



# SUSE® in the Enterprise

1

13

20

70

80

# SUSE<sup>®</sup> Linux Enterprise Technology Roadmap

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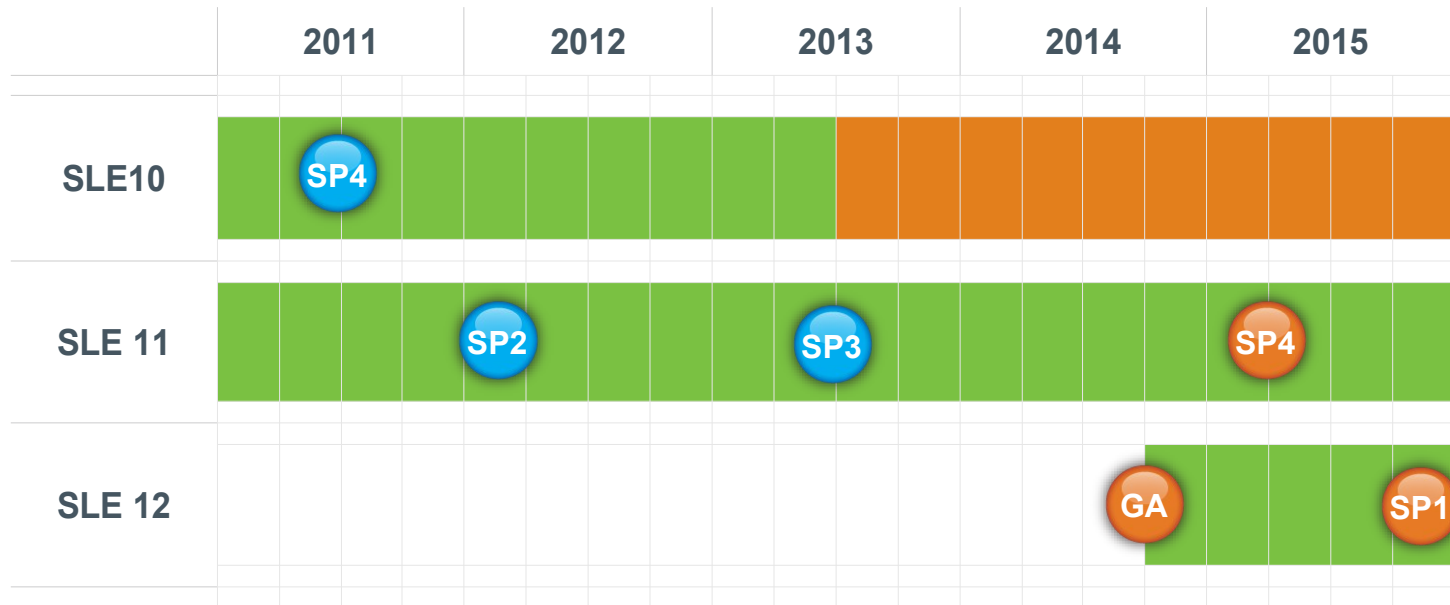


# Agenda

- Lifecycle Overview
- What We Do and How We Do It
- Server and Desktop Technology
  - Today
  - Tomorrow
  - Future
- Unix to SUSE Linux Enterprise

# Lifecycle Overview

# SUSE® Linux Enterprise Lifecycle & Code Streams



13-year lifecycle

For SLES 11 and SLES 12,  
10 years general support,  
+3 years Long Term Support

SUSE Linux Enterprise 12

Long Term Service Pack  
Support for every Service Pack

# SUSE® in the Enterprise

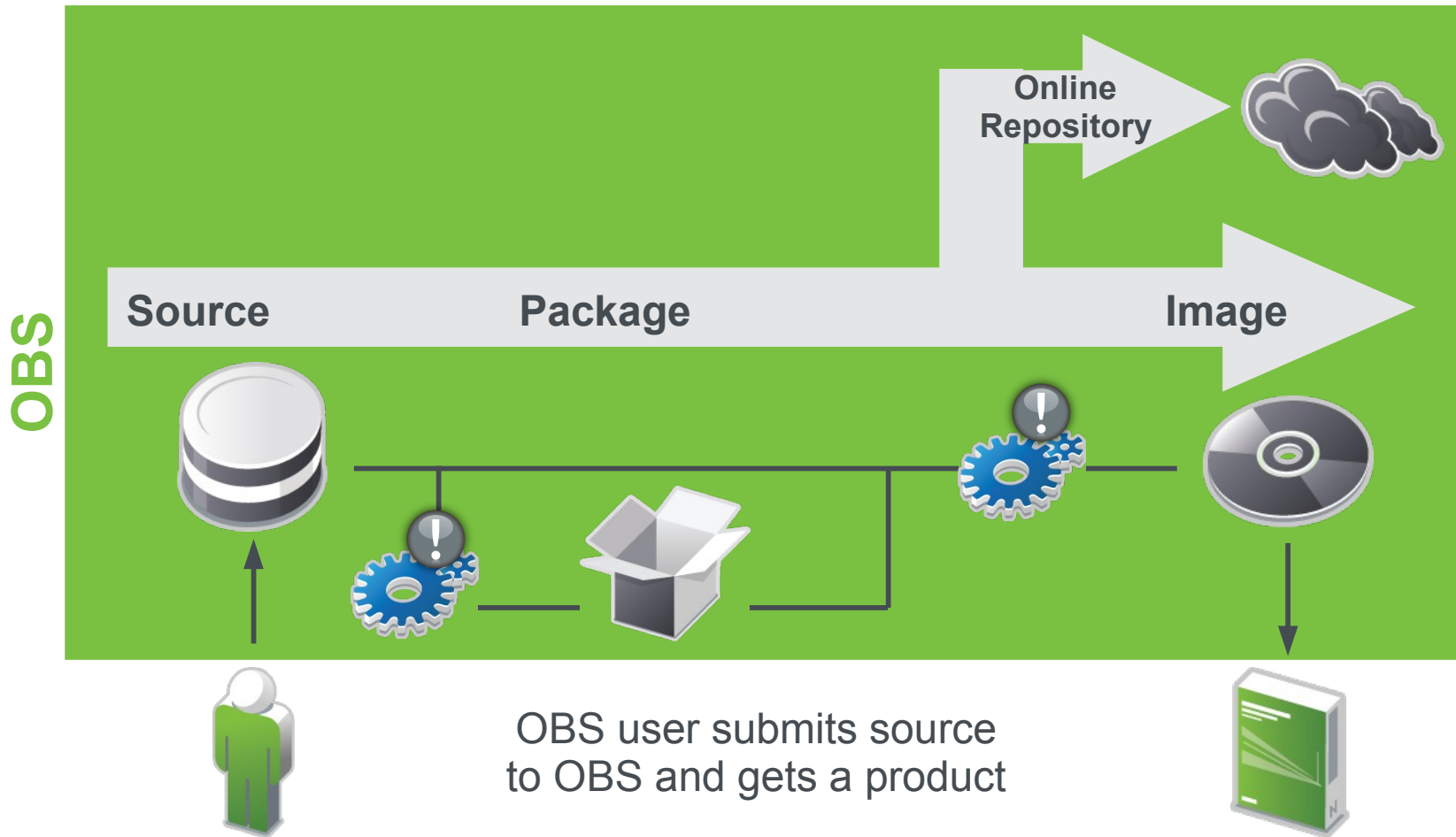
**13**      **Years Support**

What We Do and How We Do It

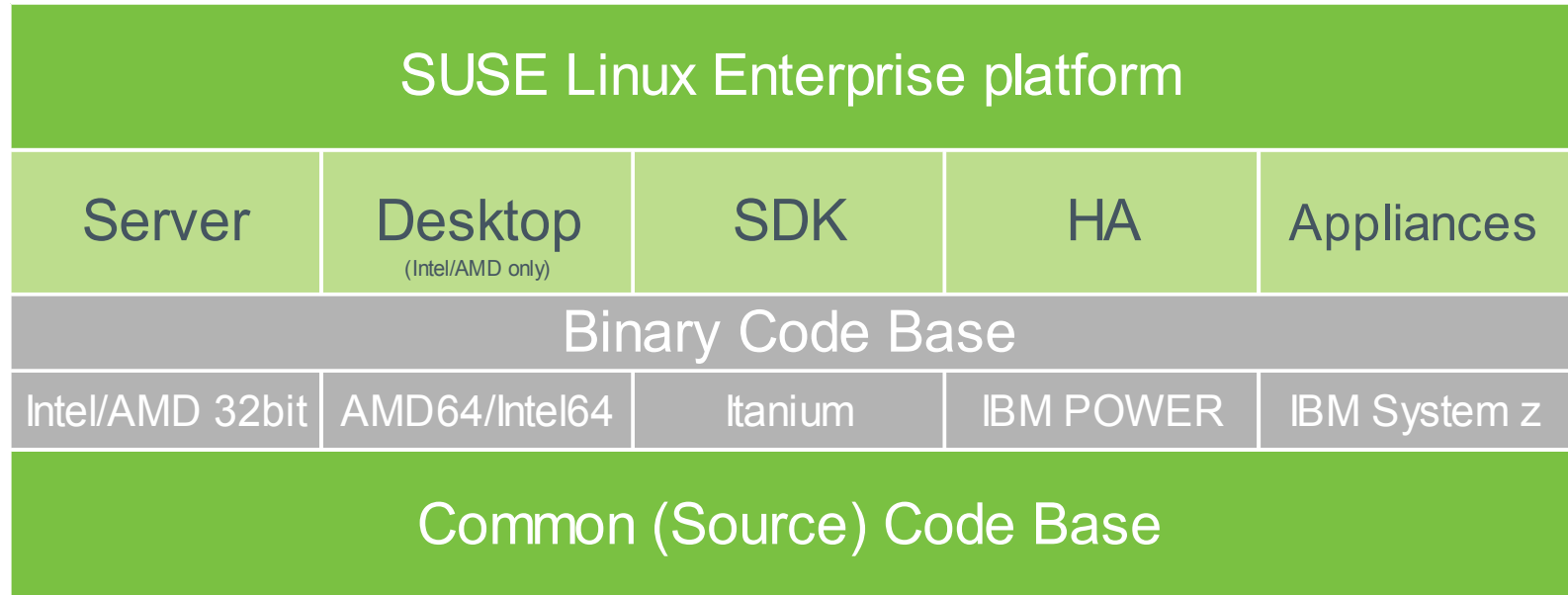


# SUSE® Linux Enterprise

## How We Build It

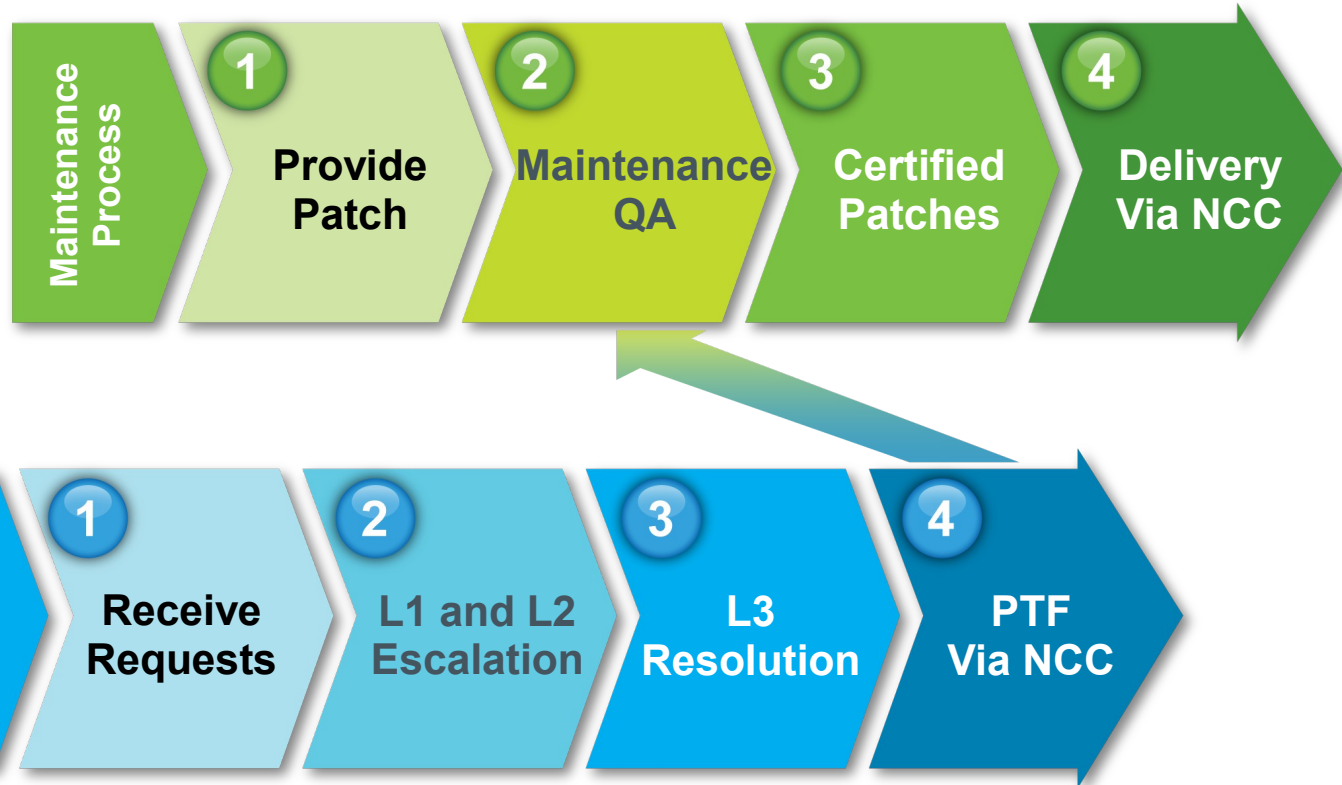


# SUSE® Linux Enterprise How We Lego It



- Foundation for all SUSE® products
- Fully supported core system
- Choose the right architecture for your workload

# SUSE® Maintenance and Support



PTF = Program Temporary Fix

NCC = The webservice where customer interact with the support organization and get access to packages and patches

# Forward Looking Development Model



New Features and  
Functionality  
Faster

Improved RAS,  
Scalability and  
Security



More Hardware  
Choice (especially  
newer)

Application  
Compatibility



Smart Innovation, Enterprise Quality  
and Investment Protection

# SUSE® in the Enterprise

**13**      **Years Support**

**20+**      **Years in Linux**

# Server and Desktop Technology

Today – Tomorrow – Future

# SUSE® – Technology Leadership

Today

Solaris Compete  
Leader in SAP &  
System z

Tomorrow

Exceed Unix and  
other OSs  
Leader in Mission  
Critical  
Infrastructures

# Server and Desktop Technology

- Scalability
- Virtualization & Cloud
- Reliability, Availability, Serviceability (RAS)
- Systems Management
- Interoperability
- Security and Certifications



Scalability

# Scalability Today (1)

- The **only** OS for **SAP** HANA
- The enterprise Linux OS that helps customers
  - Scale with their hardware and  
Compute huge amounts of data in memory
  - Most scalable Linux OS – YES certified system with 4096 logical CPUs and 16 TiB RAM  
<https://www.suse.com/nbswebapp/yesBulletin.jsp?bulletinNumber=138700>
- Deploy huge amounts of data
  - By supporting SGI's **XFS** for 10 years
  - By introducing support for **btrfs**

## Scalability Today (2)

- **System interconnect**
  - 8G/16G fiber channel, 10G/40G Ethernet adapter
  - DCB (Data Center Bridging) support
  - OFED 1.5.4.1, Infiniband
- **Thin-provisioning**  
better storage utilization by over-commit
  - btrfs
  - LVM
- **Multiple choice of standards for network convergence**
  - iSCSI LIO target: throughput and performance
  - FCoE

# Scalability Tomorrow and Future

- Network filesystem capabilities (NFS/pNFS)
  - Improve IPv6 support for NFSv3 and NFSv4
  - pNFS server support for a later version of SUSE Linux Enterprise High Availability Extension
- Support for new floating point and crypto hardware
- Availability on systems with large numbers of lower power CPUs
- Improve resource management and accounting functionality for containers
- Distributed storage option

# SUSE® in the Enterprise

**1<sup>st</sup>**      **Leading OS: Scalability**

**13**      **Years Support**

**20+**      **Years in Linux**

**70%**      **SAP on Linux**

Reliability

# SUSE® Linux Enterprise Reliability Today

- Strong cooperation with IBM
  - Optimization for mission-critical workloads on **System z**
- Hardware RAS features on **Intel 64**
  - x86-64 systems **on par with traditional RISC systems**
- Support for the **btrfs** filesystem – filesystem integrity
- Large blade centers benefit from **swap over NFS**
  - Centralize swap space and improve availability
- **Built-in** open source **MultiPath I/O (MPIO)**
  - Replace expensive proprietary solutions.

# SUSE® Linux Enterprise Reliability Tomorrow

## Continuously Running Systems (1)

Snapshot / Rollback for full system – Based on  
btrfs + Snapper + Bootloader integration

Goal

Have **well known state** where to go back

Gives **Peace of mind** for

- Kernel Upgrades
- Service Pack installations



# SUSE® Linux Enterprise Reliability Future

## Continuously Running Systems (2)

Migrate processes to more reliable memory/CPU

- Requires hardware support
- SUSE working with major CPU vendors and OEMs

Goal

Reduce Unplanned Downtime

System and Applications **survive** Hardware Errors which otherwise would have been disastrous.

Virtualization

# SUSE® Linux Enterprise Virtualization **Today (1)**

- Built-in Virtualization **Host**
  - **KVM**
    - I/O improvements, storage and network device hotplugging
    - **Microsoft Windows Server 2012 and Windows 8 support**
  - **Xen**
    - Latency improvements, flexible partitioning
    - Better fault handling, improved scalability and performance
- **Perfect guest**
  - VMware ESX
  - Microsoft Hyper-V (including clustering)
  - Citrix XenServer
  - SUSE Linux Enterprise with Xen and KVM
  - SUSE Linux Enterprise Server for VMware



# SUSE® Linux Enterprise Virtualization **Today** (2)

- **Linux Containers (LXC)**
  - Manage several workloads
  - one Linux instance
  - In a lightweight manner: **control groups** based
- Virtual machine driver pack: paravirtualized drivers
  - Increase performance, improve reliability and stability
  - Virtual Machine Driver Pack 2.1 (see appendix)
- SUSE Appliance Program and **SUSE Studio™** for easy building, testing, distributing and managing of stack

# SUSE® Linux Enterprise Virtualization Tomorrow

- Support for **Xen** and **KVM**
  - **KVM** inherits from the Linux kernel
    - Power-saving capabilities and
    - Scalability improvements
  - KVM on System z (Technology Preview)
  - Goal: **Smooth migration between Xen and KVM**
- **Perfect guest**
  - Tuning according to hypervisor
- **Containers**
  - More detailed control and tuning for single processes and process groups
  - Improve container security

# Systems Management

# 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)
- **Major Version** upgrade in the 4<sup>th</sup> generation
- **Unattended migration** from SUSE Linux Enterprise 10 to SUSE Linux Enterprise 11 reduces cost and downtime

# Systems Management **Today**

- Snapshot-Rollback for package updates with
  - **btrfs**
  - ZYpp/zypper
  - **snapper**
  - Rollback changes to the system, which have been unwanted (administrator error) or did show unwanted results or side effects



# SUSE® Linux Enterprise Systems Management Tomorrow

- System Installer
  - Improved Workflow → Reduced installation time and effort
- Next generation YaST based on Ruby
  - Community participation
- Overhaul of network management framework  
→ Open Source Wicked solution
- Open and standardized interfaces

Interoperability

# SUSE® Linux Enterprise Interoperability Today (1)

- **Active Directory**
  - Authentication to Windows domains **at OS install time** (YaST)
  - **Integration** with native SUSE Linux Enterprise systems management stack and security capabilities (e.g. PAM)
  - **No need for additional software**
- **Remote Desktop Protocol (RDP, Windows environments)**
  - xrdp server on AMD64/Intel64
  - FreeRDP client
- **Samba 3.6**
  - SMB2 protocol support
- **NFSv4.x, pNFS client support**
  - Next-generation **network infrastructure** and filesystems (interoperability with UNIX systems)

# SUSE Linux Enterprise Interoperability – Today (2) – IPv6

- **Leading OS – IPv6** compatibility and certification (USGv6)
  - <https://www.iol.unh.edu/services/testing/ipv6/usgv6tested.php>
- Tested szenarios
  - DHCP6 server and client
  - IPv6 support in NFS
  - Ensure IPv6 capabilities with UEFI network boot
- IPv6 support for all major Network services

# SUSE® in the Enterprise

**1<sup>st</sup>**      **Leading OS: Scalability, IPv6**

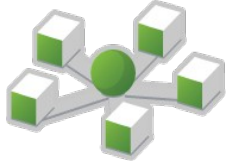
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**80%**      **Linux on IBM System z**

# SUSE Linux Enterprise Interoperability – Tomorrow



- Network
  - IPv6 (USGv6)



- Virtualization and Cloud
- Operating Systems Interop



- Windows
- UNIX
- Linux



- Standards Compliance
  - Security (NIST, BSI)
  - Accessibility

# SUSE Linux Enterprise Interoperability – Tomorrow – Samba 4

- Better **Distributed Filesystem** (DFS) capabilities
- File Server Remote VSS Protocol (FSRVP)
  - Server: integration with btrfs and Snapper
  - Client
- Server-side copy enhancements (btrfs backend)
- Protocol enhancements
  - Encryption
  - SMB 3.0 negotiation

## Benefit

- Authentication with recent Windows / AD Servers
- Linux Server behaves as expected (FSRVP)



# Security and Certifications



# SUSE® Linux Enterprise Security and Certifications Today

System Hardening	YaST2 Security Center
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)
Certifications	CGL 4.0
Measure and monitor system integrity during (re)boot	Trusted Platform Modules (TPM) – Trusted Computing

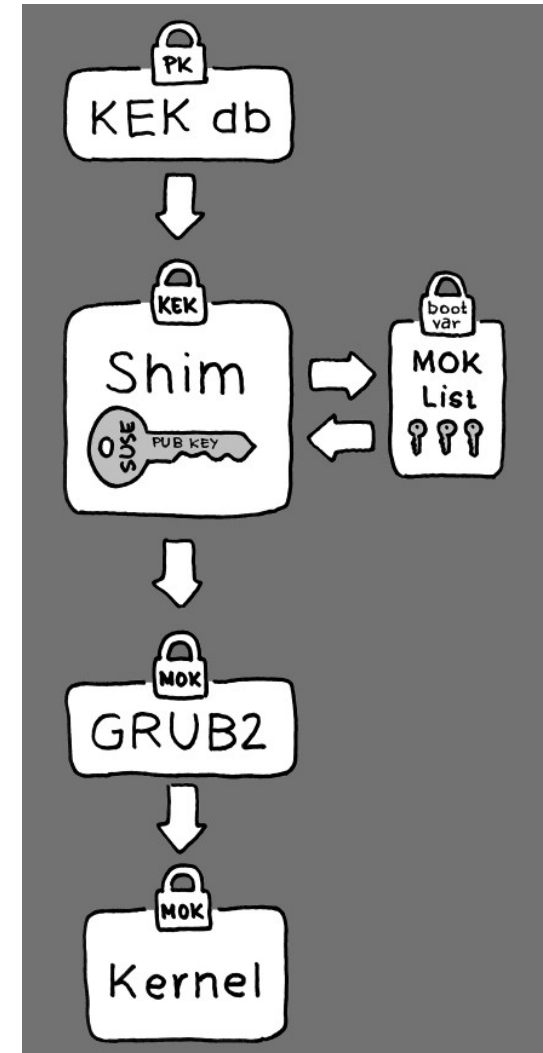
# Security and Certifications Today

- Achieved **Common Criteria Certification** (Feb 2013)
  - Evaluation Assurance Level 4 with augmentation according to the
  - BSI OSPP (CC/OSPP EAL 4+)
- **FIPS 140-2 Certification**
  - “libopenssl” module
  - tentative/future modules based on customer demand
- **Trusted Execution Technology (TXT)**
  - Enhances Trusted Computing with processor-based separation functions on a page-level in memory
  - Keep systems in consistent and proven (“measured”) state
  - in virtual environments and cloud

# SUSE® Linux Enterprise Security Today and Tomorrow

## UEFI Secure Boot

- Implementation of UEFI Secure Boot started with SUSE Linux Enterprise 11 SP3
- Refine implementation for SUSE Linux Enterprise 12
  - Key Handling
  - Usability
  - Working with HW vendors on better integration
- More information, see the blogs from Vojtech Pavlik and Olaf Kirch at: <https://www.suse.com/blogs/>



# Security and Certifications Tomorrow

- Standards and Certifications
  - Technical Preparation for Common Criteria certification and FIPS 140-2/-3 validation
  - NIST (SP) 800-131a compliance (Cryptography)
- Linux Security Modules
  - SELinux support, including MLS policy
  - AppArmor support
- Research
  - Next level of Trusted Computing / Attestation

# Unix to Linux

# Unix to Linux – Approach

From Unix ...	... to SUSE Linux Enterprise
Proprietary	Free and Open
One Architecture	Multiple Architectures
Interoperability as AddOn	Interoperability as a Principle
Vendor specific Communities	Partner-, Customer- and Developer Community

# Unix to Linux – Technology

## From Unix ...

Architecture specific  
Virtualization

Separate High Availability  
solutions

Static Configuration

- SysVInit
- Network scripts
- CoW filesystems

## ... to SUSE Linux Enterprise

Built-in Virtualization:  
Xen, KVM, Containers

Integrated High Availability  
solution

Dynamic Configuration

- SystemD
- Wicked
- Snapper with D-BUS

# SUSE® – Technology Leadership

**Today**

Solaris Compete  
Leader in SAP &  
System z

**Tomorrow**

Exceed Unix and  
other OSs  
Leader in Mission  
Critical Infrastructures



# SUSE® in the Enterprise

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**Your Questions!?**

Thank you.



# Appendix

# SUSE® Linux Enterprise 11 SP3

## Kernel Capabilities

SLE 11 SP3	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

# 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 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.

# 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/desktop/>
- <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/>

- Release Notes

- <http://www.suse.com/releasenotes/>



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