In-place upgrades - Get your SLES12 on!
TUT1404

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Agenda

Upgrades Types and Options
- SUSE Linux Enterprise Support Lifecycle
- Service Pack Upgrade – SLES12 GA/SP[1-3] to SLES 12 SP4
- Major Version Upgrade – SLES11 to SLES12 or SLES15
  - SLES12 to SLES15
- SLES 12/15 Upgrade Considerations, Planning, and Pre-Requisites

Supported Upgrade Paths / Demo (Offline/Down Server)
- Attended / Interactive, & Unattended
- SLES 11 to SLES 12
- SLES 12 to SLES 15

Automated Upgrades – SUSE Manager!
SUSE provides a thirteen year product lifecycle for SUSE Linux Enterprise 11, 12, and 15.

<table>
<thead>
<tr>
<th></th>
<th>General Support</th>
<th>Extended Support</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Years 1-5</td>
<td>Years 6-7</td>
</tr>
<tr>
<td>Maintenance Patches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical Support</td>
<td></td>
<td></td>
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<tr>
<td>Security Patches</td>
<td></td>
<td></td>
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<tr>
<td>Defect Resolution</td>
<td></td>
<td></td>
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<tr>
<td>Service Packs</td>
<td></td>
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<tr>
<td>Additional Hardware Enablement and Software Enhancements</td>
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<td></td>
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</tbody>
</table>

https://www.suse.com/support/policy/
SUSE Linux Enterprise Server
Support Lifecycle - Current Shipping Releases

SLES 11 SP4 -- Last SP for SLES 11!
General Support: March 2009 – 2022
Service Pack Release Date: 15 Jul 2015
End of General Support: 31 Mar 2019
End of LTSS/Extended Support: 31 Mar 2022

SLES 12 SP3 -- Release Date: 07 Sept 2017
End of General Support: 30 Jun 2019
End of LTSS Support: 30 Jun 2022

SLES 12 SP4 -- Release Date: 12 Dec 2018
End of General Support: 6 Months following release of SLES 12 SP5
LTSS will be provided for three years following End of General Support

https://www.suse.com/lifecycle/
SUSE Linux Enterprise Server 15
Support Lifecycle - Current Shipping Releases

SLES 15 -- Release Date: 16 Jul 2018
End of General Support: 6 Months following release of SLES 15 SP1
LTSS will be provided for three years following End of General Support

SLES 15 SP1 **BETA** -- Release Date: Summer 2019
End of General Support: 6 Months following release of SLES 15 SP2
LTSS will be provided for three years following End of General Support

https://www.suse.com/lifecycle/
SLES for SAP Applications

SLES11 SP4 – End of General Support 31 March 2019
• LTSS Support: 1 April 2019 through 31 March 2022
• LTSS Support Terms and Conditions Apply

SLES12 / SLES15: All releases
• 4.5 years total maintenance and support per service pack release
• ESPOS phase begins with End of General Support for each Service Pack release
• ESPOS = LTSS Lifecycle, LTSS Support Policy, and LTSS T&C’s

ESPOS = Extended Service Pack Overlay Support
LTSS = Long Term Service Pack Support
Before you START: Upgrade Preparation

- Check the release-notes
  - https://www.suse.com/releasenotes/x86_64/SUSE-SLES/12-SP3/
  - https://www.suse.com/releasenotes/x86_64/SUSE-SLES/12-SP4/
  - https://www.suse.com/releasenotes/x86_64/SUSE-SLES/15/

- Check disk space and filesystem requirements
  - Is there enough free disk space?
  - Software tends to grow from version to version
  - Remember: BTRFS snapshots require additional disk space

- Make a backup – TEST YOUR BACKUP!

- If using a virtual machine snapshot, shutdown your virtual machine

- If needed, migrate your PostgreSQL/MariaDB database
  - Upgrade to PostgreSQL to v9 on SLES11 before upgrading to SLES12/15
SUSE Linux Enterprise Deployment / Upgrade Scenarios
History and Context

- Major Version upgrades have been supported and available for customers since December, 2010. (Starting with SLES 10 SP2 to SLES 11 SP1)
- AutoYAST Installer Upgrade workflow was initially released as a Driver Update Disk – fully integrated with the YaST Installer with SLES11 SP2+ (autoupgrade=1)
- Boot menu selection for interactive upgrade process/manual execution has been included since SLES12. (upgrade=1)
- Upgrade path accommodation for LTSS customers
- Q/A Tested and supported upgrade paths are documented in the release notes, product documentation, and support TIDs
Technical Considerations

Evaluate the cost/benefit of each upgrade method

- Number of servers to be upgraded (>20)
- Workload / Application Certifications (Source / Destination OS)
- Available Disk Space, Disk Partitioning
- High Availability / Clustered Workload?
- Desire for New OS Features (Full System Rollback..?)
- Wish you had done it differently before
- Other business considerations
  - Hardware Lifecycle / Consolidation (P2V)
  - Hardware Architecture Changes (i586 to x86_64)
  - Application Support Lifecycle
SUSE Linux Enterprise 12 or 15?

Align decision with deployment lifecycle and ISV requirements

Consider Hardware and Software certifications
- SLES 12 SP4 and SLES 15 GA have similar hardware enablement

SLES 15 SP1 beta RC is available
- Expected in June

SLES 15 Highlights…

ISV Catalog:  https://www.suse.com/susePSC/home
YES Certified Hardware:  https://www.suse.com/partners/ihv/yes/
Significant Changes
SUSE Linux Enterprise Server 15

- Kernel 4.12
- 389 Directory Server replaces OpenLDAP
- Salt management
- Python 3
- Chrony replaces ntpd
- Firewalld replaces SUSE Firewall2
- NGINX is fully supported
- OpenJDK 10
- Systemd - xinetd has been removed
- zypper search-packages
- RMT replaces SMT
SUSE Linux Enterprise 15

HO1424 What’s New in SUSE Linux Enterprise 15
  - Tuesday April 2nd 2:00pm to 4:15pm | Midtown 1
  - Thursday April 4th 10:00am to 12:00pm | Midtown 1

FUT1434 SUSE Linux Enterprise 15+ the Future of OS
  - Wednesday April 3rd 3:15pm to 4:15pm | Fisk 2
  - Thursday April 4th 4:30pm to 5:30pm | Fisk 1

SPO1457 How to get ready for Intel Optane DC Persistent Memory, SISE SLES 15 and SAP HANA 2.3 Data Management Suite
  - Thursday April 4th 11:15am to 12:15pm | Fisk 2
Supported Upgrade Paths / Workflows
Supported Upgrade Paths – SLES 12
Supported Upgrade Paths – SLES 15

SLE 12 GA → SLE 12 SP1 → SLE 12 SP2 → SLE 12 SP3+ → SLE 15

SLE 11 → SLE 11 SP4

Leap 15

NEW

Only Offline Upgrade

Only Online Upgrade
Online vs Offline Upgrade

Online

Minor version upgrades that are executed from the running system itself are considered to be “online” (server up and running state).

Example: zypper and YaST online update connected via SUSE Customer Center (SCC), Subscription Mirroring Tool (SMT); Salt Policy via SUSE Manager

Offline

Supports both major and minor version upgrades. Offline update implies that the operating system to be upgraded is not running (server down state).

Example: Installer for target release operating system is booted; i.e. DVD installation media, PXE/network boot, or via local bootloader to perform the upgrade.
Supported Upgrade Scenarios

Major Version Upgrades:
- Offline Migration:
  - Boot from DVD, ISO image, USB stick, Network (PXE/tftp), AutoYaST with (autoupgrade=1 boot parameter)
- Online Migration: not possible

Minor Version / Service Pack Upgrades:
- Online Migration:
  - YaST or zypper migration – supporting full system rollback!
  - zypper distribution upgrade (zypper dup)
  - Reference Support Knowledgebase and Documentation for details.
- Offline Migration:
  - Boot from DVD, ISO image, USB stick, Network (PXE/tftp), AutoYaST (autoupgrade=1 parameter)
Upgrade Methods
Upgrade / Migration Options
SUSE Linux Enterprise

**Media Fully Offline.** Boot DVD (or ISO image) to upgrade without connection to any repositories on the network.

**PXE Boot Partial Offline.** PXE boot server to installation server on the network or TFTP server (e.g. SMT) boot RPM.

**Migration via SCC.** The system, directly connected to SCC, is able to receive the new migration target and run the upgrade process.

**SUSE Manager.** Systems managed by SUSE Manager is ready to be migrated to the latest service pack.

**SMT / RMT.** System behind registration proxy is ready to be migrated to the latest service pack.

**Third-party Tools.** Customers are able to receive information about the latest service pack. Access is properly documented and easily accessible.
Online Upgrade Paths
SUSE Linux Enterprise

Service Pack Upgrades Only

One-step Migration SLE10/11 (SP n to SP n+1)
- Standard online migration path supported since SUSE Linux Enterprise 10
- Option available via all tools (SCC, SUSE Manager, etc.)

Skipping a Service Pack SLE12/15 (SP n to SP n+2, n+3)
- Provide fully tested, supported and maintain path from SLES12 SP1 to SP3, SLES12 SP1(LTSS) to SP4, SLES12 SP2 to SP4/SP5
- Exception: SUSE Linux Enterprise Desktop
- Option available via all tools (SCC, SUSE Manager, etc.)
Unattended, Automated In-place Migration
SUSE Linux Enterprise 11 ⇆ 12 or 15

SLES 11 SP3/SP4 ⇆ SLES 12 SP4
SLES 11 SP4 ⇆ SLES 15 GA (fresh install recommended)

- Supported major version upgrade - retain host/application specific configuration
- Reduced administration cost and downtime
- Reduced application impact

**Warning: Root File System Conversion not Supported**
Converting the root file system to Btrfs is not supported. Either keep the existing file system or re-install the whole system from scratch.

SLES 12 Guide:

SLES 15 Guide:
Start Demo....!
Before you START: Upgrade Preparation

- Check the release-notes
  - https://www.suse.com/releasenotes/x86_64/SUSE-SLES/12-SP3/
  - https://www.suse.com/releasenotes/x86_64/SUSE-SLES/12-SP4/
  - https://www.suse.com/releasenotes/x86_64/SUSE-SLES/15/

- Check disk space and filesystem requirements
  - Is there enough free disk space?
  - Software tends to grow from version to version
  - Remember: BTRFS snapshots require additional disk space

- Make a backup – TEST YOUR BACKUP!

- If using a virtual machine snapshot, shutdown your virtual machine

- If needed, migrate your PostgreSQL/MariaDB database
  - Upgrade to PostgreSQL to v9 on SLES11 before upgrading to SLES12/15
Upgrade Workflow: Booting from Media

- Select “Upgrade” in the DVD-Boot menu
- Select keyboard layout for upgrade process, accept EULA
- Select installed system for upgrade
- Re-enable 3rd party repositories you still need
- Accept licenses and EULA for packages and modules
- Add additional Add-Ons/repositories if needed
- Check for conflicts
- Start upgrade
Upgrade Workflow: AutoYaST

- AutoYaST profile has same format as for installations
- Sections like “partitioning” don't make sense (not formatting disk)
- “Upgrade” section
  - 'only_installed_packages'
    - True: only installed packages will be upgraded
    - False: installed patterns will be upgraded
  - 'stop_on_solver_conflict'
- “Software” section
  - Block RPMs you don't want
- Backup Before Upgrade (sysconfig, config files)
  - Better do a full system backup
- Boot param ‘y2confirm’ - step through the AutoYAST install process
Upgrade or Fresh Installation
Upgrade or Fresh Installation?

We don’t know your workload!

Ask yourself…. Why am I upgrading?
SLES12 is not SLES11 SP4.5

- New major release
- Binary incompatible (shared libraries)
- New features requiring major changes to base system
- Old cruft removed
- Chance to solve old mistakes
- No inherited burdens
- ...

...
Questions - Hardware

- **How old is your hardware?**
  - Architecture changes
    - i586 to x86_64
    - POWER: big-endian to little-endian
  - If you need to replace it anyway…
- **Is your hardware supported by SLES12 and SLES15?**
  - Support for old graphic cards was removed
  - Token ring no longer supported (SLES12)
  - Support of some disk controllers was removed by some IHVs
- **Do you have enough free disk space?**
  - RPMs and data are continuously growing
Questions - Software

- What is running on your system?
  - “Small” services like DNS?
  - “Big” services like SAP+Oracle+…
  - How long can the services be down?
- Is your 3rd Party Software supported on SLES12 / SLES15?
- What do third party vendors recommend?
  - Some vendors don't support major upgrade of OS in general
- Adjustment of configuration of third party packages?
- How good is your setup documented?
- Any things you always wanted to setup differently?
Upgrade (1/2)

- No need to do new package selection
- Old stuff will stay (zypper packages –orphaned)
  - Not maintained anymore
  - No updates/security fixes
  - But: old 3rd party applications may continue to work
- Adjustment of configuration of 3rd party packages
- SLES12 Modules – Which are needed for an upgrade?
- Database migration mostly done automated
- Filesystem still supported? → Reiserfs
Upgrade (2/2)

- Not all new features are useable
  - Full system rollback for SLE12/15 depends on grub2, btrfs subvolume layout
  - New xfs on disk format
  - Full root filesystem encryption including /boot
  - IPv6 support for e.g. iSCSI (could be archived by reconfiguration)
- Check *.rpmnew config files for new options
- Check *.rpmsave config files for missing changes
- Obsolete packages could still be the default

- Updating RPMs takes longer than fresh installation!
Fresh Installation

- All new features are useable
- New / updated filesystems
  - reiserfs completely removed in SLES15
  - btrfs use cases: snapshot / rollback, transactional updates
- Need to think about new disk layout
- Need to think about package selection
- No old stuff left
- Complete new installation of third party software
- Migration of configuration files and data to new system
- Easier roll-back mechanism if BTRFS is not in use or enough free space for snapshot
Upgrade or Fresh Install to SLES 15?
General Recommendation

SLES12 will be in general support until 31-Oct-2024.

If on SLES11 SP4 and your destination is SLES15:
• Recommend fresh installation – not required  [two version hop]

If system was installed before SLES12 SP2:
• Recommend fresh installation – not required  [btrfs initial snapshot]

If system was installed with SLES12 SP2 or later:
• Upgrade or fresh installation
Unattended Upgrades… SUSE Manager!
SUSE Manager

- Provisioning function can schedule and execute unattended upgrades over the network (Spacewalk KOAN, PXE)
- Pre/Post/Chroot installation scripts can prepare, cleanup
- Clone channels for modules/updates can be integrated to the software installation / upgrade process:
  - `<add-on>` directive
- Activation keys and channel labels can be variables in AutoYaST profile
- Profile snippets can be used for re-registration and cleanup
Customer Use Case:
Large Automaker

SLES 11 SP3 ⇒ SLES 12 SP4

- Re-mediate Out of Support / LTSS distributions
- Integrate with a new SUSE Manager Deployment
- P2V migration – source instance un-touched
  - Source had disk space availability / partitioning issues
  - Using Bootable ISO created with KIWI to provision new destination virtual machine
  - Run upgrade against copy of source server
  - Source Server untouched for back-out/recovery purposes
  - Potential to change filesystem to btrfs/ext4 as part of the clone process
Customer Use Case:
Large Retailer

Architecture Change: SLES i586 ⇒ x86_64
- Store Server architecture switch from i586 to x86_64 (desire to implement KVM, SUSE Manager Proxy)
- Disk partitioning / LVM allowed for a parallel installation of a new root operating system logical volume
- Application and data mount points were attached to x64 root volume
- i586 root logical volume reclaimed when system upgrade confirmed complete and successful
- Automated, over the wire upgrade SAVED +$1M in on-site visits

- Lesson learned… Test, Test, Test!
On with the show....!
Upgrade Preparation

TUT88423 Upgrading SLES 11 to SLES 12 (SUSECON 2017)
  • https://www.youtube.com/watch?v=C_MneviV GNU

TUT1035: SUSE Linux Enterprise 15 Migration (SUSECON 2017)
  • Tuesday April 2nd 5:45pm to 6:45pm | Fisk 2 or
    https://www.brighttalk.com/webcast/11477/318427

HO1423: In-place migration from SUSE Linux Enterprise Server 11 to
12 or SUSE Linux Enterprise Server 12 to 15 with SUSE Manager
  • Tuesday April 2nd 4:30pm to 6:45pm | Midtown 2
  • Thursday April 4th 10:00am to 2:15pm | Midtown 2
Before you START: Upgrade Preparation

- Check the release-notes
  - https://www.suse.com/releasenotes/x86_64/SUSE-SLES/12-SP3/
  - https://www.suse.com/releasenotes/x86_64/SUSE-SLES/12-SP4/
  - https://www.suse.com/releasenotes/x86_64/SUSE-SLES/15/

- Check disk space and filesystem requirements
  - Is there enough free disk space?
  - Software tends to grow from version to version
  - Remember: BTRFS snapshots require additional disk space

- Make a backup – TEST YOUR BACKUP!
- If using a virtual machine snapshot, shutdown your virtual machine
- If needed, migrate your PostgreSQL/MariaDB database
  - Upgrade to PostgreSQL to v9 on SLES11 before upgrading to SLES12/15
During Upgrade

- **Enable all Modules**
  - Packages you used on SLES11 are likely in SLES12 modules or even a different module in SLES15
  - Minimum SLES15 Modules to include
    - SLE-Product-SLES15
    - SLE-Module-Basesystem15
    - SLE-Module-Desktop-Applications15
    - SLE-Module-Legacy15
    - SLE-Module-Server-Applications15
    - SLE-Module-Web-Scripting15
    - SLE-Module-Containers15 (if needed)
During Upgrade

- Only grub2 as bootloader since SLES12
  - New bootloader proposal during upgrade
  - Serial Console setup could be lost
Questions?
General Disclaimer

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Reference: Changes in SLES12
Filesystems

- Reiserfs is no longer supported for fresh installations
- Reiserfs will be deprecated in SLES 15
- Btrfs is the new, default root filesystem
  - Root should be big enough for several snapshots
  - Everything in subvolumes or on own partitions is excluded from snapshots/rollback
  - Subvolumes/Partitions can have own snapshot configuration
    - Rollback only available for root partition
    - Every subvolume can be replaced by own partition (if YaST2 partitioner allows)
- XFS is the recommended filesystem for data partitions
- Ext4 is fully supported (with exceptions)
RPM/Package incompatibilities

- Configurations gets lost during upgrade
  - RPM not able to track config files moved around
  - /etc/crontab needs restore (new cron implementation)
  - Services no longer enabled by default (no 1:1 matching of LSB init scripts with systemd unit files)
- Meaning/default of options can have changed
  - ntp commandline options
  - IPv6 privacy extensions per default active (temp_addr)
  - Samba defaults changed, so if not set explicit in config files…
  - Syslog-ng starts with old config, but behaves different
  - Same true for many more packages
Package Removals/Replacements

- SuSEConfig code moved to %post section in RPMs
- KDE Desktop was removed
- Mono was removed
- iscsitarget was replaced by lio
- Cyrus IMAP was replaced by dovecot
- Pure-ftpd was replaced by vsftpd
- LPRng was removed
- /etc/SuSE-release was obsoleted by /etc/os-release
  - Cross distribution format
Package Changes

- **OpenLDAP:**
  - Ldap overlays are now modules, adjust configuration

- **Apache Access/Deny handling changed**
  - sysconf_addword /etc/sysconfig/apache2 APACHE_MODULES
    access_compat

- **YaST2 command line interface obsoleted/gone**
  - Use zypper for package management instead

- **Ntpd**
  - Has problems chrooted, like name resolution stops working

- **Parted only resizes partitions, no longer filesystems**
  - Use filesystem specific command
Databases

- MySQL was replaced by MariaDB
  - Full L3 supported
  - Needs migration:
    - Create a backup before upgrade
    - touch /var/lib/mysql/.force_upgrade
    - rcmdsql start
    - rcmdsql status

- PostgreSQL was updated to version 9.x
  - Don't update from SLES11 with PostgreSQL 8.x directly
  - Update first PostgreSQL to version 9.x and upgrade database
Wicked

- New framework for network configuration
- Configuration file back-ends
  - SUSE style /etc/sysconfig/network/
  - Network interface configuration in XML
- Bring up and shutdown of “normal” interfaces such as Ethernet or InfiniBand, VLAN, bridge, bonds, tun, taps, dummy, macvlan, macvtab, his, qeth, iucv, wireless
- Built-in DHCPv4 and DHCPv6 client
- Nanny daemon (“interface hotplugged”, link detecting)
- Handles incremental changes (no ifdown if possible)
CUPS

- CUPS was updated to version 1.7
  - Major incompatible changes compared with SLES11
  - Default version of IPP protocol now 2.0 (rejected by older CUPS clients, add '/version=1.1' to server name on client)
- Printer browsing dropped, native DNS-SD now used
  - Use cups-browsed as replacement
- Several filters and back-ends dropped
  - Try “cups-filters”
Systemd

- System- and Session Manager for Linux
- Systemd replaces SysV-Init (New init process)
- Can execute LSB init scripts
  - "systemctl reload-daemon" after changes
- Unit Files preferred
  - Rewrite init scripts to unit files!
  - Don't use 'su' in init scripts (or create own “sessions” otherwise)
- Provides aggressive parallelization capabilities
- Uses socket and D-Bus activation for starting services
- Keeps track of processes using Linux cgroups
Systemd configuration changes

- Variables/Features from /etc/sysconfig replaced by systemd configuration tools
  - /etc/sysconfig/cron → /etc/tmpfiles.d/tmp.conf
  - /etc/sysconfig/language fallback for /etc/locale.conf
- System locale and keyboard settings
  - Localectl
    - /etc/vconsole.conf
    - /etc/X11/xorg.conf.d/00-keyboard.conf
- System time and date
  - timedatectl
CA Certificates/FIPS

- **CA Certificates**
  - Old: /etc/ssl/certs
    - PEM format only for legacy reasons
  - New: /etc/pki/trust/anchors/
  - New: /etc/pki/trust/blacklist/
    - Call 'update-ca-certificates' afterwards for both

- **FIPS enablement**
  - FIPS disables “unsafe” crypto algorithm
    - This includes traditional password hashes like DES!
Post Upgrade

- Identify orphaned packages
  - “Orphaned packages are packages which belong to no active repository anymore”
  - zypper packages --orphaned

- Cleanup remaining bootloader entries, registration data as needed (re-register/bootstrap with SUSE Manager)
Bonus Demo: Machinery!
Machinery

A command line application for creating descriptions of Linux systems and working with them.
Machinery supports use cases such as configuration discovery, system validation, and service migration.
Machinery is based on the idea of an universal system description.
It is transparent, extensible, and crafted beautifully.
Machinery is made for the system administrator of the data center. Read more about the philosophy behind it.

Watch the movie!
Machinery

- Command line application for creating descriptions of Linux systems
- Get insight into existing systems, store and track their state, create new systems
- Powerful views of individual and comparisons between systems
- Export to other tools for installation, migration, image building, containerization, or cloud deployment
- Interfaces to work with system descriptions from your custom tools
- Available in the SLES12 Advanced Management Module
Use Case Areas

Configuration Discovery
System Validation
Service Migration
Configuration Discovery

Inspect:
- SLE 11 SP3
- SLE 12
- openSUSE 13.2

System description:

Show:
- OS
- Packages
- Repositories
- Config files
- unmanaged files
System Validation
Service Migration
Use Case Elements
System Description

Tool centers around system description
Saved on central admin server

Complete system information contains:
- Installed software
- Configuration files
- Services
- Changes
- ...Unmanaged files

Can be transferred to other systems
Design Concepts

Self-contained system description
Command-line tool
No client software installation necessary
Access client machines via ssh from central admin server
Documentation
Upgrade to the latest SLES12 Service-Pack

zypper migration -n --no-recommends
Documentation

- [https://www.suse.com/documentation/sles-12/](https://www.suse.com/documentation/sles-12/)
  - Release Notes
  - Installation Quick Start
  - Deployment Guide
  - Administration Guide
  - Virtualization Guide
  - Storage Administration Guide
  - System Analysis and Tuning Guide
  - Security Guide
  - Whitepapers
Documentation

SUSE Linux Enterprise Server Deployment Guide:

- SLES 15:

- SLES 12SP4:

- SLES 11SP4:
Documentation

Unattended Upgrade Feature

• SLES 12:
  • Solution Brief:
  • Documentation:

• SLES 15:
  • SUSE Blog:
  • Documentation:
SMT vs RMT --- SMT is supported through SLES12 EOL

https://github.com/SUSE/rmt#rmt-and-smt

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<thead>
<tr>
<th>Feature/Tech</th>
<th>SMT</th>
<th>RMT</th>
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<tbody>
<tr>
<td>Available on SLES11</td>
<td>✔</td>
<td>❌</td>
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<tr>
<td>Available on SLES12</td>
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<tr>
<td>Available on SLES15</td>
<td>❌</td>
<td>✔</td>
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<tr>
<td>Sync products data from SCC</td>
<td>✔</td>
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<tr>
<td>Mirror RPMs from repositories</td>
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<td>Selective mirroring (which products to mirror)</td>
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<td>Serve RPMs via http</td>
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<td>Registration of SLE 15 systems</td>
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<td>Registration of SLE 12 systems</td>
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<tr>
<td>Registration of SLE 11 systems</td>
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<tr>
<td>Migration support SLE 12 &gt; 15</td>
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<td>Staging repositories</td>
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<tr>
<td>Air gap sync/mirroring for secure environments</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>NTLKM Proxy support</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Custom repositories</td>
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</table>

<table>
<thead>
<tr>
<th>Feature/Tech</th>
<th>SMT</th>
<th>RMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>YaST installation wizard</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>YaST management wizard</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>Client management</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>Red Hat support (Expanded Support)</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>Files deduplication</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Data transfer from SMT to RMT</td>
<td>-</td>
<td>✔</td>
</tr>
<tr>
<td>Transfer registration data to SCC</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>Reporting</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>Custom TLS certificates for webserver</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Webserver</td>
<td>Apache2</td>
<td>Nginx</td>
</tr>
<tr>
<td>Database</td>
<td>MariaDB</td>
<td>MariaDB</td>
</tr>
<tr>
<td>Platform</td>
<td>Perl</td>
<td>Ruby</td>
</tr>
</tbody>
</table>

1: Functionality is offered by SUSE Manager
2: RES support is planned for SLES15 SP1
3: Registration data transfer to SCC is planned for SLES15 SP2
AutoYAST Profile:

Pre, Post, Chroot AutoYAST Scripts

Backup directive

```xml
<backup>
  <sysconfig config:type="boolean">true</sysconfig>
  <modified config:type="boolean">true</modified>
  <remove_old config:type="boolean">false</remove_old>
</backup>
```
AutoYAST Profile Tools (2)

Upgrade Directive

<upgrade>
  <only_installed_packages config:type="boolean">false</only_installed_packages>
  <stop_on_solver_conflict config:type="boolean">true</stop_on_solver_conflict>
</upgrade>

Networking Considerations

<networking>
  <keep_install_network config:type="boolean">true</keep_install_network>
    <start_immediately config:type="boolean">true</start_immediately>
</networking>
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