



IBM and SUSE solutions on the new IBM PureFlex System

*Creating flexible and agile solutions with SUSE and IBM PureFlex
System*

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April 2012



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Abstract

This technical paper describes the joint IBM and SUSE solution design, certification testing, and tuning associated with SUSE Linux Enterprise Server 11 SP2 and SUSE Studio with the new IBM PureFlex System. The resulting benefits, along with the rationale for preferring or choosing SUSE Linux Enterprise Server and IBM PureFlex System compared to other platforms are discussed. The target audience includes IT professionals with an interest in IBM PureFlex System and SUSE Enterprise Linux solutions.

Introduction

This paper describes a joint IBM® and SUSE solution design, test and delivery effort done in the second half of the year 2011 and first half of year 2012 using SUSE Linux® Enterprise Server, SUSE Studio, and the new IBM PureFlex™ System. This paper also helps technical architects and IT services teams to do a more effective job of planning, customizing, and implementing new IBM PureFlex System and workloads built on SUSE Linux Enterprise Server.

Traditional enterprise systems have been complex and difficult to manage. Consequently, IT organizations have found themselves lacking the agility and flexibility necessary to enable a new wave of innovation that drives their business. Clients are asking for next-generation solutions that can:

- Enable advanced technology to efficiently consolidate client's existing workloads to reduce operating expenses and unleash budgets to deliver on new business imperatives
- Accelerate a client's time-to-value by reducing risk and complexity from traditional solution deployments
- Simplify workload management and service delivery to meet business demands position their business to take advantages of cloud economics

The new IBM PureFlex System is designed to address these challenges with an integrated expertise that combines the flexibility of a general purpose system, the simplicity of an appliance, and the elasticity of the cloud. The IBM PureFlex System value proposition is focused on addressing these client needs in four key categories:

- Flexibility and simplicity
- Agility
- Efficiency
- Control

SUSE is a leading provider of enterprise Linux solutions that increase agility, reduce cost, and manage complexity in dynamic environments. SUSE is dedicated to providing a foundation on which organizations can build integrated solutions for their mission-critical workloads. With an independent software vendor (ISV) portfolio of over 8,500 certified applications, SUSE enables organizations to confidently deliver computing services across physical, virtual, and cloud environments. SUSE Studio enables organizations to create workload images in several formats making them easy to deploy on a physical hardware, a cloud environment, or a hypervisor of your choice.



Prerequisites

This technical white paper assumes that the reader has a working knowledge of SUSE Linux Enterprise Server, SUSE Studio, virtualization technologies such as kernel-based virtual machine (KVM), cloud computing, and virtual appliances), and the IBM PureFlex System. The “Resources” section at the end of this paper provides the reader with pointers to additional background information for each of these topics.

Overview of the PureFlex System SUSE solution construction and testing

IBM and SUSE have a long and extensive history together around collaborating to help customers optimize workloads to achieve maximum performance and value. SUSE Linux Enterprise Server is a critical component of IBM System x®, IBM Power Systems™, IBM System z®, and IBM System Storage® solutions, and IBM is a key SUSE alliance partner.

In the second half of year 2011, IBM and SUSE started working together on a series of next-generation IT solution design and delivery efforts in support of the 2012 launch of the new IBM PureFlex System. A key design tenet of these joint IBM SUSE solutions is that they should be foundational offerings that a wide variety of customers and business partners can fully leverage and use to inherit the advanced qualities of the service delivered by the initial work done together by IBM and SUSE around the newest levels of SLES Enterprise Linux and the new IBM PureFlex System.

The IBM and SUSE solution design team decided early in the project that two key initial products from SUSE should receive the highest value of focus for deeper technical integration on to the PureFlex System: The SUSE Linux Enterprise Server, due to its critical role as a core foundational Linux operating system and hypervisor base for thousands of applications, and SUSE Studio as a core enabler of newer virtual appliances for consumption in Cloud computing environments.

It should also be noted that both customers and business partners, including independent software vendors (ISVs) and systems integrators (Sis), were targeted as exploiters of these next-generation solutions. In particular, as mentioned before, SUSE Linux and SUSE Studio have seen vast adoption across a very large spectrum of customers, ISVs, systems integrators and other business partners.

The three key initial components of the baseline IBM SUSE solution included:

- Advanced hardware technology from IBM and enterprise software from SUSE (such as SUSE Linux Enterprise), which when combined, enable efficient consolidation of clients' existing workloads to reduce operating expenses and unleash budgets to deliver on new business imperatives.
- SUSE products for virtual appliance construction and delivery on the PureFlex System which accelerates client's time-to-value by simplifying application and service delivery and appliance management to meet client's new business needs and deliver improved cloud economics.
- The brand-new SUSE Linux Enterprise 11 SP 2 software, which includes newer levels of KVM and Xen on the IBM PureFlex System for incremental levels of improved agility, performance, reliability, and efficiency, further reducing both solution risk and complexity during enterprise solution deployments.

Additionally, at the start of the project, the joint IBM SUSE team recognized that a pretested SUSE Linux Enterprise on the IBM PureFlex System solution provides a solid foundation for agility, increased



efficiency, and control for many different kinds of IT workloads, whether implemented on-premises or through cloud computing.

Testing and customization results

Actions taken during the IBM SUSE technical enablement projects focused on the PureFlex System during the first quarter of 2012 include:

- Changing the focus of the integration from SLES 11 SP1 to the brand-new SLES 11 SP2, which includes the new 3.0 Linux kernel, support for the btrfs file system, support for Linux containers, and additional support for Linux on Intel® Xeon® processor E5 and Intel Xeon processor E5 family-based server architectures. Note that this was done because the new IBM PureFlex System x86 compute nodes which incorporate the Intel Xeon processor E5 technology.
- IBM sending a pre-general availability, PureFlex System, to the SUSE location in Provo Utah. IBM and SUSE engineers worked together to install the PureFlex System at SUSE's location in Provo Utah, and the initial physical hardware setup of the PureFlex System at SUSE was very fast and easy to get the system up and running.
- SUSE certifying SLES 11 SP2 on both the IBM PureFlex System x86 and the IBM PureFlex System POWER7 nodes. This work was done by the SUSE engineering team on a pre-production PureFlex System at the SUSE location in Provo, Utah. You can find the SUSE SLES 11 SP2 certification test at:
http://www.novell.com/developer/ndk/system_test_tools_for_netware_and_suse_linux.html
- SUSE required two independent network interface cards (NICs) for certification testing with traffic loads on both NICs for the 12-hour testing. Note that the SUSE SLES 11 SP2 certification testing also included extensive testing of the brand new KVM and Xen releases included in SLES 11 SP2.
- Installing and configuring the IBM Storwize® V7000 external disk systems attached to the IBM PureFlex System running SUSE Linux Enterprise. The IBM and SUSE engineers found this process to be very easy to perform, and the test team was impressed by the clear documentation and the IBM Storage GUI. SUSE was not familiar with the IBM Storwize V7000 storage products before this effort, and was very impressed at how quickly the IBM Storwize V7000 was brought online by using an intuitive GUI.
- Migrating SUSE Studio to the new IBM PureFlex System, and then certifying SUSE Studio on the IBM PureFlex System x86 System running SLES 11 SP 1. This work was done by the SUSE engineers, on the IBM PureFlex System on the x86 nodes running SLES 11 SP 1.
- Leveraging existing SUSE Studio gallery images, created in a SUSE Studio environment, and deploying them on a virtualized SLES Enterprise Linux IBM PureFlex System.
- Testing interoperability between SUSE Studio created virtual appliances (images of SLES 11 SP 1 and SLES 11 SP2) in the OVF format and IBM ICON Virtual Appliance Construction tool in order to optimize those virtual appliances for running on the PureFlex System. This work was done jointly by IBM and SUSE engineers on a SLES-based Linux x86 KVM system at IBM Dallas, Texas.



Using SUSE Linux Enterprise Server 11 SP2

SUSE Linux Enterprise Server is a highly reliable, interoperable and manageable server operating system built to power mission-critical workloads in physical and virtual environments. With this affordable open-source foundation, you can cost-effectively deliver core business services, enable secure networks, simplify heterogeneous infrastructure, and maximize efficiency and value.

SUSE Linux Enterprise Server is a modular, general-purpose operating system that runs on five processor architectures and suitable for a wide range of workloads. And, it is optimized to run on leading hypervisors, making it the perfect guest for virtual computing. With a fully supported KVM and Xen implementation that is delivered as part of SUSE Linux Enterprise, it is also an ideal platform to use as the hypervisor on physical machines.

The inclusion of the 3.0 Linux kernel in SP2 is a noted shift in the SUSE development model. This new forward-looking development model provides customers with significant benefits in terms of:

- Smart innovation
- Enterprise quality
- Investment protection

SUSE's new forward-looking development model involves forward porting of code compared to back porting new capabilities into older Linux kernel trees. The more frequent kernel updates provide developers the ability to focus on stable user libraries for application compatibility, while inheriting new hardware support and improvements in the 3.0 Linux kernel.

System requirements

- At least 256 MB per processor
- 4 GB hard-disk space
- Network interface (Ethernet, wireless, or modem)
- For Xen virtual host server—at least 512 MB RAM for each virtual host server
- For KVM virtual host server—the limits are equal to those of SUSE Linux Enterprise Server
- For Xen or KVM virtual machines—at least an additional 256 MB RAM for each virtual machine

SUSE Linux Enterprise Server 11 SP2 is better suited for PureFlex System than most other operating systems on the market due to the ability of 3.0 Linux Kernel to support the next-generation Intel hardware, including improved L2 / L3 cache management, optimized microprocessor process-scheduling enhancements and efficient performance to power consumption ratios. New solution benefits specifically derived from SLES 11 SP2 on the PureFlex System include support for the latest Hardware and Virtualization technology including:

Hardware

Support for the following Intel processors:

- The second-generation Intel Core i7/i5/i3 processor family
- The third-generation Intel Core processor family
- Intel Xeon processor E3-1200 series
- Intel Xeon processors E5-4600/2600/2400/1600 series



Improvements in energy management and scheduling also help to control costs in physical and virtualized environments. Additional support for PCI Express Gen3 (ID-based ordering, latency tolerance reporting, optimized buffer flush / fill) and support for the following Intel platforms:

- Intel platforms based on Intel Xeon Processor E3-1200 and Intel C200 chipset product family.
- Intel platforms based on Intel Xeon Processor E5-4600/2600/2400/1600 and Intel C600 chipset product family.

Virtualization

Xen has been updated to version 4.1, which provides:

- Latency improvements, flexible partitioning
- Better fault handling, improved scalability and performance

KVM has been updated to version 0.16, which provides:

- I/O improvements, storage and network device hot-plugging
- Microsoft® Windows® support

Improved guest support for:

- Microsoft Hyper-V,
- VMware ESX
- SUSE Linux Enterprise Server with Xen and KVM

Container technology (soft partitioning)

- Kernel resource management (control groups, LXC): create lightweight virtualization-like separations for better load management

In the following quote, taken from the SUSE press release dated Feb 28, 2012 announcing SLES 11 SP2 General Availability, you can note the strong IBM endorsement of SUSE Linux Enterprise 11 SP2:

“IBM and SUSE have a long history of technical innovation and collaboration, helping our customers optimize their workload investments,” said Jean Staten Healy, director, Linux, IBM. “With the Linux 3.0 kernel, SUSE Linux Enterprise Server 11 SP2 highlights the latest performance-enhancing and power-saving capabilities of IBM Systems and can help customers optimize workloads to achieve maximum performance and value.”



SUSE Studio on the IBM PureFlex System

SUSE Studio enables you to build your own system images including your application or appliances based on SUSE Linux Enterprise or openSUSE. Its browser based interface simplifies the building and testing appliance images. SUSE Studio supports the creation of physical, virtual, or cloud-based images by leveraging a software appliance form-factor. Virtual appliances built with SUE Studio seamlessly integrate with industry-standard virtualization platforms, such as VMware, Hyper-V, Xen, and KVM. Customers can even deploy their applications with one click directly from SUSE Studio to the cloud.

SUSE Studio streamlines the configuration, maintenance, and management of Linux workloads into a few simple mouse clicks, helping you tap into an agile ecosystem of industry applications.

The SUSE Lifecycle Management Server is a component of SUSE Studio Standard and Advanced Editions. SUSE Lifecycle Management Server is delivered as an appliance and can be deployed in virtual environments or on physical hardware. Additional benefits enabled by SUSE Studio include: Reduced development costs and accelerated time to market

Minimum hardware requirements:

- 1 GB RAM
- 4 GB of hard-disk space
- Network interface (Ethernet)

Recommended hardware requirements:

- 4 GB RAM, at least 1 GB per processor
- 4 GB hard-disk space per managed appliance
- Network interface (Ethernet)

In addition, SUSE Gallery allows users of SUSE Studio to publish virtual appliances, and currently contains well over 4000 virtual images, already created and made available to developers.



IBM PureFlex System configuration used in this project

The following PureFlex System configurations were used in this project:

MTM: 7893-92X Chassis

Qty Type Device Description

- 2 FC 4558 PWR CBL, CENTER TO WALL, 2.5M, 16A/100-240V, C19 TO C20 (PDU/UPS)
- 1 FC 9039 BASE CHASSIS MANAGEMENT ELEMENT FOR 92X
- 1 FC 3595 QLOGIC 8Gb (14 INT PORT, 6 EXT PORT) Fibre Channel (FC) SCALABLE SWITCH ELEMENT ScSE) 92X (69Y1930)
- 2 FC 3286 IBM 8 Gb SFP+ Short Wave Optic Transceiver
- 1 FC 3598 BNT 1 Gb (14/28 INT, 10/20 EXT) PORTS ETHERNET SCALABLE SWITCH ELEMENT (ScSE) FOR 92X (49Y4294)
- 1 FC 3282 IBM 10 Gb Ethernet 850 nm Fiber SFP and Transceiver
- 1 FC 4380 5M LC-LC FC CABLE
- 1 FC 9038 BASE (4X) ITE FANS FOR 92X
- 2 FC 9059 BASE 92X POWER MODULE INDICATOR, MUST ORDER 2X
- 1 FC 0466 ACCIPITER CONTENT SPECIFY: 7955/01M/02P - (1X or 2X = 1 POS)
- 1 FC 4650 INDICATOR - DRAWER NOT FACTORY INTEGRATED
- 1 FC 4681 INDICATOR FOR IBM BladeCenter® 01

MTM: 7955-01M FSM

POWER ITE - MTM: 7895-22X

MTM: 7863-10X x86 nodes

Qty Type Device Description

- 1 FC 0457 IBM PureFlex System Enterprise Chassis Content Specify - 7863-10X
- 1 FC EPA7 1ST HIGH PERFORMANCE SEGMENT Intel Xeon processor E5 and 2S PLANAR
- 1 FC EPB7 2ND HIGH PERFORMANCE SEGMENT Intel Xeon processor E5 and 2S PLANAR
- 1 FC 4681 INDICATOR FOR IBM BladeCenter 01
- 1 FC 4646 CHARGEABLE PREREQ FOR CENTER INTEGRATION
- 1 FC 1764 DUAL (2X PORT) 8Gb FC, MEZZANINE CARD, (QLOGIC) (69Y1938)
- 1 FC ED01 BLCKTIP SYSTEM PUBS and MEDIA - US ENGLISH

MTM: 7863-10X x86 nodes

Qty Type Device Description

- 1 FC 0457 IBM PureFlex System Enterprise Chassis Content Specify - 7863-10X
- 1 FC EPA7 first HIGH PERFORMANCE SEGMENT Intel Xeon processor E5 and 2S PLANAR
- FC EPB7 second HIGH PERFORMANCE SEGMENT Intel Xeon processor E5 and 2S PLANAR
- 4 GB DIMMS to get to 4 GB / core
- 1 FC 4681 INDICATOR FOR BladeCenter 01
- 1 FC 4646 CHARGEABLE PREREQ FOR CENTER INTEGRATION
- 1 FC 1764 DUAL (2X PORT) 8Gb FC, MEZZANINE CARD



Type	Description	Quantity
2076-124	IBM Storwize V7000 disk control enclosure	1
10	Storage engine preload	1
3206	600 GB 2.5 inch 10k HDD	12
5305	5M Fiber Optic Cable LC-LC	8
6008	Cache 8 GB	2

Table 1: IBM Storwize V7000 configuration

Benefits realized from new components of the joint SUSE-IBM PureFlex System solution

Benefits from SUSE Linux Enterprise Server 11 Service Pack 2 include improved performance, reliability, availability, serviceability, and virtualization along with support for more third-party hardware. As it is designed for interoperability and optimized for physical, virtual, and cloud environments, SUSE Linux Enterprise Server paves the way for your future growth. It enables you to maximize the utilization of your existing IT resources and move easily from older physical servers to new, more powerful ones as they become available or your business needs change. SUSE Linux Enterprise Server is one of the most versatile and reliable Linux for mission-critical environments because the team is committed to its continuous enhancement.

Improved performance

SUSE Linux Enterprise Server 11 Service Pack 2 is able to provide up to a twenty percent performance improvement through scheduler, memory management and other enhancements in the 3.0 Linux kernel including.:

- Improved performance of compute and memory intensive workloads with support for transparent huge pages
- Faster network performance through transparent per-processor load balancing on multiqueue devices
- Control groups enhancements—I/O throttling and memory cgroup controller optimization—for optimal performance
- 10 times faster speed with USB 3.0

Improved reliability, availability, and serviceability (RAS)

Run SUSE Linux Enterprise Server with even greater confidence with the following new features:

- Support for new hardware RAS features, such as processor and memory off-lining
- btrfs support—improved services availability and data integrity with copy on write, integrated volume management, and checksums. New snapshot and rollback capabilities offer improved resilience

Better security and enhanced hardware support



Secure your environment, and grow rapidly (or at your own pace) with Service Pack 2 (SP2) enhancements that include:

- Role-based access controls in AppArmor
- More powerful firewalls with faster packet filtering
- Support for fanotify—for improved support of third-party antivirus solutions
- New drivers for over 500 of the latest processors, chipsets, networking devices, and storage systems

More robust virtualization capabilities

SP2 enables you to use resources more efficiently and to migrate workloads to virtual and cloud environments with features such as:

- Support for Linux Containers—high efficiency, low overhead OS virtualization
- Updated Xen 4.1 and KVM 0.15+ hypervisors
- Windows guest OS support in KVM
- Improved virtual machine guest OS performance with additional paravirtualized drivers for Xen, KVM, VMware vSphere and Microsoft Hyper-V

SUSE Studio enables developers to quickly create, test, and deploy virtual applications for all major hypervisors, including VMware, KVM, and Xen as well as industry standards, such as OVF. SUSE Studio stores all information about the virtual image or appliance so that it can be reproduced, duplicated, or deployed to virtual or cloud environments at the push of a button. Furthermore, an integrated update mechanism automates the maintenance of your deployed virtual application.

These benefits help IT departments:

- Increase software portability for virtual and cloud environments
- Reduce development costs with virtual applications that are optimized and ready to run on various virtualization platforms
- Build on the virtual infrastructure you have today
- Hasten your deployment of virtual applications
- Build the foundation for future cloud deployments

These benefits help software vendors:

- Provide customers with an optimized and portable solution
- Expand their reach and enter new markets
- Accelerate time to market and increase revenue. Boost their application through SUSE Gallery, a component of SUSE Studio (susegallery.com)
- Reduce the cost and complexity of developing and testing software
- Reach new deployment targets without the need of extensive rearchitecting
- Simplify deployment and patching for customers, while reducing support calls
- Build virtual applications tailored for their customers' needs
- Improve customer satisfaction and decrease support costs

In addition, SUSE has sponsored the creation for a return on investment (ROI) tool for SUSE Studio Virtual Appliances and you can find it at:

https://roianalyst.alinean.com/ent_01/AutoLogin.do?d=279532952882817786



Anticipated solution benefits

The combination of SUSE Linux Enterprise and the new IBM PureFlex System provides the foundational basis for a new family of expertly integrated systems with the following features.

- All the IBM PureFlex System SUSE solutions have been designed with a built-in expertise from both IBM and SUSE technical teams to address complex business and operational tasks automatically.
- Integration by design and verified through robust testing and certification processes.
- A platform to produce future tuned systems for optimal performance and efficiency.
- Simplified experience from solution design to purchase to maintenance
- Flexibility and simplicity – SUSE Linux Enterprise and SUSE Studio provide an on-ramp to the cloud through broad virtualization support and just enough OS for your virtualized workloads.
- Agility – Built from a common code base, SUSE provides support for XFS, btrfs and OCFS2* on both System x and Power, making it a simple choice to use the capabilities of PureFlex System.
- Efficiency – Less overhead in managing large memory pages with transparent huge page and per-processor network load balancing on multiqueue devices.
- Control – Fine grain control group enhancements of I/O throttling and memory control group optimizations.

This following table summarizes the anticipated value delivered when moving from traditional IT environments to a SUSE Linux Enterprise IBM PureFlex System environment.

From: Traditional Environments	To: SUSE PureFlex System	Value derived
New solutions up and running in months	New solutions up and running in hours	Faster time to value
Over-purchase and provision	Built-in workload elasticity	Automated workload scalability
Infrastructure complexity slows down change	Easily extendable and accommodating to change	Easily adapts to meet new needs
Create customer solutions to work with what you have	Easy integration through open standards computing	Eases adoption of next-generation technology like Cloud



Summary

The combination of the new IBM PureFlex System, along with SUSE Linux Enterprise Server 11 SP2 and SUSE Studio, provide customers, users, SIs, ISVs and business partners with a leading-edge foundational platform for next-generation computing with enhanced levels of flexibility, simplicity, and control resulting in increased efficiency, enhanced agility, and lower cost of ownership. The solution value and target markets of this brand new highly flexible foundational offering are for both traditional on-premises IT systems and newer cloud computing systems. These new solutions can also accelerate the creation and velocity of adoption of an ecosystem of high-value business solutions from IBM, ISVs, third-party business partners, and systems integrators. Finally, it is anticipated that the combination of IBM PureFlex System along with SUSE products, such as SUSE Linux Enterprise and SUSE Studio forms the basis for a leading-edge cloud computing platform, which can support a vast and diverse set of next-generation, high-value cloud services.

The following quote from Matthias Eckermann, Senior Product Manager, SUSE, summarizes the benefits of the joint SUSE and the IBM PureFlex System solutions:

“Built from a Common Code base, SUSE Linux Enterprise provides identical administration, security, scalability and functionality for both System x and Power ...This includes support for XFS and btrfs, and the SUSE Linux Enterprise High Availability extension, featuring the OCFS2 cluster file system. Thus, organizations can flexibly react on constantly changing demand, especially with PureFlex System.”*

For further reading, and additional documentation on the anticipated benefits of these solutions, refer to the links and resources in the next section.

Resources

The following websites provide useful references to supplement the information contained in this paper:

- IBM Systems on PartnerWorld
ibm.com/partnerworld/systems
- IBM Redbooks®
ibm.com/redbooks
- IBM Cloud Computing website:
ibm.com/cloud
- IBM PureFlex System Product Page
ibm.com/ibm/puresystems
- IBM Storage Storwize V7000
ibm.com/systems/ph/storage/disk/storwize_v7000/
- SUSE
www.SUSE.com
- SUSE Linux Enterprise Server
<http://www.suse.com/products/server/>
- SUSE SLES 11 SP 2 benefits
<http://www.suse.com/products/server/features/best-linux-server.html>
- SUSE Studio
www.susestudio.com
- SUSE Linux Enterprise Application Catalog
www.suse.com/partner/isv/isvcatalog
- SUSE Studio ROI calculator tool :
https://roianalyst.alinean.com/ent_01/AutoLogin.do?d=279532952882817786



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