

Oracle® Linux

**Release Notes for Unbreakable Enterprise Kernel Release 3
Quarterly Update 7**

ORACLE®

E66808-05
October 2018

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Abstract

This document contains information on Quarterly Update 7 to the Unbreakable Enterprise Kernel Release 3. This document may be updated after it is released. To check for updates to this document, and to view other Oracle documentation, refer to the Documentation section on the Oracle Technology Network (OTN) Web site:

<https://www.oracle.com/technology/documentation/>

This document is intended for users and administrators of Oracle Linux. It describes potential issues and the corresponding workarounds you may encounter while using the Unbreakable Enterprise Kernel Release 3 with Oracle Linux 6 or Oracle Linux 7. Oracle recommends that you read this document before installing or upgrading the Unbreakable Enterprise Kernel Release 3.

Document generated on: 2018-10-11 (revision: 179)

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Preface

The *Oracle Linux Unbreakable Enterprise Kernel Release Notes* provides a summary of the new features, changes, and fixed and known issues in the Unbreakable Enterprise Kernel Release 3.

Audience

This document is written for system administrators who want to use the Unbreakable Enterprise Kernel with Oracle Linux. It is assumed that readers have a general understanding of the Linux operating system.

Related Documents

The latest version of this document and other documentation for this product are available at:

<https://www.oracle.com/technetwork/server-storage/linux/documentation/index.html>.

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.
<i>italic</i>	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
<code>monospace</code>	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

Chapter 1 New Features and Changes

The Unbreakable Enterprise Kernel Release 3 (UEK R3) is Oracle's third major release of its heavily tested and optimized operating system kernel for Oracle Linux 6 and 7 on the x86-64 architecture. It is based on the mainline Linux kernel version 3.8.13.

The 3.8.13-118 release is the seventh quarterly update release for UEK R3. It includes security and bug fixes, as well as driver updates.

Oracle actively monitors upstream checkins and applies critical bug and security fixes to UEK R3.

UEK R3 uses the same versioning model as the mainline Linux kernel version. It is possible that some applications might not understand the 3.x versioning scheme. If an application does require a 2.6 context, you can use the `uname26` wrapper command to start it. However, regular Linux applications are usually neither aware of, nor affected by, Linux kernel version numbers.

1.1 Notable Changes

- Chelsio Terminator 4 (T4) Virtual Function network driver (`cxgb4vf`) version 1.0.0 has been added.
- For Oracle Linux 7 only, support for network interface teaming has been added. The ethernet team device driver has been added, with support for active-backup mode, broadcast mode, load-balancing mode, and round-robin mode.



Note

UEK R3 does not support random mode.

- Broadwell processor support.
- Bug fixes for btrfs, ext4, xfs, and OCFS2 file systems.

This kernel update also includes updated dependencies for QLogic firmware. The dependencies should be resolved when you install the new kernel.

1.2 LXC Improvements

For containers created with the `lxc-oracle` template script, you can use the `--privileged=rt` option to give a container the ability to run real-time processes. If you specify the `=rt` (real-time) modifier, you can configure the `lxc.cgroup.cpu.rt_runtime_us` setting in the container's configuration file or when you start the container. This setting specifies the maximum continuous period in microseconds for which the container has access to CPU resources from the base period set by the system-wide value of `cpu.rt_period_us`. Otherwise, a container uses the system-wide value of `cpu.rt_runtime_us`, which might cause it to consume too many CPU resources.

If you use the `--privileged=rt` option, rebooting the container terminates all of its running processes and reboots it to a clean state.

This release also includes security and bug fixes.

1.3 Xen Improvements

- Updated netfront and netback drivers.

1.4 Driver Updates

The Unbreakable Enterprise Kernel supports a wide range of hardware and devices. In close cooperation with hardware and storage vendors, several device drivers have been updated by Oracle.

Table 1.1 Updated Drivers in UEK R3 QU7

Manufacturer	Driver	Version	Description
Broadcom	bnx2	2.2.5p	NetXtreme II 1 Gigabit network adapter driver
Broadcom	bnx2fc	2.9.6	NetXtreme II FCoE driver
Broadcom	bnx2x	1.713.01	NetXtreme II 10 Gigabit network adapter driver
Chelsio	cxgb4vf	1.0.0	Terminator 4 (T4) Virtual Function network driver
Emulex	be2iscsi	10.6.0.1o (with upstream patches)	OneConnect Open-iSCSI driver
Emulex	be2net	10.6.0.3 (with upstream patches)	OneConnect (Blade Engine 2) NIC driver
Emulex	lpfc	0:11.0.0.1	LightPulse Fibre Channel SCSI driver
Intel	i40e	1.3.21-k	Ethernet Connection XL710 network driver
Intel	i40evf	1.3.13	XL710 X710 virtual function network driver
Intel	ixgbe	4.1.2	10 Gigabit PCI Express network driver
Mellanox	mlx4_en	2.1.8 (Nov 10 2015)	ConnectX HCA Ethernet driver
QLogic	qla2xxx	8.07.00.26.39.0- k	Fibre channel HBA driver
VMware	vmxnet3	1.4.2.0-k	VMware VMXNET3 virtual ethernet driver

1.5 Technology Preview

The following features included in the Unbreakable Enterprise Kernel Release 3 are still under development, but are made available for testing and evaluation purposes. Do not use these features on production systems.

- **DRBD (Distributed Replicated Block Device)**

A shared-nothing, synchronously replicated block device (*RAID1 over network*), designed to serve as a building block for high availability (HA) clusters. It requires a cluster manager (for example, pacemaker) for automatic failover.

- **Kernel module signing facility**

Applies cryptographic signature checking to modules on module load, checking the signature against a ring of public keys compiled into the kernel. GPG is used to do the cryptographic work and determines the format of the signature and key data.

- **NFS over RDMA Client**

Enables you to use NFS over the RDMA transport on the Oracle InfiniBand stack. This is more efficient than using the TCP/IPoIB transport. The technology preview does not include NFS over RDMA server support, or support for NFS over RDMA in virtualized environments. NFS version 3 and 4 are supported.

Currently, only the Mellanox ConnectX-2 and ConnectX-3 Host Channel Adapters (HCAs) are supported. The client passes the full Connectathon NFS test suite using these HCAs. The Release Notes will be updated if additional adapters are supported after the initial release.

See [Section 1.5.1, “Using the NFS over RDMA Client”](#) for details of how to use the feature.

- **Swap files on NFS shares**

Ability for a system to use swap files that reside on NFS shares. For information about using swap files, see the `swapon(8)` manual page and the *Administrator's Guide* for your Oracle Linux release.

- **Transcendent Memory**

Transcendent Memory (*tmem*) provides a new approach for improving the utilization of physical memory in a virtualized environment by claiming underutilized memory in a system and making it available where it is most needed. From the perspective of an operating system, *tmem* is fast pseudo-RAM of indeterminate and varying size that is useful primarily when real RAM is in short supply. To learn more about this technology and its use cases, see the Transcendent Memory project page at <https://oss.oracle.com/projects/tmem/>.

1.5.1 Using the NFS over RDMA Client

The following instructions also include details for enabling an NFS over RDMA server. These are provided as an example only, as the NFS over RDMA server is currently not supported with the UEK R3 kernel.

1. Install an RDMA device, set up InfiniBand and enable IPoIB.

The Oracle Linux OFED packages are available from the following channels:

- Oracle Linux 6: `o16_x86_64_ofed_UEK`
- Oracle Linux 7: `o17_x86_64_UEKR3_OFED20`

2. Check that the RDMA device is working.

```
# cat /sys/class/infiniband/driver_name/ports/1/state
4: ACTIVE
```

where `driver_name` is the RDMA device driver, for example `mlx4_0`.

3. Verify the physical InfiniBand interfaces and links.

Check that the hosts can be contacted through the InfiniBand switch, by using commands such as `ibhosts`, and `ibnetdiscover`.

4. Check the connection between the NFS client and NFS server.

You can configure the settings for an InfiniBand interface in the `/etc/sysconfig/network-scripts/ifcfg-ibN` file.

You can use the `ping` command to check the connection. For example:

```
nfs-server$ ip addr add 10.196.0.101/24 dev ib0
nfs-client$ ip addr add 10.196.0.102/24 dev ib0
nfs-server$ ping 10.196.0.102
nfs-client$ ping 10.196.0.101
```

5. Install the `nfs-utils` package on the NFS client and server.
6. Configure the NFS shares.

Edit the `/etc/exports` file. Define the directories that the NFS server will make available for clients to mount, using the IPoIB addresses of the clients. For example:

```
/export_dir 10.196.0.102(fsid=0,rw,async,insecure,no_root_squash)
/export_dir 10.196.0.0/255.255.255.0(fsid=0,rw,async,insecure,no_root_squash)
```

- On the NFS server, load the `svcrdma` kernel module and start the NFS service.

Oracle Linux 6:

```
# modprobe svcrdma
# service nfs start
# echo rdma 20049 > /proc/fs/nfsd/portlist
```

Oracle Linux 7:

```
# modprobe svcrdma
# systemctl start nfs-server
# echo rdma 20049 > /proc/fs/nfsd/portlist
```



Note

The `rdma 20049` setting does not persist when the NFS service is restarted. You have to set it each time the NFS service starts.

- On the NFS client, load the `xprtrdma` kernel module and start the NFS service.

```
# modprobe xprtrdma
# service nfs start
# mount -o proto=rdma,port=20049 host:/export /mnt
```

where `host` is the host name or IP address of the IPoIB server, and `export` is the name of the NFS share.

To check that the mount over RDMA is successful, check the `proto` field for the mount point.

```
# nfsstat -m
/mnt from 10.196.0.102:/export
Flags: rw,relatime,vers=4.0,rsize=262144,wsiz=262144,namlen=255,hard,proto=rdma,port=20049,
...
```

Alternatively:

```
# cat /proc/mounts
```

Known Issues

Any mounted file systems must be unmounted on the NFS client before you shut down the NFS server. Otherwise the NFS server hangs when you shut down.

1.6 Compatibility

Oracle Linux maintains user-space compatibility with Red Hat Enterprise Linux, which is independent of the kernel version running underneath the operating system. Existing applications in user space will continue to run unmodified on the Unbreakable Enterprise Kernel Release 3 and no re-certifications are needed for RHEL certified applications.

To minimize impact on interoperability during releases, the Oracle Linux team works closely with third-party vendors whose hardware and software have dependencies on kernel modules. The kernel ABI for UEK R3

will remain unchanged in all subsequent updates to the initial release. In this release, there are changes to the kernel ABI relative to UEK R2 that require recompilation of third-party kernel modules on the system. Before installing UEK R3, verify its support status with your application vendor.

1.7 Header Packages for Development

The `kernel-headers` packages provide the C header files that specify the interface between user-space binaries or libraries and UEK or RHCK. These header files define the structures and constants that you need to build most standard programs or to rebuild the `glibc` package.

The `kernel-devel` and `kernel-uek-devel` packages provide the kernel headers and makefiles that you need to build modules against UEK and RHCK.

To install the packages required to build modules against UEK and the C header files for both UEK and RHCK:

```
# yum install kernel-uek-devel-`uname -r` kernel-headers
```

Chapter 2 Fixed and Known Issues

This chapter describes the fixed and known issues for the Unbreakable Enterprise Kernel Release 3.



Important

Run the `yum update` command regularly to ensure that the latest bug fixes and security errata are installed on your system.

2.1 Fixed Issues

The following issues have been fixed in this update.

- **Mellanox Driver (`mlx4_en`).** The bug that caused the Mellanox `mlx4_en` driver to fail to auto-sense the data link and automatically load has been fixed. (Bug ID 20103438)

2.2 Known Issues

This section describes the known issues in this update.

Updating Oracle Linux Fails if the `kernel-uek` Package Cannot Be Updated

By default, the installation of Oracle Linux includes the `dtrace-modules` package for UEK R3. This package requires a specific `kernel-uek` version. However, a `yum update` fails if it cannot update the `kernel-uek` package when the `installonly_limit` of three updates is reached as the `dtrace-modules` package does not allow the existing `kernel-uek` packages to be removed. `yum` displays an error message similar to the following example:

```
--> Finished Dependency Resolution
Error: Package: kernel-uek-debug-3.8.13-55.1.1.el6uek.x86_64 (public_ol6_UEKR3_latest)
       Requires: kernel-firmware = 3.8.13-55.1.1.el6uek
```

The workaround is to remove any existing `dtrace-modules` packages before updating the `kernel-uek` package, for example:

```
# for package in `rpm -qa | grep dtrace-modules`; do yum remove -y $package; done
```

When you have removed all `dtrace-modules` packages, you can update Oracle Linux, including the UEK R3 kernel. If you want to use DTrace with UEK R3, reinstall the `dtrace-modules` package for the current kernel:

```
# yum install dtrace-modules-`uname -r`
```

(Bug ID 21669543)

ACPI

The following messages indicate that the BIOS does not present a suitable interface, such as `_PSS` or `_PPC`, that the `acpi-cpufreq` module requires:

```
kernel: powernow-k8: this CPU is not supported anymore, using acpi-cpufreq instead.
modprobe: FATAL: Error inserting acpi_cpufreq
```

There is no known workaround for this error. (Bug ID 17034535)

btrfs

- If you use the `--alloc-start` option with `mkfs.btrfs` to specify an offset for the start of the file system, the size of the file system should be smaller but this is not the case. It is also possible to specify an offset that is higher than the device size. (Bug ID 16946255)
- The usage information for `mkfs.btrfs` reports `raid5` and `raid6` as possible profiles for both data and metadata. However, the kernel does not support these features and cannot mount file systems that use them. (Bug ID 16946303)
- The `btrfs filesystem balance` command does not warn that the RAID level can be changed under certain circumstances, and does not provide the choice of cancelling the operation. (Bug ID 16472824)
- Converting an existing ext2, ext3, or ext4 root file system to btrfs does not carry over the associated security contexts that are stored as part of a file's extended attributes. With SELinux enabled and set to enforcing mode, you might experience many permission denied errors after reboot, and the system might be unbootable. To avoid this problem, enforce automatic file system relabeling to run at bootup time. To trigger automatic relabeling, create an empty file named `.autorelabel` (for example, by using `touch`) in the file system's `root` directory before rebooting the system after the initial conversion. The presence of this file instructs SELinux to recreate the security attributes for all files on the file system. If you forget to do this and rebooting fails, either temporarily disable SELinux completely by adding `selinux=0` to the kernel boot parameters, or disable enforcing of the SELinux policy by adding `enforcing=0`. (Bug ID 13806043)
- Commands such as `du` can show inconsistent results for file sizes in a btrfs file system when the number of bytes that is under delayed allocation is changing. (Bug ID 13096268)
- The copy-on-write nature of btrfs means that every operation on the file system initially requires disk space. It is possible that you cannot execute any operation on a disk that has no space left; even removing a file might not be possible. The workaround is to run `sync` before retrying the operation. If this does not help, remount the file system with the `-o nodatacow` option and delete some files to free up space. See <https://btrfs.wiki.kernel.org/index.php/ENOSPC>.
- On Oracle Linux 6, btrfs has a limit of 237 or fewer hard links to a file from a single directory. The exact limit depends on the number of characters in the file name. The limit is 237 for a file with up to eight characters in its file name; the limit is lower for longer file names. Attempting to create more than this number of links results in the error `Too many links`. You can create more hard links to the same file from another directory. Although the limitation of the number of hard links in a single directory has been increased to 65535, the version of `mkfs.btrfs` that is provided in the `btrfs-progs` package does not yet support the compatibility flag for this feature. Oracle Linux 7 includes a later version of `btrfs-progs` package, which does support the increased number of hard links. (Bug ID 16285431)
- If you run the `btrfs quota enable` command on a non-empty file system, any existing files do not count toward space usage. Removing these files can cause usage reports to display negative numbers and the file system to be inaccessible. The workaround is to enable quotas immediately after creating the file system. If you have already written data to the file system, it is too late to enable quotas. (Bug ID 16569350)
- The `btrfs quota rescan` command is not currently implemented on Oracle Linux 6. The command does not perform a rescan and returns without displaying any message. (Bug ID 16569350)
- When you overwrite data in a file, starting somewhere in the middle of the file, the overwritten space is counted twice in the space usage numbers that `btrfs qgroup show` displays. (Bug ID 16609467)

- If you run `btrfsck --init-csum-tree` on a file system and then run a simple `btrfsck` on the same file system, the command displays a Backref mismatch error that was not previously present. (Bug ID 16972799)
- If you use the `-s` option to specify a sector size to `mkfs.btrfs` that is different from the page size, the created file system cannot be mounted. By default, the sector size is set to be the same as the page size. (Bug ID 17087232)
- Defragmentation can break data block sharing. Due to the copy-on-write design of btrfs, snapshots initially share the same data blocks of the original subvolume. However, when either the snapshot or the subvolume is defragmented, this sharing can be undone, resulting in a higher disk space usage.

dm-nfs Module Obsolete

In UEK R2, the `dm-nfs` module provided the ability to create a loopback device for a mounted NFS file or file system. For example, the feature allowed you to create the shared storage for an Oracle 3 VM cluster on an NFS file system. The `dm-nfs` module provided direct I/O to the server and bypassed the `loop` driver to avoid an additional level of page caching. The `dm-nfs` module is not provided with UEK R3. The `loop` driver can now provide the same I/O functionality as `dm-nfs` by extending the AIO interface to perform direct I/O. To create the loopback device, use the `losetup` command instead of `dmsetup`.

DTrace

- Argument declarations for probe definitions cannot be declared with derived types such as `enum`, `struct`, or `union`.
- The following compiler warning can be ignored for probe definition arguments of type `string` (which is a D type but not a C type):

```
provider_def.h:line#: warning: parameter names (without types) in function declaration
```

- Multi-threaded processes under `ustack()`, `usym()`, `uaddr()` and `umod()` which perform `dlopen()` in threads other than the first thread may not have accurate symbol resolution for symbols introduced by the `dlopen()`.

ERST Message

You can safely ignore the following message that might be displayed in `syslog` or `dmesg`:

```
ERST: Failed to get Error Log Address Range.
```

The message indicates that the system BIOS does not support an Error Record Serialization Table (ERST). (Bug ID 17034576)

Ext4

- The inline data feature that allows the data of small files to be stored inside their inodes is not yet available. The `-O inline_data` option to the `mkfs.ext4` and `tune2fs` commands is not supported. (Bug ID 17210654)
- If `fallocate` is used to write to an ext4 file system that has the bigalloc feature enabled, this causes a kernel panic. (Bug ID 20712768)

Firmware Warning Message

You can safely ignore the following firmware warning message that might be displayed on some Sun hardware:

```
[Firmware Warn]: GHES: Poll interval is 0 for generic hardware error source:
1, disabled.
```

(Bug ID 13696512)

Huge Pages

One-gigabyte (1 GB) huge pages are not currently supported for the following configurations:

- HVM guests
- PV guests
- Oracle Database

Two-megabyte (2 MB) huge pages have been tested and work with these configurations.

(Bug ID 17299364, 17299871, 17271305)

Hyper-V

The following known issues affect Oracle Linux virtual machines running on Hyper-V:

- After you take a snapshot of a virtual machine and then use the Save action to save the virtual machine state, you might not be able to revert to the virtual machine to the snapshot using the Revert action. The workaround is to click on the last snapshot listed in the Snapshot area for the virtual machine, and then select Apply. (Bug ID 20110077)
- Oracle Linux 7 virtual machines that use Legacy Network mode lose their network connectivity if more than one virtual CPU is configured. The workaround is to configure only one virtual CPU for Oracle Linux 7 virtual machines. (Bug ID 20110058)
- Oracle Linux 6 virtual machines running on Windows Server 2012R2 display truncated messages during a system shutdown or reboot. (Bug ID Bug 20090500)
- Running the Linux Integration Services (LIS) `CORE_StressReloadModules.sh` script in an Oracle Linux 6 virtual machine on Windows Server 2012R2 causes a kernel panic. (Bug ID Bug 21191022)

I/O Scheduler

The Unbreakable Enterprise Kernel uses the `deadline` scheduler as the default I/O scheduler. For the Red Hat Compatible Kernel, the default I/O scheduler is the `cfq` scheduler.

ioapic Failure Messages

You can safely ignore messages such as `ioapic: probe of 0000:00:05.4 failed with error -22`. Such messages are the result of the `ioapic` driver attempting to re-register I/O APIC PCI devices that were already registered at boot time. (Bug ID 17034993)

InfiniBand

- You might see the following warning messages if you use the `ibportstate disable` command to disable a switch port:

```
ibwarn: [2696] _do_madrpc: recv failed: Connection timed out
ibwarn: [2696] mad_rpc: _do_madrpc failed; dport (Lid 38)
```



```
ibportstate: iberror: failed: smp set portinfo failed
```

You can safely ignore these warnings. (Bug ID 16248314)

- The Internet Protocol over InfiniBand (IPoIB) driver supports the use of either connected mode or datagram mode with an interface, where datagram mode is the default mode. Changing the mode of an InfiniBand interface by echoing either `connected` or `datagram` to `/sys/class/net/ibN/mode` is not supported. It is also not possible to change the mode of an InfiniBand interface while it is enabled.

To change the IPoIB mode of an InfiniBand interface:

1. Edit the `/etc/sysconfig/network-scripts/ifcfg-ibN` configuration file, where `N` is the number of the interface:
 - To configure connected mode, specify `CONNECTED_MODE=yes` in the file.
 - To configure datagram mode, either specify `CONNECTED_MODE=no` in the file or do not specify this setting at all (datagram mode is enabled by default).



Note

Before saving your changes, make sure that you have not specified more than one setting for `CONNECTED_MODE` in the file.

2. To enable the specified mode on the interface, use the following commands to take down the interface and bring it back up:

```
# ifdown ibN
# ifup ibN
```

(Bug ID 17479833)

Linux Containers (LXC)

- Using `yum` to update packages inside the container that use `init` scripts can undo changes made by the Oracle template.
- Migrating live containers (`lxc-checkpoint`) is not yet supported.
- If a `Device or resource busy - failed to set memory.use_hierarchy to 1` error message is displayed when you start a container, edit the `/etc/cgconfig.conf` file and add the following:

```
group . {
memory {
memory.use_hierarchy = "1";
}
}
```

(Bug ID 19237222)

Missing Documentation for PCIe Kernel Parameters

The following documentation for some PCIe kernel parameters is not included in the `kernel-parameters.txt` file in the `kernel-uek-doc` package:

<code>pcie_bus_tune_off</code>	Disable PCIe MPS (Max Payload Size) tuning and use the BIOS-configured MPS defaults.
--------------------------------	--

pcie_bus_safe	Set every device's MPS to the largest value supported by all devices below the root complex.
pcie_bus_perf	Set device MPS to the largest allowable MPS based on its parent bus. Also set MRRS (Max Read Request Size) to the largest supported value (no larger than the MPS that the device or bus can support) for best performance.
pcie_bus_peer2peer	Set every device's MPS to 128B, which every device is guaranteed to support. This configuration allows peer-to-peer DMA between any pair of devices, possibly at the cost of reduced performance. This also guarantees that hot-added devices will work.

RDMA Does Not Load the mlx4_ib Module

If you enable the OFED stack and the RDMA service but the version of the RDMA package is lower than `rdma-3.10-3.0.2.e16`, the RDMA service does not load the `mlx4_ib` module automatically.

To configure the RDMA service to load the `mlx4_ib` module at boot time:

1. Edit `/etc/rdma/rdma.conf` and set the entry `MLX4_LOAD=yes` in this file.
2. To make the change take effect, restart the RDMA service or reboot the system.

sched_yield() Settings for CFS

For the Unbreakable Enterprise Kernel, `kernel.sched_compat_yield=1` is set by default. For the Red Hat Compatible Kernel, `kernel.sched_compat_yield=0` is used by default.

Slow Performance With Multipath Devices

Starting with UEK R2, the device mapper has had the capability to check whether the underlying storage device has advertised the need to flush the data that resides in the device's cache to its non-volatile storage. For a data integrity operation, such as `fsync` and `sync`, the operation will now need to include the time to flush the device's cache (if it is advertised). Such an operation will appear to be slower when compared to a previous older kernel, however this is the correct behavior. (Bug ID 17823743)

Soft Lockup Errors When Booting

When upgrading or installing the UEK R3 kernel on fast hardware, usually with SAN storage attached, the kernel can fail to boot and `BUG: soft lockup` messages are displayed in the console log. The workaround is to increase the baud rate from the default value of 9600 by amending the kernel boot line in `/boot/grub/grub.conf` to include an appropriate console setting, for example:

```
console=ttyS0,115200n8
```

A value of 115200 is recommended as smaller values such as 19200 are known to be insufficient for some systems (for example, see https://docs.oracle.com/cd/E19045-01/blade.x6220/820-0048-18/sp.html#0_pgfld-1002490). If the host implements an integrated system management infrastructure, such as ILOM on Sun and Oracle systems or iLO on HP systems, configure the integrated console baud rate to match the setting for the host system. Otherwise, the integrated console is likely to display garbage characters. (Bug ID 17064059, 17252160)

Transparent Huge Pages

The Transparent Huge Pages (THP) feature is disabled. Following extensive benchmarking and testing, Oracle found that THP caused a performance degradation of between 5 and 10% for some workloads.

This performance degradation was a result of a slower memory allocator code path being used even when the applications were not using THP. When the fact that huge pages are not swappable was taken into account, the positive effect that THP should provide was outweighed by its negative effects.

After installing this UEK release, you cannot enable THP (for example, by specifying kernel boot parameters). The THP settings under `/sys/kernel/mm/transparent_hugepage` have also been removed. A future update might contain an updated THP implementation which resolves the performance issue.



Note

This change does not affect support for applications that use explicit huge pages (for example, Oracle Database).

(Bug ID 16823432)

User Name Spaces

The kernel functionality (`CONFIG_USER_NS`) that allows unprivileged processes to create name spaces for users inside which they have root privileges is not currently implemented because of a clash with the implementation of XFS. This functionality is primarily intended for use with Linux Containers. As a result, the `lxc-checkconfig` command displays `User namespace: missing`. (Bug ID 16656850)

Virtualization

- When booting UEK R3 as a PVHVM guest, you can safely ignore the following kernel message:

```
register_vcpu_info failed:
err=-38
```

(Bug ID 13713774)

- Under Oracle VM Server 3.1.1, migrating a PVHVM guest that is running the UEK R3 kernel causes a disparity between the date and time as displayed by `date` and `hwclock`. To prevent this from occurring, upgrade to Oracle VM Server 3.2.1 or later. The workaround post migration is either to run the command `hwclock --hctosys` on the guest or to reboot the guest. (Bug ID 16861041)
- On virtualized systems that are built on Xen version 3, including all releases of Oracle VM 2 including 2.2.2 and 2.2.3, disk synchronization requests for ext3 and ext4 file systems result in journal corruption with kernel messages similar to the following being logged:

```
blkfront: barrier: empty write xvda op failed
blkfront: xvda: barrier or flush: disabled
```

In addition, journal failures such as the following might be reported:

```
Aborting journal on device xvda1
```

The workaround is to add the mount option `barrier=0` to all ext3 and ext4 file systems in the guest VM before upgrading to UEK R3. For example, you would change a mount entry such as:

```
UUID=4e4287b1-87dc-47a8-b69a-075c7579eaf1 / ext3 defaults 1 1
```

so that it reads:

```
UUID=4e4287b1-87dc-47a8-b69a-075c7579eaf1 / ext3 defaults,barrier=0 1 1
```

This issue does not apply to Xen 4 based systems, such as Oracle VM 3. (Bug ID 17310816)

- Xen does not support the `crashkernel=auto` parameter for Kdump configuration. (Bug ID 18174580)
- Mounting or changing an ISO image in a PVHVM guest results in exception messages in the Oracle VM console. The ISO image itself is mounted correctly and is accessible. (Bug ID 19972081)
- You cannot increase (hot plug) the number of virtual CPUs in a running Oracle Linux 7 guest using the `xm vcpu-set` command. Decreasing the number of virtual CPUs does work. (Bug ID 18865156)
- In order to use jumbo frames with any network interface card on an Oracle VM Server, you must increase the `swiotlb` kernel parameter to 256 by setting `swiotlb=256` in the kernel boot line in `/boot/grub/grub.conf`. (Bug ID 20333068)

X.509 Certificates for Module Verification

The system reports a message similar to the following if there is a problem loading an in-kernel X.509 module verification certificate at boot time:

```
Loading module verification certificates
X.509: Cert 0c21da3d73dcdabaffc799e3d26f3c846a3afdc43 is not yet valid
MODSIGN: Problem loading in-kernel X.509 certificate (-129)
```

This error occurs because the hardware clock lags behind the system time as shown by `hwclock`, for example:

```
# hwclock
Tue 20 Aug 2013 01:41:40 PM EDT -0.767004 seconds
```

The solution is to set the hardware clock from the system time by running the following command:

```
# hwclock --systohc
```

After correcting the hardware clock, no error should be seen at boot time, for example:

```
Loading module verification certificates
MODSIGN: Loaded cert 'Slarti: Josteldalsbreen signing key:
0c21da3d73dcdabaffc799e3d26f3c846a3afdc43'
```

(Bug ID 17346862)

XFS

- In some circumstances on Oracle Linux 6 systems, `xfsdump` can fail when the file system to be backed up is specified as a mount point, for example:

```
xfsdump: ERROR: /mnt/myxfs/ does not identify a file system
```

The workaround is to specify the file system by its device name, for example `/dev/sdb`. (Bug ID 18483275)

- In a virtual machine, the intensive direct I/O on files which are being fragmented by `fallocate` and `punch_hole` in parallel may result, in some circumstances, in data corruption with the error `Invalid or incomplete multibyte or wide character`. (Bug ID 18711409)
- The following message might be displayed when you use the `xfs_growfs` command:

```
xfs_growfs: cannot find mount point for path `mount_point': Success
```

The message is caused by an incorrect mounted project path listed in the XFS project quota initialization file, `/etc/projects`. If you are not using project quotas, remove the `/etc/projects` file. (Bug ID 18886520)

- On Oracle Linux 6, an XFS file system can become corrupted if all of its inodes are used. (Bug ID 19217280)
- On Oracle Linux 7, `xfs_copy` fails to copy a file system if the device sector size more than 512 bytes. (Bug ID 19267663)
- `xsfs_repair` causes a segmentation fault when you try repair a file system using a short reporting interval (`-t`). (Bug ID 20015850)
- When you create an XFS file system using the `-i maxpct` option, it does not actually limit the space allocated to inodes. (Bug ID 20430515)
- Mounting an XFS file system that was created using the `-n ftype=1` option results in a mount error and the file system cannot be mounted. The `ftype` option is not supported in UEK R3. (Bug ID 20511541)
- Oracle Linux 7 Update 4 and later are incompatible with UEK R3 for file systems formatted using XFS with `d_type` enabled

All `xfs` file systems that are created by using the Oracle Linux 7 Update 4 and later Oracle Linux 7 installers have `d_type` support enabled automatically. These files systems are formatted with the `ftype=1` option. The UEK R3 kernel is incompatible with this option and therefore does not boot on systems that have been installed with the Oracle Linux 7 Update 4 or a later version installer. This problem occurs when the default file system formatting is selected because the UEK R3 kernel cannot mount any `xfs` file system that is created by specifying `ftype=1`.

Note that upgrades are unaffected because previous updates of Oracle Linux 7 formatted disks use the `ftype=0` option. However, when using UEK R3 on Oracle Linux 7 Update 4 and later, be aware that you must *explicitly* set the `ftype=0` option when formatting the disk with XFS.

When performing a kickstart installation, if you intend to use UEK R3 on the system, you can manually specify alternate file system options for formatting. If you want to continue to use XFS with UEK R3, you must explicitly set the formatting option to `ftype=0` in your kickstart configuration. (Bug ID 26176688)

`net_prio` control group not supported for Oracle Linux 7

The Network Priority cgroup subsystem (`net_prio`) is not supported on Oracle Linux 7. Attempting to use the module with UEK R3 results in error messages such as the following:

```
modprobe: FATAL: Module netprio_cgroup not found
mount: special device cgroup does not exist.
```

(Bug ID 18966564)

NetworkManager fails to set the default gateway and route for interfaces configured with DHCP on Oracle Linux 7 Update 4 and later

When running UEK R3 on Oracle Linux 7 Update 4 and later, `NetworkManager` fails to set the default gateway and route for network interfaces that are configured with DHCP. This can result in network interfaces not behaving correctly.

The workaround for this issue is to disable `NetworkManager` control over interfaces that are configured for DHCP.

To disable `NetworkManager` for an interface, edit the network script for the interface in `/etc/sysconfig/network-scripts/ifcfg-dev` and add the parameter `NM_CONTROLLED=no`, as shown in the following example:

```
# echo "NM_CONTROLLED=no" >> /etc/sysconfig/network-scripts/ifcfg-eno4
```

(Bug ID 26268996)

NetworkManager unable to add IPv6 addresses to interfaces on Oracle Linux 7 Update 4 or later

When running UEK R3 on Oracle Linux 7 Update 4 and later releases, network interfaces that are configured for IPv6 might not be brought up by [NetworkManager](#).

Messages similar to the following appear in the system log:

```
<warn> platform-linux: do-add-ip6-address[2: fe80::210:e0ff:fe5f:920c]:  
      failure 22 (Invalid argument)  
<warn> platform-linux: do-add-ip6-address[5: fd00:1:1:24::456]:  
      failure 22 (Invalid argument)
```

It is possible to manually add the IPv6 address to the interface by using the `ip addr add` command.

This issue is apparent, irrespective of whether IPv6 is configured statically, assigned dynamically through DHCP, or configured by using Stateless Address Autoconfiguration (SLAAC).

The workaround for this issue is to disable [NetworkManager](#) for interfaces where IPv6 must be configured for an interface. To disable [NetworkManager](#) for an interface, edit the network script for the interface in `/etc/sysconfig/network-scripts/ifcfg-dev` and add the parameter `NM_CONTROLLED=no`, as shown in the following example:

```
# echo "NM_CONTROLLED=no" >> /etc/sysconfig/network-scripts/ifcfg-eno4
```

(Bug ID 24848072)

Chapter 3 Installation and Availability

Unbreakable Enterprise Kernel Release 3 (UEK R3) is supported only on the x86-64 architecture.

Oracle Linux 7

UEK R3 is the default boot kernel for fresh installations of Oracle Linux 7.

Oracle Linux 6

You can install UEK R3 on Oracle Linux 6 Update 4 or later, running either the Red Hat compatible kernel or a previous version of the Unbreakable Enterprise Kernel. If you are still running an older version of Oracle Linux, first update your system to the latest available update release.

Starting with Oracle Linux 6 Update 5 for x86-64, UEK R3 is the default boot kernel for fresh installations of Oracle Linux 6.

For systems that are currently running a previous version of the Unbreakable Enterprise Kernel (UEK R2) or the Red Hat compatible kernel (RHCK), you can switch to UEK R3 at any time. For details, see:

- [Section 3.2, “Switching an Oracle Linux 6 System to UEK R3 \(ULN\)”](#)
- [Section 3.3, “Switching an Oracle Linux 6 System to UEK R3 \(Oracle Yum Server\)”](#)

Kernel Source Code

The kernel's source code is available from a public git source code repository at:
<https://oss.oracle.com/git/?p=linux-uek3-3.8.git>.

3.1 Upgrading to the Latest UEK Release

For systems that are currently running UEK R3, you upgrade to the latest UEK release as follows:

1. Ensure the system is configured to receive updates from the correct channels or repositories.

For Oracle Linux 7, subscribe to either the `o17_x86_64_UEKR3` channel on ULN, or the `o17_UEKR3` repository on the Oracle public yum server.

For Oracle Linux 6, subscribe to either the `o16_x86_64_UEKR3_latest` channel on ULN, or the `o16_UEKR3_latest` repository on the Oracle Yum Server.

2. Upgrade all packages on the system, including kernel packages.

```
# yum update
```

By default, the boot manager automatically enables the most recent kernel version so you do not need to change your GRUB or GRUB 2 configuration.

3. Reboot the system.

Oracle Linux 7:

```
# systemctl reboot
```

Oracle Linux 6:

```
# shutdown -r now
```

3.2 Switching an Oracle Linux 6 System to UEK R3 (ULN)

If you have a subscription to Oracle Unbreakable Linux support, you can obtain the packages for Unbreakable Enterprise Kernel Release 3 (UEK R3) by registering your system with the Unbreakable Linux Network (ULN) and subscribing it to additional channels.

Before you begin:

- Ensure the system is registered with ULN.

For information about registering with ULN, see the [Oracle Linux Unbreakable Linux Network User's Guide](#).

- Check that the system meets the requirements for installing UEK R3.

For details, see [Chapter 3, Installation and Availability](#).

The following instructions also include steps for updating a system to use the Oracle OpenFabrics Enterprise Distribution (OFED) tools for UEK R3.

To Switch a System to UEK R3:

1. Using a browser, log in at <https://linux.oracle.com> with the ULN user name and password that you used to register the system.
2. On the Systems tab, click the link name of your system in the list of registered machines.
3. On the System Details page, click **Manage Subscriptions**.
4. On the System Summary page, select each required channel in the **Available Channels** list and click the right arrow to move the channel to the **Subscribed Channels** list.

The kernel image and user-space packages are available on the following ULN channels:

Channel Name and Label	Description
Oracle Linux 6 Latest (x86_64) ol6_x86_64_latest	All packages released for Oracle Linux 6 (x86_64) including the latest errata packages. (x86_64).
Unbreakable Enterprise Kernel Release 3 for Oracle Linux 6 (x86_64) - Latest ol6_x86_64_UEKR3_latest	Latest packages for Unbreakable Enterprise Kernel Release 3 for Oracle Linux 6 (x86_64). Contains the <code>kernel-uek*</code> , <code>dtrace-modules-*</code> , <code>libdtrace-*</code> , and <code>uname26</code> packages.
Oracle Linux 6 Dtrace Userspace Tools (x86_64) - Latest ol6_x86_64_Dtrace_userspace_latest	The latest DTrace user space tools for Oracle Linux 6 (x86_64). Contains the <code>dtrace-utils*</code> packages.
OFED supporting tool packages for Unbreakable Enterprise Kernel on Oracle Linux 6 (x86_64) ol6_x86_64_ofed_UEK	Latest OpenFabrics Enterprise Distribution (OFED) supporting tools for the Unbreakable Enterprise Kernel (UEK) on Oracle Linux 6 (x86_64).
HA Utilities for MySQL and Oracle Linux 6 (x86_64) ol6_x86_64_mysql-ha-utils	Management Utilities for MySQL HA with Oracle Linux 6. Contains the <code>drbd84-utils</code> package.

As a minimum, you should subscribe the system to the `ol6_x86_64_latest` and the `ol6_x86_64_UEKR3_latest` channels. These channels are enabled by default when you register an Oracle Linux 6 system with ULN.



Caution

Take care not to select the `ol6_x86_64_UEK_BETA` channel.

Because you are switching to the latest UEK kernel, you no longer need to subscribe the system to the previous UEK R2 (`ol6_x86_64_UEK_latest`) channel.

5. When you have finished selecting channels, click **Save Subscriptions** and log out of ULN.
6. Log in as `root` on the system.
7. (Optional) Install the Oracle OFED packages for UEK R3.

Perform the following steps only if you want to install or update the Oracle OFED packages, or you want to replace the OFED packages installed from either the Oracle Linux 6 full installation DVD image, or from the `_base` or the `_latest` channels on ULN.

The Oracle OFED packages are available only for `x86_64` platforms.

- a. Ensure the system is subscribed to the `ol6_x86_64_ofed_UEK` channel on ULN.
- b. Edit `/etc/yum/pluginconf.d/rhnplugin.conf` and add the following lines to the end of the file:

```
[ol6_x86_64_ofed_UEK]
priority=20
```

- c. Install the `yum-plugin-priorities` package from the `ol6_x86_64_UEKR3_latest` channel:

```
# yum install yum-plugin-priorities
```

- d. Downgrade any OFED packages that are already present on the system if the package version number in the `ol6_x86_64_ofed_UEK` channel is lower than the installed one.

You can use the `yum --showduplicates list` command to check the package version numbers, for example:

```
# yum yum --showduplicates list rdma
...
Installed Packages
rdma.noarch 6.6_3.15-1.0.1.e16 @ol6_u6_x86_64_base
Available Packages
rdma.noarch 3.6-1.0.5.e16 ol6_x86_64_ofed_UEK
```

You downgrade a package with the `yum downgrade` command, for example:

```
# yum downgrade rdma
...
Removed:
  rdma.noarch 6.6_3.15-1.0.1.e16

Installed:
  rdma.noarch 3.6-1.0.5.e16

Complete!
```

- e. Remove the `ibutils-libs` package (if present):

```
# yum remove ibutils-libs
```

- f. Install the Oracle OFED packages from the `ol6_x86_64_ofed_UEK` channel as required, for example:

```
# yum install ibutils
```

8. Upgrade all packages on the system, including kernel packages.

```
# yum update
```

By default, the boot manager automatically enables the most recent kernel version so you do not need to change your GRUB configuration.

9. Reboot the system.

```
# shutdown -r now
```

3.3 Switching an Oracle Linux 6 System to UEK R3 (Oracle Yum Server)

If your system is not registered with ULN, you can obtain most of the packages for Unbreakable Enterprise Kernel Release 3 (UEK R3) from Oracle Yum Server by subscribing it to additional repositories.

Before you begin, check that the system meets the requirements for installing UEK R3, see [Chapter 3, *Installation and Availability*](#).

The following instructions also include steps for updating a system to use the Oracle OpenFabrics Enterprise Distribution (OFED) tools for UEK R3.

To Switch a System to UEK R3:

1. Log in as `root` on the system.
2. Change directory to `/etc/yum.repos.d`.

```
# cd /etc/yum.repos.d
```



Note

This assumes that `yum` on your system is configured to find repository files in the default `/etc/yum.repos.d` directory.

3. Move the existing yum repository file to a backup file, for example:

```
# mv /etc/yum.repos.d/public-yum-ol6.repo /etc/yum.repos.d/public-yum-ol6.repo.bck
```

4. Download the latest Oracle Linux 6 repository configuration file, <https://yum.oracle.com/public-yum-ol6.repo>, for example:

```
# wget -O /etc/yum.repos.d/public-yum-ol6.repo https://yum.oracle.com/public-yum-ol6.repo
```

5. Enable the required repositories by editing the `public-yum-ol6.repo` file.

You enable or disable repositories in the file by setting the value of the `enabled` directive to 1 or 0 as required.

The kernel image and user-space packages are available on the following Oracle Yum Server repositories:

Repository	Description
<code>ol6_latest</code>	All packages released for Oracle Linux 6 (x86_64) including the latest errata packages.
<code>ol6_UEKR3_latest</code>	Latest packages for Unbreakable Enterprise Kernel Release 3 for Oracle Linux 6. Contains the <code>kernel-uek*</code> , <code>dtrace-modules-*</code> , <code>libdtrace-*</code> , and <code>uname26</code> packages.
<code>ol6_ofed_UEK</code>	Latest OFED supporting tools for the Unbreakable Enterprise Kernel (UEK) on Oracle Linux 6 (x86_64).

As a minimum, you should enable the `ol6_latest` and the `ol6_UEKR3_latest` repositories.



Note

The DTrace and DRBD utility packages are not available on Oracle Yum Server.

Because you are switching to the latest UEK kernel, you can disable the previous UEK R2 (`ol6_UEK_latest`) repository.

In the following example, the `ol6_UEKR3_latest` repository is enabled, and the `ol6_UEK_latest` repository is disabled:

```
[ol6_UEKR3_latest]
name=Latest Unbreakable Enterprise Kernel for Oracle Linux $releasever ($basearch)
baseurl=https://yum.oracle.com/repo/OracleLinux/OL6/UEKR3/latest/$basearch/
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-oracle
gpgcheck=1
enabled=1

[ol6_UEK_latest]
name=Latest Unbreakable Enterprise Kernel for Oracle Linux $releasever ($basearch)
baseurl=https://yum.oracle.com/repo/OracleLinux/OL6/UEK/latest/$basearch/
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-oracle
gpgcheck=1
enabled=0
```

6. (Optional) Install the Oracle OFED packages for UEK R3.

Perform the following steps only if you want to install or update the Oracle OFED packages, or you want to replace the OFED packages installed from either the Oracle Linux 6 full installation DVD image, or from the `_base` or the `_latest` repositories on public yum.

The Oracle OFED packages are available only for x86_64 platforms.

- a. Ensure the `ol6_ofed_UEK` repository is enabled on the system.
- b. Install the `yum-plugin-priorities` package from the `ol6_latest` repository:

```
# yum install yum-plugin-priorities
```

- c. Downgrade any OFED packages that are already present on the system if the package version number in the `ol6_ofed_UEK` repository is lower than the installed one.

You can use the `yum --showduplicates list` command to check the package version numbers, for example:

```
# yum yum --showduplicates list rdma
...
Installed Packages
rdma.noarch 6.6_3.15-1.0.1.e16 @ol6_u6_base
Available Packages
rdma.noarch 3.6-1.0.5.e16 ol6_ofed_UEK
```

You downgrade a package with the `yum downgrade` command, for example:

```
# yum downgrade rdma
...
Removed:
  rdma.noarch 6.6_3.15-1.0.1.e16

Installed:
  rdma.noarch 3.6-1.0.5.e16

Complete!
```

- d. Remove the `ibutils-libs` package (if present):

```
# yum remove ibutils-libs
```

- e. Install the Oracle OFED packages from the `ol6_ofed_UEK` repository as required, for example:

```
# yum install ibutils
```

7. Upgrade all packages on the system, including kernel packages.

```
# yum update
```

By default, the boot manager automatically enables the most recent kernel version so you do not need to change your GRUB configuration.

8. Reboot the system.

```
# shutdown -r now
```