SUSE® Linux Enterprise
Server for System z
Current & Future Features - Roadmap

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What Do Have In Common

A Citizen of Miami-Dade County

A Farmer in South Africa

A Turkish Bank Cashier
They Rely On ...

SUSE Linux
Enterprise Server
for System z
We – This Is:

Marcus Kraft
Senior Product Manager
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Meike Chabowski
Senior Product Marketing Manager
chabow@suse.com
Agenda

- SUSE Linux Enterprise Life Cycle
- SUSE Linux Enterprise Server for System z Roadmap Update
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
SUSE Linux Enterprise Server

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

Linux you can rely on—for years to come
Run more mission-critical applications—physical, virtual and cloud
# Common Code Base

- Foundation for SUSE Linux Enterprise products
- Fully supported core system
- Choose the right Architecture for your workload

<table>
<thead>
<tr>
<th>SUSE Linux Enterprise platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server</td>
</tr>
<tr>
<td>Desktop <em>(Intel/AMD only)</em></td>
</tr>
<tr>
<td>SDK</td>
</tr>
<tr>
<td>HA</td>
</tr>
<tr>
<td>Appliances</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Binary Code Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel/AMD 32bit</td>
</tr>
<tr>
<td>AMD64/Intel64</td>
</tr>
<tr>
<td>Itanium</td>
</tr>
<tr>
<td>IBM POWER</td>
</tr>
<tr>
<td>IBM System z</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common (Open) Source Code Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop <em>(Intel/AMD only)</em></td>
</tr>
</tbody>
</table>
SUSE® Linux Enterprise

The SUSE® Build Service* Advantage

Development Contribution

- Linux Kernel
- LibreOffice
- YaST2
- ZYpp
- Snapper
- KVM
- Xen
- OCFS2
- New Linux HA Stack

Open Source Projects

Package Selection and Integration

Build Service
- Intel/AMD x86
- AMD64/Intel64
- Itanium
- POWER
- System z

Quality Testing
- Feature Test
- Manual Regression
- Automated Regression
- SUSE System Test

Enterprise Class Software
- SUSE Linux Enterprise

* SUSE Build Service is the internal entity of the OpenBuild Service

- Reduces production problems
- Consolidates IT skills across disparate systems
- Delivers critical updates in hours – not days or weeks
### Current SUSE® Linux Enterprise Streams

<table>
<thead>
<tr>
<th>Year</th>
<th>SLE 9</th>
<th>SLE10</th>
<th>SLE 11</th>
<th>SLE 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td></td>
<td>SP3</td>
<td>SP4</td>
<td>GA</td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
<td>SP2</td>
<td>SP3</td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td>EOGS: 07/2013</td>
<td>EOGS: 03/2016</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EOSS: 07/2016</td>
<td>EOSS: 03/2019</td>
</tr>
</tbody>
</table>

- 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.

Launch: Jul 8\textsuperscript{th} 2013
Service Pack Migration
**YaST** – unique, highly integrated local management tool
- Ease of use, effective learning curve; reduces training efforts
- Automation via AutoYaST for 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

- **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
SUSE Linux Enterprise Server for System z
What is SUSE Linux Enterprise Server for System z?

• Our Linux operating system **optimized** for IBM mainframes
  - Is an alternative to x86 platforms for **consolidating servers** and **virtualizing** Linux, UNIX and Windows **workloads**
  - Lets customers leverage the resiliency of System z servers, the power of SUSE Linux Enterprise Server for System z and the hypervisor capabilities of z/VM

• Creates a virtual environment that **lowers total cost of ownership** by
  - simplifying data center management
  - increasing flexibility
  - reducing downtime
Lower Risk
Mainframe Success

- **Back in 1999:** SUSE started cooperation with IBM and Marist College to port Linux code to IBM mainframes
- **Available since 2000:** SUSE Linux Enterprise Server for System z has been made available to customers in 2000
- **Entering a new market:** the only available enterprise-class Linux – commercially maintained and supported
- **Linux application leader:** broadest software support of any Linux distribution, get new workloads to the mainframe
- **80% market share in 2012:** SUSE Linux Enterprise Server for System z
Why Customers Prefer SUSE® Linux Enterprise Server for System z

**Additional advantages**

- All benefits of the mainframe (RAS) apply
- Five years ahead of competition (1st version in 2000)
- #1 in mainframe Linux market
- Ideal for workload consolidation, major cost savings
- Leverage economics of IFL
- New features specific to System z
- Hosting of Subscription Management Tool on System z
- Starter System available for testing and proofs of concept only for SUSE Linux Enterprise Server
- Building Images for System z with SUSE Studio
- Approx. 1,900 certified applications available
Unique Tools included with SUSE Linux Enterprise Server for System z
Unique Tools Included

• Starter System for System z
  – A pre-built installation server, deployable with z/VM tools
• **Free** High Availability Extension
  – Cluster Framework, Cluster FS, DRBD, GEO-cluster*
• AppArmor Security Framework
  – Application confinement
• YaST2 systems management
  – Install, deploy, and configure every aspect of the server
• Subscription Management Tool
  – Subscription and patch management, proxy/mirroring/staging
Starter System for System z

- A pre-built installation server that can be installed on your z/VM system using CMS tools
- Eliminates the need for coordinating access to a separate Linux or UNIX system elsewhere on your network
- Minimizes the impact of network-based installation on your internal and external networks
- Available for SUSE Linux Enterprise Server for System z 11 SP2
Enhance Your Applications
Examples

• SUSE Linux Enterprise High Availability Extension: make your workloads High Availability ready
  - Resource agents examples
    - /usr/lib/ocf/resource.d/heartbeat/* → example: Dummy resource agent
  - [http://www.opencf.org](http://www.opencf.org) Standard APIs for clustering functions

• AppArmor: secure your applications
  - Application confinement
  - Easy to use GUI tools with statics analysis and learning-based profile development
  - Create custom policy in hours, not days
SUSE® Linux Enterprise
High Availability Extension

Service availability 24/7
- Policy driven clustering
  - Messaging and membership layer
  - Pacemaker cluster resource manager

Sharing and Scaling data-access by multiple nodes
- Cluster file system
  - OCFS2
  - Clustered Logical Volume Manager

Disaster tolerance
- Data replication via IP
  - Distributed Replicated Block Device
- Node recovery

Scale network services
- IP load-balancing

User friendly tools
- Graphical user interface
- Unified command line interface
Local & Stretched Cluster

Clients

SLES SLE HA
SLES SLE HA
SLES SLE HA
SLES SLE HA

Clients

SLES SLE HA
SLES SLE HA
SLES SLE HA
SLES SLE HA
Geo Cluster – Setup

Site A

Node 1

Node 2

Site C
( Arbitrator)

boothd

Site B

Node 7

Node 8

boothd

boothd
AppArmor: usr.sbin.vsftpd
/etc/apparmor/profiles/extras/

#include <tunables/global>

/usr/sbin/vsftpd {
    #include <abstractions/base>
    #include <abstractions/nameservice>
    #include <abstractions/authentication>

    /dev.urandom r,
    /etc/fstab r,
    /etc/hosts.allow r,
    /etc/hosts.deny r,
    /etc/mtab r,
    /etc/shells r,
    /etc/vsftpd.* r,
    /etc/vsftpd/* r,
    /usr/sbin/vsftpd rwx,
    /var/log/vsftpd.log w,
    /var/log/xferlog w,
    # anon chroots
    / r,
    /pub r,
    /pub/** r,
    @{HOMEDIRS} r,
    @{HOME}/** rwx,
}
Subscription Management Tool
Overview

SMT is a proxy and auditing tool that mirrors the Customer Center and tightly integrates with it.

It allows you to accurately register and manage an entire SUSE® Linux Enterprise deployment, guaranteeing the subscription compliance and secure IT process flow organizations require.
SUSE Linux Enterprise 11 SP2
SUSE Linux Enterprise Server for System z 11 SP2
Specific Features

• Full Dynamic Resource Handling
  - Two levels of virtualizations available: LPAR and z/VM
    - Choose the level of isolation mandated by compliance
    - Flexible resource allocation and reallocation without downtime
  - CPU, memory, I/O hotplug
    - Provide the resource where they are needed in LPAR and z/VM guest

• Abundant memory, IO bandwidth and transaction capability
  - Hipersocket support connects Linux and z/OS applications and data
  - I/O fan out and transaction workload capacity is unmatched

• RAS
  - Detailed I/O device and other performance statistics available
  - Dump generation, handling and inspection tools
  - Centralized and uniform resources support DR recovery setups
  - SUSE Linux Enterprise High Availability Extension included
  - System z specific kernel messages with documentation
SUSE Linux Enterprise Server for System z 11 SP2
Specific Features

• z196 / z114 + zBX = IBM zEnterprise exploitation
  - CPU topology and instruction set exploitation of z196 (SDK)
  - New CHPID support connecting both environments
  - z9, z10 support continued

• Choose the right environment for the right workload
  - ISVs application support might mandate the platform
  - SLES supported for both hardware architectures

• Improved tools and z specific support
  - Disk storage & crypto enhancements
  - Linux RAS support, s390-tools update
Kernel 3.0
Selected benefits

• Most recent HW enablement
• Removal of BLK (Big Kernel Lock)
• Control Groups enhancements
  – I/O throttling support for process groups
  – memory cgroup controller
• Integration of AppArmor
• Transparent Huge Pages (THP)
• ...
Why btrfs?

**Btrfs (better fs) – Features**

- Scalability (16 EiB) including effective shrink
- Supports offline in-place migration from ext2, ext3
- Support for Copy on Write
- Powerful Snapshot capabilities
- Other Capabilities:
  - SSD optimization (TRIM support)
  - Data integrity (checksums)
Snapshots in SUSE Linux Enterprise 11 SP3

YaST2 Management
cgroups
cgroups - Resource Control

Consider a large university server with various users - students, professors, system tasks etc. The resource planning for this server could be along the following lines:

<table>
<thead>
<tr>
<th>CPUs</th>
<th>Memory</th>
<th>Network I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top cpuset (20%)</td>
<td>Professors = 50%</td>
<td>WWW browsing = 20%</td>
</tr>
<tr>
<td></td>
<td>Students = 30%</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td>System = 20%</td>
<td>\</td>
</tr>
<tr>
<td>CPUSet1</td>
<td></td>
<td>Prof (15%)</td>
</tr>
<tr>
<td></td>
<td>CPUSet2</td>
<td>Students (5%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Profs)</td>
<td>(Students)</td>
<td></td>
</tr>
<tr>
<td>60%</td>
<td>20%</td>
<td>Network File System (60%)</td>
</tr>
</tbody>
</table>

Source: /usr/src/linux/Documentation/cgroups/cgroups.txt
Device Subsystem
Isolation

A system administrator can provide a list of devices that can be accessed by processes under cgroup

- Allow/Deny Rule
- Allow/Deny : READ/WRITE/MKNOD

Limits access to device or file system on a device to only tasks in specified cgroup

cgroups - Memory Subsystem

- For limiting memory usage of user space processes.
- Limit LRU (Least Recently Used) pages
  - Anonymous and file cache
- No limits for kernel memory
  - Maybe in another subsystem if needed
- Note: cgroups need ~2% of (resident) memory
  - can be disable at boot time with kernel parameter "cgroup_disable=memory"

SUSE Linux Enterprise Server for System z 11 SP3
SUSE® Linux Enterprise
Server for System z 11 SP3

• zEC12 + zBX = IBM zEnterprise exploitation continued
  - zBC12, z/VM 6.3, zBX HX5 support (blade center extension)
  - z9 EC, z10 EC, z196 EC, z9 BC, z10 BC, z114 BC support
  - Java 7 and supportive kernel enhancements
  - Flash Express SC Memory support (/dev/scm)
  - GCC 4.7 for applications targeting zEC12 processor

• Improved RAS tools and System z specific support
  - 2 stage dump & network storage sharing with compression
  - Robust disk mirroring for large pools of DASDs (MD RAID10)
  - Enhanced DASD statistics for PAV & HPF
  - IUCV terminal server client & server setup support
  - s390-tools update
zEC12 Exploitation

• Kernel support to improve Java performance
  - Transactional Execution with Java 7
  - Middleware & applications using Java will benefit

• Storage class memory – Flash Express
  - Support new storage device: /dev/scm
  - IPL save 'disk storage' with low latency and high throughput

• Support for Crypto Express 4S cards
  - Hardware cryptographic acceleration

• Leverage Cross Memory Attach Functionality
  - Speedy middleware data exchange via shared main storage

• Backport GCC 4.7.x patches (SDK)
  - Add new instructions to the compiler (z196, zEC12)
  - Added new pipeline description to generate optimized code
Enhanced Dump Capabilities

- Two Stage Dumper framework
  - More flexible and efficient handling of dumps
- Compression of kernel dumps
  - More efficient use of disk storage, lower space requirements
- Fuzzy live dump
  - Extract current memory state of the kernel for (fuzzy) debugging
- Allow to compare dump system with boot system
  - Did the dump occurred on the system it was IPLed?
- Add option to mkdump to clean up older initrd's
  - Dump and initrd handling in /boot
- FICON DASD sanity check
  - Detect path connection errors
Misc

• Enhanced DASD statistics for PAV and HPF
  - Improved diagnosis and analysis
  - Supports recommendations on the use of eg PAV aliases

• Optimized compression library zlib
  - Enhanced to speed up Java, report generation, backup and installation

• ZYpp transaction auditing
  - Track transaction id also for client side

• libhugetlbfs support
  - Allow applications to benefit from hugetbls w/o recompile

• Enable larger shm segments than 256GB
  - Allows data bases to share larger areas
Technical Preview: KVM for s390x

• Kernel Based Virtual Machine
  - KVM (for Kernel-based Virtual Machine) is a virtualization solution for Linux on x86, POWER and z/Architecture hardware containing virtualization extensions.
    - It consists of a loadable kernel module, kvm.ko, that provides the core virtualization infrastructure and a processor specific module (eg. kvm-intel.ko or kvm-amd.ko)
    - KVM also requires a modified QEMU to connect to the I/O world of the hosting system.
    - Lowers the entry barrier for non-mainframe, but Linux skilled users to explore hardware and virtualization options of the mainframe
Tools / SDK
zPDT
IBM System z Personal Development Tool
https://www.ibm.com/partnerworld/page/pw_com_zpdt

• zPDT is a software-based application tool
  - 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 SP3+ x86_64, and others
  - SUSE's evaluation versions for x86_64 and s390x available at http://www.suse.com/products/server/eval.html
z196 exploitation via alternate GCC 4.6
Fate 311859 / [LTC 66797]
http://gcc.gnu.org/gcc-4.6/changes.html -> z196

• **Performance improvement for applications:** exploitation of new z196 processor instructions and optimized alignment of code (out-of-order pipeline architecture, conditional load/store instructions, new 3 register operand instructions, new atomic instructions, etc)

• **Customer benefit**

<table>
<thead>
<tr>
<th>technical</th>
<th>business</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Hardware exploitation of the z196 instruction set for user land applications (ISV and self compiled applications), recompile programs with --march=z196 and/or –mtune=z196</td>
<td>• z196 optimized code and efficient execution use less time and cycles for same workload</td>
</tr>
<tr>
<td></td>
<td>• Increase of application workload density per system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SLES</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SP1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SP2+3</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>SP4</td>
<td>-</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Developer Tools
Dynamic analysis tools

• valgrind
  - Memcheck
  - Cachegrind
  - Massif
  - Helgrind
  - DRD
  - None
  - Exp-ptrcheck
  - Callgrind

• http://valgrind.org
Software Lifecycle Management
# Customer Center

## Systems Information

**Marcus Kraft, Nuremberg, Bayern**

These are the systems that are activated against your subscriptions. Double-click on any line item to view details.

<table>
<thead>
<tr>
<th>My Groups</th>
<th>System Name</th>
<th>Updates</th>
<th>Location</th>
<th>OS</th>
<th>Last Checked In</th>
<th>Edit</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>d1isp1test</td>
<td>No Data</td>
<td>sl6-11:586</td>
<td>N/A</td>
<td>20 Oct 2011, 9:38 AM</td>
<td></td>
</tr>
<tr>
<td>Needs Activation</td>
<td>da2400</td>
<td>No Data</td>
<td>sl6-11:x86_64</td>
<td>20 Oct 2011, 12:16 PM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>utilia</td>
<td>No Data</td>
<td>sl6-11:586</td>
<td>27 Oct 2011, 12:16 PM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**System Legend**

- Active
- Evaluation
- Needs Activation
- Expired

---

*Account Rep: Customer Response Center [Send Email]*

*Service Rep: European Support Center*

+420 28 408 4051

support.novell.com

- Find Local Numbers
- Request call
- Buy
Subscription Management Tool

SMT

Customer's Network

SMT

Customer Center
How Does SUSE Manager Work?

- Customer Center
- Managed Systems
- SUSE Manager Server
  - Management
  - Provisioning
  - Monitoring
- API Layer
- IT Application
- Custom Content
- Web Interface
- Managed Systems
- SUSE Manager Proxy Server
- Firewall
SUSE® Manager
Management Module

- NCC integration
- ZYpp update stack
- Server groups
- Custom repositories
- SUSE Manager API
- Scheduler
- Role-based access control
- Search
- Virtual guest, appliance and System z management
Summary
SUSE® Linux Enterprise Server Entitlement for IBM zEnterprise and zBX

If you own or buy a SUSE Linux Enterprise Server for System z subscription you get full basic subscription entitlements for your x86_64 zBX blades.

If you own this... ...You get these
SUSE Offerings Summary
for SUSE Linux Enterprise Server for System z

• Attractive subscriptions & services are available: talk to us!
  - **Distinct Business Class and Enterprise Class pricing available** – TCO efficient entry
    - Adjusted pricing, attractive promotion, multi year, multi IFL discounts apply
    - [https://www.suse.com/promo/zbc-multiifl.html](https://www.suse.com/promo/zbc-multiifl.html)
  - **Multi year, multiple IFL subscriptions offer monetary value** – scale & save
    - For larger volumes, you get up to 45% of discount per subscription
  - **SUSE Linux Enterprise High Availability Extension included** – prevent outages
    - Additionally, save more than 500€ per IFL compared to distributed systems
  - **GEO-Clustering possible** – maximum protection across unlimited distances
  - **zBX offering** – 1 IFL, multiple zBX subscriptions – boost consolidation
    - Save up to $39k running your ensemble with SUSE Linux Enterprise Server
  - **Long Term Support Service available** – preserve your environments
How To Build a SUSE Environment

BUILD
your workloads

MANAGE
your environment

SUSE Studio
Build workloads for any platform and the cloud

SUSE Manager
Manage Linux workloads across platforms
SUSE® Linux Enterprise Server for System z

Summary

Available today
- IBM zEnterprise System exploitation
- Enhanced tools and z support
- Choose the right environment for the right workload
Consolidate. Reduce Complexity. Save on costs and efforts.

Learn more:

CAS1457  SICOOB, the second largest Linux on z implementation in the world
CAS1509  Building a Business Case for System z Linux
TT1395   How to Build an HA environment with Linux on IBM System z
TT1396   Effective Consolidation of Oracle Databases on Linux on IBM System z

Thank you.
Appendix
zEC12: Kernel support for Transactional Execution
Fate 314142 / [LTC 79946]
www.redbooks.ibm.com/redpieces/pdfs/sg248050.pdf → Transactional Execution (TX) facility

• **Description:** Allow user-space processes to use transactional execution (TX) and runtime instrumentation (RI). Supports hardware runtime instrumentation, that improves analysis of and optimization of the code generated by the new IBM JVM. Software locking overhead is minimized and scalability and parallelism is increased.

• **Customer benefit**

<table>
<thead>
<tr>
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</table>
| • improved Java performance  
• useful for lockless data structures and speculative compiler optimizations offering increased scalability and parallelism to drive higher throughput | • Java based workload consolidation |

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Support for Flash Express Storage Class Memory
Fate 314095 / [LTC 79955]
Device Drivers, Features, and Commands on SUSE Linux Enterprise Server 11 SP3
http://public.dhe.ibm.com/software/dw/linux390/docu/les3dd03.pdf → Chap. 6, p97

• **Description:** Flash Express SCM is accessed as storage-class memory increments as block devices `/dev/scm`, which can help to improve the paging rate and access performance for temporary storage.

• **Customer benefit**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>• Improves the paging rate and access performance for temporary storage</td>
<td></td>
</tr>
<tr>
<td>• Fast, low latency Linux disk storage</td>
<td></td>
</tr>
<tr>
<td>• Data storage device are combining properties of both storage and memory</td>
<td>• Database acceleration (eg. transaction log file), datawarehouse performance</td>
</tr>
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<tr>
<td>SP4</td>
<td>-</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Robust disk mirroring for large pools of DASDs
Fate 311379
SUSE document: How to operate a disk mirrored target with SUSE

• **Description:** Refurbished MD RAID10. Improve storage operation to enable continuous operation even in case of a temporary DS8000/ESS failure or timeout. This is a disk mirroring solution with real-time enhancement, based on LVM2/Device-mapper, with Linear-Mirror and Stripe-Mirror support.

• **Customer benefit**

<table>
<thead>
<tr>
<th>technical</th>
<th>business</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Migration paths from previous versions</td>
<td>• Continuous storage availability</td>
</tr>
<tr>
<td>• High Availability to bridge temp timeouts</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SLES</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SP1+2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SP3</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>SP4</td>
<td>-</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Support for crypto hardware zEC12 Crypto Express4S
Fate 314097 / [LTC 79958]
http://www-03.ibm.com/systems/z/advantages/security/zec12cryptography.html
http://www-03.ibm.com/systems/z/hardware/zenterprise/zec12_specs.html → Crypto Express 4S
Device Drivers, Features, and Commands on SUSE Linux Enterprise Server 11 SP3
http://public.dhe.ibm.com/software/dw/linux390/docu/les3dd03.pdf → Chap 34, p319

• **Description:** z90crypt device driver supports the Crypto Express 4 (CEX4) adapter card, which represents the newest-generation cryptographic feature and is designed to complement the cryptographic capabilities of the CPACF.

• **Customer benefit**

<table>
<thead>
<tr>
<th>technical</th>
<th>business</th>
</tr>
</thead>
<tbody>
<tr>
<td>• New modes for DES, 3DES, AES</td>
<td>• Enhanced security</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SLES</th>
<th>10</th>
<th>11</th>
</tr>
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<tr>
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</tr>
<tr>
<td>SP3</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>SP4</td>
<td>-</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Support up to 4 TiB of storage (main memory)
Fate 314338
http://www.vm.ibm.com/
https://www.suse.com/products/server/technical-information/ (needs update)

• **Description:** Max. 4 TB of storage is supported. This may however be reduced by limitations of the underlaying certified hardware. zEC12 offers up to 3.75 TiB of storage, supports up to 1TiB per LPAR, and z/VM 6.3 1TiB real memory, z/VM 6.2 256GB.

• **Customer benefit**

<table>
<thead>
<tr>
<th>technical</th>
<th>business</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Larger amount of memory for applications</td>
<td>• Larger consolidation scenarios</td>
</tr>
<tr>
<td>• More LPARs with large amount of memory</td>
<td>• More workloads per physical server</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SLES</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SP3</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>SP4</td>
<td>-</td>
<td>yes</td>
</tr>
</tbody>
</table>
Two Stage Dump Framework
Fate 314079 / [LTC 74309]
Using the Dump Tools on SUSE Linux Enterprise Server 11 SP3

• **Description**: kdump can be used to create system dumps, reduces both dump time and dump size and facilitates dump disk storage sharing. A setup GUI is provided by YaST.

• **Customer benefit**

<table>
<thead>
<tr>
<th>technical</th>
<th>business</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Dump time and size reduction</td>
<td>• Improve serviceability</td>
</tr>
<tr>
<td>• Dump disk space sharing</td>
<td>• Enable serviceability for customers that run huge images</td>
</tr>
<tr>
<td>• Improved easy of use</td>
<td></td>
</tr>
<tr>
<td>• Enhanced debugging capabilities,</td>
<td></td>
</tr>
<tr>
<td>potential reduction for problem resolution time</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>11</th>
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</tr>
<tr>
<td>SP3</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>SP4</td>
<td>-</td>
<td>n/a</td>
</tr>
</tbody>
</table>
**Crypto CPACF exploitation - libica part 2**

**Fate 314078 / [LTC 73703]**

weblink
doculink

- **Description:** Extends the libica library with new modes of operation for DES, 3DES and AES. These modes of operation (CBC-CS, CCM, GCM, CMAC) are supported by Message Security Assist (CPACF) extension 4, which can be used with z196 and later System z mainframes.

- **Customer benefit**
  
<table>
<thead>
<tr>
<th>technical</th>
<th>business</th>
</tr>
</thead>
</table>
  | • New modes for DES, 3DES, AES  
  | • z196 and zEC12 crypto function support | • Enhanced security |

<table>
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<tr>
<td>SP3</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>SP4</td>
<td>-</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Optimized compression library zlib
Fate 314093 / [LTC 79949]
http://www.zlib.net/ → ver 1.2.7
ftp://ds.internic.net/rfc/rfc1950.txt (zlib format), rfc1951.txt (deflate format) and rfc1952.txt (gzip format)

• **Description:** Optimized compression library zlib by using dedicated SSE instructions and optimized compile options. The compression library zlib is used by Java (decompression of class files), Cognos (PDF generation), TSM (backup) and for Linux installations (binaries compressed in RPMs)

• **Customer benefit**

<table>
<thead>
<tr>
<th>technical</th>
<th>business</th>
</tr>
</thead>
</table>
| • Java: decompressions of class files  
  • TSM: backup  
  • Faster rpm installation & update | • Better performance for specific use cases, expected target is about 10 % improvement |

<table>
<thead>
<tr>
<th>SLES</th>
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</thead>
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</tr>
<tr>
<td>SP3</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>SP4</td>
<td>-</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Support of VEPA mode for System z
Fate 314595 / [LTC 86528]

VEPA Mode

• **Description:** Virtual Edge Port Aggregator (VEPA) is part of the IEEE 802.1Qbg standard designed to reduce the complexities associated with highly virtualized deployments such as hypervisor virtual switches bridging many virtual machines.

• **Customer benefit**

<table>
<thead>
<tr>
<th>technical</th>
<th>business</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The switch then becomes a single point of control for security, filtering, and management</td>
<td>• Security</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SLES</th>
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</tr>
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<td>-</td>
</tr>
<tr>
<td>SP3</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>SP4</td>
<td>-</td>
<td>n/a</td>
</tr>
</tbody>
</table>
zEC12 support for SDK gcc 4.7
Fate 314830

- **Description:** ISVs can make use of new instructions provided by zEC12, zBC12. Enables applications to significantly improve performance through full use of architecture specific code (z9, z10, z196, zEC12) and instruction scheduling.

- **Customer benefit**

<table>
<thead>
<tr>
<th>technical</th>
<th>business</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use of new instructions to accelerate applications</td>
<td>• Improved workload consolidation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SLES</th>
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</tr>
</thead>
<tbody>
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<td>-</td>
</tr>
<tr>
<td>SP3</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>SP4</td>
<td>-</td>
<td>n/a</td>
</tr>
</tbody>
</table>
# SUSE® Linux Enterprise 11 SP3

## Kernel Capabilities

<table>
<thead>
<tr>
<th>SLE 11 SP 3</th>
<th>x86</th>
<th>ia64</th>
<th>x86_64</th>
<th>s390x</th>
<th>ppc64</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU bits</td>
<td>32</td>
<td>64</td>
<td>64</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>max. # logical CPUs</td>
<td>32</td>
<td>up to 4096</td>
<td>up to 4096</td>
<td>64</td>
<td>up to 1024</td>
</tr>
<tr>
<td>max. RAM (theoretical/practical)</td>
<td>64/16 GiB</td>
<td>1 PiB/8+ TiB</td>
<td>64 TiB/16TiB</td>
<td>4 TiB/256 GiB</td>
<td>1 PiB/1.5 TiB</td>
</tr>
<tr>
<td>max. user-/kernelspace</td>
<td>3/1 GiB</td>
<td>2 EiB/φ</td>
<td>128 TiB/128 TiB</td>
<td>φ/φ</td>
<td>2 TiB/2 EiB</td>
</tr>
<tr>
<td>max. swap space</td>
<td></td>
<td>up to 31 * 64 GB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>max. #processes</td>
<td></td>
<td></td>
<td></td>
<td>1048576</td>
<td></td>
</tr>
<tr>
<td>max. #threads per process</td>
<td></td>
<td>tested with more than 120000; maximum limit depends on memory and other parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>max. size per block device</td>
<td></td>
<td>up to 16 TiB and up to 8 EiB on all 64-bit architectures</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Supported on certified hardware only
### Filesystems

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

[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.
Resources
Product Pages

Unix to Linux Migration

Documentation
- http://www.suse.com/documentation/

Release Notes
- http://www.suse.com/releasenotes/
Resources (check)

- Product website
  www.suse.com/products/systemz

- Customer References
  www.suse.com/success → extended search for SUSE Linux Enterprise Server for System z

- Download SUSE Linux Enterprise Server for System z
  www.suse.com/products/server/eval.html

- Promotion Website
  www.novell.com/products/systemz/els.html

- Partner Website
  www.suse.com/mainframe

- Starter System for System z
  www.suse.com/partner/ibm/mainframe/startersystem.html
Resources

- SUSE Linux Enterprise Server and IBM zEnterprise

- zBX entitlement for SUSE Linux Enterprise Server offering

- SUSE Linux Enterprise Server for System z
  http://www.suse.com/products/systemz/

- IBM zEnterprise Success Story
  https://www.suse.com/success/#suselinuxenterpriseserverforsystemz

- IBM System z Personal Development Tool (zPDT) Live Demo
  https://www.suse.com/media/content/ibm-system-z-personal-development-tool-zpdt-live-demo.html

- SUSE Manager
  http://www.suse.com/products/suse-manager

- SUSE Studio
  http://www.susestudio.com
SUSE to Go
Mobile Enablement App

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