

Oracle Linux 9

Release Notes for Oracle Linux 9.5



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Oracle Linux 9 Release Notes for Oracle Linux 9.5,

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Preface

[Oracle Linux 9: Release Notes for Oracle Linux 9.5](#) provides information about the new features and known issues in the Oracle Linux 9.5 release. The information applies to both x86_64 and 64-bit Arm (aarch64) architectures. This document might be updated after first publication.

1

About Oracle Linux 9

The current Oracle Linux 9 release contains new features and enhancements that improve performance in different areas including automation and management, security and compliance, container management, and developer tools. These enhancements are especially designed to make the OS adaptable to different types of deployment such as on-premises installations, hybrid deployments that combine on-premises and cloud installations, and full cloud deployment.

! Important

Upgrading from an Oracle Linux Developer Preview release to its later official version is not supported. If you're running the Developer Preview version, you must reinstall the official Oracle Linux release upon its general availability.

System Requirements and Limitations

To check whether a specific hardware is supported on the current Oracle Linux 9 release, see the Hardware Certification List at <https://linux.oracle.com/hardware-certifications>. Note that as hardware becomes available and validated, the hardware is added to the list.

CPU, memory, disk and file system limits for all Oracle Linux releases are described in [Oracle Linux: Limits](#).

Available Architectures

The release is available for installation on the following platforms:

- Intel® 64-bit (x86_64) (x86-64-v2)
- AMD 64-bit (x86_64) (x86-64-v2)
- 64-bit Arm (aarch64) (Arm v8.0-A)

The Arm platform runs only with Unbreakable Enterprise Kernel Release (UEK).

Shipped Kernels

For the x86_64 platform, the current Oracle Linux 9 release ships with the following default kernel packages:

- 5.14.0-503.11.1 (Red Hat Compatible Kernel (RHCK))
- 5.15.0-302.167.6 (Unbreakable Enterprise Kernel Release 7 Update 3 (UEK R7U3))

For new installations, the UEK kernel is automatically enabled and installed. It also becomes the default kernel on first boot.

For the aarch64 platform, Oracle Linux ships with the UEK kernel only.

The Oracle Linux release is tested as a bundle, as shipped on the installation media image. When installed from the installation media image, the kernel's version included in the image is the minimum version that's supported. Downgrading kernel packages isn't supported, unless recommended by Oracle Support.

For more information about kernel availability on Oracle Linux 9 releases, see https://docs.oracle.com/en/operating-systems/oracle-linux/9/boot/oracle_linux9_kernel_version_matrix.html.

About the Unbreakable Enterprise Kernel

The Unbreakable Enterprise Kernel (UEK) is a Linux kernel built by Oracle and supported through Oracle Linux support. UEK is tested on Arm (aarch64), Intel® x86, and AMD x86 (x86_64) platforms. Each release contains added features, bug fixes, and updated drivers to provide support for key functional requirements, improve performance, and optimize the kernel for use on Oracle products such as Oracle's Engineered Systems, Oracle Cloud Infrastructure, and large enterprise deployments for Oracle customers.

Typically, a UEK release contains changes to the kernel ABI relative to a previous UEK release. These changes require recompilation of third-party kernel modules on the system. To minimize impact on interoperability during releases, the Oracle Linux team works with third-party vendors regarding hardware and software that have dependencies on kernel modules. Thus, before installing the latest UEK release, verify its support status with the application vendor.

The kernel ABI for a UEK release remains unchanged in all later updates to the initial release.

The kernel source code for UEK is available after the initial release through a public git source code repository at <https://github.com/oracle/linux-uek>.

For more information about UEK such as tutorials, notices, and release notes of different UEK versions, go to [Unbreakable Enterprise Kernel documentation](#).

User Space Compatibility

Oracle Linux maintains user space compatibility with Red Hat Enterprise Linux (RHEL) that's independent of the kernel version that underlies the OS. Existing applications in user space continue to run unmodified on UEK with no required recertifications for Oracle Linux certified applications.

Obtaining Installation Images

The following installation images for the current Oracle Linux 9 release are available:

- Full ISO of Oracle Linux for typical on-premises installations
- Boot ISO of Oracle Linux for network installations
- Boot ISO of the official UEK release for installing on hardware which is supported only on UEK
- Source DVDs

You can download these images from the following locations. Note that the images in these locations are for both the x86_64 and aarch64 platforms, unless indicated otherwise:

- Oracle Linux yum server at <https://yum.oracle.com/oracle-linux-downloads.html>

For more information managing and updating software on Oracle Linux systems, see [Oracle Linux: Managing Software on Oracle Linux](#).

- Oracle Software Delivery Cloud at <https://edelivery.oracle.com>

To prepare a downloaded image for installing Oracle Linux, see [Oracle Linux 9: Installing Oracle Linux](#).

Note

Aside from installation ISO images, you can also use Oracle Linux images to create compute instances on Oracle Cloud Infrastructure. For information about these images, see the release notes for the specific image that you're using on the [Oracle Cloud Infrastructure Documentation](#) page.

To use Oracle Linux on Oracle Cloud Infrastructure, see <https://docs.oracle.com/iaas/oracle-linux/home.htm>.

For information about the available ISO images for the three most recent updates to the Oracle Linux releases, see <https://yum.oracle.com/oracle-linux-isos.html>.

Upgrading From Previous Oracle Linux Releases

You can upgrade an Oracle Linux 8 system to the Oracle Linux 9 release by using the `leapp` utility.

For step-by-step instructions and information about any known issues that might arise when upgrading the system, see [Oracle Linux 9: Upgrading Systems With Leapp](#).

Upgrading From Previous Oracle Linux Update Releases

You can upgrade an Oracle Linux 9 system from a previous update level to the current update level by running the `sudo dnf update` command.

After performing a system update where many packages are updated, we recommend that you reboot the system. System functionality might become unstable if core packages are updated and the system isn't restarted to load the most recent updates. You can check whether a system requires a restart by running:

```
dnf needs-restarting -r
```

2

New Features and Changes

Unless indicated otherwise, the following new features, major enhancements, bug fixes, and other changes that are introduced in this release of Oracle Linux 9 apply to both the x86_64 and 64-bit Arm (aarch64) platforms.

Installation and Boot

The following features, enhancements, and changes related to installation and boot are introduced in this release of Oracle Linux 9.

Swap Automatically Provisioned During Installation

In the Oracle Linux 9.0 through 9.4 installation media, automatic partitioning failed to create a swap partition by default. In the 9.5 installation media, swap is created under automatic partitioning.

`boom-boot` Updated to 1.6.1

The `boom-boot` package is updated to version 1.6.1 and fixes several bugs and can now automatically repair boom boot entries that have been changed externally.

Operating System and Software Management

The following features, enhancements, and changes related to the OS and software management are introduced in this Oracle Linux 9 release.

systemd Core Management Update

In `/etc/systemd/system.conf`, the default value for the `DefaultLimitCore` option has changed. The default value is now `unlimited:unlimited`, which specifies that core dump file sizes are unlimited. This value was `0:infinity` in previous releases, which meant that core dumps were disabled.

The following defaults for `systemd-coredump` storage have also changed:

- In `/etc/systemd/coredump.conf`, the default size specified for core dumps is 1GiB.
- Core dumps are deleted after 14 days.

Infrastructure Services

The following features, enhancements, and changes related to infrastructure services are introduced in this Oracle Linux 9 release.

BIND 9.18 Added

BIND 9.18 is added as the `bind9.18` package.

Note that BIND 9.18 includes significant changes that might make installation and configuration different to BIND 9.16. See <https://kb.isc.org/docs/changes-to-be-aware-of-when-moving-from-bind-916-to-918> for more information if you're considering changing from 9.16 to 9.18.

BIND 9.18 is available as a standard application stream with life cycle support described in [Oracle Linux: Product Life Cycle Information](#).

chrony Updates and Improvements

The `chrony` package is updated with several small improvements, including a new configuration directive, `leapseclist`, to specify the path to a file containing a list of leap seconds and TAI-UTC offsets in NIST/IERS format, such as the `leap-seconds.list` file included with the system timezone database.

Security

The following features, enhancements, and changes related to security are introduced in this Oracle Linux 9 release.

NSS Updated to Version 3.101

The NSS cryptographic toolkit packages are updated to version 3.101 to provide many bug fixes and enhancements, including an important fix to prevent RSA certificates with keys shorter than 2048 bits from working, in accordance with the system-wide cryptographic policy.

OpenSSL Updated to Version 3.2.2

OpenSSL is updated to version 3.2.2. This significant update includes many feature changes, security fixes, and changes.

The following notable changes are included:

- Cryptographic operations, including ECDSA and AES-GCM-SIV, are enhanced and RSA public key handling is optimized.
- Added functionality to handle the QUIC protocol for secure multi-stream communications over UDP. See <https://github.com/openssl/openssl/blob/master/README-QUIC.md> for more information. The QUIC protocol can now be used on the client side as a Technology Preview.
- Several improvements and features are added for Certificate Management Protocol (CMP).
- Security algorithms are added and updated including hybrid public key encryption (HPKE), Ed25519ctx, Ed25519ph, among others for increased security options.
- The Argon2d, Argon2i, and Argon2id key derivation functions (KDF) are supported.
- Brainpool curves have been added to the TLS 1.3 protocol (RFC 8734) but Brainpool curves remain disabled in all supported system-wide cryptographic policies.
- TLS certificate compression is now available, including the zlib, Brotli, and zstd libraries.

- Several patches are included for critical issues such as buffer overreads, memory leaks, and denial-of-service vulnerabilities.
- Updates to code to align with FIPS 140-3 standards to enhance security and compliance.
- Older functions, including LHASH statistics are deprecated.

For more information, see <https://openssl-library.org/news/openssl-3.1-notes/index.html> and <https://openssl-library.org/news/openssl-3.2-notes/index.html>.

OpenSSH Updated to Version 8.7p1-43

OpenSSH is updated to version 8.7p1-43. This update patches several critical security issues and includes performance enhancements and bug fixes.

Notably, you can now configure default key sizes for ssh host key generation. Values for host key sizes are set in `/etc/sysconfig/ssh` by uncommenting and editing the default values:

```
#SSH_RSA_BITS=3072
#SSH_ECDSA_BITS=256
```

Trusted CA Root Certificates Added in OpenSSL `directory-hash` Format

The OpenSSL hash links to trusted CA root certificates are populated in `/etc/pki/ca-trust/extracted/pem/directory-hash/`. This update helps OpenSSL to perform certificate lookup and validation more efficiently when the `SSL_CERT_DIR` environment variable is set to the file path of the `directory-hash`.

`crypto-policies` Packages Updated for Java Algorithm Selection

The `crypto-policies` packages are updated for algorithm selection in Java. The update includes the following changes:

- DTLS 1.0 is controlled by the `protocol` option, which is disabled by default. You can enable it by setting the `protocol@java = DTLS1.0+` scoped directive.
- `anon` and `NULL` cipher suites are controlled by setting the `cipher` option, which is disabled by default. For example, set the `cipher@java = NULL` scoped directive.
- The list of signature algorithms is controlled by the `sign@java` scoped directive and aligned to the system-wide defaults. You can specify algorithms for Java with a `sign@java = <algorithm1>+ <algorithm2>+` scoped directive.
- Elliptic curve (EC) keys smaller than 256 bits are disabled unconditionally to align with upstream guidance.

For information on interoperability see the `/etc/crypto-policies/back-ends/java.config` file.

`fips-mode-setup` Checks for Use of Argon2 KDF in Open LUKS Volumes

The `fips-mode-setup` command checks open LUKS volumes for Argon2 key derivation functions (KDF) before switching to FIPS mode, and exits if any are detected. Argon2 KDF isn't FIPS compatible. This update helps prevent application of FIPS mode on systems that contain volumes that aren't FIPS compliant. Change KDFs on any volumes that are affected.

audit Updated to Version 3.1.5

The `audit` package is updated to version 3.1.5 to fix several bugs including some fixes for memory leaks, and improvement to `auparse` metrics and a manual page update to clarify `/etc/audit/audit-stop.rules`.

opencryptoki Updated to Version 3.23.0

The `opencryptoki` package is updated to version 3.23.0.

Notable changes include several bug fixes, updates to harden against RSA timing attacks, and EP11 enables FIPS-session mode.

See <https://github.com/opencryptoki/opencryptoki/releases> for more information.

Libreswan Updated to Version 4.15

The `libreswan` packages are updated to version 4.15 to provide security fixes and improvements.

See <https://github.com/libreswan/libreswan/blob/main/CHANGES> for more information.

Libreswan is also updated to resolve an issue that caused an IPsec connection to fail when configured to use certificate-based authentication with a certificate that included a `subjectAltName` extension with an IPv6 address.

clevis Updated to Version 20

The `clevis` component that's used to automate decryption of data or LUKS volumes is updated to version 20.

Notable changes include:

- Uses `jose`, instead of `pwmake`, for password generation
- Several bug fixes and improvements for static analysis in LUKS and `udisks2`

See <https://github.com/latchset/clevis/releases/tag/v19> and <https://github.com/latchset/clevis/releases/tag/v20> for more information.

jose Updated to Version 14

The `jose` package is updated to version 14. `jose` is a command line utility for performing various tasks on JSON Object Signing and Encryption (JOSE) objects. `jose` provides a full crypto stack including key generation, signing, and encryption.

See <https://github.com/latchset/jose/releases/tag/v12>, <https://github.com/latchset/jose/releases/tag/v13>, and <https://github.com/latchset/jose/releases/tag/v14> for more information.

SELinux Updates

Several significant updates are applied for SELinux in this release.

- The `afterburn_t`, `bootupd_t`, `rshim_t`, and `mptcpd_t` SELinux domains are updated so that the associated services run in enforcing mode.

- The `bootupd` service updates the bootloader, and therefore must be confined. The `bootupd` service runs in the `bootupd_t` SELinux domain.
- The SELinux policy is updated by new rules in the `nbdkit-selinux` package to confine `nbdkit` so that systems that run `nbdkit` are more resilient against privilege escalation attacks.
- A new SELinux policy Boolean is added to allow the QEMU guest agent to change to the `virt_qemu_ga_unconfined_t` domain for run files in any of the following directories:
 - `/etc/qemu-ga/fsfreeze-hook.d/`
 - `/usr/libexec/qemu-ga/fsfreeze-hook.d/`
 - `/var/run/qemu-ga/fsfreeze-hook.d/`

Enable the `virt_qemu_ga_run_unconfined` to run confined commands through the QEMU guest agent.

SCAP Security Guide Updated to Version 0.1.74

Updates to the SCAP Security Guide include the following notable changes:

- Enhanced coverage of draft for STIG profile in Oracle Linux 9:
 - Extended rules selection to match latest version of the draft document.
 - Completed ansible remediation coverage.
- Introduced `ism_o` profile for Oracle Linux 9 systems to cover the "Information Security Manual" guidance produced by Australian Cyber Security Center.

Networking

The following features, enhancements, and changes related to networking are introduced in this Oracle Linux 9 release.

NetworkManager Updated to Version 1.48

NetworkManager is updated to version 1.48 and includes several fixes and improvements.

The following key changes are included:

- The `NetworkManager-libreswan` VPN plugin for IPsec VPNs used in NetworkManager includes several updates, including:
 - A `leftsubnet` parameter that defines the local subnet when setting up subnet-to-subnet configurations.
 - A `rightcert` parameter to authenticate the remote side of the IPsec connection using a certificate.
 - A fix to provide IPv6 in addition to IPv4 when creating IPsec connections.
- The `nmstate` Network Manager state package is updated to include several enhancements, including:
 - A `cwnd` option that controls the maximum number of unacknowledged packets that can be in transit over a network at one time.
 - A `leftsubnet` parameter that defines the local subnet when setting up subnet-to-subnet configurations.

- A `rightcert` parameter to authenticate the "right" or remote side of the IPsec connection using a certificate.
- The `mac-address-blacklist` property is replaced with `mac-address-denylist` for 802-11-wireless and 802-11-wired devices as part of an inclusive language initiative.

See <https://gitlab.freedesktop.org/NetworkManager/NetworkManager/blob/main/NEWS> for more information.

firewalld Updated to Version 1.3.4

The `firewalld` package is updated to version 1.3.4 to include several bug fixes and documentation updates.

You can now enable and use `firewalld` and `nftables systemd` services at the same time. Previously, you could only use one at a time.

See <https://github.com/firewalld/firewalld/releases/tag/v1.3.4> for more information.

Kernel and System Libraries

The following notable features, enhancements, and changes apply to the Red Hat Compatible Kernel (RHCK) that's shipped with the current Oracle Linux 9 version.

eBPF Updated to Align With Linux Kernel 6.8

The eBPF functionality in RHCK is updated to align with the upstream version 6.8 Linux Kernel.

The following notable changes are included in this update:

- Exceptions can include asserting conditions in BPF programs that should never be true but are hard for the verifier to infer.
- Improved working with per-cpu objects.
- Several new open-coded iterators for `task`, `task_vma`, `css`, and `css_task`.
- Added `kfunc`, kernel functions, as an alternative to helper functions to provide functionality to get the associated cgroup of a task within a specific cgroup v1 hierarchy.
- BPF `link_info` for uprobe multi-link along with `bpf_tool` integration.
- Various improvements and bug fixes in the BPF verifier for more precise program verification, improved logic, and better control over tail calls and fentry/fexit programs.
- Added ability to pin the BPF timer to the current CPU.
- `bpf_fs` mounts include `uid` and `gid` options.

Updated Intel QAT Kernel Driver

The Intel® Quick Assist Technology (QAT) kernel driver is updated to handle 420xx devices. This update also includes a new device driver that enables updates to the firmware loader and other capabilities.

The updated driver is only available in RHCK.

New `noswap` Option For TMPFS

A new `noswap` option is available for `tmpfs` mounts that are used for the quick sharing of information across processes inside POSIX shared memory. Blocks in `tmpfs` can be swapped out during a memory shortage, but this can result in performance and privacy costs. The `noswap` mount option disables swap for the `tmpfs` mount.

File Systems and Storage

The following features, enhancements, and changes related to file systems and storage are introduced in this Oracle Linux 9 release.

`xfspgrog` is Updated to Version 6.4.0

The `xfspgrog` package is updated to version 6.4.0.

NVMe TP 8006 In-band Authentication with NVMe/TCP

Non-Volatile Memory Express (NVMe) TP 8006, which is an in-band authentication for NVMe over Fabrics (NVMe-oF), is now fully available on RHCK. The feature provides DH-HMAC-CHAP in-band authentication protocol for NVMe-oF. See the `dhchap-secret` and `dhchap-ctrl-secret` options in the `nvme-connect(1)` manual page for more information.

In-Band Authentication has been fully available on UEK since UEK R7U2.

Quotas For TMPFS

`tmpfs` can now use file system quotas to limit space or memory usage on a mounted `tmpfs` file system to help prevent users from using up all available space or memory on a system by writing to a shared file system. This feature is only available in RHCK.

Samba Updated to Version 4.20.2

The Samba packages are updated to version 4.20.2.

Note that the server message block version 1 (SMB1) protocol is deprecated and might be removed in a future release.

See <https://www.samba.org/samba/history/samba-4.20.0.html> for more information.

NVMe Over Fibre Channel Discovery and Connect

Using the `nvme-cli` utility, you can discover and connect to NVMe over Fibre Channel (NVMe/FC) enabled host bus adapters (HBAs). For more information about this feature, see [Oracle Linux 9: Managing Storage Devices](#). For more information about compatible HBA devices, see https://linux.oracle.com/Component_Compatibility_Guide.pdf.

NVMe Over Fibre Channel Installation

When you install Oracle Linux installation, you can now select NVMe over Fibre Channel (NVMe/FC) devices under the NVMe Fabrics Devices section while adding disks in the

Installation Destination window. For more information about compatible HBA devices, see https://linux.oracle.com/Component_Compatibility_Guide.pdf.

NVMe Over Fiber Channel SAN Boot

You can now boot NVMe over Fibre Channel (NVMe/FC) on NVMe/FC host bus adapters that support NVMe/FC boot capability. For more information about enabling NVMe/FC boot capability, see the NVMe-FC host bus adapter (HBA) manufacturer documentation. For more information about compatible HBA devices, see https://linux.oracle.com/Component_Compatibility_Guide.pdf.

High Availability and Clusters

The following features, enhancements, and changes related to high availability are introduced in this Oracle Linux 9 release.

Pacemaker Updates

Pacemaker updates include:

- `pcs status wait` command:
This status wait command causes Pacemaker to wait to complete any actions required by changes to the Cluster Information Base (CIB) and doesn't need to take any further actions to make the actual cluster state match the requested cluster state.
- `pcs` includes new commands to obtain the status of a resource in a cluster
The `pcs` CLI can now obtain information about:
 - resources
 - resource types
 - resource state
 - collective resource members
 - resource's node

These commands are available to use with `pcs`-based scripting because they don't require parsing plain text outputs.

- `pcs` includes resource defaults and resource `op` default options for displaying configuration in text, JSON, and command formats. The `pcs` resource defaults and resource `op` defaults commands and their aliases `pcs stonith defaults` and `pcs stonith op defaults` now provide the `--output-format` option.
 - Specifying `--output-format=text` displays the configured resource defaults or operation defaults in plain text format, which is the default value for this option.
 - Specifying `--output-format=cmd` displays the `pcs` resource defaults or `pcs` resource `op` defaults commands created from the current cluster defaults configuration. You can use these commands to re-create configured resource defaults or resource operation defaults on a different system.
 - Specifying `--output-format=json` displays the configured resource defaults or resource operation defaults in JSON format, which is suitable for machine parsing.
- Pacemaker includes an option to keep a panicked node shut down without rebooting automatically. The `PCMK_panic_action` variable in the `/etc/sysconfig/pacemaker` configuration file now includes the `off` or `sync-off` options causing a node to remain shut down after a panic condition instead of rebooting automatically.

High Availability Web UI

The High Availability Web UI now includes the following features:

- When setting the placement-strategy cluster property to default, the Web UI displays a warning near the utilization attributes for nodes and resources. The warning notes that the utilization has no effect because of placement-strategy configuration.
- The Web UI now includes a dark mode that you can set through the user menu.

Dynamic Programming Languages, Web and Database Servers

The following features, enhancements, and changes related to programming languages, web servers, and database servers are introduced in this Oracle Linux 9 release.

Python Interpreter Performance Enhancement

Python packages are built with the GCC `-O3` optimization flag, replacing the previous `-O2` flag. This change improves performance and results in faster execution of Python code.

`httpd` Updated to Version 2.4.62

The `httpd` package is updated to version 2.4.62. This update includes several security and bug fixes.

See https://downloads.apache.org/httpd/CHANGES_2.4.62 for more information.

`mod_md` Updated to Version 2.4.26

The `mod_md` package, used by the Apache `httpd` server to handle certificate provisioning using ACME, is updated to version 2.4.26. A significant number of changes apply since the previous version at 2.4.19.

See https://github.com/icing/mod_md/blob/master/ChangeLog for more information.

`nodejs:22` Stream Available

A new `nodejs:22` application stream is added to provide access to `nodejs` version 22.

See <https://nodejs.org/en/blog/announcements/v22-release-announce> for more information.

`db_converter` Tool Converts `libdb` Databases To GDBM

The deprecated Berkeley DB (`libdb`) includes the `db_converter` tool to convert `libdb` databases to the GNU dbm (GDBM) database format. The `db_converter` tool is available in the `libdb-utils` subpackage.

Compilers and Development Tools

The following features, enhancements, and changes related to compilers and development tools are introduced in this Oracle Linux 9 release.

System GCC is Updated to Version 11.5

The system GCC version is updated to 11.5 to provide many bug fixes and improvements.

elfutils Updated to Version 0.191

The `elfutils` package is updated to version 0.191.

systemtap Updated to Version 5.1

The `systemtap` package is updated to version 5.1.

Rust Toolset Updated to Version 1.79

Rust Toolset is now at version 1.79.

See <https://blog.rust-lang.org/2024/06/13/Rust-1.79.0.html> for more information.

Go Toolset Updated to Version 1.22.5

GoToolset is now at version 1.22.5.

See the <https://tip.golang.org/doc/go1.22> for more information.

GCC Toolset 14

GCC Toolset 14 is a compiler toolset that provides recent versions of development tools. The toolset is available in the form of a Software Collection in the `AppStream` repository.

The following tools and versions are available in the GCC Toolset 14:

- GCC 14.2.1
- `binutils` 2.41
- `dwz` 0.14
- `annobin` 12.70

To install the toolset, type:

```
sudo dnf install gcc-toolset-14
```

To run a tool from GCC Toolset 14, type:

```
$ scl enable gcc-toolset-14 tool
```

To run a shell session where tool versions from GCC Toolset 14 override system versions of these tools, type:

```
scl enable gcc-toolset-14 bash
```

glibc Updates

glibc is updated to include the following significant changes:

- Dynamic linking of functions that use Intel Advanced Performance Extensions (APX) is fixed so that the dynamic linker preserves APX-related registers.
- A tunable is included to place objects closer together in address space to improve performance. Objects are placed within the first 2 Gb of address space. To enable this tunable, update the GLIBC_TUNABLES environment variable:

```
export GLIBC_TUNABLES=glibc.cpu.prefer_map_32bit_exec=1
```

- Optimization of `memcpy` and `memmove` for AMD Zen architecture, such as AMD Zen 3 and Zen 4 processors.

GDB Updated to Version 14.2

GDB is updated to version 14.2. Starting with Oracle Linux 9.5, GDB is released as a rolling Application Stream with its system version updated in minor releases of Oracle Linux 9. GDB isn't included in GCC Toolset 14 in Oracle Linux 9.

Many updates are included with GDB 14.2, since the previous available version of GDB 12.1. See <https://www.sourceware.org/gdb/news/> for more information.

.NET Updated to Version 9.0

In this release, .NET is updated to version 9.0 which enables the C#13 and F#9 programming languages. This version also includes performance improvements in the garbage collector (GC), Just-In-Time (JIT) compiler, and the base libraries. Several additions and improvements are notable, including ML.NET for machine learning, .NET Aspire for building cloud-ready distributed applications, and updates to ASP.NET Core to improve authentication and authorization.

See <https://learn.microsoft.com/en-us/dotnet/core/whats-new/dotnet-9/overview> for more information.

PCP Updated to Version 6.2.2

PCP is updated to version 6.2.2 to include a significant number of bug fixes and improvements.

See <https://github.com/performancecopilot/pcp/blob/main/CHANGELOG> for more information.

Grafana Updated to Version 10.2.6

Grafana is updated to version 10.2.6.

See <https://grafana.com/docs/grafana/latest/whatsnew/> for more information.

LLVM Toolset Updated to Version 18.1.8

LLVM Toolset is updated to version 18.1.8.

See <https://releases.llvm.org/18.1.8/docs/ReleaseNotes.html> and <https://releases.llvm.org/18.1.8/tools/clang/docs/ReleaseNotes.html> for more information.

LLVM Toolset is a rolling Application Stream and only the latest version is supported.

valgrind Updated to Version 3.23.0

valgrind is updated to version 3.23.0.

See <https://valgrind.org/docs/manual/dist.news.html> for more information.

libabigail Updated to Version 2.5

libabigail is updated to version 2.5.

System Java Updated to OpenJDK 17

The default Oracle Linux 9 Java is changed from OpenJDK 11 to OpenJDK 17. After this update, the `java-17-openjdk` packages, which provide the OpenJDK 17 Java Runtime Environment and the OpenJDK 17 Java Software Development Kit, also provide the `java` and `java-devel` packages.

Containers

The following features, enhancements, and changes related to containers are introduced in this Oracle Linux 9 release.

Podman Updated to version 5.2

Podman is updated to version 5.2. The components for Podman are in the `container-tools` package.

Notable features and changes include the following:

- Using Podman and Buildah you can now add Open Container Initiative artifacts manifests to image indexes.
`buildah manifest add` includes the following options:
 - `--artifact` Creates artifact manifests.
 - `--artifact-type`, `--artifact-config-type`, `--artifact-layer-type`, `--artifact-exclude-titles`, and `--subject` specifies the contents of the artifact manifests.
`buildah manifest annotate` includes the following options:
 - the `--index` option to set annotations on the index itself instead of a one of the entries in the image index
 - the `--subject` option for setting the subject field of an image index.
`buildah manifest create` includes the `--annotation` option for adding annotations to the new image index.
- `podman manifest add` Includes a new `--artifact` option to add Open Container Initiative artifacts to a manifest list.
- Disable logging Podman `health_status` events by setting the new `healthcheck_events` option to `false` in the `containers.conf` configuration file under the `[engine]` section.
- `podman update` command of container configuration are persistent. This applies to SQLite and BoltDB database backends.

- `buildah build`, `podman build`, and `podman farm build` can use the new `--compat-volumes` option. This option triggers special handling for the contents of directories marked using the `VOLUME` instruction such that their contents can subsequently only be modified by `ADD` and `COPY` instructions. Any changes made in those locations by `RUN` instructions are discarded. Previously, this behavior was the default, but is now disabled by default.
- The system connections and farm information stored in the `containers.conf` file is now read-only. The system connections and farm information are now be stored in the `podman.connections.json` file, managed only by Podman. Podman continues to work with the old configuration options such as `[engine.service_destinations]` and the `[farms]` section. You manually add and edit connections or farms, however, you can't delete a connection from the `containers.conf` file with `podman system connection remove`. System connections that were added by Podman v4.0 remain unchanged after the upgrade to Podman v5.0.
- `podman pod inspect` provides a JSON array regardless of the number of pods. Previously, the `podman pod inspect` omitted the JSON array when inspecting a single pod.
- `podman inspect` The output for containers has changed and includes the following:
 - `Entrypoint` field changes from a string to an array of strings.
 - `StopSignal` changes from an integer to a string.
 - Returns `nil` for health checks when inspecting containers without health checks.
- `Cgroups v1` is deprecated. Podman now prints warnings when used on `cgroups v1` systems. You can set the `PODMAN_IGNORE_CGROUPSV1_WARNING` environment variable to suppress warnings.
- `pasta` replaces `slirp4netns` for improved performance as the default tool for rootless networking. Networks named `pasta` can no longer be used.

See <https://github.com/containers/podman/releases> for more information.

Cockpit Web Console

The following features, enhancements, and changes related to the Cockpit web console are introduced in this Oracle Linux 9 release.

Cockpit Web Console Updated to Version 323

The Cockpit web console is updated to version 323.

Added `cockpit-files` Package

The `cockpit-files` package is added to provide a File manager page in the Cockpit web console. With the File manager, you can browse files and directories, perform general file operations such as copying, moving, and renaming files, and you can upload files from the browser to the file system.

Virtualization

The following features, enhancements, and changes related to virtualization are introduced in this Oracle Linux 9 release.

QEMU Updated to Version 9.0.0

The `qemu-kvm` packages provided as part of the Default KVM stack are updated to version 9.0.0.

`nbdkit` Updated to Version 1.38

The `nbdkit` package is updated to version 1.38 to include many bug fixes and enhancements. Network Block Device (NBD) is a network protocol for accessing block devices over the network. Block devices are hard disks and things that behave as hard disks such as disk images and virtual machines. `nbdkit` is a toolkit for creating NBD servers.

See <https://libguestfs.org/nbdkit-release-notes-1.38.1.html> for more information

Support

The following features, enhancements, and changes related to support are introduced in this Oracle Linux 9 release.

`sos` is Updated

The `sos` package, that contains tools used to gather information from a system for debugging and diagnostic purposes, is updated.

Several new features are added:

- `sos report` is updated to provide a `--skip-cleaning-files` option to define a list of files that you don't want cleaned to obfuscate sensitive information. The option supports globs and wildcards.
- For better consistency across `sos` global options, the `--plugin-option` expects all plugin namespaces to use only hyphens instead of underscores.

3

Technology Preview

The following items are available as technical previews in this release of Oracle Linux. Note that some items listed apply to Red Hat Compatible Kernel (RHCK) and might already be available in UEK.

Security

The following features for security are available as technology preview.

KTLS

Oracle Linux 9 provides kernel Transport Layer Security (KTLS) as a technology preview.

The Linux Kernel TLS (KTLS) handles TLS records for the AES-GCM cipher. KTLS also provides the interface for offloading TLS record encryption to NICs that support this functionality.

OpenSSL 3.0 is able to use KTLS if the `enable-ktls` configuration option is used during compiling.

The updated `gnutls` packages can use KTLS for accelerating data transfer on encrypted channels. To enable KTLS, add the `tls.ko` kernel module using the `modprobe` command, and create a new configuration file `/etc/crypto-policies/local.d/gnutls-ktls.txt` for the system-wide cryptographic policies with the following content:

```
[global]
ktls = true
```

Note that `gnutls` doesn't permit you to update traffic keys through TLS `KeyUpdate` messages, which impacts the security of AES-GCM ciphersuites.

QUIC Protocol in OpenSSL

OpenSSL clients can use the QUIC transport layer network protocol as a technical preview.

`io_uring` Asynchronous I/O Interface

Although available, the `io_uring` asynchronous I/O interface is disabled in RHCK by default. To enable the feature, set the `kernel.io_uring_disabled` variable to any one of the following values when running the `sysctl` command:

- 0: All processes can create `io_uring` instances as usual.
- 1: Creating `io_uring` is disabled for unprivileged processes. With this setting, the `io_uring_setup` fails with the `-EPERM` error. It only successfully completes if the calling process is privileged by the `CAP_SYS_ADMIN` capability. However, existing `io_uring` instances can still be used.

- 2 (default): Creating `io_uring` creation is disabled for all processes. With this setting, the `io_uring_setup` always fails with `-EPERM`. However, existing `io_uring` instances can still be used.

To use this feature, an updated version of the SELinux policy to enable the `mmap` system call on anonymous inodes is also required.

Note that `io_uring` support has been available in UEK from UEK R6U3.

Infrastructure Services

The following features for infrastructure services are available as technology previews.

Socket API for TuneD

The socket API for TuneD maps one-to-one with the D-Bus API and provides an alternative communication method for cases where D-Bus isn't available. With the socket API, you can control the TuneD daemon to optimize the performance, and change the values of various tuning parameters. The socket API is disabled by default. You can enable it in the `tuned-main.conf` file.

Networking

The following networking features are available as technology previews.

`gpsd-minimal`

The `gpsd-minimal` package is available as a technical preview. `gpsd` is a service daemon that mediates access to a GPS sensor connected to the host computer by serial or USB interface, making its data on the location, course, and velocity of the sensor available to be queried on TCP port 2947 of the host computer.

WireGuard

WireGuard is a VPN solution that has improved security features and is easily configurable.

Note that WireGuard is fully supported in UEK. See [Oracle Linux: Configuring Virtual Private Networks](#) for more information on using WireGuard on Oracle Linux.

`systemd-resolved` Service

The `systemd-resolved` service provides name resolution to local applications. Its components include a caching and validating DNS stub resolver, a Link-Local Multicast Name Resolution (LLMNR), and Multicast DNS resolver and responder.

PRP and HSR

The `hsr` kernel module is included with RHCK to provide the following protocols as a technology preview:

- Parallel Redundancy Protocol (PRP)
- High-availability Seamless Redundancy (HSR)

IPsec Packet Offloading

In RHCK, complete IPsec encapsulation can be offloaded to a Network Interface Controller (NIC) to reduce workload. This functionality is offered as a technology preview.

Various Modem Network Drivers

Oracle Linux provides modem drivers in RHCK with limited functionality as a technology preview:

- Qualcomm MHI WWAM MBIM - Telit FN990Axx
- Intel IPC over Shared Memory (IOSM) - Intel XMM 7360 LTE Advanced
- Mediatek t7xx (WWAN) - Fibocom FM350GL
- Intel IPC over Shared Memory (IOSM) - Fibocom L860GL modem

Segment Routing Over IPv6

Segment Routing over IPv6 (SRv6) is available as a technology preview in RHCK. SRv6 can improve traffic flows in edge computing and provides a mechanism to program network slicing and resource reservation.

Kernel

The following kernel features are available as technology previews for RHCK.

Soft iWarp

Soft-iWARP (`siw`) is an Internet Wide-area RDMA Protocol (iWARP) software kernel driver. The driver implements the iWARP protocol suite over the TCP/IP network stack. The suite is implemented in software. Therefore, it doesn't require an RDMA hardware. The protocol suite enables a system with a standard Ethernet adapter to connect to an iWARP adapter or to another system that already has `siw` installed.

Note that from Oracle Linux 9.5, this driver is deprecated.

File Systems and Storage

The following features that are related to file systems and storage are available as technology preview.

`nvme-stas` Package

The `nvme-stas` package, which is a Central Discovery Controller (CDC) client for Linux, handles the following functionalities:

- Asynchronous Event Notifications (AEN)
- Automated NVMe subsystem connection controls
- Error handling and reporting
- Automatic (`zeroconf`) and Manual configuration.

This package consists of two daemons, Storage Appliance Finder (`stafd`) and Storage Appliance Connector (`stacd`).

Compilers and Development Tools

The following features for compilers and development tools are available as technology previews.

`jmc-core` and `owasp-java-encoder`

`jmc-core` is a library that provides core APIs for Java Development Kit (JDK) Mission Control, including APIs for:

- Parsing and writing Java Flight Recording files
- Discovering Java Virtual Machines (JVMs) through the Java Discovery Protocol (JDP)

The `owasp-java-encoder` package provides a collection of high-performance low-overhead contextual encoders for Java.

The packages are available in the Oracle Linux 9 CodeReady Builder repository, which is unsupported, and which you must explicitly enable.

Flexible Array Conversion Warning-Suppression in `libabigail` Available As a Technology Preview

When comparing binaries, you can suppress warnings related to fake flexible arrays that were converted to true flexible arrays by using the following suppression specification:

- `--- type_kind = struct has_size_change = true`
- `-- -has_strict_flexible_array_data_member_conversion = true`

This features is available as a technology preview.

Virtualization

The following virtualization features are available as technology previews.

Nested VMs

Nested KVM virtualization is provided as a technology preview for KVM virtual machines (VMs) running on Oracle Linux 9.

SEV and SEV-ES

The Secure Encrypted Virtualization (SEV) feature is provided for AMD EPYC host machines that use the KVM hypervisor. It encrypts a virtual machine's memory and protects the VM from access by the host.

SEV's enhanced Encrypted State version (SEV-ES) encrypts all CPU register contents when a VM stops running, thus preventing the host from modifying the VM's CPU registers or reading any information from them.

Note that SEV is supported in UEK.

4

Deprecated Features

This chapter lists features and functionalities that are deprecated in Oracle Linux 9. While these features might be included and operative in the release, support isn't guaranteed in future major releases. Thus, these features must not be used in new Oracle Linux 9 deployments.

Installation

The following installation related features and functionalities are deprecated in Oracle Linux 9.

Kickstart Commands

- `timezone --ntpservers`
- `timezone --nntp`
- `logging --level`
- `%packages --excludeWeakdeps`
- `%packages --instLangs`
- `%anaconda`
- `pwpolicy`
- `nvdimm`

Even though specific options are listed as deprecated, the base command and the other options remain available and operative. If you use a deprecated command in kickstart files, warnings are generated in the logs. To change deprecated command warnings to errors, set the `inst.ksstrict` boot option.

`initial-setup` Package

Instead of using this package, use the `gnome-initial-setup` package as a replacement.

`inst.geoloc` Boot Option Values `provider_hostip` And `provider_fedora_geoip`

The `provider_hostip` and `provider_fedora_geoip` values for the `inst.geoloc=` boot option are deprecated. You can use the `geolocation_provider=URL` option to set the required geolocation in the installation program configuration file, if required. Use the `inst.geoloc=0` option to disable the geolocation.

Anaconda Screenshots

Capturing screenshots of the Anaconda GUI by using a global hotkey is deprecated.

Anaconda Help

The built-in documentation from spokes and hubs of all Anaconda user interfaces that was available during Anaconda installation is deprecated. The interface is self-documented and the [Oracle Linux 9: Installing Oracle Linux](#) can be used for further assistance.

Software Management

The following software management related features and functionalities are deprecated in Oracle Linux 9.

DNF `debug` plugin

The DNF `debug` plugin, which includes the `dnf debug-dump` and `dnf debug-restore` commands, is deprecated.

DNF `libreport`

The DNF `libreport` library is deprecated.

Shell and Command Line

The following shell and command line related features and functionalities are deprecated in Oracle Linux 9.

`dump` Utility

The `dump` utility that's included in the `dump` package is deprecated.

You can alternatively use the `tar` or `dd` to achieve similar functionality.

Note that the `restore` utility, originally included in the `dump` package, remains available in Oracle Linux 9 and can be installed by using the `restore` package.

Bacula Sqlite Backend Database

The use of a SQLite backend database for the Bacula backup utility is deprecated. Bacula can use a MySQL backend database and you can migrate existing deployments to MySQL. Avoid using SQLite for new deployments of the Bacula backup utility.

TMPDIR Variable in the ReaR Configuration File

Exporting using the `TMPDIR` environment variable in the `/etc/rear/local.conf` or `/etc/rear/site.conf` ReaR configuration files, is deprecated.

Instead, you can specify a custom directory for ReaR temporary files by exporting the variable in the shell environment before executing ReaR. For example, run the `export TMPDIR=...` statement and then run the `rear` command in the same shell session or script.

Security

The following security related features and functionalities are deprecated in Oracle Linux 9.

OVAl Data Format

The Open Vulnerability Assessment Language (OVAl) data format used by the OpenSCAP suite is deprecated. Declarative security data is now provided in the Common Security Advisory Framework (CSAF) format, which is the successor of OVAl.

Using `update-ca-trust` Without Arguments

Using the `update-ca-trust` command without arguments to update the CA trust store is deprecated. Use the `update-ca-trust extract` command to update the CA trust store.

Configuring STunnel Clients to Use the Trusted Root CA Files

The option to configure STunnel Clients `CAFiles` directive to point to a file that contains trusted root certificates in the BEGIN TRUSTED CERTIFICATE format. If you use `CAfile`
= `/etc/pki/tls/certs/ca-bundle.trust.crt`, change the location to `CAfile`
= `/etc/pki/tls/certs/ca-bundle.crt`.

NSS Deprecated Algorithms

The following algorithms are deprecated in the Network Security Services (NSS) cryptographic library.

- Digital Signature Algorithm (DSA)
- SEED

Use RSA, ECDSA, SHB-DSA, ML-DSA, or FN-DSA instead.

`pam_ssh_agent_auth`

`pam_ssh_agent_auth` is deprecated.

`scap-workbench`

`scap-workbench` is deprecated.

`oscaped-anaconda-addon`

`oscaped-anaconda-addon` is deprecated.

`/etc/system-fips`

The `/etc/system-fips` file, that was used to indicate FIPS mode is removed. To install Oracle Linux in FIPS mode, add the `fips=1` parameter to the kernel command line during the system installation. You can check whether Oracle Linux operates in FIPS mode by using the `fips-mode-setup --check` command.

`libcrypt.so.1`

The `libcrypt.so.1` library is deprecated.

SHA-1 Algorithm

The SHA1 algorithm is deprecated in Oracle Linux 9. Digital signatures using SHA-1 hash algorithm are no longer considered secure and therefore not allowed on Oracle Linux 9 systems by default. Oracle Linux 9 has been updated to avoid using SHA-1 in security-related use cases.

However, the HMAC-SHA1 message authentication code and the Universal Unique Identifier (UUID) values can still be created by using SHA-1.

In cases where you need SHA-1 to verify existing or third party cryptographic signatures, you can enable SHA-1 as follows:

```
sudo update-crypto-policies --set DEFAULT:SHA1
```

As an alternative, you can switch the systemwide crypto policies to the `LEGACY` policy. However, this policy also enables other algorithms that are not secure, and therefore risks making the system vulnerable.

Furthermore, use of the SHA-1 algorithm at `SECLEVEL=2` is deprecated in OpenSSL.

SCP Protocol

In the `scp` utility, secure copy protocol (SCP) is replaced by the SSH File Transfer Protocol (SFTP) by default. Likewise, SCP is deprecated in the `libssh` library.

Oracle Linux 9 doesn't use SCP in the OpenSSH suite.

OpenSSL Cryptographic Algorithms

- MD2
- MD4
- MDC2
- Whirlpool
- RIPEMD160
- Blowfish
- CAST
- DES
- IDEA
- RC2
- RC4
- RC5
- SEED

- PBKDF1

The implementations of these algorithms have been moved to the legacy provider in OpenSSL

For instructions on how to load the legacy provider and enable support for the deprecated algorithms, see the `/etc/pki/tls/openssl.cnf` configuration file.

Digest-MD5

The Digest-MD5 authentication mechanism in the Simple Authentication Security Layer (SASL) framework is deprecated.

`/etc/system-fips` File

The `/etc/system-fips` file was used to indicate the FIPS mode in the system. This file is removed in Oracle Linux 9.

To install Oracle Linux 9 in FIPS mode, add the `fips=1` parameter to the kernel command line during the system installation. To check whether Oracle Linux 9 is operating in FIPS mode, use the `fips-mode-setup --check` command.

`libcrypt.so.1`

The `libcrypt.so.1` cryptographic library is deprecated.

`fapolicyd.rules` File

The `/etc/fapolicyd/fapolicyd.rules` file is deprecated. You can store policy rules for `fapolicyd` in the `/etc/fapolicyd/rules.d/` directory. The `fagenrules` script merges all component rule files in this directory to the `/etc/fapolicyd/compiled.rules` file.

Rules in `/etc/fapolicyd/fapolicyd.trust` continue to be processed by `fapolicyd` for backward compatibility.

OpenSSL RSA Encryption Without Padding

RSA encryption without padding for OpenSSL in FIPS mode is no longer accepted. However, key encapsulation with RSA (RSASVE) which doesn't use padding continues to be supported for OpenSSL.

OpenSSL Engines API

The Engines API is deprecated in the OpenSSL 3.0 TLS toolkit. Use the `pkcs11-provider` Providers API instead. Equally use of the OpenSSL Engines API in Stunnel is deprecated.

`openssl-pkcs11`

The `openssl-pkcs11` (`engine_pkcs11`) package, which relates to the deprecated OpenSSL Engines API, is now deprecated. Use the `pkcs11-provider` package instead.

Networking

The following network related features and functionalities are deprecated in Oracle Linux 9.

Soft-iWarp

Soft-iWarp, which was available as a technology preview in previous releases of Oracle Linux 9, is deprecated.

Network Teams

The `teamd` service, and the `libteam` library, and support for configuring network teams are deprecated in favor of network bonds. You should use network bonds instead, which have similar functions as teams, and which would receive enhancements and updates.

`dhcp-client` Package

The `dhcp-client` package and the `dhclient` tool that it contained are deprecated in favor of the internal DHCP client library built into NetworkManager.

`firewalld` Lockdown

The lockdown feature in `firewalld` is deprecated because it can't prevent processes that are running as `root` from adding themselves to the allow list.

`/etc/sysconfig/network-scripts` File

Network configurations profiles used to be in `ifcfg` format and stored in the `/etc/sysconfig/network-scripts` directory. This format is deprecated. In Oracle Linux 9, new network configurations are stored in `/etc/NetworkManager/system-connections` in keyfile format. This format works with all the connection settings provided by NetworkManager.

However, information in the `/etc/sysconfig/network-scripts` remain operative, and modifications to existing profiles continue to update the older files.

`iptables` Framework

With the deprecation of the `iptables` framework, the `iptables` backend and the `direct` interface are also deprecated.

Therefore, the following packages are also deprecated:

- `iptables-devel`
- `iptables-libs`
- `iptables-nft`
- `iptables-nft-services`
- `iptables-utils`

As an alternative to using `direct` interface, use the native features in `firewalld` to configure the required rules.

PF_KEYv2 Kernel API

The `PF_KEYv2` API is used to configure kernel IPsec implementation. However, this API isn't maintained upstream. Therefore, this API is deprecated. Instead, use the `netlink` API as a replacement.

Network Manager `nmcli` Language Changes

Because Oracle is fully committed to diversity and inclusion, the Network Manager `connection.master`, `connection.slave-type`, and `connection.autoconnect-slaves` connection property names are deprecated. They are retained for backward compatibility. However, consider using the following replacement terms instead:

- Instead of `connection.master`, use `connection.controller`
- Instead of `connection.slave-type`, use `connection.port-type`
- Instead of `connection.autoconnect-slaves` use `connection.autoconnect-ports`

Kernel

The following kernel related features and functionalities are deprecated in Oracle Linux 9.

`crashkernel=auto` Option

The `crashkernel=auto` option is deprecated and no longer supported on Oracle Linux 9 and is also unsupported for UEK R7 and later. Some platforms, such as the Raspberry Pi have maximum limits for `crashkernel` memory reservation and these must be specified explicitly. This option will be removed in a future UEK release.

Asynchronous Transfer Mode

Asynchronous Transfer Mode (ATM) encapsulation enables Layer-2 (Point-to-Point Protocol, Ethernet) or Layer-3 (IP) connectivity for the ATM Adaptation Layer 5 (AAL-5). Currently, these protocols are used only in chipsets that use ADSL technology, which are being phased out.

`kexec_load` in `kexec_tools`

The `kexec_load` system call for `kexec-tools` is deprecated.

The `kexec_file_load` system call replaces `kexec_load` and is the default system call.

`cgroupsv1`

`cgroupsv1` is deprecated in Oracle Linux 9 in favor of `cgroupsv2`. See [Oracle Linux 9: Managing the System With systemd](#) and [Oracle Linux 9: Managing Kernels and System Boot](#) for more information on using `cgroups`.

File Systems and Storage

The following features and functionalities related to file systems and storage are deprecated in Oracle Linux 9.

lsscsi NVMe

Using `lsscsi` to list information about Non-Volatile Memory Express (NVMe) devices is deprecated. Use `nvme-cli`, `lsblk`, and `blkid` instead.

sg3_utils NVMe

Using any of the tools in the `sg3_utils` package to work with Non-Volatile Memory Express (NVMe) devices is deprecated. Use `nvme-cli` instead.

lvm2-activation-generator

The `lvm2-activation-generator` program is deprecated, together with its generated services as follows:

- `lvm2-activation`
- `lvm2-activation-early`
- `lvm2-activation-net`

The `lvm.conf` `event_activation` that used to activate these services no longer works. The only method that is used for automatic activation of volume groups is event based activation.

PMDK Library

The Persistent Memory Development Kit (`pmdk`) is a collection of libraries and tools for simplifying the management and access of persistent memory devices. This set of libraries are deprecated, including the `-debuginfo` packages.

The following list of `pmdk`-related binary packages, including the `nvml` source package, have been deprecated:

- `libpmem`
- `libpmem-devel`
- `libpmem-debug`
- `libpmem2`
- `libpmem2-devel`
- `libpmem2-debug`
- `libpmemblk`
- `libpmemblk-devel`
- `libpmemblk-debug`
- `libpmemlog`
- `libpmemlog-devel`
- `libpmemlog-debug`
- `libpmemobj`
- `libpmemobj-devel`
- `libpmemobj-debug`

- `libpmempool`
- `libpmempool-devel`
- `libpmempool-debug`
- `pmempool`
- `daxio`
- `pmreorder`
- `pmdk-convert`
- `libpmemobj++`
- `libpmemobj++-devel`
- `libpmemobj++-doc`

`md-linear` and `md-faulty` MD RAID Kernel Modules

The following MD RAID kernel modules have been deprecated:

- `CONFIG_MD_LINEAR` or `md-linear`: Concatenates multiple drives so that when a single member disk becomes full, data is written to the next disk until all disks are full.
- `CONFIG_MD_FAULTY` or `md-faulty`: Tests a block device that occasionally returns read or write errors for testing purposes.

Virtual Data Optimizer Parameters in `sysfs`

Virtual Data Optimizer (VDO) parameters that appears in `sysfs` have been deprecated except for the `log_level` parameter. These include the following:

- All `kvdo` module-level `sysfs` parameters
- All individual `dm-vdo` `sysfs` parameters targets specific to VDO

Parameters that are common to all DM targets don't change. Configuration values for `dm-vdo` targets, which are set by updating the removed module-level parameters, can no longer be changed.

You can no longer access statistics and configuration values for `dm-vdo` targets using `sysfs`. However, these values are accessible using `dmsetup message stats`, `dmsetup status`, and `dmsetup table dmsetup` commands.

High Availability

The following high availability related features and functionalities are deprecated in Oracle Linux 9.

Several Pacemaker Configuration Options

Several Pacemaker configuration options are deprecated.

- Configuring a `score` parameter in order constraints
- Use of the `rkt` container engine in bundles
- Use of `upstart` and `nagios` resources

- The `monthdays`, `weekdays`, `weekyears`, `yearsdays` and `moon` date specification options when configuring Pacemaker rules
- The `yearsdays` and `moon` duration options for configuring Pacemaker rules

The `pcs` command emits a warning when a system is configured to use any of the deprecated features or options.

Dynamic Programming Languages, Web and Database Servers

The following features and functionalities that are related to dynamic programming, web, and database servers are deprecated in Oracle Linux 9.

Berkeley DB (`libdb`)

Deprecation of the Berkeley DB (`libdb`) package includes the removal of cryptographic algorithms and dependencies. Users of `libdb` should migrate to a different key-value database.

Compilers and Development

The following compiler and development related features and functionalities are deprecated in Oracle Linux 9.

Redis in Grafana, PCP, and `grafana-pcp`

Use of Redis in Grafana, PCP, and `grafana-pcp` is deprecated and will be replaced with Valkey.

`llvm-doc` HTML Content

The HTML content in the `llvm-doc` package is deprecated. See the content at <https://llvm.org/>.

Keys Smaller Than 2048-bits in OpenSSL

OpenSSL 3.0 has deprecated keys smaller than 2048 bits. Keys smaller than 2048 bits might not work in FIPS mode.

Some PKCS1 v1.5 modes

Some PKCS1 v1.5 modes aren't approved in FIPS-140-3 for encryption and are disabled.

32-bit `multilib` Linking

Linking against 32-bit `multilib` packages (`*.i686` packages) are deprecated.

Identity Management and Authentication

The following identity management and authentication features and functionalities are deprecated in Oracle Linux 9.

PAM Console

`pam_console` module is deprecated. It grants file permissions and authentication to users logged in at the physical console or terminals, and adjusts these privileges based on console login status and user presence.

BDB backend (in 389-ds-base)

Berkeley Database (BDB) backend is deprecated in `389-ds-base` package, the 389 Directory Server. As a replacement, Directory Server can now create instances with Lightning Memory-Mapped Database (LMDB) available as a Technology Preview.

sss_ssh_knownhostsproxy

`sss_ssh_knownhostsproxy`, a utility in the System Security Services Daemon (SSSD) package, is deprecated.

libsss_simpleifp

`libsss_simpleifp` that provides the `libsss_simpleifp.so` library is deprecated.

SSSD Files Provider

The SSSD `files` provider, which retrieves user information from local files such as `/etc/shadow` and group information from `/etc/groups`, is deprecated and disabled by default in Oracle Linux 9.

To retrieve user and group information from local files with SSSD:

1. Configure SSSD. Choose one of the following options:
 - a. Explicitly configure a local domain with the `id_provider=files` option in the `sssd.conf` configuration file.

```
[domain/local]
id_provider=files
...
```

- b. Enable the `files` provider by setting `enable_files_domain=true` in the `sssd.conf` configuration file.

```
[sssd]
enable_files_domain = true
```

2. Configure the name services switch.

```
sudo authselect enable-feature with-files-provider
```

OpenLDAP Utility Options

The OpenLDAP project has deprecated the `-h` and `-p` options in its utilities, and recommends using the `-H` option instead to specify the LDAP URI.

nsslapd-idlistscanlimit Parameter and Default Value

Because of optimizations to filter reordering, the `nsslapd-idlistscanlimit` parameter results in having a negative impact on search performance and is therefore deprecated. Further, the parameter's default value is changed to `2147483646`.

SMB1 Protocol

Beginning with Samba 4.11, the Server Message Block version 1 (SMB1) protocol is deprecated because of its insecure features. By default, this protocol is disabled in both Samba server and client utilities.

Desktop

The following desktop related features and functionalities are deprecated in Oracle Linux 9.

Totem Media Player

The Totem media player is deprecated.

Power Profiles Daemon

The `power-profiles-daemon` package has been deprecated. This package provides the power mode configuration in GNOME. Use `tuned` instead. You can use the `tuned-ppd` API translation daemon as a drop-in replacement for `power-profiles-daemon`.

Gedit

`gedit` is deprecated.

Qt 5

Qt 5 libraries is deprecated.

WebKitGTK

WebKitGTK web browser engine is deprecated. This includes building applications that depend on WebKitGTK.

Evolution

`evolution` is deprecated.

Festival

`Festival` speech synthesizer is deprecated. Use the `espeak-ng` speech synthesizer instead.

Eye of GNOME

The `eog` package, the Eye of GNOME image viewer application, is deprecated.

Cheese

The `Cheese` package, a camera application, is deprecated. Use the Snapshot application.

Devhelp

`devhelp`, a graphical developer tool for browsing and searching API documentation, is deprecated. Find API documentation online in specific upstream projects.

gtkmm (GTK 3 based)

The `gtkmm` package based on GTK 3 is deprecated. `gtkmm` is a C++ interface for the GTK graphical toolkit.

TigerVNC

The TigerVNC remote desktop solution is deprecated.

The following packages are deprecated:

- `tigervnc`
- `tigervnc-icons`
- `tigervnc-license`
- `tigervnc-selinux`
- `tigervnc-server`
- `tigervnc-server-minimal`
- `tigervnc-server-module`

The `gnome-connections` application can be used as an alternative VNC client, but it doesn't provide a VNC server.

Future remote desktop solutions are likely to use Remote Desktop Protocol (RDP).

X.org Server

In Oracle Linux 9, the `X.org` display server is deprecated, and consequently, the `xorg-x11-server-Xorg` package.

The default desktop session is the Wayland session. However, the X11 protocol continues to be supported by using the `XWayland` backend. Therefore, applications that require X11 can run in Wayland sessions.

GTK 2

The legacy GTK 2 toolkit and the following, related packages are deprecated:

- `adwaita-gtk2-theme`
- `gnome-common`
- `gtk2`
- `gtk2-immodules`

- `hexchat`

If you maintain an application that uses GTK 2, port the application to GTK 4 as soon as possible.

Motif Toolkit

The Motif widget tool is deprecated, including the following packages:

- `motif`
- `openmotif`
- `openmotif21`
- `openmotif22`

Likewise, the `motif-static` package has been removed. In place of Motif, use the GTK toolkit.

LibreOffice and Inkscape

The LibreOffice RPM packages are now deprecated. However, LibreOffice itself continues to be supported.

As a replacement for the RPM packages, you can use the following sources to install LibreOffice:

- Official Flatpak package in the Flathub repository: <https://flathub.org/apps/org.libreoffice.LibreOffice>.
- Official RPM packages: <https://www.libreoffice.org/download/download-libreoffice/>.

Likewise, the Inkscape Flatpak image (`inkscape-flatpak`) is also deprecated. As a replacement, use the `inkscape` RPM package from <https://inkscape.org/>.

Virtualization

The following virtualization related features and functionalities are deprecated in Oracle Linux 9.

Signatures Using SHA-1

The use of SHA1-based signatures to perform SecureBoot image verification on UEFI (PE/COFF) executables is deprecated. Instead, use signatures that are based on SHA-2 or later.

Virtual Machine Manager

In place of the deprecated Virtual Machine Manager (`virt-manager`), use the web console, otherwise known as Cockpit.

Virtual Machine Snapshots

Support for creating snapshots of VMs is limited only to those that do not use UEFI firmware. However, the operation might cause the QEMU monitor to become blocked and affects hypervisor operations.

As an alternative, use external snapshots.

libvirt Daemon

As a replacement of the deprecated `libvirt` daemon, use the modular daemons in the `libvirt` library. For example, the `virtqemu` handles QEMU drivers.

Virtual Floppy Driver

The `isa-fdc` driver controls virtual floppy disk devices. To ensure compatibility with migrated virtual machines (VMs), you should not use floppy disk devices in virtual machines that you subsequently host on Oracle Linux 9.

qcow2-v2 Format

For virtual disk images, use the `qcow2-v3` format instead.

Legacy CPU Models

The following legacy CPU models are deprecated for use in VMs:

- For Intel® : models prior to Intel® Xeon 55xx and 75xx Processor families (also known as Nehalem)
- For AMD: models prior to AMD Opteron G4

To check whether a VM is using a deprecated CPU model, use the `virsh domaininfo` command, and look for a line similar to the following in the `Messages` section:

```
tainted: use of deprecated configuration settings
deprecated configuration: CPU model 'i486'
```

RDMA-based Live Migration

In this release, RDMA-based live migration of virtual machines is deprecated.

Windows 8 and Windows Server 2012 Guest Operating System

The following Windows versions are deprecated as a guest operating system:

- Windows 8
- Windows 8.1
- Windows Server 2012
- Windows Server 2012 R2

These are deprecated because they are no longer supported by Microsoft.

NIC Device Drivers for iPXE

The following device drivers are deprecated:

- All device drivers in the `ipxe-roms` subpackage
- The following binary files from `ipxe-bootimgs-x86`:

- /usr/share/ipxe/ipxe-i386.efi
- /usr/share/ipxe/ipxe-x86_64.efi
- /usr/share/ipxe/ipxe.dsk
- /usr/share/ipxe/ipxe.iso
- /usr/share/ipxe/ipxe.lkrm
- /usr/share/ipxe/ipxe.usb

Use the following binary files from the `ipxe-bootimgs` package to provide NIC device drivers for iPXE network boot:

- /usr/share/ipxe/ipxe-snponly-x86_64.efi
- /usr/share/ipxe/undionly.kpxe

Intel vGPU

Dividing select Intel vGPUs into multiple virtual GPUs and assigning them to VMs is no longer supported.

pmem Device Passthrough

The non-volatile memory library (`nvml`) packages are deprecated. When they are removed in a future release, you will be unable to pass persistent memory (`pmem`) devices to VMs. You also will be unable to configure emulated NVDIMM devices backed by volatile memory or files as persistent, but the devices will remain available.

Containers

The following features and functionalities that are related to containers are deprecated in Oracle Linux 9.

`containers.conf` for System Connections

The `containers.conf` file is read-only for Podman commands. The system connections and farm information must be stored in the `podman.connections.json` file, managed only by Podman.

Podman continues to support the old configuration options such as `[engine.service_destinations]` and the `[farms]` section. You can still add connections or farms manually if needed, however, it's not possible to delete a connection from the `containers.conf` file with the `podman system connection rm` command.

`slirp4net`

The `slirp4netns` network mode is deprecated. The `pasta` network mode is the default network mode for rootless containers.

`cgroupsv1` in Rootless Containers

Using `cgroupsv1` for rootless containers is deprecated.

Note that `cgroupsv1` is deprecated on Oracle Linux 9. See [cgroupsv1](#).

runc Container Runtime

The `runc` container runtime is deprecated. The default container runtime is `crun`.

`pasta` as a Network Name

Using `pasta` as a network name value is deprecated.

BoltDB Database Backend

The BoltDB database backend is deprecated in favor of the SQLite database backend.

Oracle Linux 9 Containers on Oracle Linux 7 Hosts

Creating Oracle Linux 9 containers on an Oracle Linux 7 host is unsupported. Attempts to deploy this configuration might succeed, but isn't guaranteed.

SHA-1 Algorithm Within Podman

Support for using the SHA-11 algorithm to generate the filename of the rootless network namespace is removed in Podman. You should restart rootless containers that were configured by using Podman earlier than version 4.1.1. Restarting these containers rather than just using `slirp4netns` ensures that these containers and join the network and connect with containers that were created with upgraded Podman versions.

CNI Network Stack

The Container Network Interface (CNI) network stack is deprecated. You can use the Netavark network stack with Podman and other Open Container Initiative (OCI) container management applications. The Netavark network stack for Podman is also compatible with advanced Docker functionalities.

Deprecated Packages

The support status of deprecated packages remains unchanged within Oracle Linux 9. For more information about the length of support, see [Oracle Linux: Product Life Cycle Information](#).

The following packages are deprecated in Oracle Linux 9:

- `aacraid`
- `aaajohan-comfortaa-fonts`
- `adwaita-gtk2-theme`
- `adwaita-gtk2-theme`
- `adwaita-qt5`
- `af_key`
- `anaconda-user-help`
- `anaconda-user-help`
- `ant-javamail`

- apr-util-bdb
- aspnetcore-runtime-7.0
- aspnetcore-targeting-pack-6.0
- aspnetcore-targeting-pack-7.0
- atkmm
- atlas
- atlas-devel
- atlas-z14
- atlas-z15
- authselect-compat
- autoconf271
- autoconf-latest
- autocorr-af
- autocorr-bg
- autocorr-ca
- autocorr-cs
- autocorr-da
- autocorr-de
- autocorr-dsb
- autocorr-el
- autocorr-en
- autocorr-es
- autocorr-fa
- autocorr-fi
- autocorr-fr
- autocorr-ga
- autocorr-hr
- autocorr-hsb
- autocorr-hu
- autocorr-is
- autocorr-it
- autocorr-ja
- autocorr-ko
- autocorr-lb
- autocorr-lt
- autocorr-mn
- autocorr-nl

- autocorr-pl
- autocorr-pt
- autocorr-ro
- autocorr-ru
- autocorr-sk
- autocorr-sl
- autocorr-sr
- autocorr-sv
- autocorr-tr
- autocorr-vi
- autocorr-vro
- autocorr-zh
- babl
- bind9.18-libs
- bitmap-fangsongti-fonts
- bnx2
- bnx2fc
- bnx2i
- bogofilter
- Box2D
- brasero-nautilus
- cairomm
- cheese
- cheese-libs
- clucene-contribs-lib
- clucene-core
- clutter
- clutter-gst3
- clutter-gtk
- cnic
- cogl
- compat-hesiod
- compat-locales-sap
- compat-locales-sap-common
- compat-openssl11
- compat-paratype-pt-sans-fonts-f33-f34
- compat-sap-c++-12

- `compat-sap-c++-13`
- `containernetworking-plugins`
- `containers-common-extra`
- `culmus-aharoni-clm-fonts`
- `culmus-caladings-clm-fonts`
- `culmus-david-clm-fonts`
- `culmus-drugulin-clm-fonts`
- `culmus-ellinia-clm-fonts`
- `culmus-fonts-common`
- `culmus-frank-ruehl-clm-fonts`
- `culmus-hadasim-clm-fonts`
- `culmus-miriam-clm-fonts`
- `culmus-miriam-mono-clm-fonts`
- `culmus-nachlieli-clm-fonts`
- `culmus-simple-clm-fonts`
- `culmus-stamashkenaz-clm-fonts`
- `culmus-stamsefarad-clm-fonts`
- `culmus-yehuda-clm-fonts`
- `curl-minimal`
- `daxio`
- `dbus-glib`
- `dbus-glib-devel`
- `devhelp`
- `devhelp-libs`
- `dhcp-client`
- `dhcp-common`
- `dhcp-relay`
- `dhcp-server`
- `dotnet-apphost-pack-6.0`
- `dotnet-apphost-pack-7.0`
- `dotnet-hostfxr-6.0`
- `dotnet-hostfxr-7.0`
- `dotnet-runtime-6.0`
- `dotnet-runtime-7.0`
- `dotnet-sdk-6.0`
- `dotnet-sdk-7.0`
- `dotnet-targeting-pack-6.0`

- dotnet-targeting-pack-7.0
- dotnet-templates-6.0
- dotnet-templates-7.0
- double-conversion
- efs-utils
- enchant
- enchant-devel
- eog
- evince
- evince-libs
- evince-nautilus
- evince-previewer
- evince-thumbnailer
- evolution
- evolution-bogofilter
- evolution-data-server-ui
- evolution-data-server-ui-devel
- evolution-devel
- evolution-ews
- evolution-ews-langpacks
- evolution-help
- evolution-langpacks
- evolution-mapi
- evolution-mapi-langpacks
- evolution-pst
- evolution-spamassassin
- festival
- festival-data
- festvox-slt-arctic-hts
- firefox
- firefox
- firefox-x11
- firewire-core
- flite
- flite-devel
- fltk
- flute

- fontawesome-fonts
- gc
- gcr-base
- gedit
- gedit-plugin-bookmarks
- gedit-plugin-bracketcompletion
- gedit-plugin-codecomment
- gedit-plugin-colorpicker
- gedit-plugin-colorschemer
- gedit-plugin-commander
- gedit-plugin-drawspaces
- gedit-plugin-findinfiles
- gedit-plugin-joinlines
- gedit-plugin-multiedit
- gedit-plugins
- gedit-plugins-data
- gedit-plugin-sessionsaver
- gedit-plugin-smartspaces
- gedit-plugin-synctex
- gedit-plugin-terminal
- gedit-plugin-textsize
- gedit-plugin-translate
- gedit-plugin-wordcompletion
- ghc-srpm-macros
- ghostscript-x11
- git-p4
- glade
- glade-libs
- glibmm24
- gl-manpages
- gnome-backgrounds
- gnome-backgrounds-extras
- gnome-common
- gnome-logs
- gnome-photos
- gnome-photos-tests
- gnome-screenshot

- `gnome-session-xsession`
- `gnome-shell-extension-panel-favorites`
- `gnome-shell-extension-updates-dialog`
- `gnome-terminal`
- `gnome-terminal-nautilus`
- `gnome-themes-extra`
- `gnome-tweaks`
- `gnome-video-effects`
- `google-noto-cjk-fonts-common`
- `google-noto-sans-cjk-ttc-fonts`
- `google-noto-sans-khmer-ui-fonts`
- `google-noto-sans-lao-ui-fonts`
- `google-noto-sans-thai-ui-fonts`
- `gspell`
- `gtk2`
- `gtk2-devel`
- `gtk2-devel-docs`
- `gtk2-immodules`
- `gtk2-immodule-xim`
- `gtkmm30`
- `gtksourceview4`
- `gtksourceview4`
- `gubbi-fonts`
- `gvfs-devel`
- `ha-openstack-support`
- `hesiod`
- `hexchat`
- `highcontrast-icon-theme`
- `http-parser`
- `ibus-gtk2`
- `initial-setup`
- `initial-setup-gui`
- `inkscape`
- `inkscape-docs`
- `inkscape-view`
- `iptables-devel`
- `iptables-libs`

- iptables-nft
- iptables-nft-services
- iptables-utils
- iputils-ninford
- ipxe-roms
- jakarta-activation2
- jboss-jaxrs-2.0-api
- jboss-logging
- jboss-logging-tools
- jdeparser
- julietaula-montserrat-fonts
- kacst-art-fonts
- kacst-book-fonts
- kacst-decorative-fonts
- kacst-digital-fonts
- kacst-farsi-fonts
- kacst-fonts-common
- kacst-letter-fonts
- kacst-naskh-fonts
- kacst-office-fonts
- kacst-one-fonts
- kacst-pen-fonts
- kacst-poster-fonts
- kacst-qurn-fonts
- kacst-screen-fonts
- kacst-title-fonts
- kacst-titlel-fonts
- khmer-os-battambang-fonts
- khmer-os-bokor-fonts
- khmer-os-content-fonts
- khmer-os-fasthand-fonts
- khmer-os-freehand-fonts
- khmer-os-handwritten-fonts
- khmer-os-metal-chrieng-fonts
- khmer-os-muol-fonts
- khmer-os-muol-fonts-all
- khmer-os-muol-pali-fonts

- khmer-os-siemreap-fonts
- kmod-kvdo
- lasso
- libabw
- libadwaita-gt5
- libbase
- libblockdev-kbd
- libcanberra-gtk2
- libcdr
- libcmis
- libdazzle
- libdb
- libdb-devel
- libdb-utils
- libdmx
- libepubgen
- libetonyek
- libexttextcat
- libfonts
- libformula
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- mythes-ca
- mythes-cs
- mythes-da
- mythes-de

- mythes-el
- mythes-en
- mythes-eo
- mythes-es
- mythes-fr
- mythes-ga
- mythes-hu
- mythes-it
- mythes-lv
- mythes-nb
- mythes-nl
- mythes-nn
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- scap-workbench
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5

Known Issues

This chapter describes known issues that you may encounter when installing and using the Oracle Linux 9 software. Unless indicated otherwise, the issues apply to both x86_64 and aarch64 systems. Information that pertains only to a specific platform is also noted accordingly.

Installation Issues

The following are known installation issues for Oracle Linux 9.

Error Messages Displayed While Removing RHCK

When you issue the command `sudo dnf remove kernel-core-version` to remove the Red Hat Compatible Kernel (RHCK) from the system, error messages similar to the following example might be generated:

```
...
Erasing      : kernel-core-version                4/4
warning: file /lib/modules/version/modules.builtin.modinfo:
  No such file or directory
...
```

You can ignore the messages. At the end of the operation, all RHCK related files are removed successfully.

Bug ID 35964185

Virtualization Issues

The following are known virtualization issues for Oracle Linux 9

KVM Virtual Machines Panic When Started on Oracle Linux 9 Hosts

The `glibc` version that's included with Oracle Linux 9 checks for compatibility between a system's CPU and new architectures that are supported. A system might pass the compatibility check. However, the CPU flags that are set on the system after passing the check might be unknown to the KVM virtual machines that are hosted on that system. Consequently, the VMs panic when they're booted.

To work around this issue, run the following command:

```
virsh edit vm-name
```

Then, add the following declaration in the virtual machine's XML file:

```
<cpu mode='host-model' check='partial' />
```

The `check` parameter's `partial` setting sets `libvirt` to check the VM's CPU specification before starting a domain. However, the rest of the checking remains on the hypervisor, which can still provide a different virtual CPU.

(Bug ID 34224821)

Virtual Machines Fail to Start at Boot Because the `virbr0` Interface Isn't Available

After reboot, the `virbr0` network interface might be missing, which can prevent virtual machines from automatically starting up after boot.

The `libvirt` daemons on Oracle Linux 9 are modular to handle atomic features within the virtualization environment and are started and run as required, and stopped after two minutes of inactivity. The daemon responsible for setting up the networking interfaces for `libvirt` is `virtnetworkd`. This service isn't automatically started when a virtual machine is started.

To work around this issue, enable the `virtnetworkd` service so that the service starts at boot:

```
sudo systemctl enable --now virtnetworkd
```

(Bug ID 34237540)

Kernel Issues

The following are known kernel issues in Oracle Linux 9.

Kdump Might Fail on Some AMD Hardware

Kdump might fail on some AMD hardware that's running the current Oracle Linux release. Impacted hardware includes the AMD EPYC CPU servers.

To work around this issue, modify the `/etc/sysconfig/kdump` configuration file and remove the `iommu=off` command line option from the `KDUMP_COMMANDLINE_APPEND` variable. Restart the `kdump` service for the changes to take effect.

This issue appears to affect systems running RHCK.

(Bug ID 31274238, 34211826, 34312626)

(aarch64) Some GUI Elements Aren't Displayed During Installation and Boot Using VGA Output

During installations on the Arm platform, the Oracle Linux installer doesn't display some GUI elements, such as the progress update screen, on VGA output. Output is displayed on the serial console, instead.

Additionally, if you install Oracle Linux with GUI on an encrypted disk, for example, by choosing Server with GUI during the installation stage, and VGA is enabled, the password prompt doesn't appear on the VGA output at system boot, and consequently, the boot process can't be completed. The prompt appears only on a serial console, and therefore, you would need to switch to a serial console to provide the password there.

This issue is specific to systems on the Arm platform only and occurs regardless of whether you are using secure boot or non secure boot. Further, the issue applies to Oracle Linux 8 or Oracle Linux 9 systems that use UEKR6 and UEKR7. The issue occurs wherever Plymouth graphical elements are loaded in the GUI.

To resolve these GUI issues and to cause these elements to display on VGA output without using a serial console, add `plymouth.ignore-serial-console`s to the kernel command line in the GRUB configuration. For instructions, see [Oracle Linux 9: Managing Kernels and System Boot](#).

(Bug ID 35034465 and 35270637)

Certain SEV Guest Configurations Might Cause Hypervisor CPU Soft-Lockup Warnings

On older generation AMD systems that are based on the AMD Rome processors, such as E2 and E3 systems, a guest with more than 350GB memory that's configured to use Secure Encrypted Virtualization (SEV) memory encryption can trigger a CPU soft-lockup warning on the hypervisor host during guest boot or shutdown operations.

The time that's needed to flush the pinned memory that's being encrypted is proportional to the amount of guest memory. However, with larger amounts of memory in excess of 350GB, the time on the CPU to flush the memory becomes excessive, which consequently triggers a warning. After the memory is flushed, the hypervisor resumes normal operations.

Newer systems that are based on the AMD Milan processor, such as E4 systems, have hardware support that can minimize the time required for flushing the memory. Therefore, the CPU soft-hang issue isn't encountered.

As a workaround, if a SEV enabled guest with more than 350GB of memory is required, create the guest on a system that's based on the AMD Milan processor. If you are using systems with the AMD Rome processor, limit the guest memory to less than 350GB if the guest is configured with SEV memory encryption.

(Bug ID 34050377)

Systems With Btrfs Fail to Boot in FIPS Mode

When booted in FIPS mode, a system using Btrfs fails with the following message:

```
FATAL: FIPS integrity test failed
Refusing to continue
```

(Bug ID 36028061)

Leapp Upgrade Messages About Unmounted `/proc` File System

Warning messages are displayed in the package installation logs during Leapp preupgrade and Leapp upgrade:

```
/proc/ is not mounted. This is not a supported mode of operation. Please fix
your invocation environment to mount /proc/ and /sys/ properly. Proceeding anyway.
Your mileage may vary.
```

During upgrade `/proc` is mounted in a temporary chroot as part of the preparation for the upgrade rootfs. This process is normal and the warning messages aren't indicative of any real problem. You can ignore warning messages about the `/proc` file system.

(Bug ID 36512929)

Kdump Service Disabled After Upgrade

Kdump configuration might be disabled after updating NetworkManager. This is because of a version update of NetworkManager that changes the default options during `nmcli` run time for enabling kdump. Kdump is enabled again after the next reboot.

(Bug ID 36563373)

Openssl Tool Returns Unable to Print EC Key in FIPS Mode

When FIPS mode is enabled on a system, the `openssl` tool is unable to print an Elliptic Curve (EC) key, when using the following command:

```
openssl ec -in ecp256.pem -noout -text
```

The command fails with the message:

```
unable to print EC key
```

Explicitly loading the `fips` provider when running the command works around this issue, for example:

```
openssl ec -provider=fips -in ecp256.pem -noout -text
```

(Bug ID 37290712)

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Package Changes From the Upstream Release

The following sections list the changes to binary and source packages from the upstream release.

Changes to Binary Packages

This section contains information about the removed, modified, and new **binary** packages in this release. For information about the **source** package changes, see [Changes to Source Packages](#).

Added Binary Packages for BaseOS by Oracle

The following binary packages have been added to BaseOS by Oracle:

- `bcache-tools`
- `btrfs-progs`
- `dtrace`
- `iwl3945-firmware`
- `iwl4965-firmware`
- `iwl6000-firmware`
- `iwlax2xx-firmware`
- `kernel-uek`
- `kernel-uek-core`
- `kernel-uek-debug`
- `kernel-uek-debug-core`
- `kernel-uek-debug-devel`
- `kernel-uek-debug-modules`
- `kernel-uek-debug-modules-extra`
- `kernel-uek-devel`
- `kernel-uek-doc`
- `kernel-uek-modules`
- `kernel-uek-modules-extra`
- `libertas-sd8686-firmware`
- `libertas-usb8388-firmware`
- `libertas-usb8388-olpc-firmware`

- linux-firmware-core
- liquidio-firmware
- NetworkManager-config-connectivity-oracle
- ocfs2-tools
- oracle-backgrounds
- oracle-indexhtml
- oraclelinux-release
- oraclelinux-release-el9
- oracle-logos
- oracle-logos-httpd
- oracle-logos-ipa
- rhnsd

Added Binary Packages for AppStream by Oracle

The following binary packages have been added to AppStream by Oracle:

- dnf-plugin-spacewalk
- dtrace-devel
- dtrace-testsuite
- libblockdev-btrfs
- python3-dnf-plugin-spacewalk
- python3-dnf-plugin-ulninfo
- python3-hwdata
- python3-pyOpenSSL
- python3-rhn-check
- python3-rhn-client-tools
- python3-rhnlb
- python3-rhn-setup
- python3-rhn-setup-gnome
- rhn-check
- rhn-client-tools
- rhnlb
- rhn-setup
- rhn-setup-gnome

Added Binary Packages for CodeReady Linux Builder by Oracle

The following binary packages have been added to CodeReady Linux Builder by Oracle:

- oraclelinux-sb-certs

Modified BaseOS Binary Packages

The following binary packages from the BaseOS upstream release have been modified:

- alternatives
- audispd-plugins
- audispd-plugins-zos
- audit
- audit-libs
- autofs
- binutils
- binutils-gold
- biosdevname
- chkconfig
- chrony
- cockpit
- cockpit-bridge
- cockpit-doc
- cockpit-system
- cockpit-ws
- coreutils
- coreutils-common
- coreutils-single
- dbus
- dbus-common
- dbus-libs
- dbus-tools
- dnf
- dnf-automatic
- dnf-data
- dnf-plugins-core
- dracut
- dracut-config-generic
- dracut-config-rescue
- dracut-network
- dracut-squash
- dracut-tools

- efibootmgr
- efi-filesystem
- firewalld
- firewalld-filesystem
- fwupd
- glibc
- glibc-all-langpacks
- glibc-common
- glibc-gconv-extra
- glibc-langpack-aa
- glibc-langpack-af
- glibc-langpack-agr
- glibc-langpack-ak
- glibc-langpack-am
- glibc-langpack-an
- glibc-langpack-anp
- glibc-langpack-ar
- glibc-langpack-as
- glibc-langpack-ast
- glibc-langpack-ayc
- glibc-langpack-az
- glibc-langpack-be
- glibc-langpack-bem
- glibc-langpack-ber
- glibc-langpack-bg
- glibc-langpack-bhb
- glibc-langpack-bho
- glibc-langpack-bi
- glibc-langpack-bn
- glibc-langpack-bo
- glibc-langpack-br
- glibc-langpack-brx
- glibc-langpack-bs
- glibc-langpack-byn
- glibc-langpack-ca
- glibc-langpack-ce
- glibc-langpack-chr

- glibc-langpack-ckb
- glibc-langpack-cmn
- glibc-langpack-crh
- glibc-langpack-cs
- glibc-langpack-csb
- glibc-langpack-cv
- glibc-langpack-cy
- glibc-langpack-da
- glibc-langpack-de
- glibc-langpack-doi
- glibc-langpack-dsb
- glibc-langpack-dv
- glibc-langpack-dz
- glibc-langpack-el
- glibc-langpack-en
- glibc-langpack-eo
- glibc-langpack-es
- glibc-langpack-et
- glibc-langpack-eu
- glibc-langpack-fa
- glibc-langpack-ff
- glibc-langpack-fi
- glibc-langpack-fil
- glibc-langpack-fo
- glibc-langpack-fr
- glibc-langpack-fur
- glibc-langpack-fy
- glibc-langpack-ga
- glibc-langpack-gd
- glibc-langpack-gez
- glibc-langpack-gl
- glibc-langpack-gu
- glibc-langpack-gv
- glibc-langpack-ha
- glibc-langpack-hak
- glibc-langpack-he
- glibc-langpack-hi

- glibc-langpack-hif
- glibc-langpack-hne
- glibc-langpack-hr
- glibc-langpack-hsb
- glibc-langpack-ht
- glibc-langpack-hu
- glibc-langpack-hy
- glibc-langpack-ia
- glibc-langpack-id
- glibc-langpack-ig
- glibc-langpack-ik
- glibc-langpack-is
- glibc-langpack-it
- glibc-langpack-iu
- glibc-langpack-ja
- glibc-langpack-ka
- glibc-langpack-kab
- glibc-langpack-kk
- glibc-langpack-kl
- glibc-langpack-km
- glibc-langpack-kn
- glibc-langpack-ko
- glibc-langpack-kok
- glibc-langpack-ks
- glibc-langpack-ku
- glibc-langpack-kw
- glibc-langpack-ky
- glibc-langpack-lb
- glibc-langpack-lg
- glibc-langpack-li
- glibc-langpack-lij
- glibc-langpack-ln
- glibc-langpack-lo
- glibc-langpack-lt
- glibc-langpack-lv
- glibc-langpack-lzh
- glibc-langpack-mag

- glibc-langpack-mai
- glibc-langpack-mfe
- glibc-langpack-mg
- glibc-langpack-mhr
- glibc-langpack-mi
- glibc-langpack-miq
- glibc-langpack-mjw
- glibc-langpack-mk
- glibc-langpack-ml
- glibc-langpack-mn
- glibc-langpack-mni
- glibc-langpack-mnw
- glibc-langpack-mr
- glibc-langpack-ms
- glibc-langpack-mt
- glibc-langpack-my
- glibc-langpack-nan
- glibc-langpack-nb
- glibc-langpack-nds
- glibc-langpack-ne
- glibc-langpack-nhn
- glibc-langpack-niu
- glibc-langpack-nl
- glibc-langpack-nn
- glibc-langpack-nr
- glibc-langpack-nso
- glibc-langpack-oc
- glibc-langpack-om
- glibc-langpack-or
- glibc-langpack-os
- glibc-langpack-pa
- glibc-langpack-pap
- glibc-langpack-pl
- glibc-langpack-ps
- glibc-langpack-pt
- glibc-langpack-quz
- glibc-langpack-raj

- glibc-langpack-ro
- glibc-langpack-ru
- glibc-langpack-rw
- glibc-langpack-sa
- glibc-langpack-sah
- glibc-langpack-sat
- glibc-langpack-sc
- glibc-langpack-sd
- glibc-langpack-se
- glibc-langpack-sgs
- glibc-langpack-shn
- glibc-langpack-shs
- glibc-langpack-si
- glibc-langpack-sid
- glibc-langpack-sk
- glibc-langpack-sl
- glibc-langpack-sm
- glibc-langpack-so
- glibc-langpack-sq
- glibc-langpack-sr
- glibc-langpack-ss
- glibc-langpack-st
- glibc-langpack-sv
- glibc-langpack-sw
- glibc-langpack-szl
- glibc-langpack-ta
- glibc-langpack-tcy
- glibc-langpack-te
- glibc-langpack-tg
- glibc-langpack-th
- glibc-langpack-the
- glibc-langpack-ti
- glibc-langpack-tig
- glibc-langpack-tk
- glibc-langpack-tl
- glibc-langpack-tn
- glibc-langpack-to

- glibc-langpack-tpi
- glibc-langpack-tr
- glibc-langpack-ts
- glibc-langpack-tt
- glibc-langpack-ug
- glibc-langpack-uk
- glibc-langpack-unm
- glibc-langpack-ur
- glibc-langpack-uz
- glibc-langpack-ve
- glibc-langpack-vi
- glibc-langpack-wa
- glibc-langpack-wae
- glibc-langpack-wal
- glibc-langpack-wo
- glibc-langpack-xh
- glibc-langpack-yi
- glibc-langpack-yo
- glibc-langpack-yue
- glibc-langpack-yuw
- glibc-langpack-zh
- glibc-langpack-zu
- glibc-minimal-langpack
- grub2-common
- grub2-efi-aa64-modules
- grub2-efi-x64
- grub2-efi-x64-cdboot
- grub2-efi-x64-modules
- grub2-pc
- grub2-pc-modules
- grub2-tools
- grub2-tools-efi
- grub2-tools-extra
- grub2-tools-minimal
- grubby
- initscripts
- initscripts-rename-device

- `initscripts-service`
- `irqbalance`
- `iscsi-initiator-utils`
- `iscsi-initiator-utils-iscsiuio`
- `iwl1000-firmware`
- `iwl100-firmware`
- `iwl105-firmware`
- `iwl135-firmware`
- `iwl2000-firmware`
- `iwl2030-firmware`
- `iwl3160-firmware`
- `iwl3945-firmware`
- `iwl4965-firmware`
- `iwl5000-firmware`
- `iwl5150-firmware`
- `iwl6000-firmware`
- `iwl6000g2a-firmware`
- `iwl6000g2b-firmware`
- `iwl6050-firmware`
- `iwl7260-firmware`
- `iwlax2xx-firmware`
- `kexec-tools`
- `kmod`
- `kmod-kvdo`
- `kmod-libs`
- `krb5-libs`
- `krb5-pkinit`
- `krb5-server`
- `krb5-server-ldap`
- `krb5-workstation`
- `libatomic`
- `libblkid`
- `libdb`
- `libdnf`
- `libertas-sd8686-firmware`
- `libertas-sd8787-firmware`
- `libertas-usb8388-firmware`

- `libertas-usb8388-olpc-firmware`
- `libfdisk`
- `libgcc`
- `libgfortran`
- `libgomp`
- `libipa_hbac`
- `libkadm5`
- `libkcapi`
- `libkcapi-hmacalc`
- `libmount`
- `libnetapi`
- `libnfsidmap`
- `libnsl`
- `libquadmath`
- `libreport-filessystem`
- `libsmartcols`
- `libsmbclient`
- `libsss_autofs`
- `libsss_certmap`
- `libsss_idmap`
- `libsss_nss_idmap`
- `libsss_simpleifp`
- `libsss_sudo`
- `libstdc++`
- `libuuid`
- `libwbclient`
- `linux-firmware`
- `linux-firmware-core`
- `linux-firmware-whence`
- `liquidio-firmware`
- `mdadm`
- `microcode_ctl`
- `netconsole-service`
- `netronome-firmware`
- `NetworkManager`
- `NetworkManager-adsl`
- `NetworkManager-bluetooth`

- NetworkManager-config-connectivity-oracle
- NetworkManager-config-server
- NetworkManager-initscripts-updown
- NetworkManager-libnm
- NetworkManager-team
- NetworkManager-tui
- NetworkManager-wifi
- NetworkManager-wwan
- nfs-utils
- nscd
- nvmetcli
- openssh
- openssh-clients
- openssh-keycat
- openssh-server
- openssl
- openssl-fips-provider
- openssl-lib
- os-prober
- pam
- pcre2
- pcre2-syntax
- polkit
- polkit-lib
- procps-ng
- procps-ng-il8n
- python3-cffi
- python3-chardet
- python3-configshell
- python3-cryptography
- python3-dmidecode
- python3-dnf
- python3-dnf-plugin-post-transaction-actions
- python3-dnf-plugins-core
- python3-dnf-plugin-versionlock
- python3-firewall
- python3-hawkey

- python3-idna
- python3-libdnf
- python3-libipa_hbac
- python3-libsss_nss_idmap
- python3-perf
- python3-ply
- python3-pycparser
- python3-pysocks
- python3-pyyaml
- python3-samba
- python3-samba-dc
- python3-six
- python3-sss
- python3-sssdcconfig
- python3-sss-murmur
- readonly-root
- redhat-release
- rhel-net-naming-sysattrs
- samba
- samba-client-libs
- samba-common
- samba-common-libs
- samba-common-tools
- samba-dcerpc
- samba-dc-libs
- samba-ldb-ldap-modules
- samba-libs
- samba-tools
- samba-usershares
- samba-winbind
- samba-winbind-modules
- selinux-policy
- selinux-policy-doc
- selinux-policy-mls
- selinux-policy-sandbox
- selinux-policy-targeted
- shim-x64

- sos
- sos-audit
- sssd
- sssd-ad
- sssd-client
- sssd-common
- sssd-common-pac
- sssd-dbus
- sssd-ipa
- sssd-kcm
- sssd-krb5
- sssd-krb5-common
- sssd-ldap
- sssd-nfs-idmap
- sssd-passkey
- sssd-polkit-rules
- sssd-proxy
- sssd-tools
- sssd-winbind-idmap
- systemd
- systemd-container
- systemd-libs
- systemd-oomd
- systemd-pam
- systemd-resolved
- systemd-rpm-macros
- systemd-udev
- tuned
- tuned-profiles-cpu-partitioning
- unzip
- util-linux
- util-linux-core
- util-linux-user
- vim-filesystem
- vim-minimal
- xfsprogs
- yum

- yum-utils

Modified Binary Packages for CodeReady Linux Builder by Oracle

The following binary packages to CodeReady Linux Builder by Oracle have been modified:

- anaconda-widgets-devel
- bind-devel
- bind-doc
- bind-libs
- crash-devel
- cups-filters-devel
- dotnet-sdk-6.0-source-built-artifacts
- dotnet-sdk-7.0-source-built-artifacts
- dotnet-sdk-8.0-source-built-artifacts
- dotnet-sdk-9.0-source-built-artifacts
- edk2-aarch64
- edk2-tools
- edk2-tools-doc
- expect-devel
- fwupd-devel
- gcc-plugin-devel
- gdm-devel
- gdm-pam-extensions-devel
- glibc-benchtests
- glibc-nss-devel
- glibc-static
- java-11-openjdk-demo-fastdebug
- java-11-openjdk-demo-slowdebug
- java-11-openjdk-devel-fastdebug
- java-11-openjdk-devel-slowdebug
- java-11-openjdk-fastdebug
- java-11-openjdk-headless-fastdebug
- java-11-openjdk-headless-slowdebug
- java-11-openjdk-jmods-fastdebug
- java-11-openjdk-jmods-slowdebug
- java-11-openjdk-slowdebug
- java-11-openjdk-src-fastdebug
- java-11-openjdk-src-slowdebug

- java-11-openjdk-static-libs-fastdebug
- java-11-openjdk-static-libs-slowdebug
- java-17-openjdk-demo-fastdebug
- java-17-openjdk-demo-slowdebug
- java-17-openjdk-devel-fastdebug
- java-17-openjdk-devel-slowdebug
- java-17-openjdk-fastdebug
- java-17-openjdk-headless-fastdebug
- java-17-openjdk-headless-slowdebug
- java-17-openjdk-jmods-fastdebug
- java-17-openjdk-jmods-slowdebug
- java-17-openjdk-slowdebug
- java-17-openjdk-src-fastdebug
- java-17-openjdk-src-slowdebug
- java-17-openjdk-static-libs-fastdebug
- java-17-openjdk-static-libs-slowdebug
- java-1.8.0-openjdk-demo-fastdebug
- java-1.8.0-openjdk-demo-slowdebug
- java-1.8.0-openjdk-devel-fastdebug
- java-1.8.0-openjdk-devel-slowdebug
- java-1.8.0-openjdk-fastdebug
- java-1.8.0-openjdk-headless-fastdebug
- java-1.8.0-openjdk-headless-slowdebug
- java-1.8.0-openjdk-slowdebug
- java-1.8.0-openjdk-src-fastdebug
- java-1.8.0-openjdk-src-slowdebug
- java-21-openjdk-demo-fastdebug
- java-21-openjdk-demo-slowdebug
- java-21-openjdk-devel-fastdebug
- java-21-openjdk-devel-slowdebug
- java-21-openjdk-fastdebug
- java-21-openjdk-headless-fastdebug
- java-21-openjdk-headless-slowdebug
- java-21-openjdk-jmods-fastdebug
- java-21-openjdk-jmods-slowdebug
- java-21-openjdk-slowdebug
- java-21-openjdk-src-fastdebug

- java-21-openjdk-src-slowdebug
- java-21-openjdk-static-libs-fastdebug
- java-21-openjdk-static-libs-slowdebug
- kmod-devel
- libdb-cxx
- libdb-cxx-devel
- libdb-devel-doc
- libdb-sql
- libdb-sql-devel
- libdnf-devel
- libfdisk-devel
- libguestfs-devel
- libguestfs-gobject
- libguestfs-gobject-devel
- libguestfs-man-pages-ja
- libguestfs-man-pages-uk
- libnetapi-devel
- libnfsidmap-devel
- libperf
- librados-devel
- libradospp-devel
- librbd-devel
- libreoffice-sdk
- libreoffice-sdk-doc
- libsmartcols-devel
- libsmbclient-devel
- libsss_nss_idmap-devel
- libstdc++-static
- libvirt-daemon-plugin-sanlock
- libvirt-devel
- libvirt-docs
- libwbclient-devel
- lua-guestfs
- mpich
- munge-devel
- NetworkManager-libnm-devel
- nss_db

- nss_hesiod
- ocaml-libguestfs
- ocaml-libguestfs-devel
- OpenIPMI-devel
- openscap-engine-sce-devel
- PackageKit-glib-devel
- pcre2-tools
- php-libguestfs
- procps-ng-devel
- python3-ipatests
- python3-mpich
- python3-psutil-tests
- python3-samba-devel
- python3-samba-test
- python-packaging-doc
- ruby-libguestfs
- samba-devel
- samba-pidl
- samba-test
- samba-test-libs
- sanlock-devel
- sendmail-milter
- sendmail-milter-devel
- systemd-boot-unsigned
- tog-pegasus-devel
- virt-v2v-man-pages-ja
- virt-v2v-man-pages-uk
- WALinuxAgent-cvm

Modified AppStream Binary Packages

The following binary packages from the AppStream upstream release have been modified:

- anaconda
- anaconda-core
- anaconda-dracut
- anaconda-gui
- anaconda-install-env-deps
- anaconda-install-img-deps

- anaconda-tui
- anaconda-user-help
- anaconda-widgets
- aspnetcore-runtime-6.0
- aspnetcore-runtime-7.0
- aspnetcore-runtime-8.0
- aspnetcore-runtime-dbg-8.0
- aspnetcore-targeting-pack-6.0
- aspnetcore-targeting-pack-7.0
- aspnetcore-targeting-pack-8.0
- audit-libs-devel
- autocorr-af
- autocorr-bg
- autocorr-ca
- autocorr-cs
- autocorr-da
- autocorr-de
- autocorr-dsb
- autocorr-el
- autocorr-en
- autocorr-es
- autocorr-fa
- autocorr-fi
- autocorr-fr
- autocorr-ga
- autocorr-hr
- autocorr-hsb
- autocorr-hu
- autocorr-is
- autocorr-it
- autocorr-ja
- autocorr-ko
- autocorr-lb
- autocorr-lt
- autocorr-mn
- autocorr-nl
- autocorr-pl

- autocorr-pt
- autocorr-ro
- autocorr-ru
- autocorr-sk
- autocorr-sl
- autocorr-sr
- autocorr-sv
- autocorr-tr
- autocorr-vi
- autocorr-vro
- autocorr-zh
- bind
- bind-chroot
- bind-dnssec-doc
- bind-dnssec-utils
- bind-libs
- bind-license
- bind-utils
- binutils-devel
- blivet-data
- boom-boot
- boom-boot-conf
- buildah
- buildah-tests
- clang
- clang-analyzer
- clang-devel
- clang-libs
- clang-resource-filesystem
- clang-tools-extra
- cloud-init
- cockpit-composer
- cockpit-machines
- cockpit-packagekit
- cockpit-pcp
- cockpit-session-recording
- cockpit-storaged

- compat-libgfortran-48
- compat-openssl11
- containers-common
- container-tools
- cpp
- crash
- cups-filters
- cups-filters-libs
- dbus-daemon
- dbus-devel
- dbus-x11
- ddiskit
- delve
- dotnet-apphost-pack-6.0
- dotnet-apphost-pack-7.0
- dotnet-apphost-pack-8.0
- dotnet-host
- dotnet-hostfxr-6.0
- dotnet-hostfxr-7.0
- dotnet-hostfxr-8.0
- dotnet-runtime-6.0
- dotnet-runtime-7.0
- dotnet-runtime-8.0
- dotnet-runtime-dbg-8.0
- dotnet-sdk-6.0
- dotnet-sdk-7.0
- dotnet-sdk-8.0
- dotnet-sdk-8.0-source-built-artifacts
- dotnet-sdk-dbg-8.0
- dotnet-targeting-pack-6.0
- dotnet-targeting-pack-7.0
- dotnet-targeting-pack-8.0
- dotnet-templates-6.0
- dotnet-templates-7.0
- dotnet-templates-8.0
- dracut-caps
- dracut-live

- edk2-ovmf
- efi-srpm-macros
- fapolicyd
- fapolicyd-selinux
- firefox
- firefox-x11
- firewall-applet
- firewall-config
- fwupd-plugin-flashrom
- galera
- gcc
- gcc-c++
- gcc-gfortran
- gcc-offload-nvptx
- gcc-plugin-annobin
- gcc-toolset-12-gcc
- gcc-toolset-12-gcc-c++
- gcc-toolset-12-gcc-gfortran
- gcc-toolset-12-gcc-plugin-annobin
- gcc-toolset-12-gcc-plugin-devel
- gcc-toolset-12-libasan-devel
- gcc-toolset-12-libatomic-devel
- gcc-toolset-12-libgccjit
- gcc-toolset-12-libgccjit-devel
- gcc-toolset-12-libgccjit-docs
- gcc-toolset-12-libitm-devel
- gcc-toolset-12-liblsan-devel
- gcc-toolset-12-libquadmath-devel
- gcc-toolset-12-libstdc++-devel
- gcc-toolset-12-libstdc++-docs
- gcc-toolset-12-libtsan-devel
- gcc-toolset-12-libubsan-devel
- gcc-toolset-12-offload-nvptx
- gcc-toolset-13-binutils
- gcc-toolset-13-binutils-devel
- gcc-toolset-13-binutils-gold
- gdb

- gdb-doc
- gdb-gdbserver
- gdb-headless
- gdb-minimal
- gdm
- git-clang-format
- glibc-devel
- glibc-doc
- glibc-headers
- glibc-locale-source
- glibc-utils
- gnome-session
- gnome-session-wayland-session
- gnome-session-xsession
- gnome-shell-extension-background-logo
- gpsd-minimal
- gpsd-minimal-clients
- gstreamer1-rtsp-server
- httpd
- httpd-core
- httpd-devel
- httpd-filesystem
- httpd-manual
- httpd-tools
- idm-pki-acme
- idm-pki-base
- idm-pki-ca
- idm-pki-est
- idm-pki-java
- idm-pki-kra
- idm-pki-server
- idm-pki-tools
- initial-setup
- initial-setup-gui
- ipa-client
- ipa-client-common
- ipa-client-epn

- ipa-client-samba
- ipa-common
- ipa-selinux
- ipa-selinux-luna
- ipa-selinux-nfast
- ipa-server
- ipa-server-common
- ipa-server-dns
- ipa-server-trust-ad
- iputils-ninfod
- java-11-openjdk
- java-11-openjdk-demo
- java-11-openjdk-devel
- java-11-openjdk-headless
- java-11-openjdk-javadoc
- java-11-openjdk-javadoc-zip
- java-11-openjdk-jmods
- java-11-openjdk-src
- java-11-openjdk-static-libs
- java-17-openjdk
- java-17-openjdk-demo
- java-17-openjdk-devel
- java-17-openjdk-headless
- java-17-openjdk-javadoc
- java-17-openjdk-javadoc-zip
- java-17-openjdk-jmods
- java-17-openjdk-src
- java-17-openjdk-static-libs
- java-1.8.0-openjdk
- java-1.8.0-openjdk-demo
- java-1.8.0-openjdk-devel
- java-1.8.0-openjdk-headless
- java-1.8.0-openjdk-javadoc
- java-1.8.0-openjdk-javadoc-zip
- java-1.8.0-openjdk-src
- java-21-openjdk
- java-21-openjdk-demo

- java-21-openjdk-devel
- java-21-openjdk-headless
- java-21-openjdk-javadoc
- java-21-openjdk-javadoc-zip
- java-21-openjdk-jmods
- java-21-openjdk-src
- java-21-openjdk-static-libs
- kernel-rpm-macros
- kernel-srpm-macros
- krb5-devel
- ksh
- libasan
- libblkid-devel
- libblockdev
- libblockdev-btrfs
- libblockdev-crypto
- libblockdev-dm
- libblockdev-fs
- libblockdev-kbd
- libblockdev-loop
- libblockdev-lvm
- libblockdev-lvm-dbus
- libblockdev-mdraid
- libblockdev-mpath
- libblockdev-nvdim
- libblockdev-nvme
- libblockdev-part
- libblockdev-plugins-all
- libblockdev-swap
- libblockdev-tools
- libblockdev-utils
- libdb-devel
- libdb-utils
- libgccjit
- libgccjit-devel
- libgomp-offload-nvptx
- libguestfs

- libguestfs-appliance
- libguestfs-bash-completion
- libguestfs-inspect-icons
- libguestfs-rescue
- libguestfs-rsync
- libguestfs-xfstools
- libitm
- libitm-devel
- liblsan
- libmount-devel
- libquadmath-devel
- librados2
- librbd1
- libreoffice
- libreoffice-base
- libreoffice-calc
- libreoffice-core
- libreoffice-data
- libreoffice-draw
- libreoffice-emailmerge
- libreoffice-filters
- libreoffice-gdb-debug-support
- libreoffice-graphicfilter
- libreoffice-gtk3
- libreoffice-help-ar
- libreoffice-help-bg
- libreoffice-help-bn
- libreoffice-help-ca
- libreoffice-help-cs
- libreoffice-help-da
- libreoffice-help-de
- libreoffice-help-dz
- libreoffice-help-el
- libreoffice-help-en
- libreoffice-help-eo
- libreoffice-help-es
- libreoffice-help-et

- libreoffice-help-eu
- libreoffice-help-fi
- libreoffice-help-fr
- libreoffice-help-gl
- libreoffice-help-gu
- libreoffice-help-he
- libreoffice-help-hi
- libreoffice-help-hr
- libreoffice-help-hu
- libreoffice-help-id
- libreoffice-help-it
- libreoffice-help-ja
- libreoffice-help-ko
- libreoffice-help-lt
- libreoffice-help-lv
- libreoffice-help-nb
- libreoffice-help-nl
- libreoffice-help-nn
- libreoffice-help-pl
- libreoffice-help-pt-BR
- libreoffice-help-pt-PT
- libreoffice-help-ro
- libreoffice-help-ru
- libreoffice-help-si
- libreoffice-help-sk
- libreoffice-help-sl
- libreoffice-help-sv
- libreoffice-help-ta
- libreoffice-help-tr
- libreoffice-help-uk
- libreoffice-help-zh-Hans
- libreoffice-help-zh-Hant
- libreoffice-impress
- libreofficekit
- libreoffice-langpack-af
- libreoffice-langpack-ar
- libreoffice-langpack-as

- libreoffice-langpack-bg
- libreoffice-langpack-bn
- libreoffice-langpack-br
- libreoffice-langpack-ca
- libreoffice-langpack-cs
- libreoffice-langpack-cy
- libreoffice-langpack-da
- libreoffice-langpack-de
- libreoffice-langpack-dz
- libreoffice-langpack-el
- libreoffice-langpack-en
- libreoffice-langpack-eo
- libreoffice-langpack-es
- libreoffice-langpack-et
- libreoffice-langpack-eu
- libreoffice-langpack-fa
- libreoffice-langpack-fi
- libreoffice-langpack-fr
- libreoffice-langpack-fy
- libreoffice-langpack-ga
- libreoffice-langpack-gl
- libreoffice-langpack-gu
- libreoffice-langpack-he
- libreoffice-langpack-hi
- libreoffice-langpack-hr
- libreoffice-langpack-hu
- libreoffice-langpack-id
- libreoffice-langpack-it
- libreoffice-langpack-ja
- libreoffice-langpack-kk
- libreoffice-langpack-kn
- libreoffice-langpack-ko
- libreoffice-langpack-lt
- libreoffice-langpack-lv
- libreoffice-langpack-mai
- libreoffice-langpack-ml
- libreoffice-langpack-mr

- libreoffice-langpack-nb
- libreoffice-langpack-nl
- libreoffice-langpack-nn
- libreoffice-langpack-nr
- libreoffice-langpack-nso
- libreoffice-langpack-or
- libreoffice-langpack-pa
- libreoffice-langpack-pl
- libreoffice-langpack-pt-BR
- libreoffice-langpack-pt-PT
- libreoffice-langpack-ro
- libreoffice-langpack-ru
- libreoffice-langpack-si
- libreoffice-langpack-sk
- libreoffice-langpack-sl
- libreoffice-langpack-sr
- libreoffice-langpack-ss
- libreoffice-langpack-st
- libreoffice-langpack-sv
- libreoffice-langpack-ta
- libreoffice-langpack-te
- libreoffice-langpack-th
- libreoffice-langpack-tn
- libreoffice-langpack-tr
- libreoffice-langpack-ts
- libreoffice-langpack-uk
- libreoffice-langpack-ve
- libreoffice-langpack-xh
- libreoffice-langpack-zh-Hans
- libreoffice-langpack-zh-Hant
- libreoffice-langpack-zu
- libreoffice-math
- libreoffice-ogltrans
- libreoffice-opensymbol-fonts
- libreoffice-pdfimport
- libreoffice-pyuno
- libreoffice-ure

- libreoffice-ure-common
- libreoffice-wiki-publisher
- libreoffice-writer
- libreoffice-xll
- libreoffice-xsltfilter
- libreport
- libreport-anaconda
- libreport-cli
- libreport-gtk
- libreport-plugin-bugzilla
- libreport-plugin-reportuploader
- libreport-web
- libreswan
- libstdc++-devel
- libstdc++-docs
- libtsan
- libubsan
- libuuid-devel
- libvirt
- libvirt-client
- libvirt-client-qemu
- libvirt-daemon
- libvirt-daemon-common
- libvirt-daemon-config-network
- libvirt-daemon-config-nwfilter
- libvirt-daemon-driver-interface
- libvirt-daemon-driver-network
- libvirt-daemon-driver-nodedev
- libvirt-daemon-driver-nwfilter
- libvirt-daemon-driver-qemu
- libvirt-daemon-driver-secret
- libvirt-daemon-driver-storage
- libvirt-daemon-driver-storage-core
- libvirt-daemon-driver-storage-disk
- libvirt-daemon-driver-storage-iscsi
- libvirt-daemon-driver-storage-logical
- libvirt-daemon-driver-storage-mpath

- libvirt-daemon-driver-storage-rbd
- libvirt-daemon-driver-storage-scsi
- libvirt-daemon-kvm
- libvirt-daemon-lock
- libvirt-daemon-log
- libvirt-daemon-plugin-lockd
- libvirt-daemon-proxy
- libvirt-libs
- libvirt-nss
- libvirt-ssh-proxy
- libxslt
- libxslt-devel
- lorax
- lorax-docs
- lorax-lmc-novirt
- lorax-lmc-virt
- lorax-templates-generic
- lorax-templates-rhel
- mecab-ipadic
- mecab-ipadic-EUCJP
- mod_ldap
- mod_lua
- mod_proxy_html
- mod_session
- mod_ssl
- mpich
- mpich-autoload
- mpich-devel
- mpich-doc
- munge
- munge-libs
- net-snmp
- net-snmp-agent-libs
- net-snmp-devel
- net-snmp-libs
- net-snmp-perl
- net-snmp-utils

- netstandard-targeting-pack-2.1
- NetworkManager-cloud-setup
- NetworkManager-dispatcher-routing-rules
- NetworkManager-ovs
- NetworkManager-ppp
- nfs-utils-coreos
- nfsv4-client-utils
- nginx
- nginx-all-modules
- nginx-core
- nginx-filesystem
- nginx-mod-devel
- nginx-mod-http-image-filter
- nginx-mod-http-perl
- nginx-mod-http-xslt-filter
- nginx-mod-mail
- nginx-mod-stream
- npm
- ntsysv
- opa-address-resolution
- opa-basic-tools
- opa-fastfabric
- opa-fm
- opa-libopamgt
- OpenIPMI
- OpenIPMI-lanserv
- OpenIPMI-libs
- openscap
- openscap-devel
- openscap-engine-sce
- openscap-python3
- openscap-scanner
- openscap-utils
- openssh-askpass
- openssl-devel
- openssl-perl
- open-vm-tools

- open-vm-tools-desktop
- open-vm-tools-salt-minion
- open-vm-tools-sdmp
- open-vm-tools-test
- osbuild
- osbuild-composer
- osbuild-composer-core
- osbuild-composer-worker
- osbuild-depsolve-dnf
- osbuild-luks2
- osbuild-lvm2
- osbuild-ostree
- osbuild-selinux
- osinfo-db
- PackageKit
- PackageKit-command-not-found
- PackageKit-glib
- PackageKit-gstreamer-plugin
- PackageKit-gtk3-module
- pam-devel
- pam-docs
- pam_ssh_agent_auth
- pcre2-devel
- pcre2-utf16
- pcre2-utf32
- perl-Sys-Guestfs
- perl-XML-Parser
- pesign
- plymouth
- plymouth-core-libs
- plymouth-graphics-libs
- plymouth-plugin-fade-throbber
- plymouth-plugin-label
- plymouth-plugin-script
- plymouth-plugin-space-flares
- plymouth-plugin-two-step
- plymouth-scripts

- plymouth-system-theme
- plymouth-theme-charge
- plymouth-theme-fade-in
- plymouth-theme-script
- plymouth-theme-solar
- plymouth-theme-spinfinity
- plymouth-theme-spinner
- podman
- podman-docker
- podman-plugins
- podman-remote
- podman-tests
- polkit-devel
- polkit-docs
- postgresql
- postgresql-contrib
- postgresql-docs
- postgresql-plperl
- postgresql-plpython3
- postgresql-pltcl
- postgresql-private-devel
- postgresql-private-libs
- postgresql-server
- postgresql-server-devel
- postgresql-static
- postgresql-test
- postgresql-test-rpm-macros
- postgresql-upgrade
- postgresql-upgrade-devel
- pykickstart
- python3-attrs
- python3-audit
- python3-bind
- python3-blivet
- python3-blockdev
- python3-boom
- python3-clang

- python3-dnf-plugin-leaves
- python3-dnf-plugin-modulesync
- python3-dnf-plugin-show-leaves
- python3-idm-pki
- python3-ipaclient
- python3-ipalib
- python3-ipaserver
- python3-iscsi-initiator-utils
- python3-kickstart
- python3-libguestfs
- python3-libmount
- python3-libreport
- python3-net-snmp
- python3-numpy
- python3-numpy-f2py
- python3-osbuild
- python3-packaging
- python3-psutil
- python3-psycopg2
- python3-PyMySQL
- python3-rtslib
- python3-sanlock
- python3-scipy
- python3-toml
- python3-virt-firmware
- rasdaemon
- rear
- redhat-rpm-config
- rhel-system-roles
- rpmdevtools
- samba-client
- samba-gpupdate
- samba-krb5-printing
- samba-vfs-iouring
- samba-winbind-clients
- samba-winbind-krb5-locator
- samba-winexe

- sanlock
- sanlock-lib
- scap-security-guide
- scap-security-guide-doc
- selinux-policy-devel
- sendmail
- sendmail-cf
- sendmail-doc
- setroubleshoot
- setroubleshoot-plugins
- setroubleshoot-server
- sssd-idp
- sysstat
- systemd-devel
- systemd-journal-remote
- systemtap
- systemtap-client
- systemtap-devel
- systemtap-exporter
- systemtap-initscript
- systemtap-runtime
- systemtap-runtime-java
- systemtap-runtime-python3
- systemtap-runtime-virtguest
- systemtap-runtime-virthost
- systemtap-sdt-devel
- systemtap-server
- target-restore
- thunderbird
- tog-pegasus
- tog-pegasus-libs
- tuned-gtk
- tuned-ppd
- tuned-profiles-atomic
- tuned-profiles-mssql
- tuned-profiles-oracle
- tuned-profiles-postgresql

- tuned-profiles-spectrumscale
- tuned-utils
- uki-direct
- uuid
- vim-common
- vim-enhanced
- vim-X11
- virt-p2v
- virt-top
- virt-v2v
- virt-v2v-bash-completion
- WALinuxAgent
- WALinuxAgent-udev
- xfsprogs-devel
- xfsprogs-xfs_scrub
- xsane
- xsane-common

Removed BaseOS Binary Packages

The following binary packages from the BaseOS upstream release have been removed:

- kernel-uki-virt-addons
- kpatch
- kpatch-dnf
- libdnf-plugin-subscription-manager
- openssl-fips-provider-so
- python3-cloud-what
- python3-subscription-manager-rhsm
- redhat-release-eula
- rhsm-icons
- subscription-manager
- subscription-manager-cockpit
- subscription-manager-plugin-ostree
- subscription-manager-rhsm-certificates

Removed AppStream Binary Packages

The following binary packages from the AppStream upstream release have been removed:

- ansible-collection-microsoft-sql

- `ansible-collection-redhat-rhel_mgmt`
- `insights-client`
- `insights-client-ros`
- `libreport-rhel-anaconda-bugzilla`
- `NetworkManager-config-connectivity-redhat`
- `opentelemetry-collector`
- `realtime-tests`
- `redhat-backgrounds`
- `redhat-cloud-client-configuration`
- `redhat-indexhtml`
- `redhat-logos`
- `redhat-logos-httpd`
- `redhat-logos-ipa`
- `rhc`
- `rhc-worker-playbook`
- `s390utils`
- `s390utils-se-data`
- `toolbox`
- `toolbox-tests`
- `virtio-win`
- `virt-who`

Removed CodeReady Linux Builder Binary Packages

The following binary packages from the CodeReady Linux Builder upstream release have been removed:

- `redhat-sb-certs`
- `rhc-devel`

Changes to Source Packages

This section contains information about the removed, modified, and new **source** packages in this release. For information about the **binary** package changes, see [Changes to Binary Packages](#).

Added Source Packages for BaseOS by Oracle

The following source packages have been added to the BaseOS by Oracle:

- `bcache-tools`
- `btrfs-progs`
- `dtrace`

- kernel-uek
- ocfs2-tools
- oracle-indexhtml
- oraclelinux-release
- oraclelinux-release-el9
- oracle-logos
- rhnsd

Added Source Packages for AppStream by Oracle

The following source packages have been added to AppStream by Oracle:

- dnf-plugin-spacewalk
- dtrace
- pyOpenSSL
- python3-dnf-plugin-ulninfo
- python-hwdata
- rhn-client-tools
- rhnlib

Modified BaseOS Source Packages

The following source packages from the BaseOS upstream release have been modified:

- autofs
- binutils
- biosdevname
- chkconfig
- chrony
- cockpit
- coreutils
- dbus
- dnf
- dnf-plugins-core
- dracut
- efibootmgr
- efi-rpm-macros
- firewalld
- fwupd
- gcc
- glibc

- grub2
- grubby
- iscsi-initiator-utils
- kexec-tools
- kmod
- kmod-kvdo
- krb5
- libdnf
- libkcapi
- libreport
- linux-firmware
- microcode_ctl
- NetworkManager
- nvmetcli
- openssh
- openssl
- os-prober
- pcre2
- polkit
- python-cffi
- python-chardet
- python-configshell
- python-idna
- python-ply
- python-pycparser
- python-pysocks
- python-six
- PyYAML
- redhat-release
- rpm
- samba
- selinux-policy
- shim
- sos
- sssd
- systemd
- tuned

- unzip
- util-linux
- vim

Modified AppStream Source Packages

The following source packages from the AppStream upstream release have been modified:

- anaconda
- anaconda-user-help
- bind
- bind-dyndb-ldap
- binutils
- boom-boot
- buildah
- ceph
- chkconfig
- clang
- cloud-init
- cockpit
- cockpit-composer
- cockpit-machines
- cockpit-session-recording
- compat-libgfortran-48
- compat-openssl11
- containers-common
- container-tools
- crash
- cups-filters
- dbus
- ddiskit
- delve
- dnf-plugins-core
- dotnet6.0
- dotnet7.0
- dracut
- edk2
- efi-rpm-macros
- fapolicyd

- firefox
- firewallld
- fwupd
- galera
- gcc
- gdb
- gdm
- glibc
- gnome-shell-extension-background-logo
- httpd
- initial-setup
- ipa
- iscsi-initiator-utils
- jackson-databind
- java-11-openjdk
- java-17-openjdk
- java-1.8.0-openjdk
- kernel-srpm-macros
- keybinder3
- krb5
- ksh
- libblockdev
- libguestfs
- libreoffice
- libreport
- libreswan
- libvirt
- libxslt
- lorax
- lorax-templates-rhel
- mecab-ipadic
- mpich
- munge
- net-snmp
- NetworkManager
- numpy
- opa-ff

- opa-fm
- OpenIPMI
- openscap
- openssh
- openssl
- open-vm-tools
- PackageKit
- pcp
- pcre2
- perl-XML-Parser
- pesign
- pki-core
- plymouth
- podman
- polkit
- pykickstart
- python-attrs
- python-blivet
- python-packaging
- python-psutil
- python-PyMySQL
- python-rtslib
- python-toml
- rear
- rhel-system-roles
- rpm
- rpmdevtools
- samba
- sanlock
- scap-security-guide
- scipy
- selinux-policy
- sendmail
- setroubleshoot
- setroubleshoot-plugins
- sssd
- sysstat

- systemd
- systemtap
- thunderbird
- tog-pegasus
- tuned
- util-linux
- vim
- virt-p2v
- virt-top
- virt-v2v
- WALinuxAgent
- xsane

Modified Source Packages for CodeReady Linux Builder by Oracle

The following binary packages to CodeReady Linux Builder by Oracle have been modified:

- anaconda
- bind
- ceph
- crash
- cups-filters
- dotnet6.0
- dotnet7.0
- edk2
- fwupd
- gcc
- gdm
- glibc
- ipa
- java-11-openjdk
- java-1.8.0-openjdk
- kmod
- libdnf
- libguestfs
- libreoffice
- libvirt
- mpich
- munge

- NetworkManager
- ocaml
- OpenIPMI
- openscap
- PackageKit
- python-packaging
- python-psutil
- samba
- sanlock
- sendmail
- sssd
- tog-pegasus
- util-linux
- virt-v2v

Removed BaseOS Source Packages

The following source packages from the BaseOS upstream release have been removed:

- kpatch
- openssl-fips-provider
- subscription-manager
- subscription-manager-cockpit
- subscription-manager-rhsm-certificates

Removed AppStream Source Packages

The following source packages from the AppStream upstream release have been removed:

- ansible-collection-microsoft-sql
- ansible-collection-redhat-rhel_mgmt
- insights-client
- libica
- opentelemetry-collector
- realtime-tests
- redhat-cloud-client-configuration
- redhat-indexhtml
- redhat-logos
- rhc
- rhc-worker-playbook
- toolbox

- virtio-win
- virt-who