IBM PowerLinux delivers better performance, less energy consumption, rapid deployment capabilities, lower TCA and TCO and is simpler by design than a comparable x86 VMWare configuration.

¹ Reliability & Resilience are most important characteristics of SAP/ERP systems. <http://www.slideshare.net/CedricMulier/sap-ibm-sme-survey>

² Shrinking data centers http://www.mm4m.net/library/shrinking_data_centers.pdf

³ SAP CRM mid-market share <http://www.crminfo.com/crm-articles/crm-market-share.htm>

⁴ <http://www.smb-gr.com/blogs-laurie-mccabe/sap-aims-for-sme/>

⁵ Inside SAP's radical makeover http://tech.fortune.cnn.com/2012/03/29/sap-makeover-mcdermott-hagemann/?iid=HP_LN

⁶ Only 5% of SAP environments are virtualized as per data in <http://www.f5.com/pdf/reports/enterprise-virtualization.pdf>

⁷ Growth of virtualization in mission critical SAP <http://searchsap.techtarget.com/news/1353296/SAP-virtualization-becoming-more-prevalent-even-with-mission-critical-apps>

Introduction

In today's climate, businesses must innovate with flexibility and speed in response to customer demand, market opportunity, regulatory changes, or a competitor's move. Often sandwiched between a big customer and a big supplier, midsized businesses face multiple additional challenges to stay competitive and must address rapidly changing business requirements while operating within razor thin margins. Business agility and superior asset/resource utilization are required to achieve this balance between cost control, efficiency, and new capability. Increasingly, these businesses rely on Information Technology (IT) and Business Applications to improve productivity through automation and integration.

But the escalating energy and people costs for IT will force these companies to reevaluate how they can maximize their returns on IT investments. They will need clever approaches to reduce costs, manage complexity, improve productivity, reduce time to market, and enable innovation. Simply put, these companies must and will carefully examine the business value and cost of IT investments. In addition, the uptime, efficiency, performance, resilience and reliability⁸ of their IT systems supporting business critical applications such as SAP are of paramount importance.

SAP is aggressively making substantial product, channel and marketing investments⁹, especially in the SAP Business All-In-One Suite. SAP has traditionally specialized in back-office applications, but recently there is a new push from SAP top management towards consumer-friendly applications targeted for cloud and the mobile market¹⁰. For SAP customers, there is huge potential¹¹ for cost-savings through consolidation in mission critical SAP¹² landscapes.

Traditional SAP production systems need high levels of availability along with good levels of performance. Today, in some instances, x86 commodity servers are constantly improving and becoming faster and are often able to do the job at smaller SAP deployments with fewer users. But when working with global clients and suppliers, many growing midsized businesses must make real time and agile business decisions. For this, their SAP deployments must be reliable, available, and have scalable memory and processing performance. Further, their IT resources must be efficient, economical, easy to manage, and highly-utilized.

For midsized SAP deployments, the primary drivers are cost efficiency and business agility. Driven by cost considerations, more midsized companies have adopted Linux¹³ for their SAP landscapes. But they quickly realize that the perceived lower acquisition costs of x86 based Linux solutions for SAP may actually result in much higher TCO when you consider hidden operational costs such as - energy consumption, Reliability, Availability, Serviceability (RAS) costs and complexity of SAP deployments as these configurations scale up. When we examine these trends - especially in the context of virtualization, Linux adoption and midsized SAP deployments - we believe there is huge potential for cost-savings through consolidation in mission critical SAP landscapes. However, simple consolidation using x86 servers that work for smaller SAP deployments with fewer users and lower number of transactions may not be the best solution for midsized SAP deployments that also require significant performance, reliability, availability and resilience.

To address this gap, IBM offers the PowerLinux 7R2 server for midsized SAP workloads (250-500 users) supported by its PowerVM virtualization solution and the IBM DB2 database. This configuration is delivered, integrated, and supported by IBM Business Partners. IBM has positioned this PowerLinux

⁸ Reliability & Resilience are most important characteristics of SAP/ERP systems. <http://www.slideshare.net/CedricMulier/sap-ibm-sme-survey>

⁹ <http://www.smb-gr.com/blogs-laurie-mccabe/sap-aims-for-sme/>

¹⁰ Inside SAP's radical makeover http://tech.fortune.cnn.com/2012/03/29/sap-makeover-mcdermott-hagemann/?iid=HP_LN

¹¹ Only 5% of SAP environments are virtualized as per data in <http://www.f5.com/pdf/reports/enterprise-virtualization.pdf>

¹² Growth of virtualization in mission critical SAP <http://searchsap.techtarget.com/news/1353296/SAP-virtualization-becoming-more-prevalent-even-with-mission-critical-apps>

¹³ Trend from UNIX to Linux in SAP data centers http://www.realtech.com/wInternational/pdf/consulting/REALTECH_Novell_Whitepaper-on-SAP_04-08_e.pdf

solution to address the market gap between entry-level x86-based Linux servers and its much larger Power Systems used in the enterprise market.

Based on our analysis of mid-market trends and PowerLinux technology, we believe IBM is well positioned to address this definite market need for SAP users who are looking to improve business agility, economics and energy efficiencies. Companies that have outgrown their current business processes and are considering deploying SAP solutions for the first time and existing x86 SAP customers can benefit from complimentary assessments and low-cost migration services available from IBM on the PowerLinux solution. All customers can deploy their midsized SAP ERP landscapes easily to the IBM PowerLinux solution that has better performance, lower energy and facilities costs, rapid deployment capabilities, faster time to value, and is simpler by design than comparable x86 VMWare based platforms.

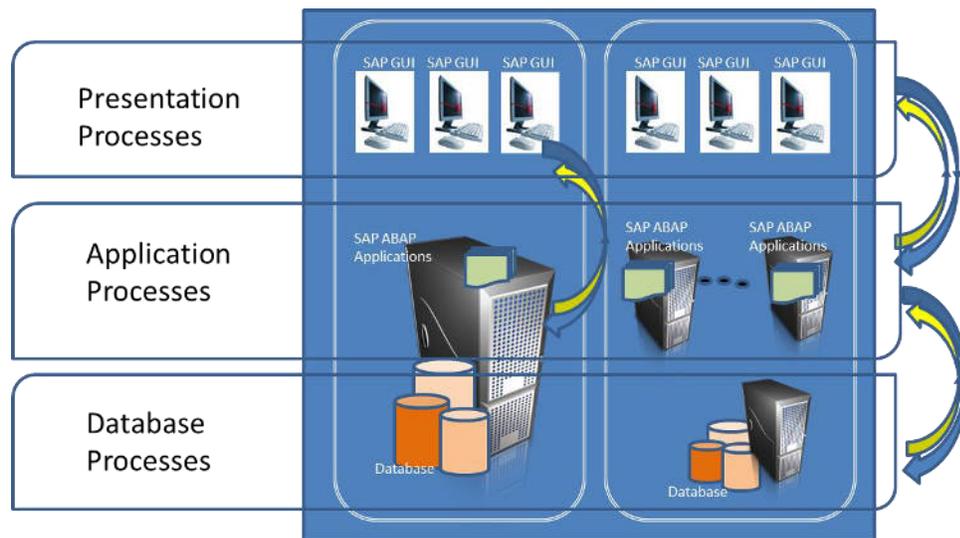


Figure 1: Traditional 2-tier and 3-tier SAP Deployments

The SAP Deployment Architecture for Small and Medium Businesses (SMB)

The classic architecture of a SAP system is a client/server design with a database and a number of application servers. One of these application servers is the central instance that contains unique resources to the SAP system for object locking and system communication mechanisms. In a 2-tier system, all components are on a single server whereas in a 3-tier configuration, application servers are distributed over multiple servers and the presentation layer (for front end users) is on a separate tier (*See Figure 1*).

2-tier SAP systems have better resource utilization and are comparatively easy to administer. As the SAP deployment grows and the number of systems increases in 3-tier, maintenance of the large number of OS images and system components gets complex. However, 3-tier is better for scale-out and for reducing exposure to single-server failure.

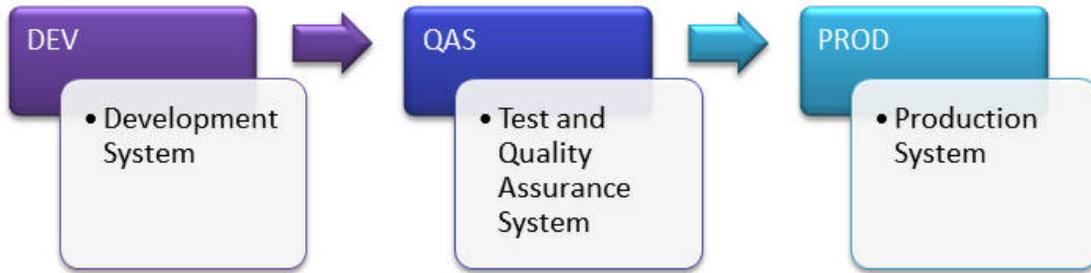


Figure 2: The Traditional SAP System Landscape

The SAP production, test and development system are 3 independent servers in a typical SAP landscape (See Figure 2). Though the development (DEV) system may be much smaller than the production system (PROD), the test system (QAS) is used to simulate production scenarios and must have the same full system capacity as the production system. A SAP landscape contains a number of core systems that cover different application areas depending upon the customer industry and needs, including Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Customer Relationship Management (CRM), Business Intelligence (BI) and additional systems to support the SAP Solution Manager. Each of these systems requires separate development, test and production configurations. Over the system life cycle and a typical

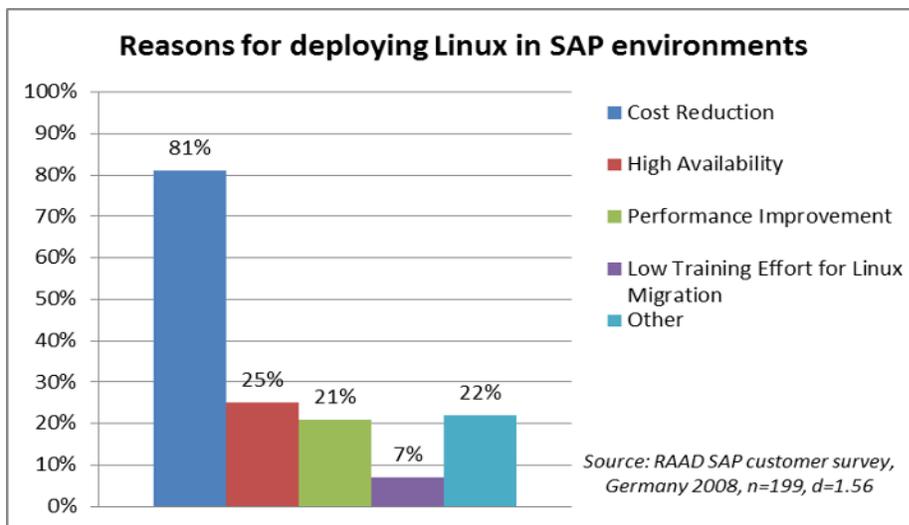


Figure 3: Cost is the Driving Factor for Linux Migration in SAP Landscapes

production day, the average utilization of each of these servers varies and could be as low¹⁴ as 15-20%. Given the large number of individual servers required in a SAP landscape, scaling up SAP from a small (<100 users) configuration can be a daunting task. This has resulted in growing interest (~70% customers¹⁵) on SAP consolidation through virtualization as reported by the RAAD survey in Germany that involved 200 SAP customers. In the next section, we take a look at some of the other drivers of virtualization in SAP landscapes today.

¹⁴ IBM Redbooks – PowerVM Virtualization <http://www.redbooks.ibm.com/redbooks/pdfs/sg247564.pdf>

¹⁵ Use of Virtualization in SAP Slide 3 dated Dec 2008 http://www.netapp-de.de/newsletter/spmstscld/fls/SAP_Virtualization_Cloud_.pdf

Drivers for Virtualization and Linux in SAP Landscapes

SAP landscapes may challenge mid-sized companies. To economically address business agility needs and the growing demands placed on the underlying server, storage and network infrastructures, SAP customers are adopting server consolidation and Linux for mission critical SAP deployments¹⁶ (See *Figure 3*).

As SAP deployments grow from small configurations to midsize SAP landscapes, many SAP users find server consolidation particularly attractive. SAP landscapes must support multiple-instance environments. This results in high levels of server proliferation in many organizations and increases SAP complexity. Even in small installations, the size and complexity of SAP landscapes pose challenges that are significantly greater than those encountered with most other types of server consolidation. Many mid-sized SAP customers are modernizing and simplifying their infrastructure; replacing established systems with deep functionality and older technology with more modern and agile systems¹⁷.

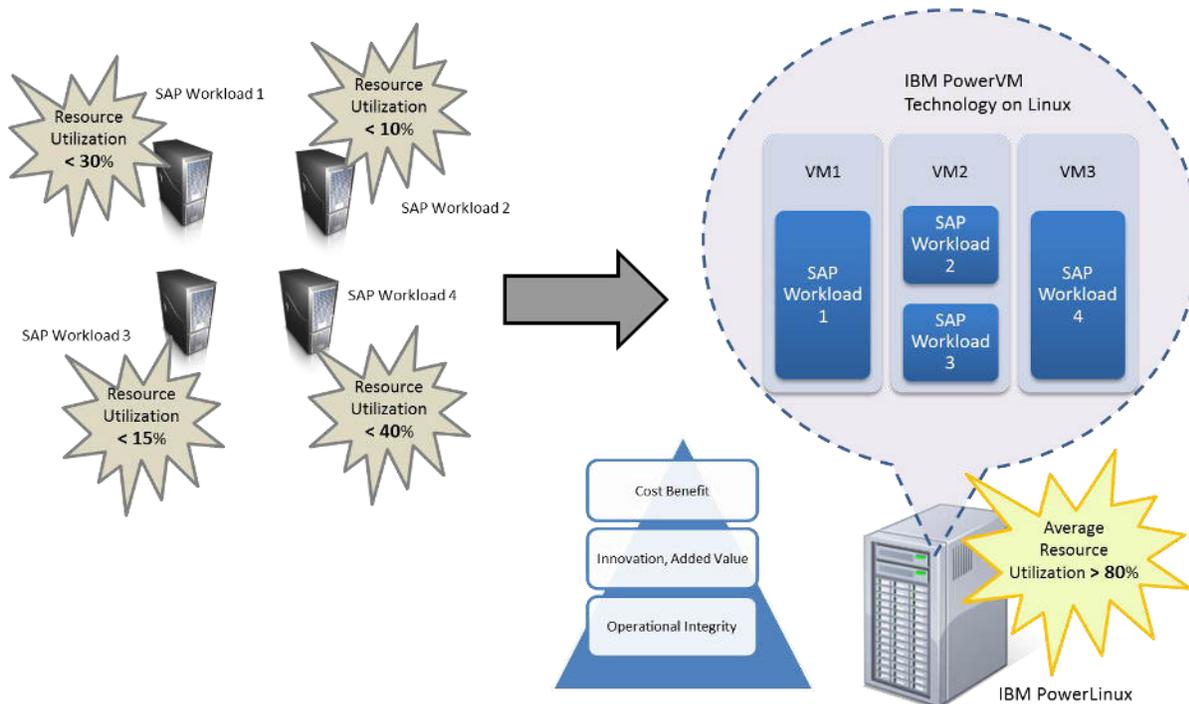


Figure 4: Potential SAP Landscape Consolidation Scheme

Today, the average SAP customer interested in Linux migration is larger in size, revenue, and number of employees. And often comes from an industry with very business critical applications. Cost is frequently the major motivation for migrating to Linux. Stability and readiness for business-critical applications are next. SAP Linux customers include energy providers, automotive suppliers, chemical companies, hosting providers, airline and hi-tech defense companies.

¹⁶ RAAD Survey of German SAP customers http://www.ibm.com/ibm/files/R430977C75885K94/SSA_Why_Power_AIX_4_SAP.pdf

¹⁷ RealTech Report on SAP: Trend towards UNIX to Linux migration

http://www.realtech.com/wInternational/pdf/consulting/REALTECH_Novell_Whitepaper-on-SAP_04-08_e.pdf

The IBM PowerLinux Solution Edition for SAP Applications – Simpler by Design

The IBM PowerLinux Solution Edition for SAP Applications is a simple, single system SAP solution on the PowerLinux 7R2 server and is positioned as an alternative platform for SAP on Linux x86. The solution is targeted at mid-sized companies with 250-500 SAP users. It consists of the IBM PowerLinux 7R2 server supported by IBM PowerVM for IBM PowerLinux virtualization software and the IBM DB2 database (See Figure 5). This solution consolidates Development, Production, Database and Solution Monitor all on one physical server; making it simpler to operate SAP environments at VMWare+x86 price points.

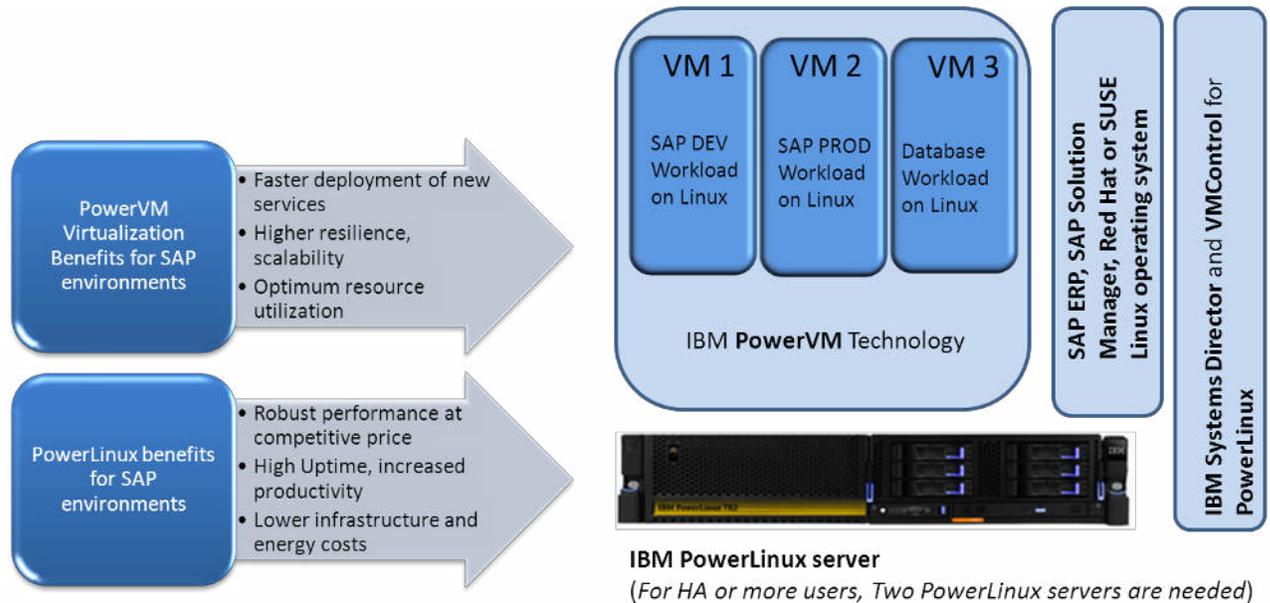


Figure 5: IBM's PowerLinux 7R2 and PowerVM Based Solution for Midsized SAP landscapes

Why PowerLinux is Simpler by Design for Midsized SAP Landscapes

The IBM PowerLinux solution for SAP offers an attractive value proposition for the upper end of the midmarket with 250-500 SAP users. Aging x86 servers and expensive virtualization solutions have created a sprawl and management nightmare that have far outweighed perceived TCA advantages of x86 servers and IT overheads are considerable. For midmarket SAP users, migration to PowerLinux/PowerVM is a worthwhile exercise. The extent of an SAP migration depends on actual SAP workloads, time to acquire new skills, budgets, and RAS requirements. For the PowerLinux solution users, IBM addresses these issues with low-cost services, experienced Business Partners, education, training and other resources.

In addition to TCA, application reliability, availability and serviceability (RAS) and flexibility in scaling are also very important for SAP ERP users. We believe that the IBM PowerLinux solution offers compelling value to SAP users who have maxed out on x86 scale-out benefits. These x86 systems, in particular, lack many of the features that are now standard on the IBM PowerLinux servers. Figure 6 shows some of the key customer benefits with IBM PowerLinux and PowerVM based SAP landscapes. The key PowerLinux SAP solution differentiators are **RAS, Virtualization, Performance, TCA** and **TCO**.

IBM Power Systems RAS Advantages: With a totally integrated approach to the design, development, and testing of every PowerLinux server has the reliability required for today's business critical workloads. All POWER7 server models include RAS features that help avoid unplanned downtime. IBM RAS engineers have optimized server design to help ensure that IBM PowerLinux servers support high levels of concurrent

error detection, fault isolation, recovery, and availability. High availability software solutions from IBM Tivoli and SUSE further enhance this inherent hardware reliability.

Just to illustrate *one* RAS feature advantage of POWER7 over x86, the First Failure Data Capture (FFDC) feature in PowerLinux detects almost every type of soft or hard error that can occur within a system allowing for preventive action prior to an actual failure. It can potentially provide precise identification of the cause of failure thus speeding resolution through a fast reboot around failing components and specific parts. FFDC can take preventive action such as dynamically de-allocating components from adapter cards to memory and cache lines and even processor cores.

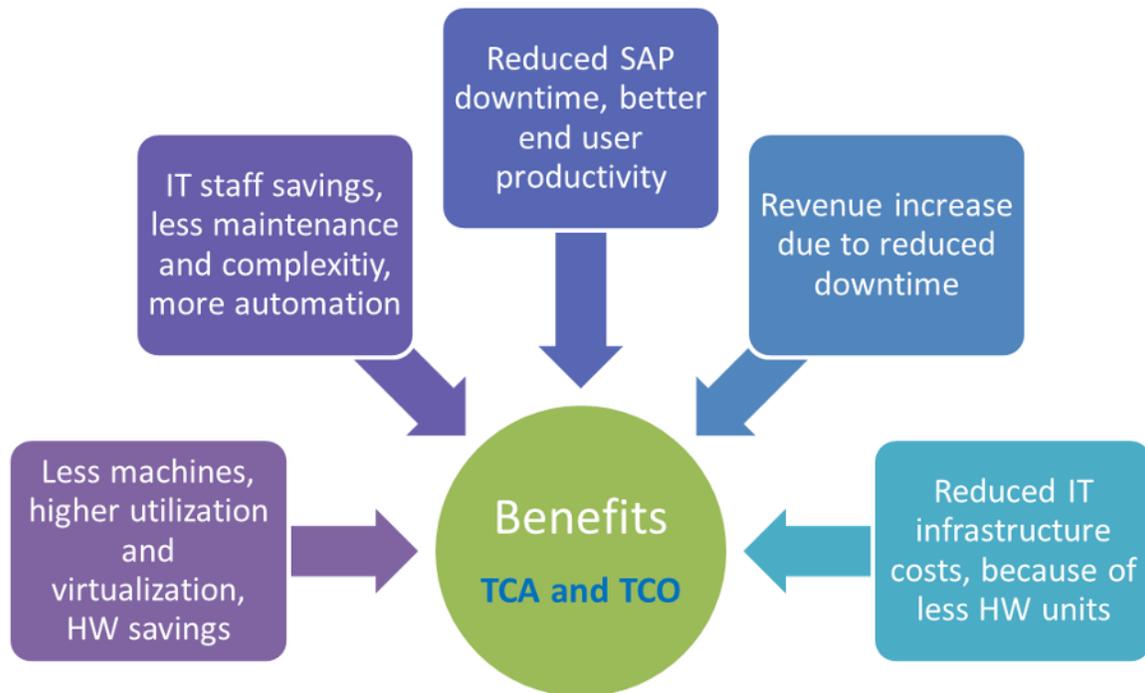


Figure 6: Benefits of Consolidating SAP with PowerLinux and PowerVM

However, for x86 systems, Intel’s competing technology, Machine Check Architecture Recovery (MCA) is very limited to what it can detect. It has very few preventive actions that can be taken to avoid a failure, much less even identify what caused the failure. IBM’s PowerLinux servers utilize a hardware service processor to examine causes of errors and direct action to fix on the fly, de-allocate components or cause a partition to reboot around failing components. On the other hand, Intel’s MCA Recovery relies primarily on operating systems or virtualization managers to solve hardware related problems and this only results in additional downtime at the expense of customer¹⁸.

In addition, to further improve fault tolerance and preventive actions, IBM’s PowerLinux offers exclusive features such dynamic processor de-allocation, check point/restart, alternate processor recovery, cache line delete to name a few. Alternate processor recovery can handle processor core errors on the fly including core failure, without affecting running workloads. Together, these features offer excellent system availability for PowerLinux servers.

¹⁸ VMWare Knowledge Base Machine Check Exception –Purple Screen
http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1005184

It is important to note that a system which is low cost but suffers relatively high numbers of outages may not be the best option for mission critical applications such as SAP. At x86 price points, IBM PowerLinux servers feature an impressive array of RAS capabilities to benefit SAP landscapes that are not currently available on x86 systems.

IBM PowerVM Virtualization Advantages: In addition to the raw performance of the IBM Power Systems, a customer also benefits from the IBM PowerVM virtualization solution. PowerVM can be used to consolidate many different workloads including ERP, CRM, BI, SCM and other production database and application servers, high availability servers, backup/recovery servers and non-production servers onto a single, smaller set of servers. In Power Systems the virtualization hypervisor resides in the firmware allowing complete separation of workloads in different virtualization which promotes better security on-premise or in the cloud. While some of this is possible with x86 virtualization technologies, it is rarely done, partly because of “best practices” separation of workloads and also to support restrictions by some software products when used in a virtualized x86 environment¹⁹.

This typically results in a requirement for many more servers in x86 SAP landscapes. Many of IBM’s customers routinely drive their utilization to 80% or higher, whereas the best x86 virtualization customers rarely drive to even 50% utilization²⁰. It is very common to see 2 or 3 times the number of systems for x86 customers than for equivalently sized Power Systems customers. Full SAP landscapes on PowerLinux often require far fewer systems at about the same price per system as an equivalent x86 platform.

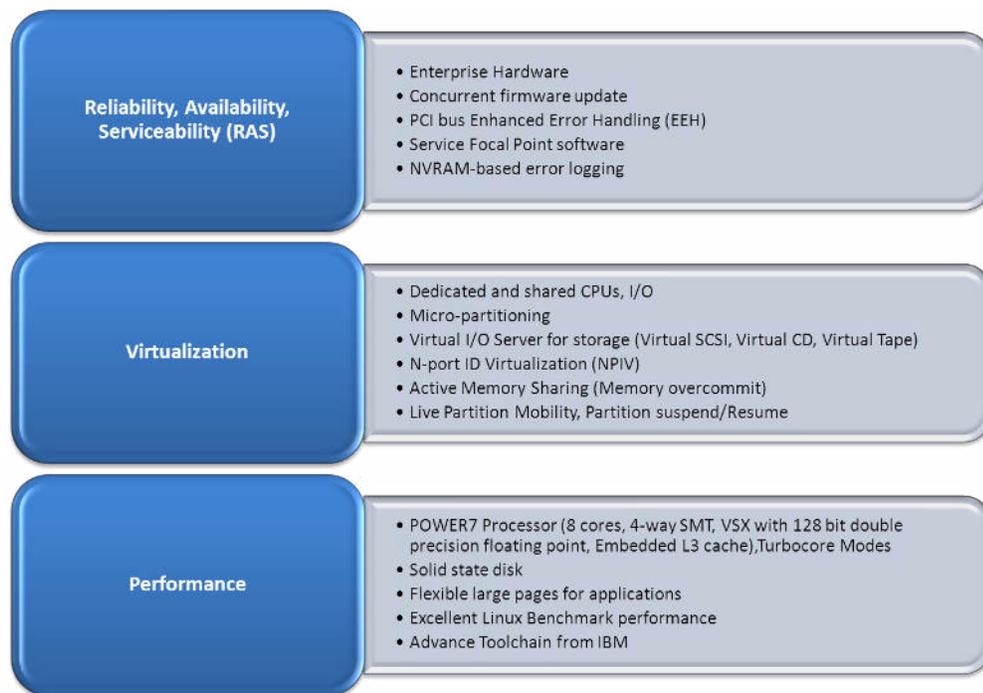


Figure 7: PowerLinux Differentiators: Performance, Virtualization and RAS

¹⁹ Oracle database support for server virtualization <http://www.oracle.com/technetwork/database/enterprise-edition/db-virtualization-support-133757.pdf>

²⁰ <http://saponpower.wordpress.com/tag/x86/>

While x86 based systems are mostly used in the low-end of the SAP deployment market, IBM PowerLinux and PowerVM technologies are geared for the midrange to the high end of the midsized market²¹. For customers who are approaching the limits of their current data centers (floor space, power or cooling), x86 horizontal proliferations may drive the need for data center expansion that will only further increase costs.

With higher scalability and advanced virtualization capabilities in PowerLinux servers and PowerVM, customers can potentially achieve higher levels of consolidation; potentially avoiding the need for that data center expansion. The IBM PowerVM Virtual I/O Server owns the physical resources (SCSI, Fiber Channel, and network adapters) and allows virtual partitions to share access to them, thus minimizing the number of physical adapters in the system and further improving the economics of consolidation. The Virtual I/O Server eliminates the requirement that every partition has a dedicated I/O or network resource, and therefore can assign large number of partitions²².

For approximately the same price as a similarly configured x86 and VMWare based platform, we believe midsized customers benefit more from the simplicity and many TCO advantages of IBM PowerLinux solutions: lower management and administration costs, less power, cooling, and floor space, and potentially lower cost of third party software.

Performance Advantages of the IBM PowerLinux solution: SAP systems are among the most demanding environments deployed on any server platform. We examine SAP benchmarks²³ for IBM Power Systems (on SLES 11) compared to traditional x86 servers. These benchmark numbers illustrate the fundamental performance advantages of the POWER7 processor, superior memory bandwidth, and workload optimizing technologies included within the system i.e. the PowerVM virtualization solution.

Windows or Linux are the preferred options today with small to midsized SAP users. Running Linux on commodity x86 may be cost-effective for the lower end of the SMB market, but as the number of users scales up to over 250, these x86 based configurations cannot scale up without significant loss of performance, efficiency and reliability.

To meet distinct landscape and multi-tier complexity challenges, SAP users have traditionally tried to consolidate servers to save costs, improve infrastructure scalability and flexibility, and enhance quality of service, especially in test and development. For small and medium SAP users, the combination of powerful, inexpensive, x86 hardware and virtualization have offered a compelling value proposition. But beyond a point, such scale up using x86 server clusters and virtualization is counterproductive.

A recent study found that three-year IT costs in organizations consolidating x86 Windows and Linux servers onto Power Systems range from 14% to 46% lower, and an average 39% lower than with Intel Xeon 7500-based servers and the VMware vSphere 4 offering²⁴. As compared to many other x86 based systems, PowerLinux 7R2 provides comparable price/performance²⁵ (See Figure 8).

²¹ Forum Discussion: <http://forums.theregister.co.uk/user/26099/>

²² http://www.joshkrischer.com/files/Consolidating_x86_on_System_p.pdf

²³ SAP on Linux and IBM Power Systems benchmark blog <http://www.2ting.info/advantages-ibm-power-systems-running-linux-outperform-competi/>

²⁴ Value proposition for IBM POWER7 based systems – x86server consolidation in SAP enterprise systems, International Technology Group, Feb 2011

²⁵ Performance References:

<http://h71016.www7.hp.com/dstore/MiddleFrame.asp?page=config&ProductLineId=573&FamilyId=3403&BaseId=33095&oi=E9CED&BEID=20598&SBLID=>, <https://www.redhat.com/apps/store/server>, <http://www.spec.org/cpu2006/results/res2011q4/cpu2006-20111121-18997.html>

Server	Dell/Intel	HP/Intel	IBM ¹ /Power
List Price (Server+Linux+Virtualization)	\$21,397	\$23,605	\$21,638
Model	Dell PowerEdge R720	HP ProLiant DL380 G8	IBM PowerLinux 7R2
Processor	16-core, 2.40 GHz E5-2665, Sandy Bridge	16-core, 2.4 GHz E5-2665, Sandy Bridge	16-core, 3.55 GHz POWER7
Number of Sockets	2	2	2
Total Memory	64GB	64GB	64GB
Hard Drives	4 x 300GB, 10K SAS	4 x 300GB, 10K SAS	4 x 300GB, 10K SAS
Network Controller	4 x 1GbE	4 x 1GbE	4 x 1GbE
Storage Controller	SAS, DVD, RAID	SAS, DVD, RAID	SAS, DVD, RAID

¹ IBM PowerLinux 7R2 server in a 2U rack-mount package. The SAP solution includes the IBM PowerLinux 7R2 rack server, IBM PowerVM for IBM PowerLinux, choice of Linux operating system, 64GB of memory. IBM PowerLinux 7R2 SAP solution configuration: <http://www.ibm.com/systems/power/software/linux/powerlinux/7r2/browse.html>. Other systems: dell.com, hp.com, vmware.com as of April 20, 2012.

Figure 8: Excellent Price with IBM PowerLinux 7R2 with PowerVM Solution

Using multiple low cost x86 servers to get the performance and resilience is an attractive option, but there are some other important costs that must be considered in addition to the purchase price of servers. Each node requires shared access to central storage so a high performance interconnect is required to allow the nodes to communicate between each other to ensure data integrity, provide cluster heartbeat signals and enable parallel execution of queries. These infrastructure elements are critical to the overall performance of the system and add to the complexity of the solution²⁶. The performance per core reduces each time an additional node is added to the cluster so significantly more cores may be needed to get the desired performance. This can also have a significant impact on overall TCO.

Given all the factors considered above, IBM PowerLinux and PowerVM solution is well optimized for a midsized SAP ERP landscape with ~250 users or more.

Features and Specifications of IBM PowerLinux 7R2 for Midsized SAP Landscapes

This section describes some key features and specifications of the IBM PowerLinux Solution Edition for SAP Applications designed for mid-market SAP Linux installations. To put the solution in context, it helps to examine the advantages of the IBM Power Architecture and servers in a Linux and Open Source environment.

Linux and Open Source are now pervasive trends in enterprise computing. Gartner estimates that by 2016, Open Source software will be included in mission-critical software portfolios in 99% of Global 2000 enterprises²⁷ – up from 75% in 2010. IBM has a history of adapting to evolving customer needs on the Linux front and contributes²⁸ robust *virtualization* technologies, *RAS* enhancements and provides Linux clients platform choices based on their needs.

²⁶ Choosing between x86 and Unix System <http://centiq.co.uk/choosing-between-an-x86-or-unix-system.html>

²⁷ What Every IT Practitioner needs to know about OSS, Mark Driver, Gartner http://www.blackducksoftware.com/media/wp/Gartner_Report_ITandOSS.pdf

²⁸ <http://www.linuxfoundation.org/news-media/announcements/2012/04/linux-foundation-releases-annual-linux-development-report>

POWER is a reduced instruction set computer (RISC) developed by IBM. Power Systems is the name of IBM's Power Architecture-based server line. The POWER7 processor is a substantial evolution of the design, focusing on delivering business performance through enhanced technology such as multiple cores and simultaneous multithreading. The POWER7 processor has eight cores, and four threads per core. PowerLinux servers have two sockets with up to 16 POWER7 cores providing 64 simultaneous threads.

Watson, a POWER-based computer, won the Jeopardy quiz show in 2011.

The prowess of IBM Power Systems running Linux was showcased in a dramatic fashion in early 2011 when Watson, an IBM natural language supercomputer competed in and won the quiz show Jeopardy²⁹, in the show's only human-versus-machine match-up to date. Watson used SUSE Linux Enterprise Server³⁰ running on a cluster of POWER7 systems to execute thousands of complex analytical tasks simultaneously. Now, Watson technologies are being put to work to facilitate rapid deployment of new natural language analytics applications in healthcare³¹ and financial services³².

PowerLinux solutions are also central to IBM's smarter computing initiatives and include:

- **Big data analytics solutions** to harness and manage today's data explosion for better informed business decisions
- **Industry application solutions** to combine domain expertise from leading industry software providers and workload optimized systems to deliver solutions that are customized for individual industries
- **Open Source Infrastructure Services (OSIS) solution** for vital applications such as web, e-mail, and social media collaboration services
- **Additional solutions** are under development.

For customers, this means that IBM has a clear development roadmap for PowerLinux and substantial resources allocated for continued development and optimization.

IBM PowerLinux 7R2 is a high performance, efficient server ideal for running multiple Linux workloads and virtualized with PowerVM. IBM demonstrates significant savings on IT infrastructure acquisition and operational costs.



Processors	Scalability	Economics
<ul style="list-style-type: none"> • Two sockets with eight POWER7 cores per socket • 16-cores - 3.55 and 3.3 GHz options • 256 GB maximum memory with 4/8/16 GB DIMMs 	<ul style="list-style-type: none"> • PowerVM exploiting integrated hypervisor • Support up to 10 VMs / core, 160 VMs / server • Up to 20 PowerLinux 7R2s in a single 42U rack 	<ul style="list-style-type: none"> • Comparable server & system software pricing to x86 Linux • Up to 33% lower³³ TCA - total solution cost for virtualized infrastructure (hardware + operating system + virtualization software + open source applications) compared to x86

²⁹ <http://www.nytimes.com/2010/06/20/magazine/20Computer-t.html?pagewanted=all>

³⁰ "System Administration of the IBM Watson Supercomputer", Linux Journal, April 2012.

³¹ <http://www.ibm.com/press/us/en/pressrelease/36989.wss>

³² <http://www.americanbanker.com/people/ibm-watson-citigroup-jeopardy-1047403-1.html>

³³ <http://www.ibm.com/systems/power/software/linux/powerlinux/claims.html>

Improved Efficiencies and Performance with the IBM PowerLinux 7R2 for SAP

How does the PowerLinux 7R2 achieve better efficiencies and performance compared to a Linux x86 based solution? The key is *simplicity*. Instead of installing and configuring the hardware, operating system, and SAP on multiple x86 servers for development, test, production, database, SAP monitor and so on, users can now do it all with one simple PowerLinux system. While no benchmarks have been published yet for the IBM PowerLinux 7R2, IBM internal testing shows the PowerLinux 7R2 server has been measured to perform at least as well as the following industry standard benchmarks published for the IBM Power 730:³⁴

- SPECint_rate2006 578
- SPECfp_rate2006 477
- Linpack 435,400

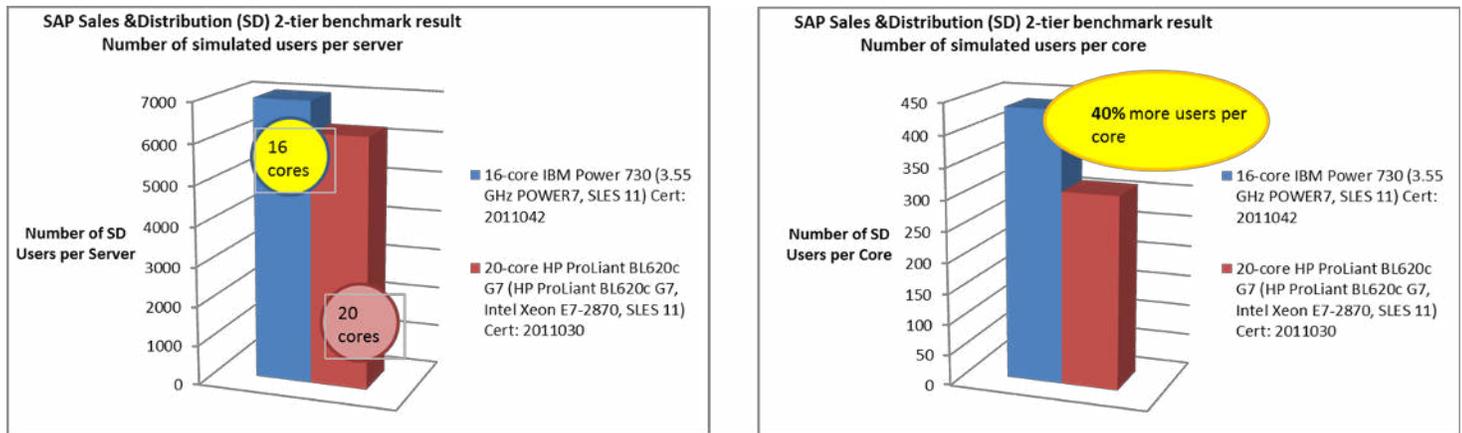


Figure 9: SAP SD 2-tier benchmark comparison on SLES 11: IBM Power 730 vs. HP ProLiant DL380 G7

The performance of the 2-socket IBM Power 730 is significantly better than comparable x86 based systems such as the ProLiantDL 380 G7 from HP³⁵ (See Figure 9). Along the vertical axis, the two graphs depict the number of Users which is the number of simulated users and SAPS which is the SAP application performance for this benchmark.

PowerVM on PowerLinux Delivers SAP Services Faster and More Economically. IBM PowerVM based virtualization and the widely available Linux skills result in quicker deployments, more automation, less maintenance, and reduced complexity. Integrated Virtualization Manager (IVM) lets users set up the virtual machines once, after which PowerVM can dynamically allocate system resources as needed. If manual resource management is desired that is also an option.

For example, if the database is heavily hit with order entry transactions and the SAP ERP application is heavily hit with other functions, PowerVM will optimize the performance of all of them -- constantly, dynamically, and without any administrator intervention. This frees IT administrators to focus on new applications that drive the business and does not tie them down to IT housekeeping. This overall optimization of system resources can result in 20% more efficiency compared to x86 based configurations.

One of the key technologies available with PowerVM for PowerLinux is Live Partition Mobility (LPM). It allows a user to move a running Linux partition from one physical Power server to another compatible server without application downtime. This useful feature allows applications to continue running during activities that previously required a scheduled downtime, for example, for hardware and firmware maintenance and upgrades, for workload rebalancing, or for server consolidation.

³⁴ www.spec.org

³⁵ SAP, from <http://www.sap.com/solutions/benchmark/sd2tier.epx>

IBM's PowerLinux and PowerVM platform have been benchmarked in SAP landscapes and found to offer superior SD Benchmarks on PowerLinux³⁶ (See Figure 9).

Figure 10 is a comparison between PowerVM for PowerLinux, and VMWare for x86. PowerVM is more flexible, scalable, and economical as compared with VMWare.

<i>Virtualization features</i>	PowerVM for IBM PowerLinux	VMware vSphere 5.0 – Enterprise ¹
Server platforms supported	PowerLinux 7R2 (2 socket – 16 cores)	x86-64 based servers
Guest operating systems supported	Linux	Linux, Windows, Solaris and others
Virtual memory cap / license entitlement	Unlimited	64GB per socket
Virtual CPUs per VM	Up to 256 – limited by the number of cores on the server	Up to 32 – limited to 8 per socket by licensing
CPU threads	4 per core	2 per core
Dynamic virtual CPUs and virtual memory	Add/Remove	Limited Hot Add/Hot Remove (hot add only for memory)
Secure hypervisor (zero reported vulnerabilities)	Yes (h/w based)	No (s/w based)
License + 3 year, 9x5 SWMA	16% Lower Cost	-----

¹VMware features: <http://www.vmware.com/pdf/vsphere5r50/vsphere-50-configuration-maximums.pdf>

²VMware pricing: <http://www.vmware.com/products/vsphere/pricing.html>

³Based on Pricing for IBM Power VM for IBM PowerLinux

Figure 10: Flexibility, scalability and better economics with PowerVM for PowerLinux vs. VMWare

Improved Economics and Cost Efficiencies. Documented testing of SAP applications on PowerLinux³⁷ found that the single virtualized system solution configuration can support up to 500 SAP users. The PowerLinux SAP reference architecture provides an option for a second system for high availability or additional capacity. Another study³⁸ saw 70% utilization on Power Systems running Linux vs. 34% for x86 Linux. This 2x higher resource utilization lowers IT infrastructure costs and enhances staff productivity.

Some of the benefits are subtle. All Linux platforms for SAP use the same build environment (compiler, OS version) and need to perform the same certifications for hardware and virtualization, and must fulfill minimum monitoring requirements. But there are definite advantages in opting for an integrated environment such as PowerLinux with PowerVM. This combination ensures enhanced monitoring utilities for hardware virtualization based on the combined IBM and SAP virtualization experience since 2004.

SAP is a multi-tiered landscape with test, development and production setups. However, these different SAP landscapes should not be consolidated on to the same x86 server as this may cause reliability and performance exposures especially in a virtualized environment.

³⁶ SAP source: <http://www.sap.com/benchmark/> as of 06/14/11.

³⁷ SAP on PowerLinux Reference Architecture <http://www.sdn.sap.com/irj/scn/go/portal/prtroot/docs/library/uuid/904b62ee-a64d-2f10-9cae-93f1fe232b03?QuickLink=index&overridelayout=true&53953379192934>

³⁸ <http://www.ibm.com/common/ssi/cgi-bin/ssialias?infotype=SA&subtype=WH&htmlfid=POL03076USEN>

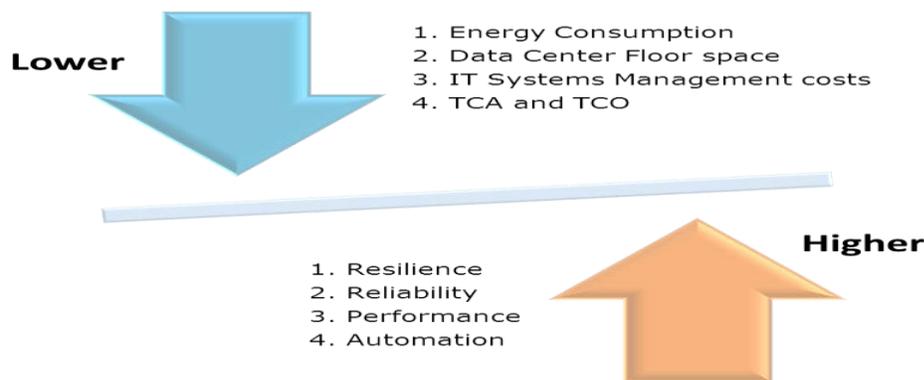


Figure 11: Benefits Gained with PowerLinux and Virtualization in Midsized SAP Landscapes

Case Study: University of Hamburg PHYSnet

Putting it all together, let's take a look at how a PowerLinux based solution helped University of Hamburg Physics Department Datacenter (PHYSnet)³⁹ drive faster IT services with superior system performance. PHYSnet deploys the same hardware, OS and PowerVM foundation for their open source infrastructure applications that a potential SAP customer would use as the basis for SAP ERP applications in development and production. The SAP client would also have DB2 running on virtual machines.

The existing servers at University of Hamburg's PHYSnet did not deliver the required levels of performance. The university wanted to improve file serving throughput without investing in a large number of physical servers (budgets and power were constraints). Using the IBM PowerLinux Open Source Infrastructure Services (OSIS) solution, PHYSnet implemented a virtual distributed configuration for its OpenAFS file system. They deployed two IBM PowerLinux 7R2 servers running ten virtual Linux servers using IBM PowerVM virtualization.

These PowerLinux servers helped PHYSnet improve file serving performance by 50 percent. Additional benefits were improved economics with 30 percent less cost and five times less cooling than competing x86-based options. PHYSnet saved 30 percent by investing in just two IBM PowerLinux 7R2 servers, as opposed to 10 Intel-based x86 systems. Implementing fewer servers also reduced power and cooling costs. IBM PowerLinux servers use five times less cooling and electricity compared to equivalent x86-based servers.

³⁹: http://www.ibm.com/common/ssi/cgi-bin/ssialias?subtype=AB&infotype=PM&appname=STGE_PO_PO_USEN&htmlfid=POC03088USEN&attachment=POC03088USEN.PDF

The IBM PowerLinux SAP Reference Architecture for Midsized Deployments⁴⁰

The SAP on PowerLinux reference architecture is a basic SAP landscape that targets small ERP implementations and provides the flexibility to grow. It supports two SAP products, SAP ERP and the SAP Solution Manager. The SAP Solution Manager is mandatory for every SAP landscape and provides monitoring and other supporting functions. Only one Solution Manager needs to be installed for both development and production - unlike other ERP applications which require a separate VM. The SAP ERP production system is set up as a virtualized 3-tier system with the Database residing on one Linux virtual machine, the ERP application logic on another and the Web Application Server can be implemented on yet another. This ensures flexibility for the ERP landscape and improved scalability as it enables moving any tier, if needed, to another hardware system to support higher transaction rates or increasing database sizes.

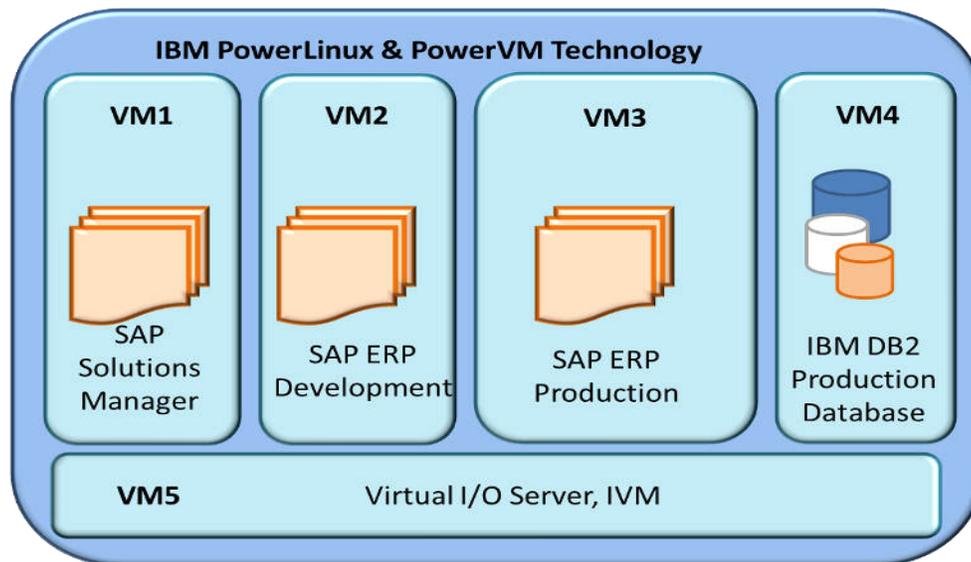


Figure 12: IBM PowerLinux Solution Edition for SAP Applications for midsized SAP landscapes

Management and monitoring abilities/tools for setting up the hardware and partitions are available via a Virtual I/O Server residing on a separate VM. IBM PowerLinux uses PowerVM virtualization which can be managed using an easy-to-use and browser-based Integrated Virtualization Manager (IVM). IVM is included at no additional charge and is packaged in the Virtual I/O Server software. Virtual I/O Server provides an unrestricted set of virtual Ethernet and disk adapters to the other VMs on the system which frees them up from limits on the number of physical adapters.

Additional logical partitions or virtual machines running other SAP products or third party software could also be added to this basic SAP landscape solution as needed. Segmenting the products and functions on several logical partitions offers better resource differentiation. It also guarantees better system resource utilization as the resources can be assigned based on system priorities; preventing resource shortage for production systems.

IVM helps configure logical partitions or virtual machines by:

- creating the partition configuration

⁴⁰ SAP on PowerLinux Reference Architecture <http://www.sdn.sap.com/irj/scn/go/portal/prtroot/docs/library/uuid/904b62ee-a64d-2f10-9cae-93f1fe232b03?QuickLink=index&overridelayout=true&53953379192934>

- assigning storage and network connections using Virtual I/O Server
- allocating memory and CPU shares, and
- configuring resources sharing priority.

Unlike other virtualization solutions, PowerVM can virtualize the primary system resources: CPUs, memory, I/O, and network adapters. This allows utilization of resources in the most effective way. Each VM does not use the resources exclusively but shares them with other VMs on the PowerLinux server, thus increasing system resource utilization to much higher levels. Midsized SAP clients can easily prioritize resources based on business priorities using IVM. It also ensures that the production system gets shared resources whenever needed instead of waiting for resources, thus reducing application latencies and improving response times and business productivity.

IVM also provides the management of the full life cycle of VMs running on IBM PowerLinux. This includes monitoring of available hardware resources, starting and stopping of VMs, and the “hot-plug” or Dynamic Logical Partitioning (DLPAR) feature. These features allow dynamic add *and remove* of system resources allocated to VMs. This frees up unused resources (including memory) without stopping the VMs and all its SAP workloads. Other beneficial PowerVM features include Live Partition Mobility through which partitions running SAP workload can be relocated from one physical IBM Power System to another one in a non-disruptive way. For details see the [SAP on PowerLinux Reference Architecture document](#)⁴¹ on the SAP Community⁴² website.

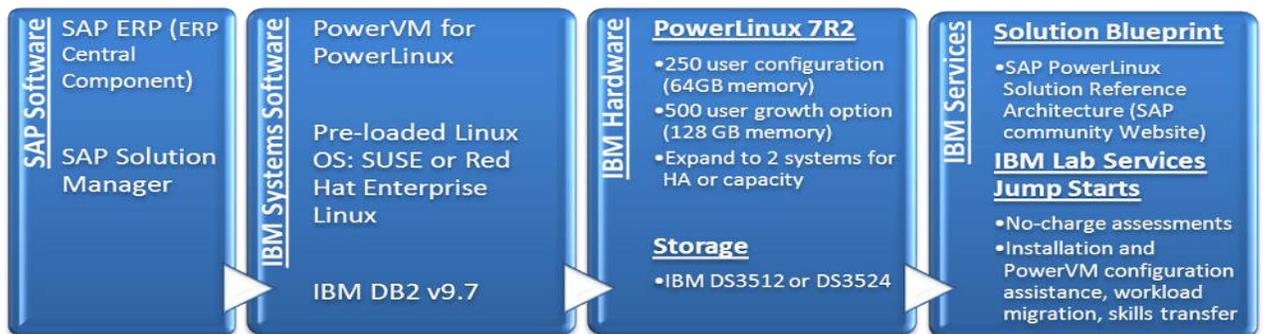


Figure 13: Components of IBM PowerLinux Solution Edition for SAP Applications (Source: IBM)

Delivering the PowerLinux Solution Edition for SAP Applications –Services

The solution building blocks are provided by IBM, SAP, and the Linux distribution vendors. IBM Business Partners are trained to deliver and deploy the total Solution Edition for SAP Applications (See Figure 13). To help customers implement their midsize SAP deployments on Linux, IBM offers several services built around PowerLinux and PowerVM.

⁴¹ SAP on PowerLinux Reference Architecture <http://www.sdn.sap.com/irj/scn/go/portal/prtroot/docs/library/uuid/904b62ee-a64d-2f10-9cae-93f1fe232b03?QuickLink=index&overridelayout=true&53953379192934>

⁴² SAP Community website <http://www.sdn.sap.com/irj/sdn?QuickLink=index&overridelayout=true&53953379192934>

Migration Services - Facilitating Midsized SAP Migration to PowerLinux: IBM Migration Factory offers complimentary migration assessments⁴³ to potential PowerLinux Solution Edition for SAP Applications customers. Low-cost services to migrate entire SAP landscapes from Windows or Linux on x86 to PowerLinux are also available. Migration Factory will provide migration once the new system is setup; all the virtual machines are in place and ready to accept the workload from the original deployment⁴⁴.

Platform Deployment Services – Setting Up the Virtualized Environment: IBM offers the Getting Started with the IBM PowerLinux Solution Edition for SAP Applications Jump Start (See Figure 14) to help midsized SAP clients get started quickly on IBM PowerLinux, by setting up virtual machines for the SAP Applications according to the published Getting Started with the IBM PowerLinux Solution Edition for SAP Applications Technical White Paper⁴⁵. This Jump Start helps customers onboard PowerLinux servers with PowerVM to achieve a highly virtualized, workload optimized, cloud-ready SAP platform that can support more workloads per server and derive greater throughput per virtual server.

Getting Started with the IBM PowerLinux Solution Edition for SAP Applications Jump Start

- Price: \$3500
- Includes:
 - 2 days, on-site offering
 - PowerVM Getting Started Instructional Workshop
 - Setup of one IBM PowerLinux 7R2 with PowerVM
 - Setup of the virtual machines for the IBM PowerLinux Solution Edition for SAP Applications, according to the [Getting Started with the IBM PowerLinux Solution Edition for SAP Applications Technical White Paper](#) published on [ibm.com](#). The resulting virtualized system will be ready for SAP ERP application and Solution Manager, and IBM DB2 database installation.

Figure 14: Getting Started with the IBM PowerLinux Solution Edition for SAP Applications Jump Start

Besides PowerLinux SAP Jump Start, IBM also offers a private cloud starter service (See Figure 15) based on PowerVM and IBM Systems Director VMControl technologies. PowerLinux advanced virtualization capabilities provide a cloud management platform with high speed image deployment, substantial resource sharing, and reduced cost per VM. These benefits are delivered through PowerVM features - memory compression, copy on write and dynamic workload optimization and balancing. These help customers optimally deploy SAP on PowerLinux servers; creating an intelligently consolidated, highly-utilized and managed midsized SAP landscape.

⁴³ IBM Complimentary Migration Assessment, http://www.ibm.com/common/ssi/cgi-bin/ssialias?subtype=FY&infotype=PM&appname=STGE_PO_PO_USEN&htmlfid=POF03018USEN&attachment=POF03018USEN.PDF

⁴⁴ IBM Migration Factory for SAP http://www.ibm.com/systems/resources/systems_migratetoibm_factory_pdf_sap.pdf

⁴⁵ [http://www.ibm.com/common/ssi/cgi-](http://www.ibm.com/common/ssi/cgi-bin/ssialias?subtype=WH&infotype=SA&appname=STGE_PO_PO_USEN&htmlfid=POW03080USEN&attachment=POW03080USEN.PDF)

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Figure 15: IBM Private Cloud Jump Starts (Information from IBM)

Conclusions – A Simpler Design Matters for SAP Landscapes

Moore's law continues to persist at the processor level. And every 18 months or so, the computational performance delivered by new generation of systems continues to more than double at roughly the same price point. Technological advances in x86 processors continue to be impressive. However, they still lack many of the capabilities of IBM Power Systems when it comes to mid-market SAP Linux deployments, especially in Reliability, Availability and Serviceability (RAS)⁴⁶. In addition, PowerVM virtualization provides further value to SAP customers by keeping their overheads much lower compared to other virtualization technologies that have two digit overheads⁴⁷ in midsize SAP deployments.

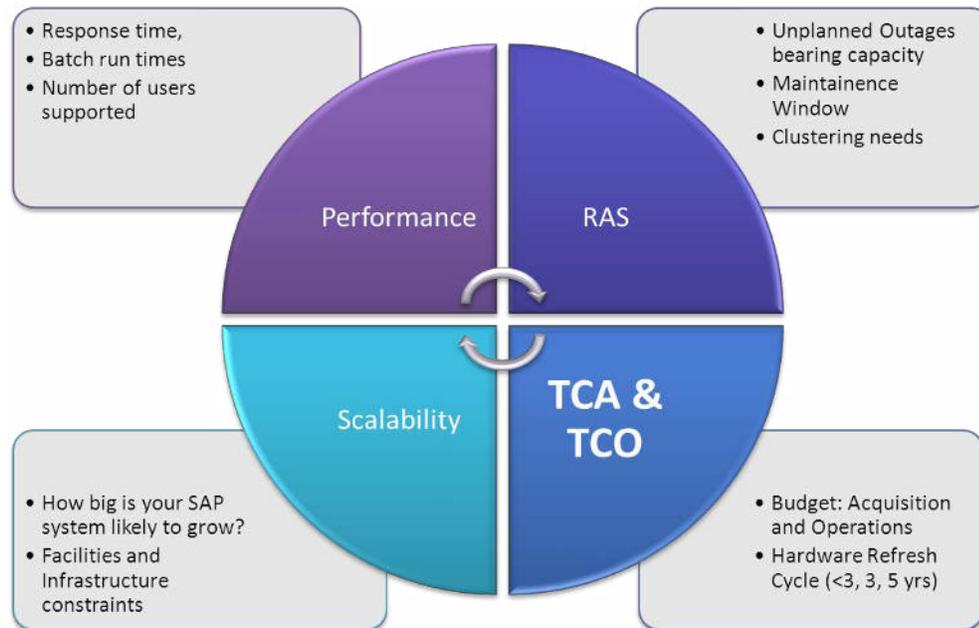


Figure 16: Choosing x86 vs. Power: Prioritize System Objectives for SAP Linux environment

⁴⁶ RAS costs, http://www.cabotpartners.com/Downloads/9509IBM_Power_HPC_RAS_Final.pdf, December, 2009.

⁴⁷ ~10% overhead for SAP on VMWare – paper by EMC <http://www.emc.com/collateral/software/white-papers/h6859-virtzng-business-crtcl-appts-wp.pdf>

In addition to the Total Cost of Acquisition (TCA), the escalating Total Cost of Ownership (TCO) of building and operating a SAP infrastructure is also important. The TCO is influenced by increasing energy, facilities, and other operational costs. Studies⁴⁸ have also found that the most common causes of failures are processor, memory, and storage errors - hardware contributes to over 50% of the failures, software another 20% and the remaining causes are unaccounted for. These failures cause a substantial increase in TCO and often translate to a many fold loss in business, operational, and IT value. If users have to restart their SAP applications several times during execution, it raises TCO and also leads to loss in revenues (1 day of delay in bringing a new drug to market in the pharmaceutical industry could result in losses of \$3M/day⁴⁹).

Based on our analysis, we believe that x86 server consolidation using VMware or other virtualization technologies may be effective for small workloads or smaller SAP landscapes. As businesses grow and evolve to midsized SAP landscapes, the IBM PowerLinux Solution Edition for SAP Applications provides significant value to customers by delivering robust performance, handling heterogeneous SAP workloads with higher flexibility, and improving productivity with much lower downtime compared to x86 servers. PowerVM and PowerLinux servers provide better resource utilization, enabling customers to deploy new services faster, scale cost-effectively and accelerate their time to value. The IBM PowerLinux solution for SAP will deliver faster return on investment than a comparable x86 VMWare configuration. And all these benefits are realized by a *simpler design*.

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⁴⁸ Why IBM Power Systems lead in RAS http://www.ibm.com/systems/resources/systems_deepcomputing_IBMPower-HPC-RAS_Final-1.pdf

⁴⁹ Swami Subramaniam, "Productivity and attrition: key challenges for biotech and pharma", Drug Discovery Today, Volume 8, Issue 12, 15 June 2003, Pages 513-515.