

# Release Notes

SUSE Linux Enterprise Server is a modern, modular operating system for both multimodal and traditional IT. This document provides a high-level overview of features, capabilities, and limitations of SUSE Linux Enterprise Server 15 SP5 (prerelease) and highlights important product updates.

*This product will be released in June 2023.* The latest version of these release notes is always available at <https://www.suse.com/releasenotes>. Drafts of the general documentation can be found at <https://susedoc.github.io/doc-sle/main>.

Publication Date: 2022-10-18, Version: 15.5.20221018

## Contents

- 1 About the release notes 3
- 2 SUSE Linux Enterprise Server 3
- 3 Modules, extensions, and related products 10
- 4 Installation and upgrade 12
- 5 Changes affecting all architectures 17
- 6 Removed and deprecated features and packages 25
- 7 Obtaining source code 26
- 8 Legal notices 26
- A Changelog for 15 SP5 (prerelease) 27

## B Kernel parameter changes 28

# 1 About the release notes

These Release Notes are identical across all architectures, and the most recent version is always available online at <https://www.suse.com/releasenotes> .

Entries are only listed once but they can be referenced in several places if they are important and belong to more than one section.

Release notes usually only list changes that happened between two subsequent releases. Certain important entries from the release notes of previous product versions are repeated. To make these entries easier to identify, they contain a note to that effect.

However, repeated entries are provided as a courtesy only. Therefore, if you are skipping one or more service packs, check the release notes of the skipped service packs as well. If you are only reading the release notes of the current release, you could miss important changes.

## 2 SUSE Linux Enterprise Server

SUSE Linux Enterprise Server 15 SP5 (prerelease) is a multimodal operating system that paves the way for IT transformation in the software-defined era. It is a modern and modular OS that helps simplify multimodal IT, makes traditional IT infrastructure efficient and provides an engaging platform for developers. As a result, you can easily deploy and transition business-critical workloads across on-premises and public cloud environments.

SUSE Linux Enterprise Server 15 SP5 (prerelease), with its multimodal design, helps organizations transform their IT landscape by bridging traditional and software-defined infrastructure.

### 2.1 Interoperability and hardware support

Designed for interoperability, SUSE Linux Enterprise Server integrates into classical Unix and Windows environments, supports open standard interfaces for systems management, and has been certified for IPv6 compatibility.

This modular, general-purpose operating system runs on four processor architectures and is available with optional extensions that provide advanced capabilities for tasks such as real-time computing and high-availability clustering.

SUSE Linux Enterprise Server is optimized to run as a high-performance guest on leading hypervisors. This makes SUSE Linux Enterprise Server the perfect guest operating system for virtual computing.

## 2.2 What is new?

### 2.2.1 General changes in SLE 15

SUSE Linux Enterprise Server 15 introduces many innovative changes compared to SUSE Linux Enterprise Server 12. The most important changes are listed below.

#### Migration from openSUSE Leap to SUSE Linux Enterprise Server

SLE 15 SP2 and later support migrating from openSUSE Leap 15 to SUSE Linux Enterprise Server 15. Even if you decide to start out with the free community distribution, you can later easily upgrade to a distribution with enterprise-class support. For more information, see the *Upgrade Guide* at <https://documentation.suse.com/sles/15-SP5/html/SLES-all/cha-upgrade-online.html#sec-upgrade-online-opensuse-to-sle>.

#### Extended package search

Use the new Zypper command `zypper search-packages` to search across all SUSE repositories available for your product, even if they are not yet enabled. For more information see [Section 5.5.1, "Searching packages across all SLE modules"](#).

#### Software Development Kit

In SLE 15, packages formerly shipped as part of the Software Development Kit are now integrated into the products. Development packages are packaged alongside other packages. In addition, the *Development Tools* module contains tools for development.

#### RMT replaces SMT

SMT (Subscription Management Tool) has been removed. Instead, RMT (Repository Mirroring Tool) now allows mirroring SUSE repositories and custom repositories. You can then register systems directly with RMT. In environments with tightened security, RMT can also proxy other RMT servers. If you are planning to migrate SLE 12 clients to version 15, RMT is the supported product to handle such migrations. If you still need to use SMT for these migrations, beware that the migrated clients will have *all* installation modules enabled. For more information see [Section 4.2.4, "SMT has been replaced by RMT"](#).

## Media changes

The *Unified Installer* and *Packages* media known from SUSE Linux Enterprise Server 15 SP1 have been replaced by the following media:

- **Online Installation Medium:** Allows installing all SUSE Linux Enterprise 15 products. Packages are fetched from online repositories. This type of installation requires a registration key. Available SLE modules are listed in [Section 3.1, “Modules in the SLE 15 SP5 \(prerelease\) product line”](#).
- **Full Installation Medium:** Allows installing all SUSE Linux Enterprise Server 15 products without a network connection. This medium contains all packages from all SLE modules. SLE modules need to be enabled manually during installation. RMT (Repository Mirroring Tool) and SUSE Manager provide additional options for disconnected or managed installations.

## MAJOR UPDATES TO THE SOFTWARE SELECTION:

### Salt

SLE 15 SP5 (prerelease) can be managed via Salt, making it integrate better with modern management solutions such as SUSE Manager.

### Python 3

As the first enterprise distribution, SLE 15 offers full support for Python 3 development in addition to Python 2.

### Directory Server

389 Directory Server replaces OpenLDAP as the LDAP directory service.

## 2.2.2 Changes in 15 SP5 (prerelease)

SUSE Linux Enterprise Server 15 SP5 (prerelease) introduces changes compared to SUSE Linux Enterprise Server 15 SP4. The most important changes are listed below:

### 2.2.3 Package and module changes in 15 SP5 (prerelease)

The full list of changed packages compared to 15 SP4 can be seen at this URL:

- [https://documentation.suse.com/package-lists/sle/15-SP5/package-changes\\_SLE-15-SP4-GA\\_SLE-15-SP5-GA.txt](https://documentation.suse.com/package-lists/sle/15-SP5/package-changes_SLE-15-SP4-GA_SLE-15-SP5-GA.txt) ↗

The full list of changed modules compared to 15 SP4 can be seen at this URL:

- [https://documentation.suse.com/package-lists/sle/15-SP5/module-changes\\_SLE-15-SP4-GA\\_SLE-15-SP5-GA.txt](https://documentation.suse.com/package-lists/sle/15-SP5/module-changes_SLE-15-SP4-GA_SLE-15-SP5-GA.txt) ↗

## 2.3 Important sections of this document

If you are upgrading from a previous SUSE Linux Enterprise Server release, you should review at least the following sections:

- *Section 2.7, “Support statement for SUSE Linux Enterprise Server”*
- *Section 4.2, “Upgrade-related notes”*
- *Section 5, “Changes affecting all architectures”*

## 2.4 Security, standards, and certification

SUSE Linux Enterprise Server 15 SP5 (prerelease) has been submitted to the certification bodies for:

- Common Criteria Certification, see <https://www.commoncriteriaportal.org/> ↗
- FIPS 140-2 validation, see <https://doi.org/10.6028/NIST.FIPS.140-2> ↗

For more information about certification, see <https://www.suse.com/support/security/certifications/> ↗.

## 2.5 Documentation and other information


### 2.5.1 Available on the product media

- Read the READMEs on the media.
- Get the detailed change log information about a particular package from the RPM (where *FILENAME.rpm* is the name of the RPM):

```
rpm --changelog -qp FILENAME.rpm
```

- Check the ChangeLog file in the top level of the installation medium for a chronological log of all changes made to the updated packages.
- Find more information in the docu directory of the installation medium of SUSE Linux Enterprise Server 15 SP5 (prerelease). This directory includes PDF versions of the SUSE Linux Enterprise Server 15 SP5 (prerelease) Installation Quick Start Guide.

### 2.5.2 Online documentation

- For the most up-to-date version of the documentation for SUSE Linux Enterprise Server 15 SP5 (prerelease), see <https://susedoc.github.io/doc-sle/main>  (draft version).

## 2.6 Support and life cycle

SUSE Linux Enterprise Server is backed by award-winning support from SUSE, an established technology leader with a proven history of delivering enterprise-quality support services.

SUSE Linux Enterprise Server 15 has a 13-year life cycle, with 10 years of General Support and three years of Extended Support. The current version (SP5) will be fully maintained and supported until six months after the release of SUSE Linux Enterprise Server 15 SP6.

If you need additional time to design, validate and test your upgrade plans, Long Term Service Pack Support can extend the support duration. You can buy an additional 12 to 36 months in twelve month increments. This means that you receive a total of three to five years of support per Service Pack.

For more information, see the pages [Support Policy \(https://www.suse.com/support/policy.html\)](https://www.suse.com/support/policy.html) and [Long Term Service Pack Support \(https://www.suse.com/support/programs/long-term-service-pack-support.html\)](https://www.suse.com/support/programs/long-term-service-pack-support.html).

## 2.7 Support statement for SUSE Linux Enterprise Server

To receive support, you need an appropriate subscription with SUSE. For more information, see [https://www.suse.com/support/?id=SUSE\\_Linux\\_Enterprise\\_Server](https://www.suse.com/support/?id=SUSE_Linux_Enterprise_Server).

The following definitions apply:

### L1

Problem determination, which means technical support designed to provide compatibility information, usage support, ongoing maintenance, information gathering, and basic troubleshooting using the documentation.

### L2

Problem isolation, which means technical support designed to analyze data, reproduce customer problems, isolate the problem area, and provide a resolution for problems not resolved by Level 1 or prepare for Level 3.

### L3

Problem resolution, which means technical support designed to resolve problems by engaging engineering to resolve product defects which have been identified by Level 2 Support.

For contracted customers and partners, SUSE Linux Enterprise Server is delivered with L3 support for all packages, except for the following:

- Technology Previews, see [Section 2.8, “Technology previews”](#)
- Sound, graphics, fonts and artwork
- Packages that require an additional customer contract, see [Section 2.7.2, “Software requiring specific contracts”](#)
- Some packages shipped as part of the module *Workstation Extension* are L2-supported only
- Packages with names ending in `-devel` (containing header files and similar developer resources) will only be supported together with their main packages.

SUSE will only support the usage of original packages. That is, packages that are unchanged and not recompiled.

### 2.7.1 General support

To learn about supported features and limitations, refer to the following sections in this document:

- *Section 5.2, “Kernel”*
- *Section 5.3, “Storage and file systems”*
- *Section 5.6, “Virtualization”*
- *Section 6, “Removed and deprecated features and packages”*

### 2.7.2 Software requiring specific contracts

Certain software delivered as part of SUSE Linux Enterprise Server may require an external contract. Check the support status of individual packages using the RPM metadata that can be viewed with `rpm`, `zypper`, or YaST.

Major packages and groups of packages affected by this are:

- PostgreSQL (all versions, including all subpackages)

### 2.7.3 Software under GNU AGPL

SUSE Linux Enterprise Server 15 SP5 (prerelease) (and the SUSE Linux Enterprise modules) includes the following software that is shipped *only* under a GNU AGPL software license:

- Ghostscript (including subpackages)

SUSE Linux Enterprise Server 15 SP5 (prerelease) (and the SUSE Linux Enterprise modules) includes the following software that is shipped under multiple licenses that include a GNU AGPL software license:

- MySpell dictionaries and LightProof
- ArgyllCMS

## 2.8 Technology previews

Technology previews are packages, stacks, or features delivered by SUSE to provide glimpses into upcoming innovations. Technology previews are included for your convenience to give you a chance to test new technologies within your environment. We would appreciate your feedback! If you test a technology preview, contact your SUSE representative and let them know about your experience and use cases. Your input is helpful for future development.

Technology previews come with the following limitations:

- Technology previews are still in development. Therefore, they may be functionally incomplete, unstable, or in other ways not suitable for production use.
- Technology previews are **not** supported.
- Technology previews may only be available for specific hardware architectures. Details and functionality of technology previews are subject to change. As a result, upgrading to subsequent releases of a technology preview may be impossible and require a fresh installation.
- Technology previews can be removed from a product at any time. This may be the case, for example, if SUSE discovers that a preview does not meet the customer or market needs, or does not comply with enterprise standards.

## 3 Modules, extensions, and related products

This section comprises information about modules and extensions for SUSE Linux Enterprise Server 15 SP5 (prerelease). Modules and extensions add functionality to the system.




### Note: Package and module changes in 15 SP5 (prerelease)


For more information about all package and module changes since the last version, see [Section 2.2.3, “Package and module changes in 15 SP5 \(prerelease\)”](#).

### 3.1 Modules in the SLE 15 SP5 (prerelease) product line


The SLE 15 SP5 (prerelease) product line is made up of modules that contain software packages. Each module has a clearly defined scope. Modules differ in their life cycles and update timelines.

The modules available within the product line based on SUSE Linux Enterprise 15 SP5 (prerelease) at the release of SUSE Linux Enterprise Server 15 SP5 (prerelease) are listed in the *Modules and Extensions Quick Start* at <https://susedoc.github.io/doc-sle/main/html/SLES-modules/>  (draft version).



Not all SLE modules are available with a subscription for SUSE Linux Enterprise Server 15 SP5 (prerelease) itself (see the column *Available for*).

For information about the availability of individual packages within modules, see <https://scc.suse.com/packages> .

## 3.2 SLE extensions

SLE Extensions add extra functionality to the system and require their own registration key, usually at additional cost. Most extensions have their own release notes documents that are available from <https://www.suse.com/releasenotes> .


The following extensions are available for SUSE Linux Enterprise Server 15 SP5 (prerelease):

- SUSE Linux Enterprise Live Patching: <https://www.suse.com/products/live-patching> 
- SUSE Linux Enterprise High Availability Extension: <https://www.suse.com/products/highavailability> 
- SUSE Linux Enterprise Workstation Extension: <https://www.suse.com/products/workstation-extension> 





The following extension is not covered by SUSE support agreements, available at no additional cost and without an extra registration key:

- SUSE Package Hub: <https://packagehub.suse.com/>  (see *Section 5.4, “SUSE Package Hub”*)

## 3.3 Derived and related products

This sections lists derived and related products. Usually, these products have their own release notes documents that are available from <https://www.suse.com/releasenotes> .

- SUSE Linux Enterprise JeOS: <https://www.suse.com/products/server/jeos>  (see *Section 4.3, “Minimal-VM and Minimal-Image”*)
- SUSE Linux Enterprise Desktop: <https://www.suse.com/products/desktop> 

- SUSE Linux Enterprise Server for SAP Applications: <https://www.suse.com/products/sles-for-sap> 
- SUSE Linux Enterprise for High-Performance Computing: <https://www.suse.com/products/server/hpc> 
- SUSE Linux Enterprise Real Time: <https://www.suse.com/products/realtime> 
- SUSE Manager: <https://www.suse.com/products/suse-manager> 

## 4 Installation and upgrade

SUSE Linux Enterprise Server can be deployed in several ways:


- Physical machine
- Virtual host
- Virtual machine
- System containers
- Application containers

### 4.1 Installation

This section includes information related to the initial installation of SUSE Linux Enterprise Server 15 SP5 (prerelease).



#### Important: Installation documentation

The following release notes contain additional notes regarding the installation of SUSE Linux Enterprise Server. However, they do not document the installation procedure itself. For installation documentation, see the *Deployment Guide* at <https://susedoc.github.io/docsle/main/html/SLES-deployment/>  (draft version).

### 4.1.1 New media layout

The set of media has changed with 15 SP2. There still are two different installation media, but the way they can be used has changed:

- You can install with registration using either the online-installation medium (as with SUSE Linux Enterprise Server 15 SP1) or the full medium.
- You can install without registration using the full medium. The installer has been added to the full medium and the full medium can now be used universally for all types of installations.
- You can install without registration using the online-installation medium. Point the installer at the required SLE repositories, combining the `install=` and `instsys=` boot parameters:
  - With the `install=` parameter, select a path that contains either just the product repository or the full content of the media.
  - With the `inst-sys=` parameter, point at the installer itself, that is, `/boot/ARCHITECTURE/root` on the medium.

For more information about the parameters, see [https://en.opensuse.org/SDB:Linuxrc#p\\_install](https://en.opensuse.org/SDB:Linuxrc#p_install).

## 4.2 Upgrade-related notes

This section includes upgrade-related information for SUSE Linux Enterprise Server 15 SP5 (prerelease).



### Important: Upgrade documentation

The following release notes contain additional notes regarding the upgrade of SUSE Linux Enterprise Server. However, they do not document the upgrade procedure itself.

For upgrade documentation, see the *Upgrade Guide* at <https://susedoc.github.io/doc-sle/main/html/SLES-upgrade/> (draft version).

#### 4.2.1 Hibernation requires manual intervention

Previously, it was possible for data loss to occur due to the system not hibernating correctly.

In 15 SP5 (prerelease), a sanity check was introduced to prevent this. It works by removing the kernel `resume` parameter if it points to a non-existent device. However, that means a system would not use the hibernation data. To fix it, do the following:

1. Edit `/etc/default/grub` and correct the `resume` parameter to point to an existing device.
2. Regenerate `initrd`.
3. Reboot.

#### 4.2.2 Make sure the current system is up-to-date before upgrading

Upgrading the system is only supported from the most recent patch level. Make sure the latest system updates are installed by either running `zypper patch` or by starting the YaST module *Online Update*. An upgrade on a system that is not fully patched may fail.

#### 4.2.3 Skipping service packs requires LTSS

Skipping service packs during an upgrade is only supported if you have a Long Term Service Pack Support contract. Otherwise, you need to first upgrade to SLE 15 SP4 before upgrading to SLE 15 SP5 (prerelease).

#### 4.2.4 SMT has been replaced by RMT

*SLE 12 is the last codestream that SMT (Subscription Management Tool) is available for.*

When upgrading your OS installation to SLE 15, we recommend also upgrading from SMT to its replacement RMT (Repository Mirroring Tool). RMT provides the following functionality:

- Mirroring of SUSE-originated repositories for the SLE 12-based and SLE 15-based products your organization has valid subscriptions for.
- Synchronization of subscriptions from SUSE Customer Center using your organization's mirroring credentials. (These credentials can be found in SCC under *Select Organization, Organization, Organization Credentials*)

- Selecting repositories to be mirrored locally via `rmt-cli` tool.
- Registering systems directly to RMT to get required updates.
- Adding custom repositories from external sources and distributing them via RMT to target systems.
- Improved security with proxying: If you have strict security requirements, an RMT instance with direct Internet access can proxy to another RMT instance without direct Internet access.
- Nginx as Web server: The default Web server of RMT is Nginx which has a smaller memory footprint and comparable performance than that used for SMT.

Note that unlike SMT, RMT does not support installations of SLE 11 and earlier.

For more feature comparison between RMT and SMT, see [https://github.com/SUSE/rmt/blob/master/docs/smt\\_and\\_rmt.md](https://github.com/SUSE/rmt/blob/master/docs/smt_and_rmt.md).

For more information about RMT, also see the new RMT Guide at <https://documentation.suse.com/sles/15-SP3/html/SLES-all/book-rmt.html>.

## 4.3 Minimal-VM and Minimal-Image

SUSE Linux Enterprise Server Minimal-VM and Minimal-Image is a slimmed-down form factor of SUSE Linux Enterprise Server that is ready to run in virtualization environments and the cloud. With SUSE Linux Enterprise Server Minimal-VM and Minimal-Image, you can choose the right-sized SUSE Linux Enterprise Server option to fit your needs.

SUSE provides virtual disk images for Minimal-VM and Minimal-Image in the file formats `.qcow2`, `.vhd`, and `.vmdk`, compatible with KVM, Xen, OpenStack, Hyper-V, and VMware environments. All Minimal-VM and Minimal-Image images set up the same disk size (24 GB) for the system. Due to the properties of different file formats, the size of Minimal-VM and Minimal-Image image downloads differs between formats.

## 4.4 JeOS renamed Minimal-VM and Minimal-Image

We have received feedback from users confused by the name JeOS, as a matter of fact the acronym JeOS, which meant Just enough Operating System, was not well understood and could be confused with other images provided by SUSE or openSUSE.

We have decided to go with simplicity and rename JeOS by "Minimal-VM" for all our Virtual Machine Images and "Minimal-Image" for the Raspberry Pi Image. We have also removed a few other characters, in the full images name to make it more simple and clear:

- [SLES15-SP4-Minimal-VM.x86\\_64-kvm-and-xen-GM.qcow2](#)
- [SLES15-SP4-Minimal-VM.x86\\_64-OpenStack-Cloud-GM.qcow2](#)
- [SLES15-SP4-Minimal-VM.x86\\_64-MS-HyperV-GM.vhdx.xz](#)
- [SLES15-SP4-Minimal-VM.x86\\_64-VMware-GM.vmdk.xz](#)
- [SLES15-SP4-Minimal-VM.aarch64-kvm-GM.qcow2](#)
- [SLES15-SP4-Minimal-Image.aarch64-RaspberryPi-GM.raw.xz](#)

#### 4.4.1 Alternative Python 3 development interpreter moved to a separate module

SLE 15 SP4 introduces a new *Python 3* Module, which includes the alternatively available development Python interpreter, formerly included in the *Basesystem* Module. This new module will allow for more flexibility for the lifecycle of the packages provided within it and a clean separation between the system and development interpreter.

As the `python39` package was part of the *Basesystem* Module on SLE 15 SP3, the introduction of this new module will require some changes when migrating to SLE 15 SP5 (prerelease). If you are using `python39` and migrate from SLE 15 SP3, you will have to add the *Python 3* module after migration via SUSEConnect to receive updates for this alternative interpreter. Otherwise the package will remain orphaned and without security updates.

Packages inside this module can have differing support level and support lifecycle. For more information, see documentation.

## 4.5 For more information

For more information, see [\*Section 5, "Changes affecting all architectures"\*](#) and the sections relating to your respective hardware architecture.

## 5 Changes affecting all architectures

Information in this section applies to all architectures supported by SUSE Linux Enterprise Server 15 SP5 (prerelease).

### 5.1 Development

#### 5.1.1 Alternative Python 3 development interpreter moved to a separate module

SLE 15 SP4 introduces a new *Python 3* Module, which includes the alternatively available development Python interpreter, formerly included in the *Basesystem* Module. This new module will allow for more flexibility for the lifecycle of the packages provided within it and a clean separation between the system and development interpreter.

As the `python39` package was part of the *Basesystem* Module on SLE 15 SP3, the introduction of this new module will require some changes when migrating to SLE 15 SP5 (prerelease). If you are using `python39` and migrate from SLE 15 SP3, you will have to add the *Python 3* module after migration via SUSEConnect to receive updates for this alternative interpreter. Otherwise the package will remain orphaned and without security updates.

Packages inside this module can have differing support level and support lifecycle. For more information, see documentation.

#### 5.1.2 Supported Java versions

The following Java implementations are available in SUSE Linux Enterprise Server 15 SP5 (prerelease):

Name (Package Name)	Version	Module	Support
OpenJDK ( <code>java-11-openjdk</code> )	11	Base System	SUSE, L3, until 2026-12-31
OpenJDK ( <code>java-17-openjdk</code> )	17	Base System	SUSE, L3, until 2028-06-30

Name (Package Name)	Version	Module	Support
OpenJDK ( <code>java-1_8_0-openjdk</code> )	1.8.0	Legacy	SUSE, L3, until 2026-12-31
IBM Java ( <code>java-1_8_0-ibm</code> )	1.8.0	Legacy	External, until 2025-04-30

## 5.2 Kernel

### 5.2.1 Kernel limits

This table summarizes the various limits which exist in our recent kernels and utilities (if related) for SUSE Linux Enterprise Server 15 SP5 (prerelease).

SLES 15 SP5 (prerelease) (Linux 5.3)	AMD64/Intel 64 (x86_64)	IBM Z (s390x)	POWER (ppc64le)	ARMv8 (AArch64)
CPU bits	64	64	64	64
Maximum number of logical CPUs	8192	256	2048	768
Maximum amount of RAM (theoretical/certified)	> 1 PiB/ 64 TiB	10 TiB/ 256 GiB	1 PiB/64 TiB	256 TiB/n.a.
Maximum amount of user space/kernel space	128 TiB/ 128 TiB	n.a.	512 TiB <sup>1</sup> / 2 EiB	256 TiB/ 256 TiB
Maximum amount of swap space	Up to 29 * 64 GB	Up to 30 * 64 GB		
Maximum number of processes	1,048,576			
Maximum number of threads per process	Upper limit depends on memory and other parameters (tested with more than 120,000) <sup>2</sup> .			

SLES 15 SP5 (prerelease) (Linux 5.3)	AMD64/Intel 64 (x86_64)	IBM Z (s390x)	POWER (ppc64le)	ARMv8 (AArch64)
Maximum size per block device	Up to 8 EiB on all 64-bit architectures			
FD_SETSIZE	1024			

<sup>1</sup> By default, the user space memory limit on the POWER architecture is 128 TiB. However, you can explicitly request mmmaps up to 512 TiB.

<sup>2</sup> The total number of all processes and all threads on a system may not be higher than the "maximum number of processes".

## 5.3 Storage and file systems

### 5.3.1 Comparison of supported file systems

SUSE Linux Enterprise was the first enterprise Linux distribution to support journaling file systems and logical volume managers in 2000. Later, we introduced XFS to Linux, which allows for reliable large-scale file systems, systems with heavy load, and multiple parallel reading and writing operations. With SUSE Linux Enterprise 12, we started using the copy-on-write file system Btrfs as the default for the operating system, to support system snapshots and rollback.

The following table lists the file systems supported by SUSE Linux Enterprise.

*Support status:* + supported / – unsupported

Feature	Btrfs	XFS	Ext4	OCFS 2 <sup>1</sup>
Supported in product	SLE	SLE	SLE	SLE HA
Data/metadata journaling	N/A <sup>2</sup>	– / +	+ / +	– / +
Journal internal/external	N/A <sup>2</sup>	+ / +	+ / +	+ / –
Journal checksumming	N/A <sup>2</sup>	+	+	+
Subvolumes	+	–	–	–

Feature	Btrfs	XFS	Ext4	OCFS 2 <sup>1</sup>
Offline extend/shrink	+ / +	- / -	+ / +	+ / - <sup>3</sup>
Inode allocation map	B-tree	B+ -tree	Table	B-tree
Sparse files	+	+	+	+
Tail packing	-	-	-	-
Small files stored inline	+ (in metadata)	-	+ (in inode)	+ (in inode)
Defragmentation	+	+	+	-
Extended file attributes/ ACLs	+ / +	+ / +	+ / +	+ / +
User/group quotas	- / -	+ / +	+ / +	+ / +
Project quotas	-	+	+	-
Subvolume quotas	+	N/A	N/A	N/A
Data dump/restore	-	+	-	-
Block size default	4 KiB <sup>4</sup>			
Maximum file system size	16 EiB	8 EiB	1 EiB	4 PiB
Maximum file size	16 EiB	8 EiB	1 EiB	4 PiB

<sup>1</sup> OCFS 2 is fully supported as part of the SUSE Linux Enterprise High Availability Extension.

<sup>2</sup> Btrfs is a copy-on-write file system. Instead of journaling changes before writing them in-place, it writes them to a new location and then links the new location in. Until the last write, the changes are not "committed". Because of the nature of the file system, quotas are implemented based on subvolumes (qgroups).

<sup>3</sup> To extend an OCFS 2 file system, the cluster must be online but the file system itself must be unmounted.

<sup>4</sup> The block size default varies with different host architectures. 64 KiB is used on POWER, 4 KiB on other systems. The actual size used can be checked with the command `getconf PAGE_SIZE`.

### Additional notes

Maximum file size above can be larger than the file system's actual size because of the use of sparse blocks. All standard file systems on SUSE Linux Enterprise Server have LFS, which gives a maximum file size of  $2^{63}$  bytes in theory.

The numbers in the table above assume that the file systems are using a 4 KiB block size which is the most common standard. When using different block sizes, the results are different.

In this document:

- 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>.

Some file system features are available in SUSE Linux Enterprise Server 15 SP5 (prerelease) but are not supported by SUSE. By default, the file system drivers in SUSE Linux Enterprise Server 15 SP5 (prerelease) will refuse mounting file systems that use unsupported features (in particular, in read-write mode). To enable unsupported features, set the module parameter `allow_unsupported=1` in `/etc/modprobe.d` or write the value `1` to `/sys/module/MODULE_NAME/parameters/allow_unsupported`. However, note that setting this option will render your kernel and thus your system unsupported.

### 5.3.2 Supported Btrfs features

The following table lists supported and unsupported Btrfs features across multiple SLES versions.

*Support status:* + supported / – unsupported

Feature	SLES 11 SP4	SLES 12 SP5	SLES 15 GA	SLES 15 SP1	SLES 15 SP2	SLES 15 SP3
Copy on write	+	+	+	+	+	+
Free space tree (Free Space Cache v2)	–	–	–	+	+	+
Snapshots/ subvolumes	+	+	+	+	+	+
Swap files	–	–	–	+	+	+
Metadata integrity	+	+	+	+	+	+
Data integrity	+	+	+	+	+	+
Online metadata scrubbing	+	+	+	+	+	+
Automatic defragmentation	–	–	–	–	–	–
Manual defragmentation	+	+	+	+	+	+
In-band deduplication	–	–	–	–	–	–
Out-of-band deduplication	+	+	+	+	+	+
Quota groups	+	+	+	+	+	+
Metadata duplication	+	+	+	+	+	+
Changing metadata UUID	–	–	–	+	+	+

Feature	SLES 11 SP4	SLES 12 SP5	SLES 15 GA	SLES 15 SP1	SLES 15 SP2	SLES 15 SP3
Multiple devices	–	+	+	+	+	+
RAID 0	–	+	+	+	+	+
RAID 1	–	+	+	+	+	+
RAID 5	–	–	–	–	–	–
RAID 6	–	–	–	–	–	–
RAID 10	–	+	+	+	+	+
Hot add/remove	–	+	+	+	+	+
Device replace	–	–	–	–	–	–
Seeding devices	–	–	–	–	–	–
Compression	–	+	+	+	+	+
Big metadata blocks	–	+	+	+	+	+
Skinny metadata	–	+	+	+	+	+
Send without file data	–	+	+	+	+	+
Send/receive	–	+	+	+	+	+
Inode cache	–	–	–	–	–	–
Fallocate with hole punch	–	+	+	+	+	+

## 5.4 SUSE Package Hub

SUSE Package Hub brings open-source software packages from openSUSE to SUSE Linux Enterprise Server and SUSE Linux Enterprise Desktop.

Usage of software from SUSE Package Hub is not covered by SUSE support agreements. At the same time, usage of software from SUSE Package Hub does not affect the support status of your SUSE Linux Enterprise systems. SUSE Package Hub is available at no additional cost and without an extra registration key.

### 5.4.1 Important package additions to SUSE Package Hub

Among others, the following packages have been added to SUSE Package Hub:

## 5.5 System management

### 5.5.1 Searching packages across all SLE modules

In SLE 15 SP5 (prerelease) you can search for packages both within and outside of currently enabled SLE modules using the following command:

```
zypper search-packages -d SEARCH_TERM
```

This command contacts the SCC and searches all modules for matching packages. This functionality makes it easier for administrators and system architects to find the software packages needed.

## 5.6 Virtualization

For more information about acronyms used below, see <https://documentation.suse.com/sles/15-SP5/html/SLES-all/book-virtualization.html>.



### Important: Virtualization limits and supported hosts/guests


These release notes only document changes in virtualization support compared to the immediate previous service pack of SUSE Linux Enterprise Server. Full information regarding virtualization limits for KVM and Xen as well as supported guest and host systems is now available as part of the SUSE Linux Enterprise Server documentation.

See the *Virtualization Guide* at <https://susedoc.github.io/doc-sle/main/html/SLES-virtualization/cha-virt-support.html>  (draft version).

### 5.6.1 QEMU



#### Note: Deprecation notice

In previous versions, if no explicit image format was provided, some QEMU tools tried to guess the format of the image, and then process it accordingly. Because this feature is a potential source of security issues, it has been deprecated and removed. It is now necessary to explicitly specify the image format. For more information, see <https://qemu-project.gitlab.io/qemu/about/removed-features.html#qemu-img-backing-file-without-format-removed-in-6-1> .

## 6 Removed and deprecated features and packages

This section lists features and packages that were removed from SUSE Linux Enterprise Server or will be removed in upcoming versions.



#### Note: Package and module changes in 15 SP5 (prerelease)

For more information about all package and module changes since the last version, see [Section 2.2.3, “Package and module changes in 15 SP5 \(prerelease\)”](#).

### 6.1 Removed features and packages

The following features and packages have been removed in this release.

- Setting up Kerberos with LDAP backend via YaST has been removed.
- The thunderbolt-user-space package has been removed.

## 6.2 Deprecated features and packages

The following features and packages are deprecated and will be removed in a future version of SUSE Linux Enterprise Server.

## 7 Obtaining source code

This SUSE product includes materials licensed to SUSE under the GNU General Public License (GPL). The GPL requires SUSE to provide the source code that corresponds to the GPL-licensed material. The source code is available for download at <https://www.suse.com/products/server/download/> on Medium 2. For up to three years after distribution of the SUSE product, upon request, SUSE will mail a copy of the source code. Send requests by e-mail to [sle\\_source\\_request@suse.com](mailto:sle_source_request@suse.com) ([mailto:sle\\_source\\_request@suse.com](mailto:sle_source_request@suse.com)). SUSE may charge a reasonable fee to recover distribution costs.

## 8 Legal notices

SUSE makes no representations or warranties with regard to the contents or use of this documentation, and specifically disclaims any express or implied warranties of merchantability or fitness for any particular purpose. Further, SUSE reserves the right to revise this publication and to make changes to its content, at any time, without the obligation to notify any person or entity of such revisions or changes.

Further, SUSE makes no representations or warranties with regard to any software, and specifically disclaims any express or implied warranties of merchantability or fitness for any particular purpose. Further, SUSE reserves the right to make changes to any and all parts of SUSE software, at any time, without any obligation to notify any person or entity of such changes.

Any products or technical information provided under this Agreement may be subject to U.S. export controls and the trade laws of other countries. You agree to comply with all export control regulations and to obtain any required licenses or classifications to export, re-export, or import deliverables. You agree not to export or re-export to entities on the current U.S. export exclusion

lists or to any embargoed or terrorist countries as specified in U.S. export laws. You agree to not use deliverables for prohibited nuclear, missile, or chemical/biological weaponry end uses. Refer to <https://www.suse.com/company/legal/> for more information on exporting SUSE software. SUSE assumes no responsibility for your failure to obtain any necessary export approvals.

Copyright © 2010-2022 SUSE LLC.

This release notes document is licensed under a Creative Commons Attribution-NoDerivatives 4.0 International License (CC-BY-ND-4.0). You should have received a copy of the license along with this document. If not, see <https://creativecommons.org/licenses/by-nd/4.0/>.

SUSE has intellectual property rights relating to technology embodied in the product that is described in this document. In particular, and without limitation, these intellectual property rights may include one or more of the U.S. patents listed at <https://www.suse.com/company/legal/> and one or more additional patents or pending patent applications in the U.S. and other countries.

For SUSE trademarks, see the SUSE Trademark and Service Mark list (<https://www.suse.com/company/legal/>). All third-party trademarks are the property of their respective owners.


## A Changelog for 15 SP5 (prerelease)

### A.1 2022-10-18

#### A.1.1 New

- Added note about removing Kerberos/LDAP from YaST in *Section 6, “Removed and deprecated features and packages”* (Bugzilla ([https://bugzilla.suse.com/show\\_bug.cgi?id=1202257](https://bugzilla.suse.com/show_bug.cgi?id=1202257)))
- Added note about removing `thunderbolt-user-space` in *Section 6, “Removed and deprecated features and packages”* (Jira (<https://jira.suse.com/browse/PED-1358>))

### A.1.2 Updated

- Updated Java lifecycle in *Section 5.1.2, “Supported Java versions”* (Jira (<https://jira.suse.com/browse/PED-1590>) - OpenJDK 11 end of life is now end of 2026
- OpenJDK 17 added
- OpenJDK 18 end of life is now end of 2026

## B Kernel parameter changes



### Warning

This list of changes may not be exhaustive.

### B.1 Changes from SP4 to SP5

These Linux kernel parameters have been changed since SLES 15 SP4.