SUSE® Linux Enterprise

Technology Road Map

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SUSE®
We adapt. You succeed.

SUSE /ˈsuːsə/, not /ˈsuːs/ or /ˈsuːsiː/

SUSE is a leading provider of enterprise Linux solutions that increase agility, reduce cost and manage complexity in dynamic environments. With a portfolio centered around SUSE Linux Enterprise, the most interoperable platform for mission-critical computing, SUSE enables organizations to confidently deliver computing services across physical, virtual and cloud environments. For more information, visit http://www.suse.com

Enterprise Computing

Cloud Infrastructure

Integrated Systems

SUSE® at a Glance

SETTING THE BAR

LEADING PROVIDER

of enterprise linux solutions

GLOBAL MARKET

CUSTOMERS WORLDWIDE

15,000+

GLOBAL ORGANIZATION

EMPLOYEES IN 43 COUNTRIES

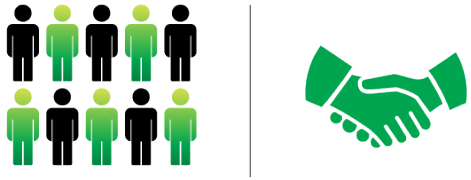
750+

KNOW HOW

20+

years of linux engineering experience

PARTNERS



5,000+ member partner ecosystem

THE GOLD STANDARD

AWARD WINNING

technical support and customer service

SUSE® Leadership

MAINFRAME LINUX

Over 80% of all Linux running on mainframe computers is SUSE Linux Enterprise Server

SAP ON LINUX

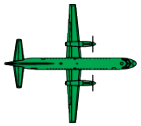
SAP

70% of all SAP applications running on Linux run on SUSE Linux Enterprise

LINUX IN CHINA

SUSE Linux Enterprise Server is the most widely used commercial enterprise Linux distribution in China - more popular than Red Hat

LINUX IN AEROSPACE AND DEFENSE



Almost 80% of the US Fortune 500 aerospace and defense companies use SUSE Linux Enterprise Server

MOST CERTIFIED APPLICATIONS

Over 9,500 applications are certified and supported on SUSE Linux Enterprise Server, more than any other Linux distribution

LINUX IN RETAIL

Nearly 70%

of the US Fortune 100 merchandisers, specialty retailers, and food and drug stores use SUSE Linux Enterprise Server

LINUX IN AUTOMOTIVE

Nearly all of the world's major automobile manufacturers use SUSE Linux Enterprise Server

LINUX IN HPC

Half of the world's largest supercomputer clusters use SUSE Linux Enterprise Server

BEST LINUX SUPPORT

SUSE offers better Linux support than Red Hat or Oracle

LINUX IN GLOBAL FORTUNE 100

Over two-thirds of the Fortune Global 100 use SUSE Linux Enterprise Server

MOST CERTIFIED HARDWARE DEVICES

13,500+

SUSE is certified on over 13,500 hardware devices. More than any other Linux distribution.

Comprehensive Portfolio

SERVER

SUSE Linux Enterprise Server

SUSE Linux Enterprise Server for System z

SUSE Linux Enterprise Server for SAP Applications

SUSE Linux Enterprise Point of Service

EXTENSIONS

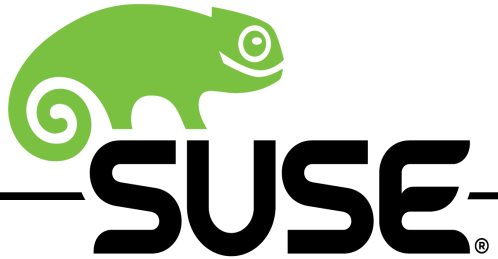
SUSE Linux Enterprise High Availability Extension

SUSE Linux Enterprise Real Time Extension

SUPPORT

SUSE Linux Enterprise Server with Expanded Support

SUSE Linux Enterprise Server Long Term Service Pack Support



VIRTUALIZATION

SUSE Linux Enterprise Server for VMware

SUSE Linux Enterprise Virtual Machine Driver Pack

DESKTOP

SUSE Linux Enterprise Desktop

LibreOffice

MANAGEMENT

SUSE Manager

SUSE Studio

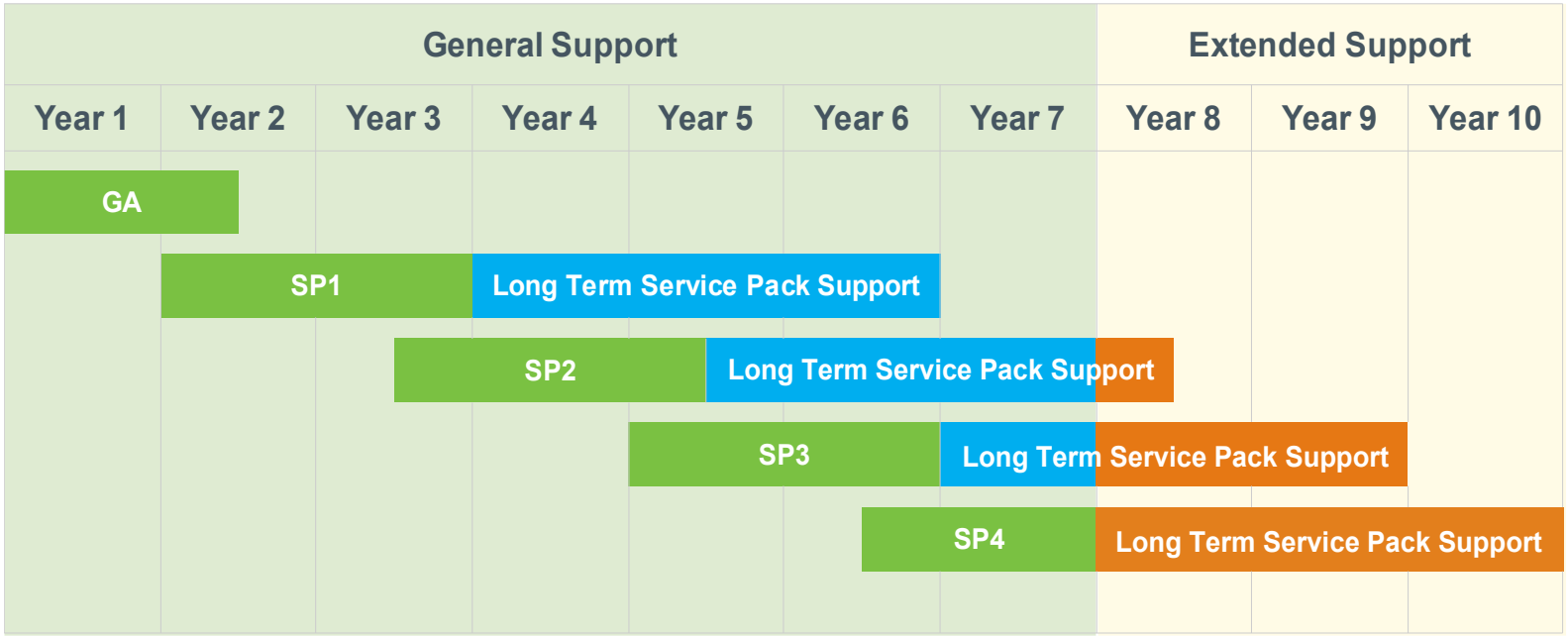
CLOUD

SUSE Cloud

SUSE Linux Enterprise Server for Public Cloud

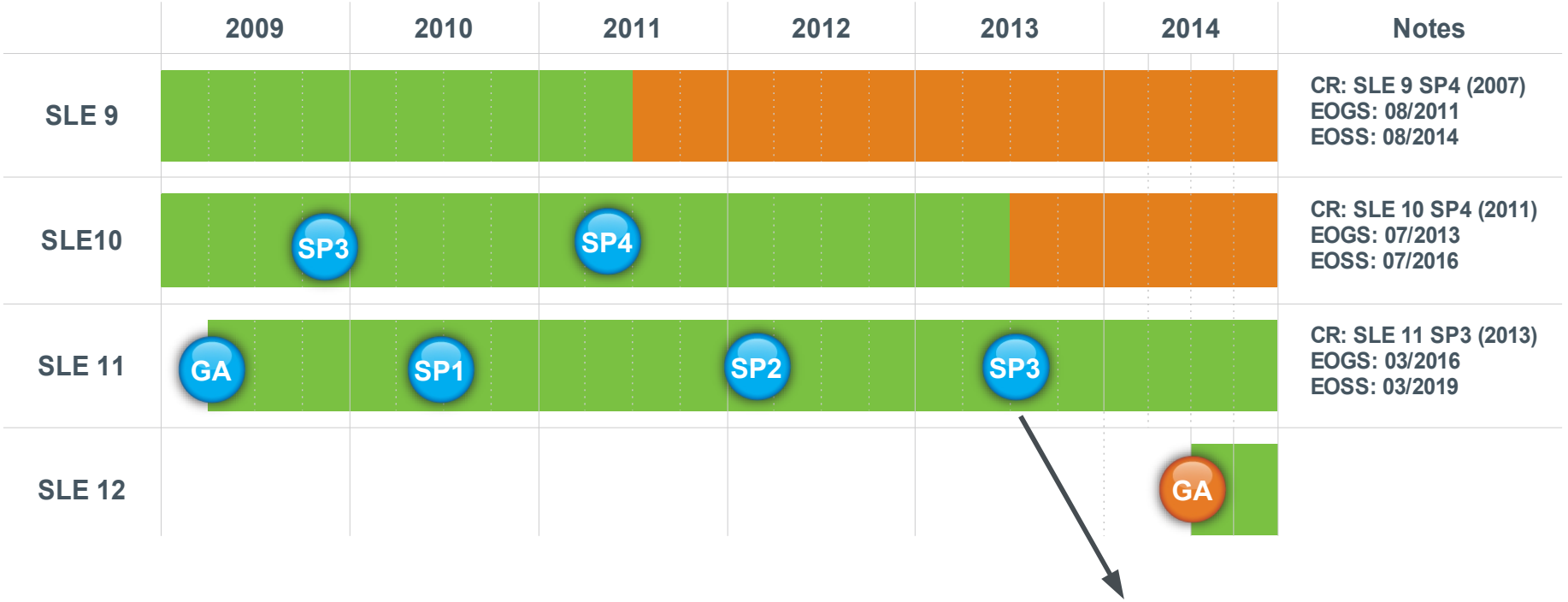
Portfolio and Lifecycle

SUSE® Linux Enterprise Standard Lifecycle



- 10-year lifecycle
- Service Packs every ~18 months
  - 5 years lifetime with
  - ~2 years general support per Service Pack
  - 6 month upgrade window after release of the next Service Pack
- Long Term Service Pack Support (LTSS)
  - Extend upgrade window or major release lifecycle

Current SUSE® Linux Enterprise Streams



- Dependable release timing
- Predictability for planning rollouts and migrations
  - Service Pack releases, development and product schedules announced to customers and partners
- Major releases every 4-5 years.

Long Term Service Pack Support (LTSS)

Use Cases

I want to run my software stack unchanged for a very long time

- Updating OS does not improve my business process
- Updates can be very expensive to deploy
- Any change may impose additional risk

I need more time to move to the next Service Pack

- Approval process from stake holders
- QA processes
- Very large and/or distributed environment

LTSS – Overview

Long Term Service Pack Support (LTSS) gives customers the flexibility to decide when to take advantage of new features in SUSE Linux Enterprise Server. The longer support window for a SP allows customers to efficiently plan the resources and deployment cycles based on internal Requirements while maintain a secure system.

Availability:

- LTSS is only available for x86_64 and System z.
- LTSS will not be offered for every Service Pack release.

What does LTSS cover?

Feature	General Support for Most Recent Service Pack		General Support for Former Service Pack with LTSS Option	Extended Support with LTSS Option
	Year 1–5	Year 6–7		Year 8–10
Technical Support	Yes	Yes	Yes	Yes
Access to Patches and Fixes	Yes	Yes	Yes	Yes
Access to Documentation and Knowledgebase	Yes	Yes	Yes	Yes
Support for Existing Stacks and Workloads	Yes	Yes	Yes	Yes
Support for New Deployments	Yes	Limited[1]	Limited[1]	No
Enhancement Requests	Yes	Limited[1]	No	No
Hardware Enablement/Optimization	Yes	No	No	No
Driver Updates via PLDP	Yes	Limited[1]	Limited[1]	No
Backport of Fixes From More Recent Service Pack	Yes	N/A	Limited[2]	N/A
Critical Security Updates	Yes	Yes	Yes	Yes
Defect Resolution	Yes	Limited[2]	Limited[2]	Limited[2]

1 Based on partner and customer requests.

2 Severity Level 1 and 2 defects only.

SUSE Linux Enterprise 11 Service Pack 3

SUSE Linux Enterprise Server

A highly reliable, scalable and secure server operating system, built to power physical, virtual and cloud-based mission-critical workloads.

General Highlights

- LAMP Stack
  - Updated PHP to 5.3.17
  - Updated MySQL to 5.5.30
- Java
  - Removed IBM Java 1.4.2
  - Keeping IBM Java 6
  - Added IBM Java 7 (1.7.0 sr4)
- Lustre 2.1 base kernel enablement
  - Requested by a number of customers and partners
  - Included kernel patches enable building Lustre modules
  - Supported by SUSE deployment partners

Hardware Enablement

- Latest Intel 64 / AMD64 CPUs and Chipsets
  - Intel Ivy-Bridge EP 2S 4S, Centerton, Haswell enablement
  - UEFI Secure Boot
  - AMD Opteron 6000 & 4000 and related chipsets

- New NICs, HBA, other interconnects
  - Driver Updates (70+)
  - PCI ID updates

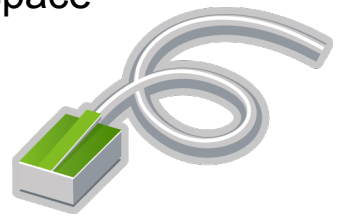
- Other hardware platforms
  - Continue support for x86, x86_64, iA64, ppc64, s390x
  - Support larger amounts of memory
  - Exploit crypto acceleration hardware

Hardware Enablement is a functionality of the Common Codebase and valid across products

Hardware Enablement

Networking and Storage

- Networking
  - Update the Fibre Channel over Ethernet (FCoE) stack
    - Required kernel changes to sysfs and FC libraries and userspace management tools
  - Update OFED userspace to 1.5.4.1
    - Refurbished software stack, support for faster devices
  - New & refurbished 10G / 40G ethernet adapter drivers



- Storage
  - LVM thin provisioning
    - Over commit physical storage to more effectively use storage
  - ext4 runtime switch for write capability
    - RO supported for data migration; RW not supported by SUSE
    - Replaces the SUSE Linux Enterprise 11 SP2 ext4-writable-KMP
  - New & refurbished 8G / 16G fiber channel adapter drivers

Systems Management

- ZYpp Transaction Auditing
  - Easier ITIL auditing
  - Checkpoint for investigation on software stack issue after a change or update
  - SUSE Manager will use this information in a future release
- Snapper
  - Role-based, non-root snapshots/rollback with dbus
    - Non-root users can manage snapshots for specific subvolumes
  - Updated capabilities in the YaST2 snapper module
  - Faster comparison of snapshots on btrfs
  - After SP3: Snapper cleanup rules based on age and free space

Virtualization

- Release Virtual Machine Driver Pack (VMDP) 2.1
  - Windows Server 2012 and Windows 8 support
  - SCSI pass-through support

- Virtual Machine OS support (XEN and KVM)
  - SUSE Linux Enterprise 10 SP4, 11 SP1, 11 SP2, 11 SP3 **(L3)**
  - Windows 2003 SP2+, 2008 SP2+, 2008 R2+, 2012+ **(L3)**
  - OES 2 SP3, OES 11+, NetWare 6.5 SP8 (32bit only) **(L3)**
  - RHEL 4.9+, 5.8+, 6.3+ **(L2 or L3 with expanded support)**
  - SUSE Linux Enterprise Desktop 11 SP3 **(Tech Preview L2)**
  - Windows XP SP3+, Vista SP2+, 7 SP1+, 8+ **(L2)**

Virtualization

XEN and KVM

- XEN 4.2.1
  - Large VT-d pages
  - APIC virtualization feature for recent Intel CPUs

- KVM 1.4.0
  - Like XEN, large VT-d pages and APICv support
  - HBA pass-through
  - KVM hypervisor install scenario in YaST
  - Export Platform Power Management Capability (S3 and S4) through libvirt Framework

Virtualization

Hyper-V and LXC

- Hyper-V
  - Memory ballooning support
  - Updated framebuffer driver
    - Allows for screen resolution up 1920x1080 on Windows Server 2012 host and 1600x1200 on Windows Server 2008 R2 or earlier
    - Solves the double mouse cursor issue of the emulated
  - Host initiated backup
    - Ensure that a backup will be file system consistent by “freeze/thaw” filesystem

- Linux Containers (LXC)
  - Update LXC to its latest version (0.8.0)

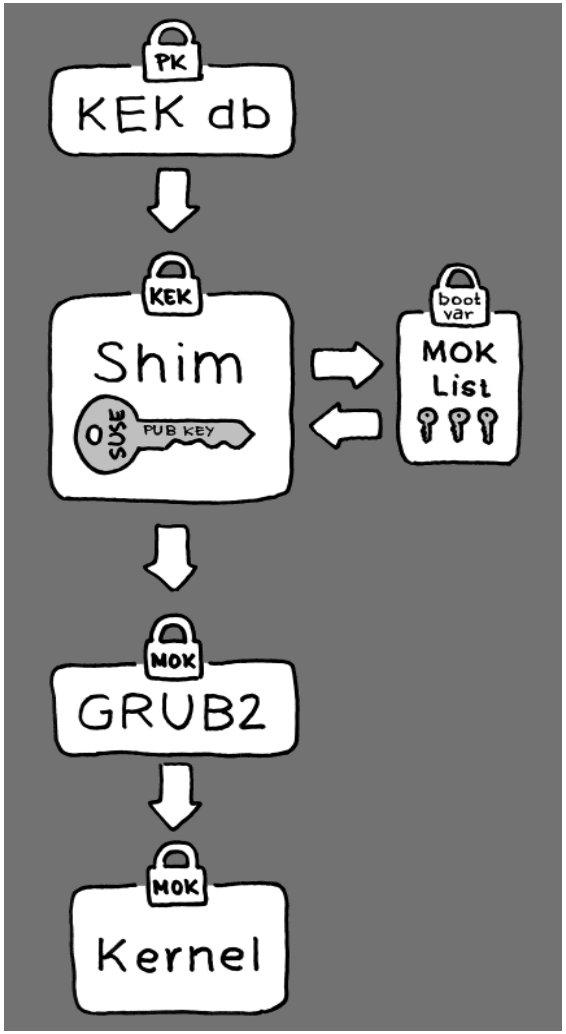
Security and Certifications

- Include third-party Apache Module mod_security2
  - L3 Supported
- Certifications
  - Common Criteria certification in Evaluation Assurance Level 4 with Augmentation (CC OSPP EAL 4+) achieved for SUSE Linux Enterprise Server 11 SP2
  - FIPS 140-2 certification achieved for OpenSSL 0.9.8j in SUSE Linux Enterprise Server 11 SP2
  - Updated openssh to 6.1p1 which works in FIPS mode (not validated yet)
  - Considering FIPS certification of further modules
  - Researching compliance with NIST SP800-131a

Security and Certifications

Unified Extensible Firmware Interface (UEFI)

- Extensive information about implementation
  - https://www.suse.com/blogs/uefi-secure-boot-details/
- Secure Boot support
- Ship a Secure Boot UEFI compatible bootloader (grub2) and shim loader
- Bootloader, kernel and kernel modules must be signed
- UEFI Secure boot limitations
  - kexec and kdump are disabled
  - Limitations assumed to be removed in SUSE Linux Enterprise12



SUSE Linux Enterprise
IBM System z

Unique Tools

Included with SUSE Linux Enterprise Server for System z

YaST and Integrated Systems Management

Configure every aspect of the server

Subscription Management Tool Hosting

Subscription and patch management made easy

Starter System for System z

A pre-built installation server

AppArmor Security Framework

Included in SLES for System z

Multi-IFL Pricing

Volume Pricing Model to encourage growth

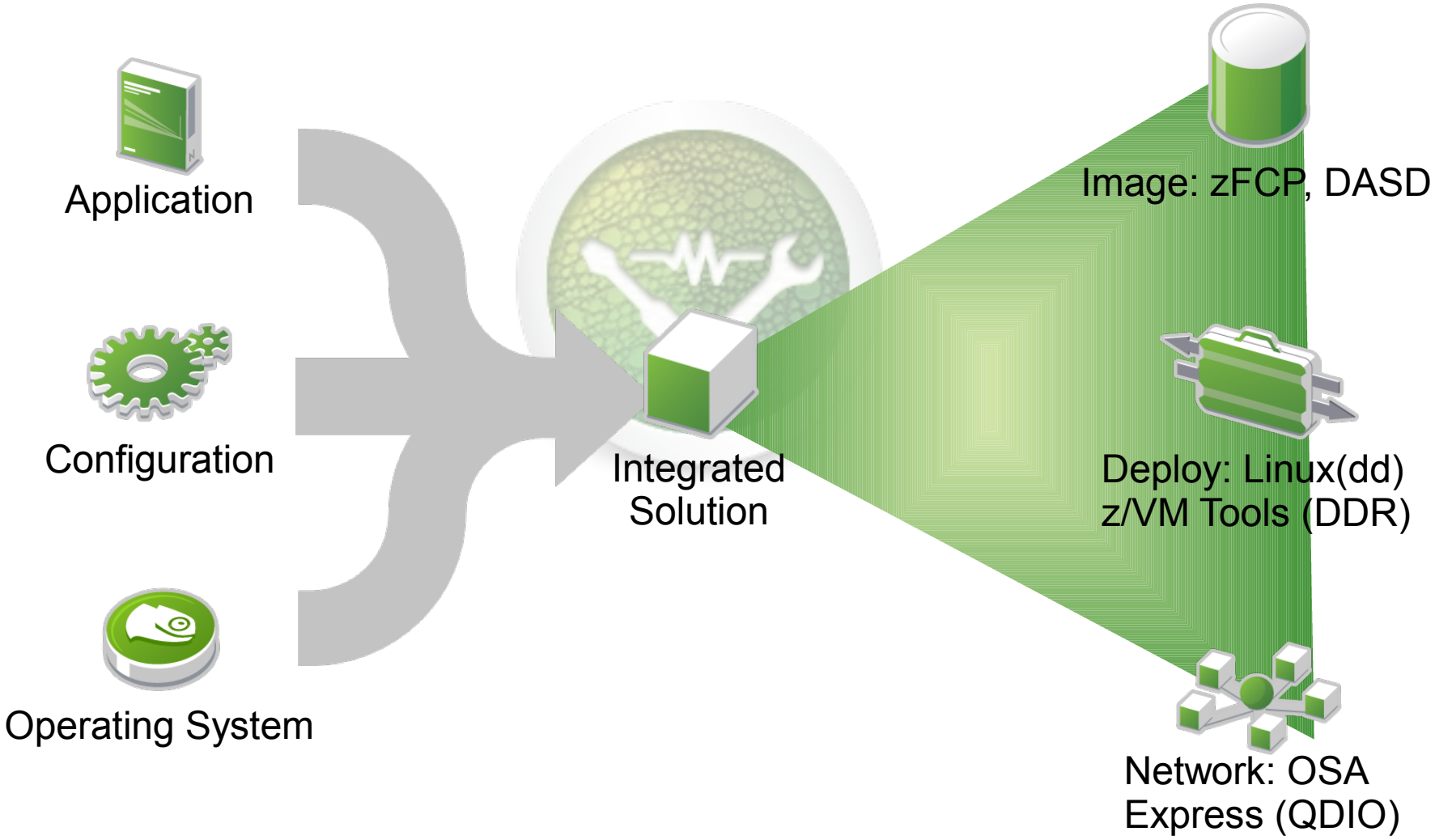
SUSE continues to add value

SUSE Studio
Build workloads for physical, virtual, and the cloud
https://www.suse.com/products/susestudio/

SUSE Linux Enterprise High Availability Extension
Open Source High Availability Cluster Solution
https://www.suse.com/products/highavailability/

SUSE Manager
Complete Life Cycle Management for Linux Servers
https://www.suse.com/products/suse-manager/

SUSE Studio for System z



SUSE® Manager

SUSE Manager

Manage both SUSE Linux Enterprise and Red Hat Enterprise Linux servers with a single centralized solution

Automated and cost-effective software management, system provisioning/configuration and monitoring capabilities

Manage Linux server deployments across physical, virtual and cloud environments

SUSE® Linux Enterprise Server for System z 11 SP3

- zEC12 + zBX = IBM zEnterprise exploitation continued
  - z9,z10,z196,z114 support continued
  - zBX HX5 support
  - Flash Express support (as Linux block devices)
  - Update to Java 7 and supportive kernel enhancements
  - Cross memory attach APIs for middleware
  - GCC 4.7 for applications targeting EC12 processor
- Improved RAS tools and System z specific support
  - Enhanced DASD statistics for PAV & HPF
  - Robust disk mirroring for DASDs (MD RAID10)
  - 2 stage dump & network storage sharing incl. compression
  - s390-tools update, terminal server appliance for z/VM

Device Drivers, Features, and Commands on SUSE Linux Enterprise Server 11 SP3
http://www.ibm.com/developerworks/linux/linux390/documentation_suse.html

Technology Preview

- **Remember:**
  - Not officially supported by SUSE
  - Please test any of these features in the lab!

- KVM on System z (s390x)
  - Allows Linux hosted and Linux based virtual machines in LPARs
- KVM nested virtualization with Intel VT
  - Will provide feature parity with AMD-V and Xen
- Include virtio-blk-data-plane (qemu)
  - High-performance code path for I/O requests from KVM guests
- Hot-Add Memory
  - Selected (YES certified) System x and System p hardware

zPDT

IBM System z Personal Development Tool

https://www.ibm.com/partnerworld/page/pw_com_zpdt

- zPDT is a software-based application tool
  - Low cost IBM System z platform for ISV application development, testing, demo
  - A virtual System z architecture environment that allows select mainframe operating systems, middleware and software to run unaltered on x86 processor-compatible platforms.
  - Portable System z platform for training & education of applications and operating system environments
  - Supports openSUSE 11+, SLES 11 SP2 x86_64, and others
  - SUSE's evaluation versions for x86_64 and s390x available at http://www.suse.com/products/server/eval.html

Service Pack Migration

Systems Management Today

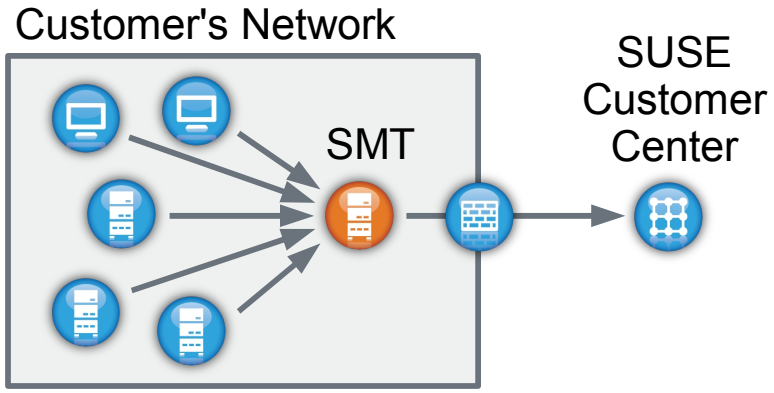
- YaST – unique, highly integrated local management tool
  - Ease of use, effective learning curve; reduces training efforts
  - Automation via AutoYaST data center mass deployments
- Fastest open source update stack (ZYpp)
  - Reduce management time, effort and cost
  - Improve reliability and availability by reducing downtimes
  - ZYpp handles multiple installed package versions (e.g. Kernel)
- Build in Installation Server
  - Easy setup, allows for internal high speed repository serving
  - Allows to speed up and automated release and SP migrations
  - Can be combined with SMT to serve multiple SUSE products

SUSE® Linux Enterprise 11

Systems Management Today

- Unattended migration reduces cost and downtime
  - SUSE Linux Enterprise 10 SP4 to SUSE Linux Enterprise 11 SP3
  - SUSE Linux Enterprise 11 SP2 to SUSE Linux Enterprise 11 SP3
- Example: http://www.suse.com/documentation/sles11/book_sle_deployment/?page=/documentation/sles11/book_sle_deployment/data/cha_update_auto.html

- Subscription Management Tool
  - SMT is a proxy and auditing tool that mirrors the Customer Center
  - Tightly integrates with it
  - Accurately registers and manages deployments
  - Guarantees subscription compliance
  - Secures IT process flow



Where to go for more information

SUSE to Go

Mobile Enablement App

ADownload from the iTunes App Store or Google Play or point your device to: www.suse.com/susetogo

SUSECon

Nov 12-15, 2013, Lake Buena Vista, Florida

4 Days. Everything Linux.

- Technical and business presentations
- Hands-on labs
- Advanced technical training
- Industry partner technology showcase
- Customer case studies
- Keynotes from industry leaders

Register at www.susecon.com.

We'll See You at These IBM Events

- Linux Ambassador Calls
  - August 8: SUSE Cloud 2.0
    - Get the scoop on the new release of SUSE Cloud 2.0, based on the OpenStack Grizzly release.
  - October 24: High Availability
    - Learns what's available and what's new with SUSE and with SUSE Linux Enterprise High Availability Extension
- IBM Enterprise Systems
  October 21-25, Orlando, FL
- Linux on System z & z/VSE Customer Workshop
  October 15-16,
  IBM Lab Boeblingen, Germany
- SHARE
  August 11-16, Boston
- T3 Classes - IBM & Partners
  - Major Markets
    - EMEA, IBM Lab Boeblingen, July 9-11
    - US, co-located with a conference tbd (1day)
    - GMU
  - ASEAN
    - Malaysia
    - GCG
  - CEE (Moscow)
- Guide Share Europe
  - Hamburg: October
  - BeNeLux: November
  - UK: November

Questions?

Thank you.

Appendix

SUSE Linux Enterprise High Availability Extension & Geo Clustering

Reasons for

SUSE® Linux Enterprise High Availability

- Long history track record
- Most up-to-date Open Source High Availability stack
- Open Source Leadership
- Geo cluster support
- Superior Cluster File System
- Integrated Data Replication
- Deep OS integration
- Ready for Virtualization

Unique Selling Points

SUSE High Availability

x86 plus IBM System z, IBM Power support

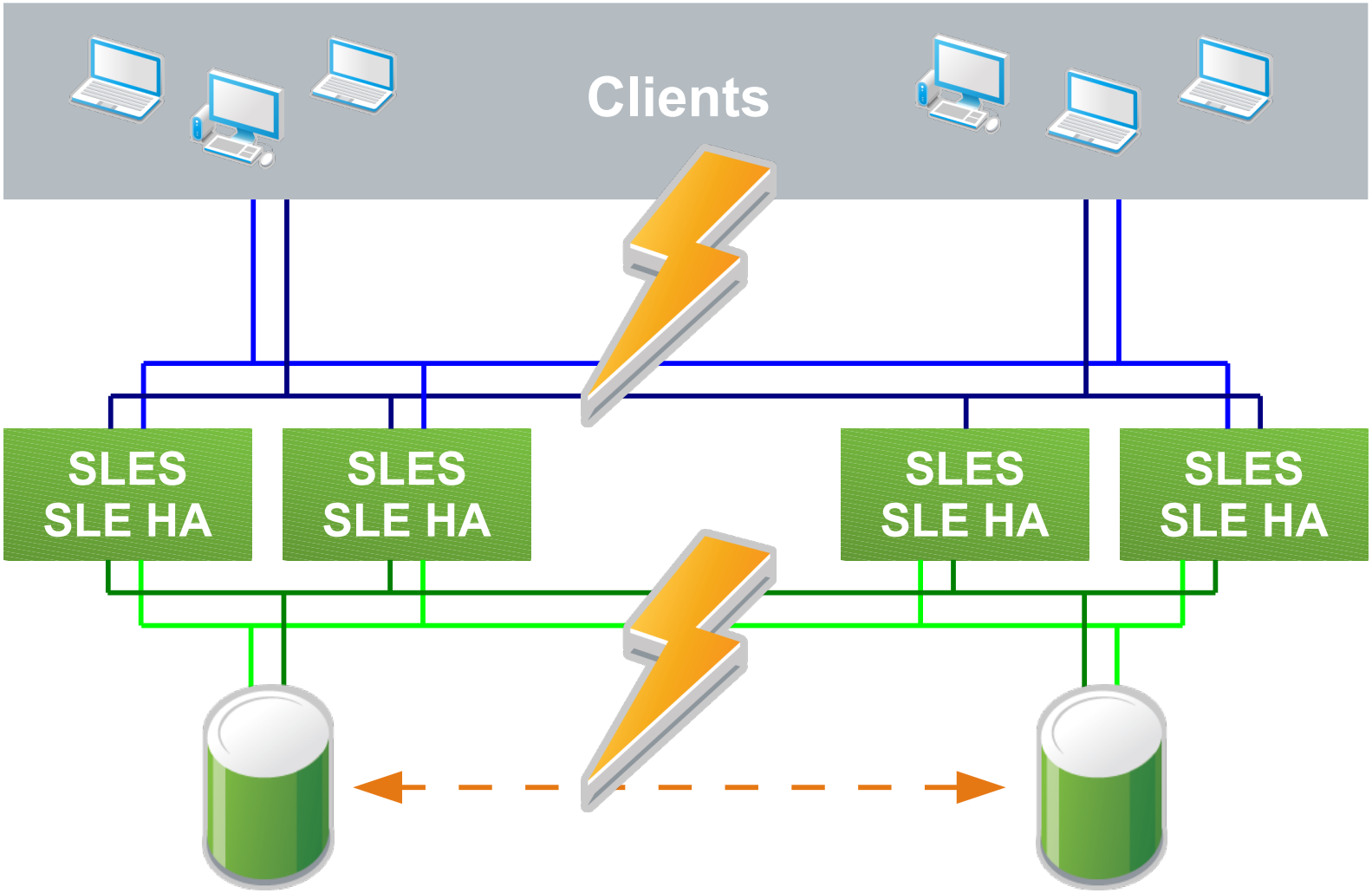
Geographical cluster with unlimited distance

Network based storage replication

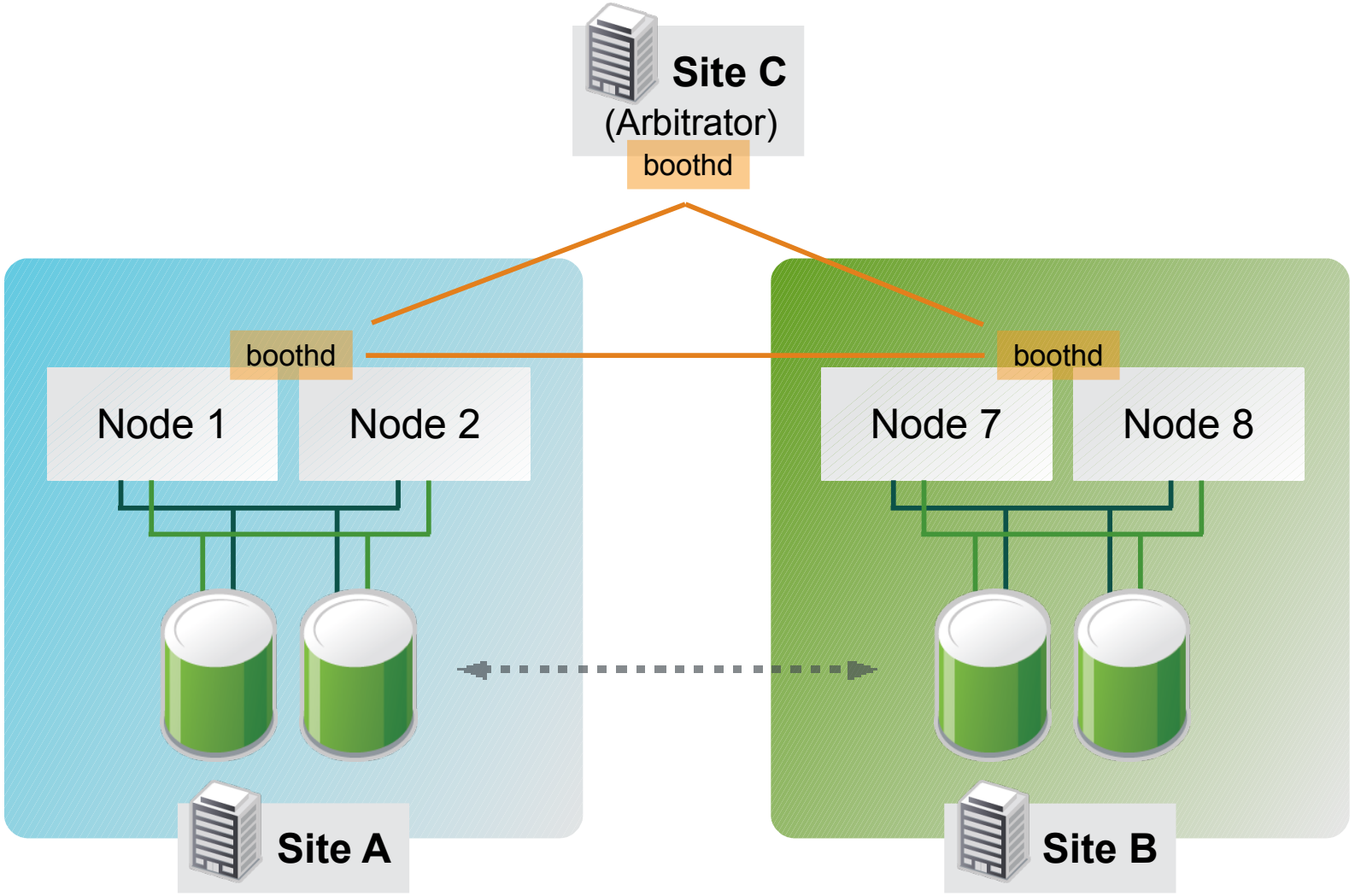
Up-to-date Open Source HA stack

Virtualization agnostic

Local & Stretched Cluster

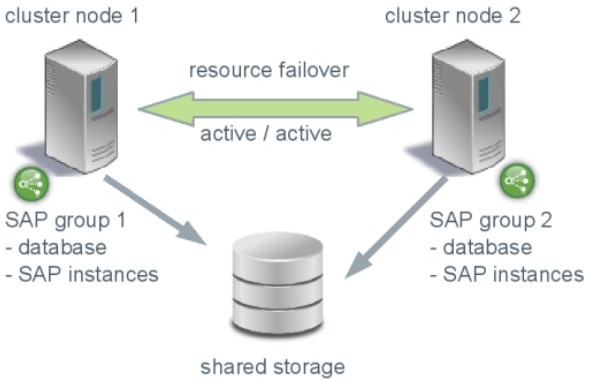


Geo Cluster – Setup

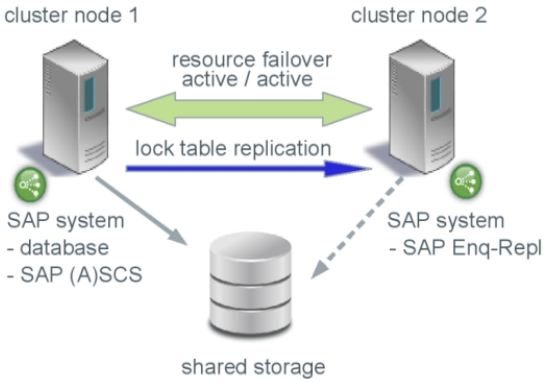


High Availability – Use Cases

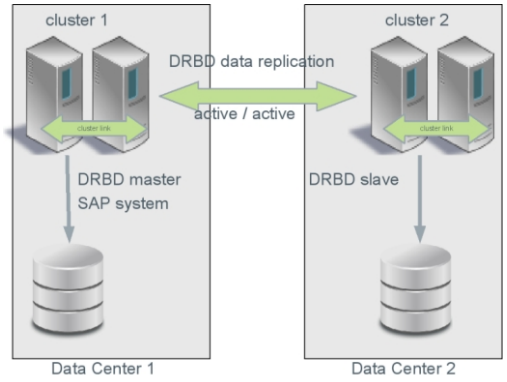
Simple Stack



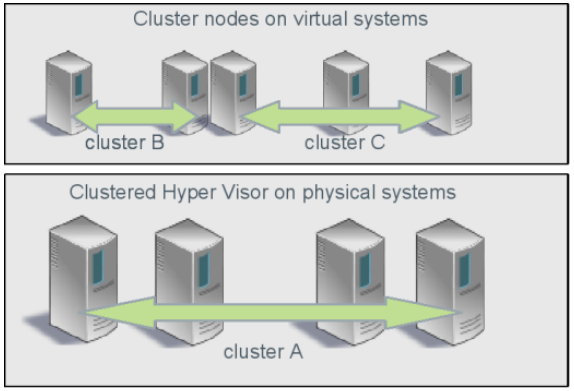
Enqueue Replication



DRBD Data Sync



HA in Virtual Environments



Misc

SUSE® Linux Enterprise 11 SP3

Kernel Capabilities

SLE 11 SP 3	x86	ia64	x86_64	s390x	ppc64
CPU bits	32	64	64	64	64
max. # logical CPUs	32	up to 4096	up to 4096	64	up to 1024
max. RAM (theoretical/practical)	64/ 16 GiB	1 PiB/ 8+ TiB	64 TiB/ 16TiB	4 TiB/ 256 GiB	1 PiB/ 512 GiB
max. user-/ kernelspace	3/1 GiB	2 EiB/φ	128 TiB/ 128 TiB	φ/φ	2 TiB/ 2 EiB
max. swap space	up to 31 * 64 GB				
max. #processes	1048576				
max. #threads per process	tested with more than 120000; maximum limit depends on memory and other parameters				
max. size per block device	up to 16 TiB	and up to 8 EiB on all 64-bit architectures			

Supported on certified hardware only

SUSE® Linux Enterprise 11 SP3

Filesystems

Feature	Ext 3	reiserfs	XFS	OCFS 2	btrfs
Data/Metadata Journaling	•/•	○/•	○/•	○/•	N/A [3]
Journal internal/external	•/•	•/•	•/•	•/○	N/A
Offline extend/shrink	•/•	•/•	○/○	•/○	•/•
Online extend/shrink	•/○	•/○	•/○	•/○	•/•
Inode-Allocation-Map	table	u. B*-tree	B+-tree	table	B-tree
Sparse Files	•	•	•	•	•
Tail Packing	○	•	○	○	•
Defrag	○	○	•	○	•
ExtAttr / ACLs	•/•	•/•	•/•	•/•	•/•
Quotas	•	•	•	•	○
Dump/Restore	•	○	•	○	○
Blocksize default	4KiB				
max. Filesystemsize [1]	16 TiB	16 TiB	8 EiB	4 PiB	16 EiB
max. Filesize [1]	2 TiB	1 EiB	8 EiB	4 PiB	16 EiB
Support Status	SLES	SLES	SLES	SLE HA	SLES

SUSE® Linux Enterprise was the first enterprise Linux distribution to support journaling filesystems and logical volume managers back in 2000. Today, we have customers running XFS and ReiserFS with more than 8TiB in one filesystem, and the SUSE Linux Enterprise engineering team is using our 3 major Linux journaling filesystems for all their servers. We are excited to add the OCFS2 cluster filesystem to the range of supported filesystems in SUSE Linux Enterprise. For large-scale filesystems, for example for file serving (e.g., with with Samba, NFS, etc.), we recommend using XFS. (In this table "+" means "available/supported"; "-" is "unsupported")

[1] The maximum file size above can be larger than the filesystem's actual size due to usage of sparse blocks. It should also be noted that unless a filesystem comes with large file support (LFS), the maximum file size on a 32-bit system is 2 GB (2^{31} bytes). Currently all of our standard filesystems (including ext3 and ReiserFS) have LFS, which gives a maximum file size of 2^{63} bytes in theory. The numbers given in the above tables assume that the filesystems are using 4 KiB block size. When using different block sizes, the results are different, but 4 KiB reflects the most common standard.

[2] 1024 Bytes = 1 KiB; 1024 KiB = 1 MiB; 1024 MiB = 1 GiB; 1024 GiB = 1 TiB; 1024 TiB = 1 PiB; 1024 PiB = 1 EiB (see also http://physics.nist.gov/cuu/Units/binary.html)

[3] Btrfs is a copy-on-write logging-style file system, so rather than needing to journal changes before writing them in-place, it writes them in a new location, and then links it in. Until the last write, the new changes are not "committed."

[4] Btrfs quotas will operate differently than traditional quotas. The quotas will be per-subvolume rather than operating on the entire filesystem at the user/group level. They can be made functionally equivalent by creating a subvolume per- user or group.

SUSE® Security – SUSE® Linux Enterprise

Security Today

System Hardening	YaST2 Security Center Documentation: Security an Hardening Guide
Application confinement	AppArmor
System Confinement	SE Linux (Stack Support)
Intrusion Detection (Filesystem)	AIDE
Fine-grained access rights	Filesystem POSIX capabilities
Encryption capabilities	Three ways: “Full Disk” – Volume – File System (eCryptFS)
Measure and monitor system integrity during (re)boot	Trusted Platform Modules (TPM) – Trusted Computing
Enhance Trusted Computing with processor-based separation functions	Trusted Execution Technology (TXT)
Boot process control (UEFI)	UEFI Secure Boot (Starting with SLE 11 SP3)

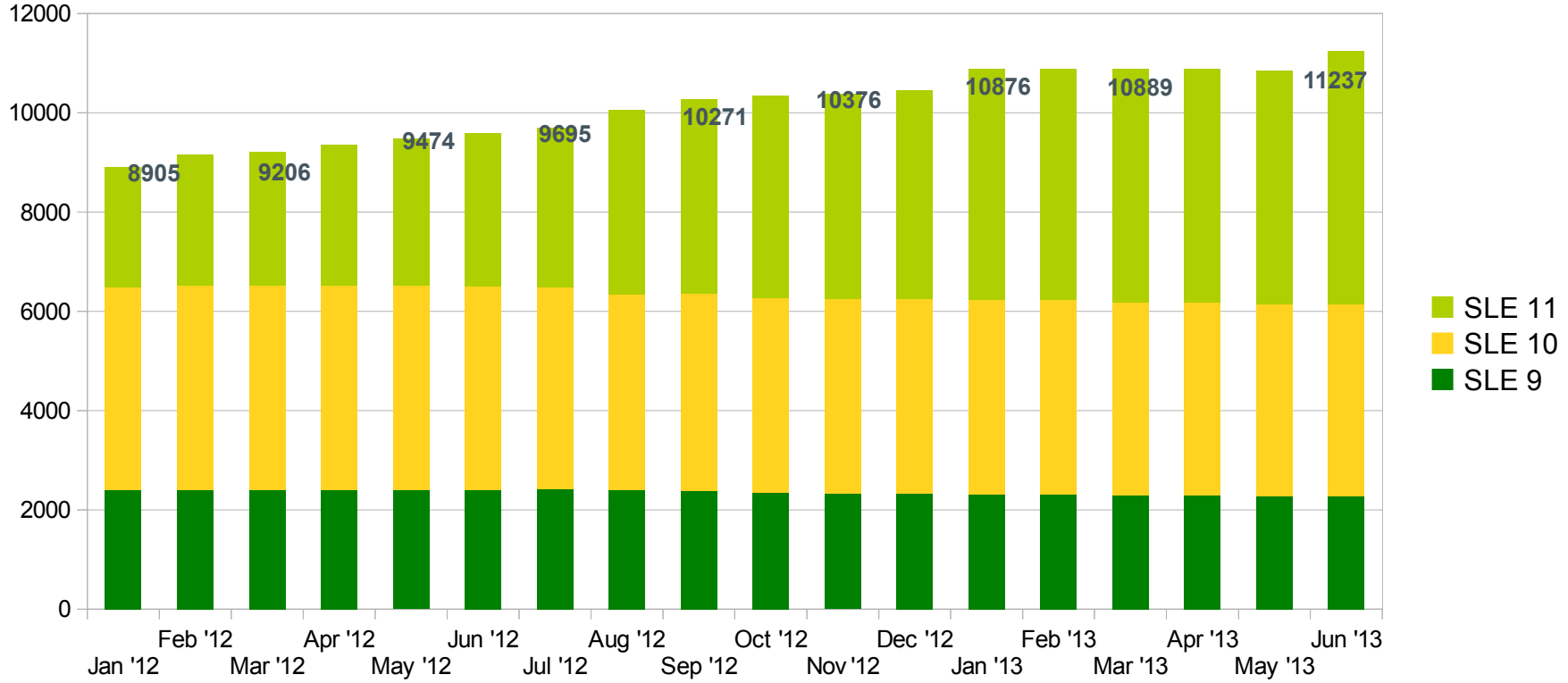
SUSE® Security – SUSE® Linux Enterprise

Certifications Today

Common Criteria	Common Criteria Certification in Evaluation Assurance Level 4 with augmentation according to the BSI OSPP (CC/OSPP EAL 4+)
FIPS 140-2	Module(s): openssl
IT Certification for Russia	FSTEK (currently for SLES 11 SP1 only)
Finance / PCI-DSS	Not a direct product certification. SUSE helped customers to achieve this with SLES and SLE POS
IPv6	USGv6
CGL	4.0

Partner Software Catalog Entries

by most recent version supported – June 2013



SUSE / Oracle Support Matrix

Oracle/Platform	SLES 9	SLES 10	SLES 11
10gR2			
x86_64	Certified	Certified	Certified
IBM Power	Certified	Certified	Certified
IBM System z	Certified	Certified	Certified
11gR1			
x86_64	N/A	Certified	Certified
11gR2			
x86_64	N/A	Certified	Certified
IBM System z	N/A	Certified	Certified

SUSE® Linux Enterprise

Documentation and Release Notes

- Product Pages
  - http://www.suse.com/products/server/
  - http://www.suse.com/products/sles-for-sap/
  - http://www.suse.com/products/highavailability/
  - http://www.suse.com/products/realtime/
- Unix to Linux Migration
  - http://www.suse.com/solutions/enterprise-linux-servers/unixtolinux.html
- Documentation
  - http://www.suse.com/documentation/
  - http://www.ibm.com/developerworks/linux/linux390/documentation_suse.ht
- Release Notes
  - http://www.suse.com/releasenotes/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