Unbreakable Enterprise Kernel

Unbreakable Enterprise Kernel 8 - Release Notes (6.12.0-0.20.20)

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Unbreakable Enterprise Kernel Unbreakable Enterprise Kernel 8 - Release Notes (6.12.0-0.20.20),

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Contents

Preface

Unbreakable Enterprise Kernel Release 8: Release Notes (6.12.0-0.20.20) provides a summary of the new features, significant changes, and any known issues in Unbreakable Enterprise Kernel 8 (UEK 8).

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

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Oracle is fully committed to diversity and inclusion. Oracle respects and values having a diverse workforce that increases thought leadership and innovation. As part of our initiative to build a more inclusive culture that positively impacts our employees, customers, and partners, we are working to remove insensitive terms from our products and documentation. We are also mindful of the necessity to maintain compatibility with our customers' existing technologies and the need to ensure continuity of service as Oracle's offerings and industry standards evolve. Because of these technical constraints, our effort to remove insensitive terms is ongoing and will take time and external cooperation.

1

About Unbreakable Enterprise Kernel 8

This chapter provides an overview of Unbreakable Enterprise Kernel 8 (UEK 8) and contains important information about this major release.

> **Note:**
>
> Upgrading from an Unbreakable Enterprise Kernel Developer Preview release to its later official version isn't supported. If you're running the Developer Preview version, you must reinstall the official UEK release upon its general availability.

UEK 8 is initially released with the 6.12.0-0.20.20 version of the kernel. The kernel's source code is available through a public git source code repository at https://github.com/oracle/linux-uek.

The following is a general description of the scope of support for UEK 8:

- The kernel is developed, built, and tested on the 64-bit Arm (aarch64), Intel® 64-bit x86_64, and AMD 64-bit x86_64 architectures and is based on the mainline Linux kernel version 6.12 (LTS).
- UEK 8 is made available for installation on the latest Oracle Linux 9 update releases.
- In UEK 8, more features are enabled to provide support for key functional requirements and patches are applied to improve performance and optimize the kernel for use on Oracle operating environments. Note that Oracle actively monitors upstream check-ins and applies critical bug and security fixes to UEK 8.
- Although UEK 8 uses the same versioning model as the mainline Linux kernel version, it's possible that some applications might not understand the 6.12.0 versioning scheme. Note, however, that regular Linux applications are usually neither aware of nor affected by Linux kernel version numbers.
- A version of UEK 8 that enables 64k pages is available for 64-bit Arm (aarch64) platforms for Oracle Linux 9 and later. The `kernel-uek64k` package is available on Oracle Cloud Infrastructure Arm compute shapes only. Use of this kernel outside of Oracle Cloud Infrastructure is only available as a technical preview.

Certification of UEK 8 for Oracle Products

The following important information applies to the certification of Oracle products with UEK 8.

Note that certification of different Oracle products with UEK 8 might not be immediately available at the time of the UEK 8 release. Ensure that the product you're using is certified for use with UEK 8 before upgrading or installing the kernel. You can check for certification information at https://support.oracle.com/epmos/faces/CertifyHome.

Oracle Automatic Storage Management Cluster File System (Oracle ACFS) certification for different kernel versions is described in Document ID 1369107.1, which is available at https://support.oracle.com/epmos/faces/DocumentDisplay?id=1369107.1.

Compatibility

Oracle Linux maintains full user space compatibility with Red Hat Enterprise Linux (RHEL), which is independent of the kernel version that's running underneath the OS. Note that existing applications in user space continue to run unmodified with UEK 8; no recertifications are required for RHEL certified applications.

To minimize any impact on interoperability during releases, the Oracle Linux team works with third-party vendors that have hardware and software with dependencies on kernel modules. The kernel ABI for UEK 8 remains unchanged in all subsequent updates to the initial release. Customers migrating from UEK R7 must be aware that kernel ABIs have changed in UEK 8. If an application is using kernel modules, users must verify the support status with the application vendor.

Notable changes in kernel headers

Upstream changes to kernel headers might mean that third-party modules don't compile across different kernel versions without modification to source code. Notably, the `memcg_cache_params` structure has been moved from `include/linux/slab.h` to `mm/slab.h`, which means that code must be refactored to account for the change if you're compiling across kernel versions.

To solve this problem so that the code can compile for UEK R7 and UEK 8, change the header requirements in the source code. For example, change lines like those in the following example to what's shown in the second example:

```
#ifdef CONFIG_SLUB
#include <linux/slub_def.h>
#endif
```

```
#if ( LINUX_VERSION_CODE < KERNEL_VERSION(5,4,0) )

#ifdef CONFIG_SLUB
#include <linux/slub_def.h>
#endif

#endif
```

2

New Features and Changes

This chapter describes new features, enhancements, and other notable changes that are introduced in UEK 8.

Summary of Notable Changes in UEK 8

The following is a summary of the features, changes, and improvements that are introduced in UEK 8, relative to UEK R7:

- **Linux 6.12 stable kernel base**

  The 6.12 mainline kernel release that's used as the base kernel for UEK 8 includes many upstream kernel features and improvements over previous UEK releases and over RHCK on Oracle Linux 9.

- **Kernel module packaging is updated**
  Kernel modules are distributed in more atomic packages to reduce the attack surface on the kernel, to improve kernel module maintenance, and to also improve visibility of module deprecation. See Changes to UEK Content Distribution and Packaging for a complete view of kernel packaging in UEK 8.

- **64k Base Page Size on Arm**

  In this release, a version of the kernel with a 64k base page size is available for Ampere Arm-based Compute shapes in Oracle Cloud Infrastructure only. The 64k base page size improves how Arm platforms process workloads with large, contiguous memory datasets. See (aarch64) 64k Base Page Size on Arm for more information.

- **Other platform updates**

  Several generic platform updates are included. See Generic Platform Updates. Some other Intel-specific platform updates are available, including security features such as Intel Software Guard Extensions and new hardware support for Intel Quick Assist Technology (QAT). See Intel Platform Updates.

- **Completely Fair Scheduler (CFS) replaced by Earliest Eligible Virtual Deadline First (EEVDF)**

  CFS is replaced by the EEVDF scheduler to improve scheduling behavior and to reduce configuration complexity. See EEVDF Scheduler Replaces CFS.

- **Improved Memory Management**

  Many memory management improvements appear in UEK 8, including several memory mapping optimizations, improvements to performance through the introductions of folio structures, and some enhancements to Huge Page handling. See Memory Management.

- **File systems updates**

  Support for the Btrfs and OCFS2 file systems is enabled in UEK 8. Significant enhancements are available for the Btrfs, XFS, and NFS file systems in this release. For more information about new file systems features that are introduced in UEK 8, see File Systems

- **ASMLib v3 and io_uring**

Several io_uring enhancements are included in this release of UEK, which also supports ASMLib v3. ASMLib v3 uses io_uring for the Automatic Storage Management feature of the Oracle Database. See `io_uring` Enhancements and ASMLib v3.

- **Networking updates**

  Several general networking enhancements are included in UEK 8. See General Networking Enhancements.

- **Security related updates**

  Some other security related updates are included in this release of UEK, including some updates to the Random Number Generator help improve performance and security. See Random Number Generator Enhancements. The kernel TLS offload facility is enabled in UEK 8. See KTLS.

- **Berkeley Packet Filter**

  Several enhancements are available in the Berkeley Packet Filter (BPF) used for tracing, including a dedicated memory allocator, a new user ring buffer, and the use of resilient BPF Type Format (BTF) modules to use BTF for out-of-tree modules. See Berkeley Packet Filter (BPF) Enhancements.

- **DTrace v2.0**

  Dtrace v2.0 continues to be available in UEK 8 and leverages kernel tracing facilities such as eBPF. Detailed information about DTrace releases and other notable changes are available at Oracle Linux: DTrace Release Notes.

  .

Changes to UEK Content Distribution and Packaging

The following table provides details about how UEK 8 content is distributed and packaged and includes information about package dependencies, and any other notable requirements.

Note:

Kernel packaging is updated in UEK 8 and differs from previous UEK releases. Most notably, kernel modules are now shipped in a collection of separate packages. Separating modules out of the core kernel packages helps to reduce overhead, provides a mechanism to minimize attack surface, and improves kernel module maintenance.

Configuration files to identify modules that are denied from loading are renamed from 'blacklist' files to 'denylist' as part of Oracle's initiative to use more inclusive language in its products.

Also, some kernel utility tools that were bundled in the `kernel-uek-core` package in previous releases are moved into a separate package, `kernel-uek-tools`.

You can list the modules available in each package by running:

```
rpm -q -l kernel-uek-modules-<ext>
```

To find which package a module that's available on the system belongs to, you can run:

```
rpm -q -f /lib/modules/$(uname -r)/<path to module>
```

If you run the modprobe command for a module and the package that the module belongs to isn't installed, the output notifies you and provides the package name that you must install. Note that you might need to update the `kmod` package to the latest version for this functionality to work.

```
sudo modprobe wl1251_sdio
```

```
modprobe: FATAL: Module wl1251_sdio not found in directory /lib/
modules/6.12.0-0.20.20.el9uek.x86_64,
ensure the following package is installed: kernel-uek-modules-
wireless-6.12.0-0.20.20.el9uek.x86_64
```

A package mapping file is included at `/lib/modules/$(uname -r)/modules.packages` and is shipped in the `kernel-uek-core` package for UEK 8 and later. You can also use this file to identify the module package that contains a particular driver.

Package	Description
`kernel-uek`	This is a meta package that doesn't contain any files. In Oracle Linux 9, the package has the following dependencies: • `kernel-uek-core` • `kernel-uek-modules-core` • `kernel-uek-modules` • `kernel-uek-modules-desktop` • `kernel-uek-modules-extra-netfilter` • `kernel-uek-modules-usb` • `kernel-uek-modules-wireless` Installing this package is equal to installing the full UEK kernel. Installing this package maintains compatibility with previous releases.
`kernel-uek-core`	This package contains the UEK kernel binary and supporting files, which are copied to `/boot`. The package is installed along with the `kernel-uek-modules-core` package and the `kernel-uek-modules` package. Note that this package requires that the `linux-firmware-core` package also be installed.
`kernel-uek-modules-core`	This package contains a minimal number of core kernel modules and supporting files used for Oracle engineered systems. The package is a dependency of the `kernel-uek-core` and is installed by default.
`kernel-uek-modules`	This package contains various modules that are commonly used in most server configurations. Note that this package requires that the `linux-firmware` package also be installed.
`kernel-uek-modules-desktop`	This package contains modules for desktop-type hardware. This package can be removed to harden the system on many server platforms if none of the modules are used.
`kernel-uek-modules-usb`	This package contains USB drivers. This package can be removed to harden the system on many server platforms if none of the modules are used.
`kernel-uek-modules-wireless`	This package contains wireless drivers. This package is can be removed to harden the system on many server platforms if none of the modules are used.
`kernel-uek-modules-extra-netfilter`	This package contains uncommon netfilter modules. This package can be removed to harden the system on many server platforms if none of the modules are used.

Package	Description
`kernel-uek-modules-deprecated`	This package contains modules that we plan to remove in future releases. This package is optional and you can install the package manually from the yum repository or ULN channel. Modules included in this package are deprecated and might be removed in a future release.
`kernel-uek-modules-extra`	This package contains extra modules for server configurations, but which aren't commonly used. This package is optional and you can install the package manually from the yum repository or ULN channel.
`kernel-uek-tools`	This package contains tools that are required to satisfy other build and runtime dependencies in the `tools/perf` code base, and which can be used after boot to interact with the kernel. For example, the `perf` tool used for system performance analysis is included in this package.
`linux-firmware-core`	This package contains core firmware components and is a dependency for the `kernel-uek-core` package.
`linux-firmware`	This package contains firmware components that aren't provided in the `linux-firmware-core` package and is a dependency for the `kernel-uek-modules` package. Note that this package requires that the `linux-firmware-core` package also be installed.

For security hardening, we recommend that you remove any of the `kernel-uek-modules-*` packages that aren't required by the system. To remove packages:

1. Mark the core modules packages that you require on the system to prevent them from being removed. For example:

   ```
   sudo dnf mark install kernel-uek-core kernel-uek-modules
   ```

2. Remove the unused modules packages and the `kernel-uek` metapackage from the system:

   ```
   sudo dnf erase kernel-uek-modules-desktop kernel-uek
   ```

(aarch64) 64k Base Page Size on Arm

In addition to the standard build of UEK for Arm (aarch64), which sets a base 4k page size, a `kernel-uek64k` package that sets a 64k base page size is available for Ampere Arm-based Compute shapes in Oracle Cloud Infrastructure only. For use cases other than OCI, the `kernel-uek64` package is available only as a technical preview. The `kernel-uek64k` package is available for Oracle Linux 9 and later.

The 64k page size kernel is a useful option for Ampere (Arm-based) platforms that process workloads with large, contiguous memory datasets, and can achieve better performance for some types of memory and CPU intensive operations.

The 4k page size kernel is useful for smaller environments, where minimizing physical system memory usage is a priority.

Note that the 4k page size kernel and 64k page size kernel don't differ in user experience as the user space is the same.

After a system is installed with `kernel-uek64k` switching to a 4k kernel page size is unsupported.

Installing `kernel-uek64k`

> **Note:**
>
> Installation of `kernel-uek64k` on systems outside of Oracle Cloud Infrastructure (OCI) is only available as a technical preview. Don't install this kernel on production systems outside of OCI.

To install the `kernel-uek64k` on a system installed with the standard 4k page size `kernel-uek`:

1. Install the `kernel-uek64k` package.

   ```
   sudo dnf install -y kernel-uek64k
   ```

2. Set the 64k page size kernel as the default kernel.

   ```
   sudo grubby --set-default=$(echo /boot/vmlinuz*64k)
   ```

   Note that if you have more than one 64k page kernel installed, you must explicitly declare the kernel that you intend to be the default. For example:

   ```
   sudo grubby --set-default=/boot/vmlinuz-6.12.0-0.20.20.el9uek.aarch64.64k
   ```

3. Reboot the system.

   ```
   sudo reboot
   ```

4. After the system is rebooted, verify that the page size is 64k.

   ```
   getconf PAGESIZE
   ```

   If the PAGESIZE returns 65536, the 64k kernel is loaded. If the PAGESIZE returns 4096, the 4k kernel is loaded and you must check that the default kernel is set correctly.

   You can also check that the running kernel contains the 64k string, for example:

   ```
   uname -a|grep 64k
   ```

5. If the system is running the 64k kernel, proceed to remove the 4k page size kernel packages to avoid future conflicts.

```
sudo dnf erase kernel-uek-core
```

Generic Platform Updates

Some generic platform updates are available in UEK 8. Updates include:

- Split-lock detection for operations on memory that spans two cache lines, such as misaligned memory access. See also https://docs.kernel.org/arch/x86/buslock.html
- Call depth tracking is implemented to improve performance in the Retbleed security vulnerability mitigation code.
- x86 CPU bringup is updated so that secondary CPU cores are booted in parallel to improve kernel boot times on high core count systems.
- 32-bit emulation on x86_64 kernels with the `ia32_emulation` command-line parameter. When set to true, you can load 32-bit programs and run 32-bit system calls.

Intel Platform Updates

Some upstream Intel platform updates are included in UEK 8. Notable items include:

- Intel Software Guard Extensions (SGX2), a hardware-based implementation of Enclave Dynamic Memory Management (EDMM), is an enhanced version of a security technology that can protect sensitive data and code by isolating them in private memory regions called enclaves. SGX2 introduces new features such as dynamic memory management, so that enclaves can resize and manage their memory during runtime. This update is important for applications with dynamic workloads or larger memory requirements, that require a more scalable architecture. SGX2 provides robust confidentiality and integrity for sensitive workloads in both on-premises and cloud environments. See https://www.intel.com/content/www/us/en/support/articles/000058764/software/intel-security-products.html.
- Quick Assist Technology (QAT) functionality is updated to support 4th Gen Intel Xeon processors.

EEVDF Scheduler Replaces CFS

Earliest Eligible Virtual Deadline First (EEVDF) is a new kernel scheduler that replaces the Completely Fair Scheduler (CFS). EEVDF provides a better scheduling policy for the kernel and reduces configuration complexity and improves scheduling behavior.

Memory Management

Several important memory management updates are available in UEK 8 with upstream changes that are included from v5.15 to v6.12.

- The folios data structure replaces struct page to provide better abstraction for the management of pages. Folios is a new data structure that represents one or more pages of memory. The new structure reduces type confusion and memory overhead.
- Huge Pages are improved with several useful updates, including:

  - Update to handle hugeTLB faults when using per-VMA locking. Memory management operations like page faults and memory mapping can be handled in a more fine-grained and efficient manner reducing contention and improving concurrency.
  - Split underused THPs, and improve THP=always policy. These changes improve overprovisioning of THPs in sparsely accessed memory areas.
- Continued improvements to memory control groups code, memcg, to decouple v1 fields in the code from the v2 code base.
- Memory Mapping optimizations:
  - Maple Tree replaced Red-Black Trees (RB Trees) for managing virtual memory areas (VMAs) for better performance with faster lookups, inserts, and deletes.
  - Per-VMA mmap locking to improve concurrency and reduce contention in multithreaded applications with many VMAs.
  - Introduction of the `ptdesc` data structure to optimize management of page tables by decoupling page metadata from the `page` data structure.

File Systems

The following file systems features and enhancements are introduced in UEK 8:

Btrfs

The following notable Btrfs file system changes are introduced in UEK 8:

- Compressed data can be sent or received without transformation, and data chunks larger than 64K are now handled for writes.
- Quota accounting is simplified. Simple quotas can be used instead of quota groups for straightforward tracking of space usage by linking extents to their subvolumes. This approach can improve performance, but simple quotas are unable to track shared data, so are best suited to environments where extents are immutable and persist longer than any copies.
- The introduction of a temporary FSID makes it possible to mount cloned devices. The file system gets a randomly generated UUID on mount.
- Improved NOCOW write checks improve throughput by 9%.
- A new mount option `discard=async` is enabled by default for devices that support trim/discard, applying asynchronous discard for the whole file system.
- The mount option `ignoremetacsums` ignores invalid metadata checksums, and the `ignoresuperflags` mount option can be set to ignore superblock flags tracking conversion progress.
- Send and relocation tasks, such as balance, device removal, shrink, and block group reclaim, run in parallel.
- Devices can be added during a paused balance.

XFS

The following notable XFS file system changes are introduced in UEK 8:

- You can now mount a file system with the blocksize larger than the pagesize.
- Large extent counts are available for big virtual disk images.

- Atomic file content commits are now available.
- Fully autonomous online fsck and repair are available as a technical preview.
- An update to the `mkfs.xfs` command sets a minimum XFS file system size to 300 MB to prevent the creation of small file systems that caused performance and redundancy problems. This change differs from the command included in the earlier `xfsprogs` package available in the `ol9_baseos_latest` repository on Oracle Linux 9 systems.

NFS

The following notable NFS file system changes are introduced in UEK 8:

- NFSv4.2 READ_PLUS feature is enabled by default within the kernel to improve handling of sparse files by including a description of holes, or data blocks that are uninitialized.
- Various older protocol features for NFS are removed in UEK 8. See Deprecated and Removed Features.

Berkeley Packet Filter (BPF) Enhancements

Several important updates are available in UEK 8 for the Berkeley Packet Filter (BPF), including:

- Introduction of a dedicated BPF memory allocator is added to improve the reliability of allocations made within BPF programs, which can run in a wide variety of contexts.
- Addition of a new user ring buffer BPF map type for asynchronous message passing and faster data transfer between a BPF program and user space.
- BPF programs can now call kernel functions from a loadable module, can access and store task_struct objects, and can use absolute time values.
- Friendlier helper functions, such as `bpf_trace_vprintk`, and also destructive helpers such as `crash_kexec`, are included.
- BPF programs can attach filter functions to kfuncs. The filter can limit the contexts from which the kfunc can be invoked.
- Resilient BPF Type Format (BTF) information for modules is included so that out-of-tree modules can define BTF that works for the lifetime of a UEK release.
- BPF trampoline is now available for aarch64 platforms to provide faster BPF tracing program execution using Fentry and Fexit programs.
- BPF hooks:
  - To see and filter complete packets.
  - To change the requested protocol for a new socket, primarily to transparently cause programs requesting TCP connections to use multipath TCP instead.

`io_uring` Enhancements

`io_uring` is a system call interface to manage storage device asynchronous I/O operations. Several features and improvements are provided in the implementation that's available in UEK 8 and some of these might have been backported to previous UEK releases. Updates include many optimizations for security and performance. Significant new features and changes include:

- `io_uring` now supports sending and receiving T10 Protection Information along with the data buffer.
- Operations for `getsockopt()`, `setsockopt()`, `bind()`, `listen()` and `waitid()`.
- Mechanism to omit system calls with IORING_SETUP_SQPOLL at setup time. A call to `io_uring_enter()` starts a kernel thread that occasionally polls the submission queue and automatically submits any requests found there.
- Batch request for `recv()` calls and for `reads()`.
- IORING_OP_SENDZC to perform Zero-copy writes.
- Several Ring code optimizations:
  - Rings and submission queue can be in user space memory, such as huge pages.
  - One ring is now able to signal another to speed up message requests.
  - Ring related work can be deferred until an application asks for it.
- `io_uring` improvements in buffered writes, in XFS.
- `io_uring` optimization in XFS and Ext4 can handle multiple direct-I/O writes to a file in parallel.
- Absolute timeouts, along with the relative timeouts that were already available, are now possible.

ASMLib v3

ASMLib is a library for the Automatic Storage Management feature of the Oracle Database. ASMLib v3 takes advantage of the `io_uring` features included in the kernel to deliver high performance. UEK 8 is tested and fully supported with Oracle ASMLib v3.

Note that with this update, the `oracleasm` kernel module is no longer included, as Oracle ASMLib v3 no longer requires this module to work.

ASMLIB release 3.1 leverages the protection information passthrough enhancements added to `io_uring` in UEK 8. Through this interface CRC checksums can be attached to each I/O, providing an additional layer of protection against data corruption.

To use this feature, ASM disks must be provisioned on storage hardware which implements T10 Protection Information (SCSI controller with DIX support or NVMe).

See Oracle Linux: Installing and Configuring Oracle ASMLIB v3.

RDMA

UEK 8 includes Remote Direct Memory Access (RDMA) features that are provided in the upstream kernel, with the addition of Ksplice and DTrace functionality. RDMA enables direct memory access between two systems that are connected by an InfiniBand or RoCE network. RDMA facilitates high-throughput and low-latency networking in clusters.

For more information about installing RDMA packages, see Installing and Upgrading Oracle-Supported RDMA Packages on Oracle Linux.

General Networking Enhancements

Some general networking enhancements are available in UEK 8 with upstream changes that are included from v5.15 to v6.12.

- BIG TCP, which uses bigger TSO/GRO packet sizes for IPv6 traffic, is included to improve the performance when sending large IPv6 TCP packets on data-center networks. Note that this feature isn't enabled by default because it can affect eBPF programs that might assume the TCP header immediately follows the IPv6 header. BIG TCP is enabled by setting the `gro_ipv6_max_size` and `gso_ipv6_max_size` on a link device.
- A new socket option SO_RESERVE_MEM is available to provide a mechanism for users to reserve a certain amount of memory for the socket. With this socket option set, the networking stack spends less cycles doing forward alloc and reclaim, which can lead to better system performance, with the cost of an amount of preallocated and irreclaimable memory, even under memory pressure.
- The fair queuing packet scheduler has gained several performance improvements, including a 5% throughput increase in intensive TCP Request/Response (TCP_RR) workload, and 13% increase for UDP packets without a pacing rate set on the socket.
- Several core networking data structures are reorganized for better cache efficiency that can result in TCP performance improvement in where the are many concurrent connections.

KTLS

KTLS handles TLS records using the symmetric encryption or decryption algorithms in the kernel for the AES-GCM cipher. KTLS was enabled in UEK R7U3 for TLS encrypted connections for NFS. KTLS continues to be available in UEK 8.

TLS Encrypted Connections for NFS

RPC-With-TLS is enabled in the Linux NFS server and client. This update provides a standards-based peer authentication mechanism over an encrypted connection using TLS. The TLS Record protocol is handled entirely by kTLS.

Note that both the server and client systems must run UEK R7U3 or later, or must be running a kernel and user space client that supports RFC 9289, to use this functionality. The user space package, `ktls-utils`, is also required and must be installed on both the client and server systems. Also ensure that you have installed the most recent version of the `nfs-utils` package or that you have done a full system update.

RPC-With-TLS is contributed upstream by Oracle and is described in RFC 9289.

Random Number Generator Enhancements

Some enhancements to the Random Number Generator (RNG) are available in UEK 8 with upstream changes that are included from v5.15 to v6.12. Most notably, RNG has switched from the SHA1 hash algorithm to the faster and more secure BLAKE2s algorithm.

Also, the `getrandom()` system call is now implemented in the kernel's virtual dynamic shared object (vDSO) area. This implementation improves performance when obtaining random number data by removing the need to switch from a user space context into the kernel context.

KVM and Virtualization

The following KVM and virtualization changes are included in this release of UEK 8:

- Two-Dimensional Paging (TDP) MMU support is added to significantly improve page fault performance on many-VCPU VMs. This functionality is enabled by default.
- The UEK 8 kernel configuration for VCPUs is increased to a theoretical limit of 4096. Note that the actual vCPU limit is use case specific and dependent on many factors including system and QEMU configuration.

Updated Drivers

Device drivers included in UEK 8 are aligned with the drivers in the upstream mainline Linux 6.12 kernel. A few notable updates are included where drivers include functionality or fixes available in later upstream kernel versions.

Many driver modules no longer track version information. Oracle works with vendors to align device drivers included in UEK 8 with the code available in upstream kernel versions.

Notable driver updates are presented in the following table:

Table 2-1 Driver Alignment

Driver Module	Driver Description	Aligned Kernel Version	Notable Updates
`fnic`	Cisco FCoE HBA Driver	6.14	Updates from 6.14 were backported to this release. Note that this driver includes a version string: 1.8.0.0.
`lpfc`	Broadcom Emulex Fibre Channel HBA Driver	6.14	Updates from 6.14 were backported to this release. Note that this driver includes a version string: 0:14.4.0.8.
`mlx5`	NVIDIA 5th Generation Network Adapters (NVIDIA ConnectX series) Core Driver	6.12	Several fixes and improvements from 6.14 were backported in this release.

Deprecated and Removed Features

The following features are deprecated, removed, or no longer supported in UEK 8:

Deprecated Features

- **Kernel modules moved to the `kernel-uek-modules-deprecated` package are now deprecated.**

  These modules might be removed in a future release of UEK.

  See Module Deprecations (x86_64) and Module Deprecations (aarch64) for a detailed listing.

- **`cgroupsv1` is deprecated**

  `cgroupsv1` is deprecated in Oracle Linux 9 and will be removed in a future Oracle Linux release.

- **`XFS_SUPPORT_V4` is deprecated**

  The V4 file system format contains known weaknesses in the on-disk format. Therefore, the option is deprecated in UEK 8 and will be removed in a future UEK release.

  You can check whether the file system is formatted to use V4, by running the `xfs_db -r -c version` <*device*> command.

  If the feature is enabled, you must backup data, reformat the device, and restore data.

- **`XFS_SUPPORT_ASCII_CI` is deprecated**

  The XFS ASCII case-insensitive name feature is deprecated in UEK 8 and will be removed in a future UEK release. The feature provided an option to format an XFS file system with the `ascii-ci` option enabled to disable case-sensitivity.

  You can check whether the feature is enabled by using the `xfs_info` command.

  If the feature is enabled, you must backup data, reformat the device with the option disabled, and restore data.

- **`CONFIG_SECURITY_SELINUX_DISABLE` and `CONFIG_SECURITY_WRITABLE_HOOKS` options are disabled**

  The option to disable SELinux at runtime by using the sysfs interface is removed in this UEK release.

  The preferred method of disabling SELinux is by using the `selinux=0` boot parameter

Removed Features

- **`CONFIG_RPCSEC_GSS_KRB5_ENCTYPES_DES` option for 3DES/DES3 RPCSEC GSS encryption types is disabled**

  The RPCSEC GSS encryption types DES and Triple-DES (3DES/DES3) is removed in this UEK release.

  These encryption types were deprecated by RFCs 6649 and 8429 because they're known to be insecure.

- **`CONFIG_NFS_V2` and `CONFIG_NFSD_V2` options for NFSv2 client and server are disabled**
  Support for NFSv2 clients and NFSv2 servers is removed in this UEK release.

  NFSv2 has long been replaced by NFSv3 and NFSv4, which offer improved functionality, performance, and security.

- **`CONFIG_NFS_DISABLE_UDP_SUPPORT` option for NFSv3 over UDP is enabled**
  Support for NFS version 3 over the UDP network protocol is removed in this UEK release.

  Modern NFS/RPC over TCP and RDMA implementations provide better performance than UDP, and provide reliable ordered delivery of data combined with congestion control.

  Note that NFSv4 is already not supported over UDP, for the same reasons.

- **`CONFIG_STAGING` option is disabled**

  The `CONFIG_STAGING` kernel configuration option is disabled in UEK 8. The kernel option made available drivers that don't necessarily meet the highest kernel quality level and which were available for test use. The option was deprecated in UEK R7 and is removed in UEK 8.

- **`CONFIG_IXGB` option is disabled**
  The `CONFIG_IXGB` for Intel PRO/10GbE hardware is removed in this UEK release.
- **crashkernel=auto removed**

  The `crashkernel=auto` option was deprecated in UEK R7 and unsupported for Oracle Linux 9. The kernel option is removed in UEK 8. For more information about configuring the `crashkernel` setting on Oracle Linux 9, see Oracle Linux 9: Managing Kernels and System Boot.
- **`CONFIG_IP_NF_TARGET_CLUSTERIP` option is disabled**
  The `CONFIG_IP_NF_TARGET_CLUSTERIP` option that allowed you to build load-balancing clusters of network servers without a dedicated load-balancing router or switch is removed in favor of functionality already in Netfilter cluster match.
- **`CONFIG_EFI_VARS` option disabled**
  The `CONFIG_EFI_VARS` option that provided the `efivars` sysfs interface to configure UEFI variables is removed from this release of UEK. Replacement functionality has been present in the kernel since 2012. For more information, see https://www.kernel.org/doc/html/latest/filesystems/efivarfs.html.
- **Firewire driver removed**

  The `CONFIG_FIREWIRE` option is disabled in this UEK release.
- **Several Network Scheduler Modules Removed**

  The following network scheduler modules were deprecated in UEK R7 and are now removed in UEK 8:

  - `cls_tcindex`
  - `cls_rsvp`
  - `sch_dsmark`
  - `sch_atm`
  - `sch_cbq`
- **`resilient_rdmaip` Module Removed**

  The `resilient_rdmaip` module was deprecated in UEK R7 and is now removed.
- **`oracleasm` Kernel Module Removed**

  The `oracleasm` kernel module is removed in UEK 8. Note that this module continues to be supported in the UEK R5 and UEK R6 releases.

  Oracle ASMLib continues to be supported using `io_uring` interfaces. See ASMLib v3 for more information.
- **`sundance` Kernel Module Removed**

  The DLink Sundance (ST201), `sundance`, driver is removed in UEK 8. The module was removed in the upstream kernel because it was unmaintained.
- **`cpu5_wdt` Kernel Module Removed**

  The `cpu5_wdt` watchdog driver is removed in UEK 8. The module was removed in the upstream kernel because it had several issues that were unresolved and lacked maintenance.
- **`i2c-amd756-s4882` and `i2c-nforce2-s4985` Kernel Modules Removed**

The `i2c-amd756-s4882` and `i2c-nforce2-s4985` legacy muxing drivers are removed in UEK 8. The module was removed in the upstream kernel because they're old and contain technically inaccurate code.

- **`CONFIG_CRYPTO_OFB` and `CONFIG_CRYPTO_CFB` cryptographic modes**

  The CFB (Cipher Feedback) mode (NIST SP800-38A) used for TPM2 cryptography and the OFB (Output Feedback) mode (NIST SP800-38A) used to turn a block cipher into a synchronous stream cipher are removed in UEK 8, to align with upstream changes.

3
Related User Space Packages

To expose newly added functionality that's included in UEK 8, several user space binary packages are required. Some of these packages are separate from the packages that are included in the base distribution.

For more information about the ULN channels and Oracle Linux yum server repositories in which these packages are available, see Installation and Availability.

The packages listed in the following table are specific to user space functionality. The versions listed are tested to take advantage of the features that are available in UEK 8. If you use any of the packages that are listed with UEK 8, update the package to the latest version for full compatibility with all the features that are included in this release. Note that `btrfs-progs`, `ocfs2-tools` and the user space packages released in the UEK 8 repository are only supported with UEK 8 and should not be installed on systems using RHCK.

Table 3-1 User Space Packages for UEK 8

Package Name	Oracle Linux 9 Version
adaptivemm	2.1.0-2
bcache-tools	1.0.8-3.101.0.1
bpftool	7.4.0-503.23.2
btrfs-progs	6.12.0-0
btrfs-progs-devel	6.12.0-0
crash	8.0.6-1.0.1
cxl-cli	78-2
cxl-devel	78-2
cxl-libs	78-2
daxctl	78-2
daxctl	78-2
dmidecode	3.6-1
dnf-plugins-extras	4.0.15-3.0.1
dtrace	2.0.2-5
dtrace-devel	2.0.2-5
dtrace-testsuite	2.0.2-5
dwarves	1.28-1
e2fsprogs	1.46.5-5
ipmctl	03.00.00.0485-1.0.1
iproute	6.8.0-2
kexec-tools	2.0.29-5.0.2

Table 3-1 (Cont.) User Space Packages for UEK 8

Package Name	Oracle Linux 9 Version
libbpf	1.5.0-2.0.1
libbpf-devel	1.5.0-2.0.1
libdnf	0.69.0-12.0.1
libdwarves1	1.28-1
libipmctl5	03.00.00.0485-1.0.1
libipmctl5-devel	03.00.00.0485-1.0.1
libnvme	1.9-3
linux-firmware	20250319-999.39.git430633ec
mcelog	204-1.0.1
microcode_ctl	20240910-1.0.2
ndctl	78-2
nvme-cli	2.9.1-6
ocfs2-tools	1.8.6-17
pciutils	3.7.0-5
pciutils-libs	3.7.0-5
snapper	0.8.7-4
wireguard-tools	1.0.20210914-3
xfsprogs	6.12.0-1.0.1

4

Known Issues

This chapter describes any known issues for Unbreakable Enterprise Kernel 8.

Unusable or Unavailable Features for Arm Platforms

The following features are known to not work, remain untested, or have issues that render the feature unusable. The following features aren't supported on Arm platforms:

- InfiniBand
- FibreChannel
- RDMA

5

Installation and Availability

This chapter provides information about the availability of UEK 8 on Oracle Linux and includes installation and instructions on upgrading from a previous UEK release to UEK 8.

UEK 8 is supported on the Intel® 64-bit x86_64, AMD 64-bit x86_64 and 64-bit Arm (aarch64) platforms.

About Upgrading From a Previous Oracle Linux or UEK Release to UEK 8

UEK 8 is made available for installation on Oracle Linux 9, starting with the Oracle Linux 9.5 release.

The suggested migration path for upgrading the system from an earlier UEK release to UEK 8 is as follows:

- If you're running an Oracle Linux 8 release you must upgrade to Oracle Linux 9 to install UEK 8. For instructions on upgrading an Oracle Linux 8 system to Oracle Linux 9, see Oracle Linux 9: Upgrading Systems With Leapp.
- If you're running an Oracle Linux 9 release, you must ensure that the system is updated to the latest update level before installing UEK 8.

Obtaining Packages for Installation

If you have a subscription to Oracle Unbreakable Linux support, you can obtain the packages for UEK 8 by registering the system with the Unbreakable Linux Network (ULN) and then subscribing it to other channels. See Subscribing to ULN Channels.

If the system isn't registered with ULN, you can obtain most of the required packages from the Oracle Linux yum server. See Enabling Access to Oracle Linux Yum Server Repositories.

When you have subscribed the system to the appropriate ULN channels or to the Oracle Linux yum server, you can proceed to upgrade the system to UEK 8. See Upgrading a System to UEK 8.

Enabling Access to Oracle Linux Yum Server Repositories

Packages for UEK 8 and any associated user space applications are available on the Oracle Linux yum server at https://yum.oracle.com/ in yum repositories that are available for each supported Oracle Linux release.

- Oracle Linux 9: `ol9_UEKR8`

Oracle Linux 9

To enable access to the UEK 8 repository on the Oracle Linux yum server, use the `dnf config-manager` command.

1. Ensure that you have the latest `oraclelinux-release-el9` package installed and updated.

   ```
   sudo dnf install -y oraclelinux-release-el9
   ```

   The package contains the yum repository definition for the `ol9_UEKR8` repository.
2. Enable the `ol9_developer_UEKR8` repository.

   ```
   sudo dnf config-manager --set-enabled ol9_UEKR8
   ```

3. Install the UEK 8 packages, for example:

   ```
   sudo dnf install -y kernel-uek kernel-uek-devel
   ```

   Installing the `kernel-uek-devel` package also installs the `gcc-toolset-14` packages.
4. Verify the UEK 8 kernel packages are installed, for example:

   ```
   dnf list --installed kernel-uek*-6.12.0-*
   ```

Subscribing to ULN Channels

UEK 8 kernel image and user space packages are made available for the each supported Oracle Linux release and platform architecture in the following ULN channels:

- Oracle Linux 9 (x86_64): `ol9_x86_64_UEKR8`
- Oracle Linux 9 (aarch64): `ol9_aarch64_UEKR8`

The following instructions assume that you have already registered the system with ULN.

To subscribe a system to a ULN channel:

1. Sign in to https://linux.oracle.com with a ULN username and password.
2. On the Systems tab, in the list of registered machines, select the link that corresponds to the name of the system.
3. On the System Details page, select **Manage Subscriptions**.
4. On the System Summary page, from the list of available channels, select each of the required channels, then select the right arrow to move the selected channel to the list of subscribed channels.
5. Select **Save Subscriptions**.

For more information about using ULN, see Oracle Linux: Managing Software on Oracle Linux.

Upgrading a System to UEK 8

The following instructions describe how to upgrade a system to UEK 8. For more details about the suggested migration paths for upgrading to UEK 8, see About Upgrading From a Previous Oracle Linux or UEK Release to UEK 8.

1. Enable access to the appropriate ULN channels or yum repositories, as described in Subscribing to ULN Channels and Enabling Access to Oracle Linux Yum Server Repositories.

> **Tip:**
>
> Disable any other UEK channels or repositories that you might have previously configured as good practice.

2. After enabling access to the appropriate channels or repositories, upgrade the system to UEK 8 by running the following commands:

```
sudo dnf install -y kernel-uek
sudo dnf update -y
```

3. After the upgrade has completed, reboot the system.

   Ensure to select the UEK 8 kernel (version 6.12.0) if it's not the default boot kernel. For more information about setting the default boot kernel, see Oracle Linux 9: Managing Kernels and System Boot.

For questions regarding installing software or updating a system, see Oracle Linux: Managing Software on Oracle Linux.

Installing and Upgrading Oracle-Supported RDMA Packages on Oracle Linux

The following instructions describe how to install and upgrade Oracle-supported RDMA packages on Oracle Linux 9.

Installing Oracle-Supported RDMA Packages on Oracle Linux 9

> **Note:**
>
> These instructions apply to the x86_64 platform.

The following instructions describe how to install RDMA release packages on an Oracle Linux 9 system:

1. Ensure that you have subscribed to the ULN channel or have enabled the yum repository that contains the RDMA-related user space packages for Oracle Linux 9.
   - If you're installing packages from ULN, subscribe to the `ol9_x86_64_RDMA` channel.
   - If you're installing packages from the Oracle Linux yum server, enable the `ol9_RDMA` yum repository.
2. Clean the yum cached files from all the enabled repositories by running the following command:

```
sudo dnf clean all
```

3. Install the RDMA packages for UEK 8.

- Use the following commands to install the core packages:

```
sudo dnf install rdma-core
sudo dnf install libibverbs-utils
sudo dnf install librdmacm-utils
sudo dnf install mstflint
sudo dnf install mlnx-tools
sudo dnf install rds-tools
```

  - If installing on a bare-metal system, install the `infiniband-diags` package:

```
sudo dnf install infiniband-diags
```

  - If installing on a guest VM, install the `infiniband-diags-guest` package:

```
sudo dnf install infiniband-diags-guest
```

- (Optional) If you require the `perftest` package, install the package by running:

```
sudo dnf install perftest
```

- (Optional) If you require the `qperf` package, install the package by running:

```
sudo dnf install qperf
```

- (Optional) If you require the `libpcap` package, install the package by running:

```
sudo dnf install libpcap
```

- (Optional) If you require the `ibacm` package, install the package by running:

```
sudo dnf install ibacm
```

- (Optional) If you require the `srp_daemon` package, install the package by running:

```
sudo dnf install srp_daemon
```

Upgrading Oracle-Supported RDMA Packages on Oracle Linux 9

You can upgrade the Oracle-supported RDMA packages on Oracle Linux 9 by using the `dnf update` command.

If you're upgrading a system that has the `oracle-rdma-release` or `oracle-rdma-release-guest` package installed, if the package version is lower than version 0.18.1-1 and you intend to upgrade to version 0.18.1-1, or later, you must first manually remove the `rdma-core-devel` package. Remove this package by using the `rpm -e --nodeps` command, which removes the package outside of the standard yum or DNF package manager control and leaves any dependencies intact, for example:

```
sudo /bin/rpm -e --nodeps rdma-core-devel
sudo dnf update
```

If the system you have upgraded has the `oracle-rdma-release` or `oracle-rdma-release-guest` package installed and if the package version is version 0.31.0-1, then you can remove it because that package no longer serves any purpose:

```
sudo dnf remove oracle-rdma-release*
```

A

Module Deprecations (x86_64)

The following modules are deprecated in this release of UEK 8. While these modules are available and operative in this release, they are planned for removal and support isn't guaranteed in future UEK releases. Thus, these modules should not be used in new UEK 8 deployments to avoid problems upgrading in the future.

Table A-1 Module Deprecations (x86_64)

Module Name	Description
a8293	Allegro A8293
adm8211	ADMtek ADM8211 support
af9013	Afatech AF9013 demodulator
af9033	Afatech AF9033 DVB-T demodulator
atbm8830	AltoBeam ATBM8830/8831 DMB-TH demodulator
atmtcp	ATM over TCP
au8522_common	
au8522_decoder	Auvitek AU8522 based ATV demod
au8522_dig	Auvitek AU8522 based DTV demod
b2c2-flexcop	
b2c2-flexcop-pci	Technisat/B2C2 Air/Sky/Cable2PC PCI
b2c2-flexcop-usb	Technisat/B2C2 Air/Sky/Cable2PC USB
b43legacy	Broadcom 43xx-legacy wireless support (mac80211 stack)
bcm3510	Broadcom BCM3510
cpu5wdt	SMA CPU5 Watchdog
cx22700	Conexant CX22700 based
cx22702	Conexant cx22702 demodulator (OFDM)
cx23885	Conexant cx23885 (2388x successor) support
cx24110	Conexant CX24110 based
cx24113	Conexant CX24113/CX24128 tuner for DVB-S/DSS
cx24116	Conexant CX24116 based
cx24117	Conexant CX24117 based
cx24120	Conexant CX24120 based
cx24123	Conexant CX24123 based

Table A-1 (Cont.) Module Deprecations (x86_64)

Module Name	Description
cxd2099	Sony CXD2099AR Common Interface driver
cxd2820r	Sony CXD2820R
cxd2841er	Sony CXD2841ER
dib0070	DiBcom DiB0070 silicon base-band tuner
dib0090	DiBcom DiB0090 silicon base-band tuner
dib3000mb	DiBcom 3000M-B
dib3000mc	DiBcom 3000P/M-C
dib7000m	DiBcom 7000MA/MB/PA/PB/MC
dib7000p	DiBcom 7000PC
dib8000	DiBcom 8000MB/MC
dibx000_common	DiBcom 9000
drx39xyj	Micronas DRX-J demodulator
drxd	Micronas DRXD driver
drxk	Micronas DRXK based
ds3000	Montage Tehnology DS3000 based
dvb-pll	Generic I2C PLL based tuners
dvb-usb	Support for various USB DVB devices
dvb-usb-a800	AVerMedia AverTV DVB-T USB 2.0 (A800)
dvb-usb-af9005	Afatech AF9005 DVB-T USB1.1 support
dvb-usb-af9005-remote	Afatech AF9005 default remote control support
dvb-usb-af9015	Afatech AF9015 DVB-T USB2.0 support
dvb-usb-af9035	Afatech AF9035 DVB-T USB2.0 support
dvb-usb-anysee	Anysee DVB-T/C USB2.0 support
dvb-usb-au6610	Alcor Micro AU6610 USB2.0 support
dvb-usb-az6007	AzureWave 6007 and clones DVB-T/C USB2.0 support
dvb-usb-az6027	Azurewave DVB-S/S2 USB2.0 AZ6027 support
dvb-usb-ce6230	Intel CE6230 DVB-T USB2.0 support
dvb-usb-cinergyT2	Terratec CinergyT2/qanu USB 2.0 DVB-T receiver
dvb-usb-cxusb	Conexant USB2.0 hybrid reference design support
dvb-usb-dib0700	DiBcom DiB0700 USB DVB devices (see help for supported devices)
dvb-usb-dibusb-common	DiBcom USB DVB-T devices (based on the DiB3000M-B) (see help for device list)

Table A-1 (Cont.) Module Deprecations (x86_64)

Module Name	Description
dvb-usb-dibusb-mb	DiBcom USB DVB-T devices (based on the DiB3000M-B) (see help for device list)
dvb-usb-dibusb-mc	DiBcom USB DVB-T devices (based on the DiB3000M-C/P) (see help for device list)
dvb-usb-dibusb-mc-common	
dvb-usb-digitv	Nebula Electronics uDigiTV DVB-T USB2.0 support
dvb-usb-dtt200u	WideView WT-200U and WT-220U (pen) DVB-T USB2.0 support (Yakumo/Hama/Typhoon/Yuan)
dvb-usb-dtv5100	AME DTV-5100 USB2.0 DVB-T support
dvb-usb-dvbsky	DVBSky USB support
dvb-usb-dw2102	DvbWorld & TeVii DVB-S/S2 USB2.0 support
dvb-usb-ec168	E3C EC168 DVB-T USB2.0 support
dvb-usb-gl861	Genesys Logic GL861 USB2.0 support
dvb-usb-gp8psk	GENPIX 8PSK->USB module support
dvb-usb-lmedm04	LME DM04/QQBOX DVB-S USB2.0 support
dvb-usb-m920x	Uli m920x DVB-T USB2.0 support
dvb-usb-mxl111sf	
dvb-usb-nova-t-usb2	Hauppauge WinTV-NOVA-T usb2 DVB-T USB2.0 support
dvb-usb-opera	Opera1 DVB-S USB2.0 receiver
dvb-usb-pctv452e	Pinnacle PCTV HDTV Pro USB device/TT Connect S2-3600
dvb-usb-rtl28xxu	Realtek RTL28xxU DVB USB support
dvb-usb-technisat-usb2	Technisat DVB-S/S2 USB2.0 support
dvb-usb-ttusb2	Pinnacle 400e DVB-S USB2.0 support
dvb-usb-umt-010	HanfTek UMT-010 DVB-T USB2.0 support
dvb-usb-vp702x	TwinhanDTV StarBox and clones DVB-S USB2.0 support
dvb-usb-vp7045	TwinhanDTV Alpha/MagicBoxII, DNTV tinyUSB2, Beetle USB2.0 support
dvb_dummy_fe	Dummy frontend driver
dvb_usb_v2	Support for various USB DVB devices v2
e4000	Elonics E4000 silicon tuner
ec100	E3C EC100
fc0011	Fitipower FC0011 silicon tuner
fc0012	Fitipower FC0012 silicon tuner
fc0013	Fitipower FC0013 silicon tuner

Table A-1 (Cont.) Module Deprecations (x86_64)

Module Name	Description
fc2580	FCI FC2580 silicon tuner
gp8psk-fe	
isl6405	ISL6405 SEC controller
isl6421	ISL6421 SEC controller
isl6423	ISL6423 SEC controller
it913x	ITE Tech IT913x silicon tuner
itd1000	Integrant ITD1000 Zero IF tuner for DVB-S/DSS
ix2505v	Sharp IX2505V silicon tuner
l64781	LSI L64781
lg2160	LG Electronics LG216x based
lgdt3305	LG Electronics LGDT3304 and LGDT3305 based
lgdt3306a	LG Electronics LGDT3306A based
lgdt330x	LG Electronics LGDT3302/LGDT3303 based
lgs8gxx	Legend Silicon LGS8913/LGS8GL5/LGS8GXX DMB-TH demodulator
libertas_sdio	Marvell Libertas 8385/8686/8688 SDIO 802.11b/g cards
lnbh25	LNBH25 SEC controller
lnbp21	LNBP21/LNBH24 SEC controllers
lnbp22	LNBP22 SEC controllers
m88ds3103	Montage Technology M88DS3103
m88rs2000	M88RS2000 DVB-S demodulator and tuner
m88rs6000t	Montage M88RS6000 internal tuner
max2165	Maxim MAX2165 silicon tuner
mb86a16	Fujitsu MB86A16 based
mb86a20s	Fujitsu mb86a20s
mc44s803	Freescale MC44S803 Low Power CMOS Broadband tuners
mn88472	Panasonic MN88472
mn88473	Panasonic MN88473
mt2060	Microtune MT2060 silicon IF tuner
mt2063	Microtune MT2063 silicon IF tuner
mt20xx	Microtune 2032 / 2050 tuners
mt2131	Microtune MT2131 silicon tuner
mt2266	Microtune MT2266 silicon tuner

Table A-1 (Cont.) Module Deprecations (x86_64)

Module Name	Description
mt312	Zarlink VP310/MT312/ZL10313 based
mt352	Zarlink MT352 based
mxl111sf-tuner	MxL111SF DTV USB2.0 support
mxl5005s	MaxLinear MSL5005S silicon tuner
mxl5007t	MaxLinear MxL5007T silicon tuner
mxl5xx	MaxLinear MxL5xx based tuner-demodulators
mxl692	MaxLinear MXL692 based
nxt200x	NxtWave Communications NXT2002/NXT2004 based
nxt6000	NxtWave Communications NXT6000 based
or51132	Oren OR51132 based
or51211	Oren OR51211 based
parport_pc	PC-style hardware
parport_serial	Multi-IO cards (parallel and serial)
pluto2	Pluto2 cards
qm1d1b0004	Sharp QM1D1B0004 tuner
qm1d1c0042	Sharp QM1D1C0042 tuner
qt1010	Quantek QT1010 silicon tuner
r820t	Rafael Micro R820T silicon tuner
rt2400pci	Ralink rt2400 (PCI/PCMCIA) support
rt2500pci	Ralink rt2500 (PCI/PCMCIA) support
rt61pci	Ralink rt2501/rt61 (PCI/PCMCIA) support
rtl2830	Realtek RTL2830 DVB-T
rtl2832	Realtek RTL2832 DVB-T
rtl2832_sdr	Realtek RTL2832 SDR
rtl818x_pci	Realtek 8180/8185/8187SE PCI support
s5h1409	Samsung S5H1409 based
s5h1411	Samsung S5H1411 based
s5h1420	Samsung S5H1420 based
s921	Sharp S921 frontend
si2157	Silicon Labs Si2157 silicon tuner
si2165	Silicon Labs si2165 based
si2168	Silicon Labs Si2168
si21xx	Silicon Labs SI21XX based

Table A-1 (Cont.) Module Deprecations (x86_64)

Module Name	Description
sp2	CIMaX SP2
sp887x	Spase sp887x based
stb0899	STB0899 based
stb6000	ST STB6000 silicon tuner
stb6100	STB6100 based tuners
stv0288	ST STV0288 based
stv0297	ST STV0297 based
stv0299	ST STV0299 based
stv0367	ST STV0367 based
stv0900	ST STV0900 based
stv090x	STV0900/STV0903(A/B) based
stv0910	STV0910 based
stv6110	ST STV6110 silicon tuner
stv6110x	STV6110/(A) based tuners
stv6111	STV6111 based tuners
sundance	Sundance Alta support
tc90522	Toshiba TC90522
tda10021	Philips TDA10021 based
tda10023	Philips TDA10023 based
tda10048	Philips TDA10048HN based
tda1004x	Philips TDA10045H/TDA10046H based
tda10071	NXP TDA10071
tda10086	Philips TDA10086 based
tda18212	NXP TDA18212 silicon tuner
tda18218	NXP TDA18218 silicon tuner
tda18250	NXP TDA18250 silicon tuner
tda18271	NXP TDA18271 silicon tuner
tda18271c2dd	NXP TDA18271C2 silicon tuner
tda665x	TDA665x tuner
tda8083	Philips TDA8083 based
tda8261	Philips TDA8261 based
tda826x	Philips TDA826X silicon tuner
tda827x	Philips TDA827X silicon tuner
tda8290	TDA 8290/8295 + 8275(a)/18271 tuner combo

Table A-1 (Cont.) Module Deprecations (x86_64)

Module Name	Description
tda9887	TDA 9885/6/7 analog IF demodulator
tea5761	TEA 5761 radio tuner
tea5767	TEA 5767 radio tuner
ts2020	Montage Tehnology TS2020 based tuners
tua6100	Infineon TUA6100 PLL
tua9001	Infineon TUA9001 silicon tuner
tuner-simple	
tuner-types	Simple tuner support
ves1820	VLSI VES1820 based
ves1x93	VLSI VES1893 or VES1993 based
wl1251	TI wl1251 driver support
wl1251_sdio	TI wl1251 SDIO support
xc4000	Xceive XC4000 silicon tuner
xc5000	Xceive XC5000 silicon tuner
zl10036	Zarlink ZL10036 silicon tuner
zl10039	Zarlink ZL10039 silicon tuner
zl10353	Zarlink ZL10353 based

B

Module Deprecations (aarch64)

The following modules are deprecated in this release of UEK 8. While these modules are available and operative in this release, they are planned for removal and support isn't guaranteed in future UEK releases. Thus, these modules should not be used in new UEK 8 deployments to avoid problems upgrading in the future.

Table B-1 Module Deprecations (aarch64)

Module Name	Description
a8293	Allegro A8293
af9013	Afatech AF9013 demodulator
af9033	Afatech AF9033 DVB-T demodulator
as102_fe	
ascot2e	Sony Ascot2E tuner
atbm8830	AltoBeam ATBM8830/8831 DMB-TH demodulator
ath10k_sdio	Atheros ath10k SDIO support
ath6kl_sdio	Atheros ath6kl SDIO support
au8522_common	
au8522_decoder	Auvitek AU8522 based ATV demod
au8522_dig	Auvitek AU8522 based DTV demod
b2c2-flexcop	
b2c2-flexcop-pci	Technisat/B2C2 Air/Sky/Cable2PC PCI
b43legacy	Broadcom 43xx-legacy wireless support (mac80211 stack)
bcm3510	Broadcom BCM3510
cw1200_wlan_sdio	Support SDIO platforms
cw1200_wlan_spi	Support SPI platforms
cx22700	Conexant CX22700 based
cx22702	Conexant cx22702 demodulator (OFDM)
cx23885	Conexant cx23885 (2388x successor) support
cx24110	Conexant CX24110 based
cx24113	Conexant CX24113/CX24128 tuner for DVB-S/DSS
cx24116	Conexant CX24116 based
cx24117	Conexant CX24117 based

Table B-1 (Cont.) Module Deprecations (aarch64)

Module Name	Description
cx24120	Conexant CX24120 based
cx24123	Conexant CX24123 based
cxd2099	Sony CXD2099AR Common Interface driver
cxd2820r	Sony CXD2820R
cxd2841er	Sony CXD2841ER
dib0070	DiBcom DiB0070 silicon base-band tuner
dib0090	DiBcom DiB0090 silicon base-band tuner
dib3000mb	DiBcom 3000M-B
dib3000mc	DiBcom 3000P/M-C
dib7000m	DiBcom 7000MA/MB/PA/PB/MC
dib7000p	DiBcom 7000PC
dib8000	DiBcom 8000MB/MC
dibx000_common	DiBcom 9000
drx39xyj	Micronas DRX-J demodulator
drxd	Micronas DRXD driver
drxk	Micronas DRXK based
ds3000	Montage Tehnology DS3000 based
dvb-pll	Generic I2C PLL based tuners
dvb-usb	Support for various USB DVB devices
dvb-usb-a800	AVerMedia AverTV DVB-T USB 2.0 (A800)
dvb-usb-af9005	Afatech AF9005 DVB-T USB1.1 support
dvb-usb-af9005-remote	Afatech AF9005 default remote control support
dvb-usb-af9015	Afatech AF9015 DVB-T USB2.0 support
dvb-usb-af9035	Afatech AF9035 DVB-T USB2.0 support
dvb-usb-anysee	Anysee DVB-T/C USB2.0 support
dvb-usb-au6610	Alcor Micro AU6610 USB2.0 support
dvb-usb-az6007	AzureWave 6007 and clones DVB-T/C USB2.0 support
dvb-usb-az6027	Azurewave DVB-S/S2 USB2.0 AZ6027 support
dvb-usb-ce6230	Intel CE6230 DVB-T USB2.0 support
dvb-usb-cinergyT2	Terratec CinergyT2/qanu USB 2.0 DVB-T receiver
dvb-usb-cxusb	Conexant USB2.0 hybrid reference design support
dvb-usb-dib0700	DiBcom DiB0700 USB DVB devices (see help for supported devices)

Table B-1 (Cont.) Module Deprecations (aarch64)

Module Name	Description
dvb-usb-dibusb-common	DiBcom USB DVB-T devices (based on the DiB3000M-B) (see help for device list)
dvb-usb-dibusb-mb	DiBcom USB DVB-T devices (based on the DiB3000M-B) (see help for device list)
dvb-usb-dibusb-mc	DiBcom USB DVB-T devices (based on the DiB3000M-C/P) (see help for device list)
dvb-usb-dibusb-mc-common	
dvb-usb-digitv	Nebula Electronics uDigiTV DVB-T USB2.0 support
dvb-usb-dtt200u	WideView WT-200U and WT-220U (pen) DVB-T USB2.0 support (Yakumo/Hama/Typhoon/Yuan)
dvb-usb-dtv5100	AME DTV-5100 USB2.0 DVB-T support
dvb-usb-dvbsky	DVBSky USB support
dvb-usb-dw2102	DvbWorld & TeVii DVB-S/S2 USB2.0 support
dvb-usb-ec168	E3C EC168 DVB-T USB2.0 support
dvb-usb-gl861	Genesys Logic GL861 USB2.0 support
dvb-usb-gp8psk	GENPIX 8PSK->USB module support
dvb-usb-lmedm04	LME DM04/QQBOX DVB-S USB2.0 support
dvb-usb-m920x	Uli m920x DVB-T USB2.0 support
dvb-usb-mxl111sf	
dvb-usb-nova-t-usb2	Hauppauge WinTV-NOVA-T usb2 DVB-T USB2.0 support
dvb-usb-opera	Opera1 DVB-S USB2.0 receiver
dvb-usb-pctv452e	Pinnacle PCTV HDTV Pro USB device/TT Connect S2-3600
dvb-usb-rtl28xxu	Realtek RTL28xxU DVB USB support
dvb-usb-technisat-usb2	Technisat DVB-S/S2 USB2.0 support
dvb-usb-ttusb2	Pinnacle 400e DVB-S USB2.0 support
dvb-usb-umt-010	HanfTek UMT-010 DVB-T USB2.0 support
dvb-usb-vp702x	TwinhanDTV StarBox and clones DVB-S USB2.0 support
dvb-usb-vp7045	TwinhanDTV Alpha/MagicBoxII, DNTV tinyUSB2, Beetle USB2.0 support
dvb_dummy_fe	Dummy frontend driver
dvb_usb_v2	Support for various USB DVB devices v2
e4000	Elonics E4000 silicon tuner
ec100	E3C EC100
fc0011	Fitipower FC0011 silicon tuner

Table B-1 (Cont.) Module Deprecations (aarch64)

Module Name	Description
fc0012	Fitipower FC0012 silicon tuner
fc0013	Fitipower FC0013 silicon tuner
fc2580	FCI FC2580 silicon tuner
gp8psk-fe	
helene	Sony HELENE Sat/Ter tuner (CXD2858ER)
horus3a	Sony Horus3A tuner
isl6405	ISL6405 SEC controller
isl6421	ISL6421 SEC controller
isl6423	ISL6423 SEC controller
it913x	ITE Tech IT913x silicon tuner
itd1000	Integrant ITD1000 Zero IF tuner for DVB-S/DSS
ix2505v	Sharp IX2505V silicon tuner
l64781	LSI L64781
lg2160	LG Electronics LG216x based
lgdt3305	LG Electronics LGDT3304 and LGDT3305 based
lgdt3306a	LG Electronics LGDT3306A based
lgdt330x	LG Electronics LGDT3302/LGDT3303 based
lgs8gxx	Legend Silicon LGS8913/LGS8GL5/LGS8GXX DMB-TH demodulator
libertas_sdio	Marvell Libertas 8385/8686/8688 SDIO 802.11b/g cards
lnbh25	LNBH25 SEC controller
lnbp21	LNBP21/LNBH24 SEC controllers
lnbp22	LNBP22 SEC controllers
m88ds3103	Montage Technology M88DS3103
m88rs2000	M88RS2000 DVB-S demodulator and tuner
m88rs6000t	Montage M88RS6000 internal tuner
max2165	Maxim MAX2165 silicon tuner
mb86a16	Fujitsu MB86A16 based
mb86a20s	Fujitsu mb86a20s
mc44s803	Freescale MC44S803 Low Power CMOS Broadband tuners
mn88472	Panasonic MN88472
mn88473	Panasonic MN88473
mt2060	Microtune MT2060 silicon IF tuner

Table B-1 (Cont.) Module Deprecations (aarch64)

Module Name	Description
mt2063	Microtune MT2063 silicon IF tuner
mt20xx	Microtune 2032 / 2050 tuners
mt2131	Microtune MT2131 silicon tuner
mt2266	Microtune MT2266 silicon tuner
mt312	Zarlink VP310/MT312/ZL10313 based
mt352	Zarlink MT352 based
mxl111sf-tuner	MxL111SF DTV USB2.0 support
mxl5005s	MaxLinear MSL5005S silicon tuner
mxl5007t	MaxLinear MxL5007T silicon tuner
mxl5xx	MaxLinear MxL5xx based tuner-demodulators
mxl692	MaxLinear MXL692 based
nxt200x	NxtWave Communications NXT2002/NXT2004 based
nxt6000	NxtWave Communications NXT6000 based
or51132	Oren OR51132 based
or51211	Oren OR51211 based
pluto2	Pluto2 cards
qm1d1b0004	Sharp QM1D1B0004 tuner
qm1d1c0042	Sharp QM1D1C0042 tuner
qt1010	Quantek QT1010 silicon tuner
r820t	Rafael Micro R820T silicon tuner
rsi_sdio	Redpine Signals SDIO bus support
rt2400pci	Ralink rt2400 (PCI/PCMCIA) support
rt2500pci	Ralink rt2500 (PCI/PCMCIA) support
rt61pci	Ralink rt2501/rt61 (PCI/PCMCIA) support
rtl2830	Realtek RTL2830 DVB-T
rtl2832	Realtek RTL2832 DVB-T
rtl2832_sdr	Realtek RTL2832 SDR
rtl818x_pci	Realtek 8180/8185/8187SE PCI support
s5h1409	Samsung S5H1409 based
s5h1411	Samsung S5H1411 based
s5h1420	Samsung S5H1420 based
s921	Sharp S921 frontend
si2157	Silicon Labs Si2157 silicon tuner

Table B-1 (Cont.) Module Deprecations (aarch64)

Module Name	Description
si2165	Silicon Labs si2165 based
si2168	Silicon Labs Si2168
si21xx	Silicon Labs SI21XX based
sp2	CIMaX SP2
sp887x	Spase sp887x based
stb0899	STB0899 based
stb6000	ST STB6000 silicon tuner
stb6100	STB6100 based tuners
stv0288	ST STV0288 based
stv0297	ST STV0297 based
stv0299	ST STV0299 based
stv0367	ST STV0367 based
stv0900	ST STV0900 based
stv090x	STV0900/STV0903(A/B) based
stv0910	STV0910 based
stv6110	ST STV6110 silicon tuner
stv6110x	STV6110/(A) based tuners
stv6111	STV6111 based tuners
sundance	Sundance Alta support
tc90522	Toshiba TC90522
tda10021	Philips TDA10021 based
tda10023	Philips TDA10023 based
tda10048	Philips TDA10048HN based
tda1004x	Philips TDA10045H/TDA10046H based
tda10071	NXP TDA10071
tda10086	Philips TDA10086 based
tda18212	NXP TDA18212 silicon tuner
tda18218	NXP TDA18218 silicon tuner
tda18250	NXP TDA18250 silicon tuner
tda18271	NXP TDA18271 silicon tuner
tda18271c2dd	NXP TDA18271C2 silicon tuner
tda665x	TDA665x tuner
tda8083	Philips TDA8083 based
tda8261	Philips TDA8261 based

Table B-1 (Cont.) Module Deprecations (aarch64)

Module Name	Description
tda826x	Philips TDA826X silicon tuner
tda827x	Philips TDA827X silicon tuner
tda8290	TDA 8290/8295 + 8275(a)/18271 tuner combo
tda9887	TDA 9885/6/7 analog IF demodulator
tea5761	TEA 5761 radio tuner
tea5767	TEA 5767 radio tuner
ts2020	Montage Tehnology TS2020 based tuners
tua6100	Infineon TUA6100 PLL
tua9001	Infineon TUA9001 silicon tuner
tuner-simple	
tuner-types	Simple tuner support
ves1820	VLSI VES1820 based
ves1x93	VLSI VES1893 or VES1993 based
wl1251	TI wl1251 driver support
wl1251_sdio	TI wl1251 SDIO support
wl1251_spi	TI wl1251 SPI support
wl12xx	TI wl12xx support
wl18xx	TI wl18xx support
wlcore	TI wlcore support
wlcore_sdio	TI wlcore SDIO support
wlcore_spi	TI wlcore SPI support
xc4000	Xceive XC4000 silicon tuner
xc5000	Xceive XC5000 silicon tuner
zd1301	ZyDAS ZD1301
zd1301_demod	ZyDAS ZD1301
zl10036	Zarlink ZL10036 silicon tuner
zl10039	Zarlink ZL10039 silicon tuner
zl10353	Zarlink ZL10353 based