Oracle® Linux 6

Release Notes for Oracle Linux 6.9

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Abstract

This document contains information about Oracle Linux 6.9. This document might be updated after it is released. To check for updates to this document, see *Oracle® Linux 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 Oracle Linux. Oracle recommends that you read this document before installing or upgrading Oracle Linux.

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Preface

Oracle® Linux 6: Release Notes for Oracle Linux 6.9 provides a summary of the new features, changes, and fixed and known issues in Oracle Linux 6.9.

Audience

This document is written for system administrators who want to install or update Oracle Linux. It is assumed that readers have a general understanding of the Linux operating system.

Document Organization

The document is organized as follows:

- Chapter 1, *New Features and Changes* contains a summary of the new features and changes in this release.
- Chapter 2, *Fixed and Known Issues* contains details of the fixed and known issues with the software.
- Chapter 3, *Upgrading to Oracle Linux 6.9* contains information about how to install updates on your system.

Related Documents

The documentation for this product is available at:

Oracle® Linux Documentation

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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Chapter 1 New Features and Changes

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This chapter describes the new features and notable changes that are introduced by Oracle Linux 6.9.

1.1 Hardware Enablement

The `cpuid` utility is now available. This utility dumps detailed information about CPUs gathered from CPUID instruction. The utility is also capable of determining exact CPU models. The `cpuid` utilty supports Intel, AMD, and VIA CPUs.

1.2 Hyper-V Features

The following Hyper-V features are new or updated.

1.2.1 RHCK Hyper-V Updates

The following Red Hat Compatible Kernel (RHCK) Hyper-V updates have been made:

- Improved Hyper-V storage driver performance

  The `storvsc` Hyper-V driver update provides a moderate performance improvement of I/O operations when using the driver for certain workloads.

- Hyper-V clocksource support for Time Stamp Counter (TSC) page

  TSC page is now used as the Hyper-V clock source. TSC page computes the per-guest reference counter value more efficiently than the model-specific register (MSR) that was used previously. As a result, kernel operations that involve reading time stamps are faster.

1.2.2 Hyper-V Daemons

The `hyperv-daemons` package, which includes the `hypervfcopyd`, `hypervkvpd`, and `hypervvssd` packages, provides the Hyper-V file-copy, key-value pair (KVP), and volume shadow copy service (VSS) daemons for an Oracle Linux guest that is running under Hyper-V on a Microsoft Windows host.

The file-copy daemon (`hv_fcopy_daemon`) implements a file-copying service (`hypervfcopyd`) between the host and a guest.

The KVP daemon (`hv_kvp_daemon`) implements the `hypervkvpd` service, which uses the virtual machine bus (*VMbus*) to send information about a guest to the host.

The VSS daemon (`hv_vss_daemon`) implements the `hypervvssd` service, which allows you to create snapshots and backups of volumes from the host without preventing processes that are running in a guest from writing to or reading from those volumes.

Reboot the guest after installing the package.

1.3 `NetworkManager` Enhancement

`NetworkManager` now supports manual Domain Name System (DNS) configuration with `dns=none`. You can prevent `NetworkManager` from modifying the `/etc/resolv.conf` file by setting the `dns=none` property. This feature is useful when manually configuring DNS.

1.4 RHCK Kernel Driver Updates

The following RHCK drivers have been updated in this release:

- `ahci` driver supports Marewell 88SE9230
- `bnxt_en` driver updated to the latest upstream version
- `i40e` driver updated to version 1.5.10
- `i40evf` driver updated to version 1.5.10
- `ksc` driver updated to version 0.9.16-1

1.5 Security Features

Oracle Linux 6.9 includes Transport Layer Security (TLS) 1.2 support for all system components. Other changes include `vsftpd` support for TLS 1.2 and `auditd` support for `incremental_async`.

1.6 Shipped Kernels

Oracle Linux 6.9 ships with the following kernel packages:

- Unbreakable Enterprise Kernel Release 4 (`kernel-uek-4.1.12-61.1.28.el6uek`) for x86-64
- Unbreakable Enterprise Kernel Release 2 (`kernel-uek-2.6.39-400.294.3.el6uek`) for i386
- Red Hat Compatible Kernel (`kernel-2.6.32-696.el6`) for i386 and x86-64

By default, both the Unbreakable Enterprise Kernel and the Red Hat Compatible Kernel for the specific architecture (i386 or x86-64) are installed and the system boots the Unbreakable Enterprise Kernel.

The ISO image for Oracle Linux 6.9 for i386 includes the Red Hat Compatible Kernel and the Unbreakable Enterprise Kernel Release 2 but not the Unbreakable Enterprise Kernel Release 4, which does not support i386.

The ISO image for Oracle Linux 6.9 for x86-64 includes the Red Hat Compatible Kernel and the Unbreakable Enterprise Kernel Release 4 Update 2 but not the Unbreakable Enterprise Kernel Release 2. You are still able to run Oracle Linux 6.9 using the latest Unbreakable Enterprise Kernel Release 3 version.

Note that the default I/O scheduler used for the Unbreakable Enterprise Kernel is `deadline`, while for the Red Hat Compatible Kernel, `cfq` is the default.

To make your system boot the Red Hat Compatible Kernel by default:

1. Edit `/etc/grub.conf` and change the value of the `default` parameter to indicate the Red Hat Compatible Kernel. (Each entry for a bootable kernel in the file starts with a `title` definition. The entries are effectively numbered from 0 upwards, where 0 corresponds to the first entry in the file, 1 to the second entry, and so on. To view the GRUB manual, use the `info grub` command.)
2. Edit `/etc/sysconfig/kernel` and change the setting for the default kernel package type from `DEFAULTKERNEL=kernel-uek` to `DEFAULTKERNEL=kernel`.

1.7 Unbreakable Enterprise Kernel Release 2

The Unbreakable Enterprise Kernel Release 2 (UEK R2) is based on the upstream kernel 3.0.36 stable source tree.

The Unbreakable Enterprise Kernel supports a wide range of hardware and devices. In close cooperation with hardware and storage vendors, a number of device drivers have been updated by Oracle in the 2.6.39-400 kernel. For details, see the *Oracle Linux Unbreakable Enterprise Kernel Release 2 Quarterly Update 5 Release Notes*.

1.8 Unbreakable Enterprise Kernel Release 4

The Unbreakable Enterprise Kernel Release 4 Update 2 (UEK R4u2) is based on the upstream kernel 4.1.12 stable source tree. For more information about UEK R4, see *Unbreakable Enterprise Kernel: Release Notes for Unbreakable Enterprise Kernel Release 4 Update 2*.

A very large number of changes have taken place in mainline Linux between 3.0.x, on which UEK R2 is based, and 4.1.12, on which UEK R4 is based. For details of all these changes, see the kernel change logs that the Linux Kernel Newbies maintain at https://kernelnewbies.org/LinuxVersions.

1.9 Ceph

Although previous releases of Oracle Linux 6 provide some support for Ceph Storage Release 1.0, which is based on the Ceph Community Firefly release (v0.80). No support is provided on Oracle Linux 6 for the subsequent Ceph Storage Release 2.0, which is based on the Ceph Community Jewel release (v10.2.2).

From Oracle Linux 6.9, and later, Ceph is no longer supported on Oracle Linux 6. Continued support for subsequent releases of Ceph is available on Oracle Linux 7.

1.10 OpenSCAP

The Open Security Content Automation Protocol (OpenSCAP) Guide package, `scap-security-guide`, provides guidance, baselines, and validation mechanisms for implementing security hardening of an Oracle

Linux 6 system. OpenSCAP includes the `oscap` utility that you use to test the security compliance of a system and produce an online report that describes security policy requirements and how your system measures up to these requirements. OpenSCAP allows you to check system compliance as required by your site security policy.

For more information, see *Oracle® Linux 6: Security Guide*.

1.11 Load Balancing and High Availability

Oracle Linux 6 now includes the Keepalived and HAProxy technologies for balancing access to network services while maintaining continuous access to those services.

Keepalived uses the IP Virtual Server (IPVS) kernel module to provide transport layer (Layer 4) load balancing, redirecting requests for network-based services to individual members of a server cluster. IPVS monitors the status of each server and uses the Virtual Router Redundancy Protocol (VRRP) to implement high availability.

HAProxy is an application layer (Layer 7) load balancing and high availability solution that you can use to implement a reverse proxy for HTTP and TCP-based Internet services.

For more information, see *Oracle® Linux 6: Administrator's Guide*.

1.12 Enhanced SSSD Support for Active Directory

The System Security Services Daemon (SSSD) now supports the following features when using Oracle Linux clients with Active Directory (AD):

- Dynamic updates to DNS.
- Group and user lookups of NetBIOS names.
- Site discovery of domain controllers.
- User and group resolution and user authentication for trusted domains within a single AD forest.

1.13 Removing the RHCK from a System

If you need to remove the RHCK from a system, you can use the `kernel-transition` package to prepare the system for removing the RHCK without removing dependent packages such as `bluez`, `fuse`, and `irqbalance` that might be needed for system operation. The `kernel-transition` package does not contain any files itself but instead it transfers the package dependencies from the `kernel` package to the `kernel-uek` package.

Note

You must have subscribed the system to be transitioned to the `ol6_latest` channel on ULN.

Because the `xorg-x11-drv-nouveau` package requires `kernel-drm-nouveau` version 16 but `kernel-uek` provides `kernel-uek-drm-nouveau` version 12, removing the RHCK also removes `xorg-x11-drv-nouveau`. If you use this procedure on systems with Nvidia graphics hardware, the graphical interface will become low resolution and slow.

To transition a system from the RHCK to the UEK:

1. Install the `kernel-transition` package on the system:

```
# yum install kernel-transition
```

   This command changes the dependencies for important packages from the RHCK to the UEK.

2. Remove the RHCK:

```
# yum remove kernel
```

   This command prompts you before removing remaining packages that depend on the RHCK.

Caution

When `yum` prompts you to remove a package, only remove packages that relate to the `kernel` package. If you are prompted to remove a package that your system requires, enter **n** to prevent the package being removed. You should also retain any other dependent packages.

   Running the `yum update` command subsequently will update only the UEK.

If you want to reinstall the RHCK, use the following command:

```
# yum install kernel
```

You can also use `kernel-transition` with kickstart installation. Include the following lines in the `%packages` section to install the `kernel-uek` and `kernel-transition` packages but not the `kernel` package:

```
-kernel
kernel-transition
```

If you create a customized installation ISO, you can replace the `kernel` package with `kernel-transition` so that dependency resolution will pull in `kernel-transition` instead of `kernel`. If `kernel-transition` is present on the installation media, it cannot be installed accidentally because it provides a kernel version that is lower than that of any RHCK.

1.14 Oracle Automatic Storage Management (ASM) Enhancements

The log format for Oracle ASMLib, used to manage Oracle ASM devices dedicated to Oracle Databases, is updated to include timestamps of the activities logged to `/var/log/oracleasm`.

The `oracleasm` command line utility is improved for the `scandisks` operation to scan devices that are not directly available under `/dev`, but may be available within subdirectories within `/dev`. Additional directories to be scanned during the `scandisks` operation can be configured by setting the `Directories to scan` option when using the interactive configuration tool. For example:

```
# oracleasm configure -I
Configuring the Oracle ASM library driver.
...
The next two configuration options take substrings to match device names.
The substring "sd" (without the quotes), for example, matches "sda", "sdb",
etc.  You may enter more than one substring pattern, separated by spaces.
The special string "none" (again, without the quotes) will clear the value.
.
```

```
Device order to scan for ASM disks []:
Devices to exclude from scanning []: dm
Directories to scan []: /dev/mapper/
Use device logical block size for ASM (y/n) [n]:
Writing Oracle ASM library driver configuration: done
```

1.15 Technology Preview Features

Technology Preview features are still under development but are made available for testing and evaluation purposes and to give the features wider exposure. These features are not supported under Oracle Linux support subscriptions and are not suitable for production use.

Features that are currently under technology preview when using UEK R4u2 are described in *Unbreakable Enterprise Kernel: Release Notes for Unbreakable Enterprise Kernel Release 4 Update 2*.

Features that are currently under technology preview when using UEK R2QU5 are described in Oracle Linux Release Notes for Unbreakable Enterprise Kernel Release 2 Quarterly Update 5.

The following Technology Preview features are currently not supported under Oracle Linux 6 and might not be functionally complete:

- Apache IPA identity management modules
- Cross Realm Kerberos Trust Functionality (relies on the Samba 4 client library)
- DIF/DIX support for SCSI
- `dm-era` is a device mapper target that records when blocks are written to a device and is typically intended for use by backup applications
- `fence_ipmilan` agent diagnostic pulse
- `fence_sanlock` agent for `luci`
- FS-Cache
- Kerberos v1.10 DIR cache storage type to handle TGTs for multiple KDCs
- Kernel Media support
- Linux Containers (LXC), except when using UEK R3 or UEK R4
- LVM API
- Mellanox SR-IOV Support
- System Information Gatherer and Reporter (SIGAR)
- Trusted Platform Module (TPM)
- QFQ queuing discipline
- System monitoring using SNMP for KVM hosts
- `trousers` and `tpm-tools` packages that support Trusted Platform Module (TPM) hardware
- vCPU hot unplug

Note

FUSE is a supported feature in the UEK R2, UEK R3 and UEK R4 distributions.

LXC is a supported feature in the UEK R3 and UEK R4 distributions.

Chapter 2 Fixed and Known Issues

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This chapter describes the fixed and known issues for Oracle Linux 6.9.

Important

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

For details of the fixed and known issues with the Unbreakable Enterprise Kernel Release 4 Update 2, see *Unbreakable Enterprise Kernel: Release Notes for Unbreakable Enterprise Kernel Release 4 Update 2*.

For details of the fixed and known issues with the Unbreakable Enterprise Kernel Release 2 Quarterly Update 5, see the *Oracle Linux Unbreakable Enterprise Kernel Release 2 Quarterly Update 5 Release Notes*.

2.1 Fixed Issues

The following sections describe the major issues that are fixed in this update:

2.1.1 dm-cache support

UEK R4 provides support for the `dm-cache` device mapper target although this feature is considered experimental and might not be suitable for production systems. (Bug ID 19611720)

2.1.2 Kdump Service Can Be Enabled by Using system-config-kdump Under UEK R4

The `system-config-kdump` utility failed to enable the kdump service when run under UEK R3. The issue is resolved in UEK R4.

(Bug ID 21300512)

2.1.3 iSCSI Boot Issue Resolved For Systems Installed Using the `Specialized Storage Device` Option

An issue that caused some systems to fail to boot from an iSCSI LUN if the operating system was installed using the `Specialized Storage Device` option in the installer has been fixed in this release.

(Bug ID 23202886)

2.1.4 `initramfs` Corruption due to Limited Disk Space Fixed

The `weak-modules` command uses `/boot` to generate a temporary `initramfs`. If the partition does not have enough space, the `weak-modules` command could overwrie a healthy `initramfs` with an incomplete file, resulting in failure to boot. A fix was applied to check the `dracut` return code to avoid

creating an incomplete initramfs in the event that there is not enough disk space available. The fix includes a message to notify the user to recreate the initramfs manually.

(Bug ID 23737293)

2.1.5 sosreport Utility Hangs Collecting lastlog Fixed

The sosreport utility would hang trying to collect the lastlog file as it incorrectly calculated the disk space required by this sparsely allocated database file. The updated version of sosreport no longer attempts to collect the lastlog file directly.

(Bug ID 25256165)

2.1.6 Error Mounting NFS Target Due to Missing Path in the start-statd Script Fixed

The start-statd command, that is called when mounting an NFS file system with locking enabled, uses the cat command. An incorrect system path reference in the script resulted in an error finding the cat command to complete the operation. The script is updated to fix the system path reference.

(Bug ID 25059557)

2.2 Known Issues

The following sections describe known issues in this update.

2.2.1 Unable to boot after installation on systems using the Broadcom MegaRAID 9460 controller

Some systems use the updated Broadcom MegaRAID 9460 RAID controller that depends on the MegaRAID_SAS v7.x. driver. This driver is not available on the installation media for this release. If Oracle Linux 6 is installed on a RAID volume attached to this controller the system is not able to boot.

To install the correct driver modules for this hardware, you must download and prepare a Driver Update Disk. This Driver update disk contains the following updated driver modules:

- megaraid_sas 07.701.17.00-rc1
- mpt3sas 15.100.00.00
- smartpqi 1.0.4-100

Updated modules are provided for UEK. No Updates are required for RHCK.

You can download the Driver Update Disk from the Oracle Software Delivery Cloud at https://edelivery.oracle.com/. Search for 'Oracle Linux 6.9' and select the software to add it to your basket. Click on the 'Selected Software' basket and click Continue. Accept the Oracle Standard Terms and Restrictions and click Continue. You can select the Driver Update Disk files that are part of this media pack to download:

- V959604-01.zip Readme for Driver Update Disk
- V959603-01.iso Driver Update Disk for Oracle Linux 6 x86_64

Instructions for preparation and installation are covered in *Oracle® Linux 6: Installation Guide*.

(Bug ID 26426929)

2.2.2 Installer does not show `Network Devices` screen when installing with iSCSI enabled

If a system is configured to use iSCSI storage on a network interface within the BIOS or UEFI, the Oracle Linux installer does not provide an option to select the network device to use if the `URL` option is selected on the `Installation Method` screen.

Workarounds include the following:

- Disable iSCSI configuration in the BIOS or UEFI to cause the installer to display the `Network Devices` screen when viewing the `URL Setup` options.
- Make sure that the URL is accessible using the same network device that is configured for iSCSI in the BIOS or UEFI, as this is the network interface that is used by default by the installer when the `Installation Method` is set to `URL`.
- Perform a Kickstart installation and specify the `ksdevice` kernel boot parameter to point to the correct network interface to use for the installation. The `Network Devices` screen is still not displayed in the installer, but a network interface not configured for iSCSI can be used to complete the installation. For more information, see *Oracle® Linux 6: Installation Guide*

(Bug ID 23273430)

2.2.3 Kickstart installation fails on multipath device when the `ignoredisk --only-use` option is used

A kickstart installation fails when the `ignoredisk --only-use` option is used to point to a multipath device. The problem is that multipath is not started by the time that the installer searches the multipath map to match the device.

The workaround is to specify which drives should not be used in the partitioning section rather than using the `--only-use` parameter to specify the multipath device that you intend to use. This can be done by using the `ignoredisk --drives` option. For example:

```
clearpart --all --initlabel
ignoredisk  --drives=sda,sdb
part /boot --fstype=ext4 --size=500 --asprimary
      --ondisk=/dev/disk/by-id/scsi-3600144f0cab1f53e000058a15c870904
part / --fstype=ext4 --size=8192 --grow --maxsize=51200 --asprimary
      --ondisk=/dev/disk/by-id/scsi-3600144f0cab1f53e000058a15c870904
part swap --size=16384 --asprimary
      --ondisk=/dev/disk/by-id/scsi-3600144f0cab1f53e000058a15c870904
```

(Bug ID 25548146)

2.2.4 Btrfs File System Issues on UEK

For a description of the known issues for btrfs with Unbreakable Enterprise Kernel Release 2 Quarterly Update 5, see the *Oracle Linux Unbreakable Enterprise Kernel Release 2 Quarterly Update 5 Release Notes*.

For a description of the known issues for btrfs with Unbreakable Enterprise Kernel Release 4 Update 2, see *Unbreakable Enterprise Kernel: Release Notes for Unbreakable Enterprise Kernel Release 4 Update 2*.

2.2.5 xfs: Kernel panic in the multi-block buffer logging code

A bug exists in the multi-block buffer logging code, for XFS, that can cause a kernel panic at log push time due to invalid regions being set in the buffer log format bitmap. (Bug ID 24400444)

2.2.6 btrfs: Unable to replay log after snapshot delete and parent directory fsync

If a snapshot is deleted and the parent directory is fsynced the log cannot be replayed during the next mount operation, preventing the file system from mounting. This is solvable by wiping the log trees using the btrfs-zero-log tool but is very inconvenient as it results in the loss of any data and metadata fsynced before the parent directory was fsynced. (Bug ID 24424719)

2.2.7 btrfs: Empty symbolic link after fsync of parent directory

If a symbolic link is created and the parent directory is fsynced, a system crash or power outage results in an empty symbolic link when the file system is remounted. (Bug ID 23748445)

2.2.8 btrfs: Incorrect directory entries after fsync log replay

If a directory or file is moved to a new parent directory and the file system logs the new parent but does not explicitly log the old parent, when the log is replayed entries for the moved directory of file can appear in both the old and new parent directories. (Bug ID 23748405)

2.2.9 btrfs: File loss on log replay after renaming a file and fsync

If a file is renamed and fsynced and a system crash or power outage occurs, when the log is replayed, the file is deleted because the `last_unlink_trans` value is not captured in the log of the inode leaving the log without enough information to later replay the rename operation. (Bug ID 23725060)

2.2.10 btrfs: Kernel oops when unmounting during a quota rescan or disable

Operations that trigger a quota rescan or to disable the quota on a mounted file system cause a kernel oops message when attempting to unmount the file system. This can cause the system to hang. (Bug ID 22377928)

2.2.11 `mkfs.ext4` does not support the documented `-f` option

The man page for `mkfs.ext4` describes an optional command line parameter, `-f`, to specify fragment size. However, this option was removed when support for creating bigalloc file systems was added. Attempts to create an `ext4` file system using the `mkfs.ext4` command in conjunction with this option may result in an error notifying the user of an invalid option. (Bug ID 25512202)

2.2.12 btrfs, ext4 and xfs: Kernel panic when freeze and unfreeze operations are performed in multiple threads

Freeze and unfreeze operations performed across multiple threads on any supported file system can cause the system to hang and the kernel to panic. This is the result of a race condition that occurs when

the unfreeze operation is triggered before it is actually frozen. The resulting unlock operation attempts a write operation on a non-existent lock resulting in the kernel panic. (Bug ID 25321899)

2.2.13 ext4: System hang when processing corrupted orphaned inode list

If the orphaned inode list is corrupted the inode may be processed repeatedly resulting in a system hang. For example, if the orphaned inode list contains a reference to the bootloader inode, `ext4_iget()` returns a bad inode resulting in the processing loop that can hang the system. (Bug ID 24433290)

2.2.14 OFED iSER target login fails from an initiator on Oracle Linux 6

An Oracle Linux 6 system with the `oracle-ofed-release` packages installed and an iSER (iSCSI Extensions for RDMA) target configured, fails to login to the iSER target as an initiator. On the Oracle Linux 6 initiator machine, the following behavior is typical:

```
# iscsiadm -m node -T iqn.iser-target.t1 -p 10.196.100.134 --login
Logging in to [iface: default, target: iqn.iser-target.t1, portal:
10.196.100.134,3260] (multiple)
iscsiadm: Could not login to [iface: default, target: iqn.iser-target.t1,
portal: 10.196.100.134,3260].
iscsiadm: initiator reported error (8 - connection timed out)
iscsiadm: Could not log into all portals
```

This is expected behavior resulting from an errata fix for CVE-2016-4564, to protect against a write from an invalid context.

(Bug ID 23615903)

2.2.15 Kernel panic when booting the Red Hat Compatible Kernel on a btrfs root partition

If the root partition is formatted using `btrfs`, the system is unable to boot into the Red Hat Compatible Kernel. This is because the features included in the version of `btrfs` provided, are not supported on older kernel versions. `btrfs` is included only as a technology preview for the Red Hat Compatible Kernel and is not fully supported on this kernel.

`btrfs` is fully supported in production with the Unbreakable Enterprise Kernel. Systems booting into this kernel are unaffected by the issue.

Users must be aware when formatting file systems from the installation ISO, that formatting the root partition with `btrfs` makes it impossible to boot into the Red Hat Compatible Kernel. Note that `btrfs` is the default file system for system disks when using the `boot-uek.iso`. If you are installing from this ISO and you intend to use the RHCK, you must change the default system disk layout in the installer.

(Bug ID 23198167)

2.2.16 DTrace Issues

- Support for DTrace is only available for UEK R4. To use DTrace, you must have the `ol6_x86_64_UEKR4` and `ol6_x86_64_UEKR4_DTrace_userspace` channels enabled for ULN.
- Using `kill -9` to terminate `dtrace` can leave breakpoints outstanding in processes being traced, which might sooner or later kill them.
- The following compiler warning can be ignored for static 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
```

2.2.17 Linux Containers (LXC)

- The Linux Containers package (`lxc`) is available for the x86-64 architecture with UEK R3 but not i386.
- The default location for a container's configuration has changed from `/etc/lxc/name` to `/container/name` in `lxc 0.8.0` onward.

  To start a container that you created with a previous update of Oracle Linux, specify the `-f` option to `lxc-start`, for example:

  ```
  # lxc-start -n ol6u3 -f /etc/lxc/ol6u3/config
  ```

  To convert an existing container to use the new location:

  1. Move the container's configuration directory to `/container/name`:

     ```
     # mv /etc/lxc/name /container
     ```

  2. Edit the `/container/name/config` file and change the values of any `lxc.rootfs` and `lxc.mount` parameters to refer to `/container` instead of `/etc/lxc`.

     For example, the `config` file might contain the following entries:

     ```
     lxc.rootfs = /etc/lxc/example/rootfs
     lxc.mount.entry=/lib /etc/lxc/example/rootfs/lib none ro,bind 0 0
     lxc.mount.entry=/usr/lib /etc/lxc/example/rootfs/usr/lib none ro,bind 0 0
     lxc.mount.entry=/lib64 /etc/lxc/example/rootfs/lib64 none ro,bind 0 0
     lxc.mount.entry=/usr/lib64 /etc/lxc/example/rootfs/usr/lib64 none ro,bind 0 0
     ```

     You would change these entries to read:

     ```
     lxc.rootfs = /container/example/rootfs
     lxc.mount.entry=/lib /container/example/rootfs/lib none ro,bind 0 0
     lxc.mount.entry=/usr/lib /container/example/rootfs/usr/lib none ro,bind 0 0
     lxc.mount.entry=/lib64 /container/example/rootfs/lib64 none ro,bind 0 0
     lxc.mount.entry=/usr/lib64 /container/example/rootfs/usr/lib64 none ro,bind 0 0
     ```

  After converting the container, you do not need to specify the `-f` option to `lxc-start`. (Bug ID 15967411)

- Attempting to create an `lxc-oracle` container on a remote file system mounted using NFS v4 fails. In addition, attempting to mount a remote file system using NFS v4 from within an `lxc-oracle` container also fails. The workaround is to use NFS v3 instead. (Bug ID 16316266)

2.2.18 avahi-daemon Fails to Start with UEK R2

The `avahi-daemon` fails to start with UEK R2 and messages such as the following are logged:

```
avahi-daemon[PID]: SO_REUSEPORT failed: Protocol not available
avahi-daemon[PID]: Failed to create server: No suitable network protocol available
```

The workaround is to comment out the `disallow-other-stacks` entry in `/etc/avahi/avahi-daemon.conf` as shown here:

```
#disallow-other-stacks=yes
```

(Bug ID 19712845)

2.2.19 Booting UEK R2 as a PVHVM Guest

When booting UEK R2 as a PVHVM guest, you can safely ignore the kernel message `register_vcpu_info failed: err=-38`, which might be displayed. (Bug ID 13713774)

2.2.20 Console Appears to Hang when Booting

On some hardware, the console may appear to hang during the boot process after starting `udev`. However, the system does boot properly and is accessible. A workaround to this problem is to add `nomodeset` as a kernel boot parameter in `/etc/grub.conf`. (Bug ID 10094052, 13485328)

2.2.21 Default Reverse Path Filtering Mode Affects Certain Oracle Products

Oracle Linux 6 defaults to reverse path filtering in strict mode. Some Oracle products and network storage devices work more reliably with reverse path filtering in loose mode. To enable loose mode, issue the following command (where *`iface`* is the network interface, for example, `eth1`).

```
# sysctl net.ipv4.conf.iface.rp_filter=2
```

The default setting is 1 for strict mode. (Bug ID 10649976)

2.2.22 Enabling FIPS Mode

To make an Oracle Linux 6.9 system compliant with Federal Information Processing Standard (FIPS) Publication 140-2, perform the following steps:

1. Install the `dracut-fips` package:

   ```
   # yum install dracut-fips
   ```

2. Recreate the `initramfs` file system:

   ```
   # dracut -f
   ```

3. Identify either the device file path (*`device`*) under `/dev` of your system's boot device or its UUID (*`uuid`*) by using `ls -l` to examine the entries under `/dev/disk/by-uuid`.

4. Add either a `boot=`*`device`* entry or a `boot=UUID=`*`uuid`* entry for the boot device to the `kernel` command line in `/etc/grub.conf`.

5. Add a `fips=1` entry to the `kernel` command line in `/etc/grub.conf` to specify strict FIPS compliance.

6. Disable prelinking by setting `PRELINKING=no` in `/etc/sysconfig/prelink`.

7. Remove all existing prelinking from binaries and libraries:

   ```
   # prelink -ua
   ```

8. Install the `openssh-server-fips` and `openssh-client-fips` packages and their dependent packages:

   ```
   # yum install openssh-server-fips openssh-client-fips
   ```

9. Shut down and reboot the system.

Note

If you specify `fips=1` on the kernel command line but omit a valid `boot=` entry, the system crashes because it cannot locate the kernel's `.hmac` file.

If you do not disable and remove all prelinking, users cannot log in and `/usr/sbin/sshd` does not start.

(Bug ID 17759117)

2.2.23 Error message Following First Reboot on an HP ProLiant Server

You might see a message similar to the following during the first reboot of an HP ProLiant server:

```
[Firmware Bug]: the BIOS has corrupted hw-PMU resources (MSR 186 is 43003c)
```

You can safely ignore this message. The functionality and performance of the operating system and the server are not affected.

2.2.24 `ext4` Inline Data

The inline data feature that allows the data of small files to be stored inside their inodes is not yet available with the UEK. The `-O inline_data` option to the `mkfs.ext4` and `tune2fs` commands is not supported. (Bug ID 17210654)

2.2.25 `xfs` Feature Incompatible With RedHat Compatible Kernel (RHCK)

The `xfsprogs` (3.2.0) user space tool introduced a new superblock format (v5) that includes a metadata checksum scheme. While this feature is supported in UEK R4, it is not currently supported on RHCK. If an `xfs` file system is created on a system running UEK R4, where cyclic redundancy checking (CRC) is enabled, mkfs.xfs generates the v5 superblock automatically and the file system can no longer be mounted on a system running RHCK. The following error is returned:

```
mount: wrong fs type, bad option, bad superblock on /dev/sdb1,
       missing codepage or helper program, or other error
       In some cases useful info is found in syslog - try
       dmesg | tail ..."
```

To check the superblock version number, you can run:

```
sudo xfs_db -r -c "sb" -c p /dev/sdb1 | grep versionnum
```

This command returns the hexadecimal value of `0xb4a5` for a file system formatted with a v5 superblock that requires CRC support in the kernel.

Do not try to mount a metadata CRC enabled `xfs` file system on an RHCK, since it does not support this functionality. (Bug ID 25489518)

2.2.26 gcc-libraries Package

The `gcc-libraries` package has been replaced by individual packages for `libatomic`, `libcilkrts`, and `libitmed`. (Bug ID 19829494)

2.2.27 Intel TCO Watchdog Timer Messages

Some server hardware does not support the Intel TCO watchdog driver. `dmesg` might display messages such as the following at boot time:

```
iTCO_vendor_support: vendor-support=0
iTCO_wdt: Intel TCO WatchDog Timer Driver v1.05
iTCO_wdt: failed to reset NO_REBOOT flag, reboot disabled by hardware
iTCO_wdt: No card detected
intel_rng: FWH not detected
```

To suppress this warning at boot time, disable the TCO watchdog timer driver by adding the following line to `/etc/modprobe.d/blacklist-watchdog`:

```
blacklist iTCO_wdt
```

2.2.28 Mellanox ConnectX Drivers

The Mellanox ConnectX core, Ethernet, and InfiniBand drivers are supported only for the x86-64 architecture on UEK. (Bug ID 16228063)

2.2.29 mlx4_core Conflicts Between the mlnx_en and ofa Packages

Both the `mlnx_en` and `ofa` packages contain `mlx4_core`. Only one of these packages should be installed. Attempting to install both packages on a single server results in a package conflict error. If you have a Mellanox Ethernet Controller, install `mlnx_en`. If you have a Mellanox InfiniBand Controller, install `ofa`. If your system has both controllers, use `ofa` as it supports both the Ethernet and InfiniBand controllers.

2.2.30 mlx4_ib Insertion Error when RDMA Starts

You can safely ignore the following error when the Oracle-supported RDMA service starts:

```
Loading OpenIB kernel modules:insmod: error inserting
'/lib/modules/3.8.13-69.3.4.el6uek.x86_64/kernel/drivers/infiniband/hw/mlx4/
mlx4_ib.ko': -1 File exists
```

The message indicates that the `mlx4_ib` module is already loaded.

(Bug ID 21410136)

2.2.31 Oracle Clusterware Fails to Start on ASM Storage with SELinux Enabled

If the SELinux policy packages have not been updated recently, Cluster Ready Services (CRS) might fail to start with messages such as the following in `/var/log/messages`:

```
SELinux is preventing /usr/lib/oracleasm/oracleasm-instantiate-disk from
associate access on the filesystem DATA1.
```

The solution is to upgrade the `selinux-policy` and `selinux-policy-targeted` packages to ensure that you are running a version no earlier than 3.7.19-195.0.1el6_4.5:

```
# yum update 'selinux-policy*'
```

After upgrading the packages, reboot the system. (Bug ID 13925445)

2.2.32 Oracle VM 3.0 Guests Crash During Oracle Database Installation

PVHVM guests on Oracle VM 3.0 crash during Oracle Database installation if the value of the maximum memory (`maxmem`) parameter set for the guest is greater than the amount specified at boot time (`memory`). To avoid this issue, ensure that the values of the `maxmem` and `memory` parameters are the same. This issue has been resolved in Oracle VM 3.1.1. (Bug ID 13396734, 13970935)

2.2.33 Oracle VM 3.3.1 32-bit Guests with UEK R2 Panic

A panic can occur in 32-bit guests with UEK R2 on Oracle VM 3.3.1. (Bug ID 20057995)

2.2.34 Paravirtualized Drivers in a Hardware Virtualized Guest

The Unbreakable Enterprise Kernel adds support for PV drivers in an HVM guest (PVHVM) on Oracle VM. The default is to present only PV drivers when running in an HVM guest. To run `kernel-uek` fully hardware virtualized, including the drivers, add the parameter `xen_emul_unplug=never` to the boot parameters in `/etc/grub.conf`, for example:

```
kernel /vmlinuz-2.6.32-300.2.1.el6uek ro root=/dev/VolGroup00/LogVol00 xen_emul_unplug=never
```

Adding this parameter makes the kernel also present the emulated drivers as previously (for example, the `8139cp` network driver).

2.2.35 RHCK Panics When an ext4 File System Is Defragmented

Under certain conditions, the RHCK can panic if an ext4 file system is defragmented. (Bug ID 21163148)

2.2.36 sched_yield() Settings for the Completely Fair Scheduler

For the Unbreakable Enterprise Kernel, the default setting is `kernel.sched_compat_yield=1`.

For the Red Hat Compatible Kernel, the default setting is `kernel.sched_compat_yield=0`.

2.2.37 Setting the Serial Console in a Hardware Virtualized Guest

To set the serial console in a hardware virtualized guest, use following settings in the guest:

- Add the following parameters to the kernel boot line in `/etc/grub.conf`:

  ```
  console=tty0 console=ttyS0,57600n8
  ```

- Add the following line to `/etc/securetty`:

  ```
  ttyS0
  ```

2.2.38 Support for Large Memory 32-bit Systems

Releases of Oracle Linux prior to Oracle Linux 5 supplied a *hugemem* kernel to allow a system to address up to 64 GB of memory in 32-bit mode. The hugemem kernel is no longer available in Oracle Linux 5 and later releases.

The Unbreakable Enterprise Kernel (UEK) supports a maximum of 16 GB of memory for 32-bit kernels on bare metal and hardware virtualized machine (HVM) systems, and 8 GB for fully paravirtualized machine

(PVM) systems. 32-bit PVM guest operating systems must be located in the first 128 GB of physical memory on the host.

The Red Hat Compatible Kernel (RHCK) has the same limitations, except that PVM systems can have up to 16 GB of memory. The limitation of 8 GB for PVM on UEK was chosen for reasons of reliability.

A 32-bit system uses the PAE (physical address extension) memory feature to map physical memory beyond 4 GB into the 32-bit address space that is available to each process. A 64-bit system can address memory beyond 4 GB without requiring an extra layer of memory abstraction.

Oracle Linux on x86-64 includes 32-bit libraries, which allow applications built for both 64-bit and 32-bit Linux to run on the same system. This capability provides scalability to virtually unlimited memory sizes, while retaining the ability to run 32-bit applications. Oracle recommends this configuration for any system with more than 4 GB of memory. (Bug ID 16974301)

2.2.39 Unable to Register Oracle Linux Guest with ULN

Registering an Oracle Linux guest running under Virtual Box with the Unbreakable Linux Network (ULN) might fail with a server communication error. The workaround is to run the following command as `root` on the guest:

```
# echo "uuid=`uuidgen -t`" >> /etc/sysconfig/rhn/up2date
```

You can then run `uln_register` again. (Bug ID 14696776)

2.2.40 Unable to Register with ULN After First Reboot

Following the first reboot after installing Oracle Linux 6, you are prompted to register your system with ULN. If you did not configure your network during the installation, the registration process to ULN cannot succeed. To register your system, log in as `root`, configure the system's network manually, and run `uln_register`.

2.2.41 Boot from SAN installation fails using multipath on Pure Storage FlashArray

Systems installed with Oracle Linux 6 update 9 and configured to use the UEK R4 kernel fail to boot if the boot disk is a multipath LUN on a Pure Storage FlashArray. The system boots successfully if the LUN is exposed on a single path, or if the system is installed using Oracle Linux 6 update 8. The system is also able to boot successfully if configured to use the RHCK.

The exact cause of the issue is currently under investigation, but was replicated using a Pure Storage FlashArray FA-420 Pure Array and a QLogic QLE2562 HBA. (Bug IDs 26732037, 27093062).

Chapter 3 Upgrading to Oracle Linux 6.9

Table of Contents

This chapter describes how to upgrade your system to Oracle Linux 6.9.

3.1 Supported Upgrade Paths

On i386 systems, upgrading from Oracle Linux 6 GA or a previous update to Oracle Linux 6 is supported for the Unbreakable Enterprise Kernel Release 2 and the Red Hat Compatible Kernel. The Unbreakable Enterprise Kernel Release 4 is not supported on the i386 architecture.

On x86-64 systems, upgrading from a previous update to Oracle Linux 6 or from Oracle Linux 6 GA or is supported for the Unbreakable Enterprise Kernel Release 2, the Unbreakable Enterprise Kernel Release 3, the Unbreakable Enterprise Kernel Release 4, and the Red Hat Compatible Kernel.

Upgrading from a beta release is not supported.

In-place upgrading from a major version of Oracle Linux 5 or earlier is not supported. Although Anaconda provides an option to perform an upgrade, fresh installation is strongly recommended.

If you have an Oracle Linux 5.8 system, you can use new features in the Unbreakable Enterprise Kernel Release 2 without upgrading to Oracle Linux 6 as Oracle Linux 5.8 includes the Unbreakable Enterprise Kernel Release 2. You cannot use features from the Unbreakable Enterprise Kernel Release 4 as this kernel is not available for Oracle Linux 5.8.

3.2 Obtaining Oracle Linux 6.9 Packages

You can download Oracle Linux installation media from the Oracle Software Delivery Cloud at https://edelivery.oracle.com/linux. You can also obtain Oracle Linux packages from the Unbreakable Linux Network (ULN) and the Oracle Linux Yum server.

3.2.1 About the Unbreakable Linux Network

You have the option of registering a system with ULN when you install Oracle Linux 6 on a system. To register with ULN after installation, use the `uln_register` command.

To obtain Oracle Linux updates from ULN, you must have an Oracle Linux support subscription. For more information about ULN, see https://linux.oracle.com.

From Oracle Linux 6.9, ULN registration subscribes a server to the Oracle Linux 6 latest channel and either the UEK R2 latest channel (`ol6_i386_UEK_latest`) for i386 or the UEK R4 channel (`ol6_x86_64_UEKR4`) for x86-64.

If you want to install UEK R4 on a ULN-registered x86-64 system that is currently running UEK R2, manually subscribe the system to the UEK R4 channel (`ol6_x86_64_UEKR4`) and unsubscribe the server from the UEK R2 latest channel (`ol6_x86_64_UEK_latest`) before running `yum update`.

ULN also provides channels for Oracle-specific software packages such as Oracle's `ASMlib` user-space package and the Oracle Instant Client. To enable access to these packages, log in to ULN and subscribe your system to the Oracle Software channel.

3.2.2 About the Oracle Linux Yum Server

Oracle provides all errata and updates for Oracle Linux through the Oracle Linux yum server, which includes updates to the base distribution, but does not include Oracle-specific software. You do not require an Oracle Linux support subscription to use this service. For more information on how to obtain updates from Oracle Linux yum server and how to update your `yum` configuration files for the latest Oracle Linux 6 release, see https://yum.oracle.com.

By default, all new installations of Oracle Linux 6.9 are automatically configured to use the Oracle Linux yum server. If you subsequently register the system with ULN, the Oracle Linux yum server is automatically disabled.

The Oracle Linux yum server provides a direct mapping of all of the Unbreakable Linux Network (ULN) channels that are available to the public without any specific support agreement. The repository labels used for each repository on the Oracle Linux yum server map directly onto the channel names on ULN. See *Oracle® Linux: Unbreakable Linux Network User's Guide for Oracle Linux 6 and Oracle Linux 7* for more information about the channel names and common suffixes used for channels and repositories.

Prior to January 2019, Oracle shipped a single yum repository configuration file for each Oracle Linux release. This configuration file is copied into `/etc/yum.repos.d/public-yum-ol6.repo` at installation, but can also be downloaded from the Oracle Linux yum server directly to obtain updates.

The original configuration file is deprecated in favor of modular repository files that are managed and updated automatically via yum in the form of RPM packages that are more targeted in scope. For example, core repository configuration files required for Oracle Linux 6 are available in the `oraclelinux-release-el6` package. This package includes all of the repository configuration required to install base packages for the release, including packages from the `ol6_latest`, `ol6_addons` repositories and all of the supported repositories for UEK.

The modular yum repository configuration files released as packages that can be maintained via yum can help to simplify repository management and also ensure that your yum repository definitions are kept up to date automatically, whenever you update your system.

A list of all available RPM files to manage all of the possible yum repository configurations for your release can be obtained by running:

```
# yum list *release-el6*
```

To install the yum repository configuration for a particular set of software that you wish to use, use yum to install the corresponding package. For example, to install the yum repository configuration for the Oracle Linux Software Collection Library, run:

```
# yum install oracle-softwarecollection-release-el6
```

If your system is still configured to use the original single yum repository configuration file at `/etc/yum.repos.d/public-yum-ol6.repo`, you should update your system to transition to the current

approach to handling yum repository configuration. To do this, ensure that your system is up to date and then run the `/usr/bin/ol_yum_configure.sh` script:

```
# yum update
# /usr/bin/ol_yum_configure.sh
```

The `/usr/bin/ol_yum_configure.sh` script checks the `/etc/yum.repos.d/public-yum-ol6.repo` file to determine which repositories are already enabled and installs the appropriate corresponding packages before renaming the original configuration file to `/etc/yum.repos.d/public-yum-ol6.repo.sav` to disable it in favor of the more recent modular repository configuration files.

If, for some reason, you manage to remove all configuration to access the Oracle Linux yum server repositories, you should create a temporary yum repository configuration file at `/etc/yum.repos.d/ol6-temp.repo` with the following as the minimum required content:

```
[ol6_latest]
name=Oracle Linux $releasever Latest ($basearch)
baseurl=https://yum.oracle.com/repo/OracleLinux/OL6/latest/$basearch/
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-oracle
gpgcheck=1
enabled=1
```

Then reinstall the `oraclelinux-release-el6` package to restore the default yum configuration:

```
# yum reinstall oraclelinux-release-el6
# rm /etc/yum.repos.d/ol6-temp.repo
```

For more information on manually setting up Oracle Linux yum server repository configuration files, see https://yum.oracle.com/getting-started.html.

You can enable or disable repositories in each repository configuration file by setting the value of the `enabled` directive to 1 or 0 for each repository listed in the file, as required. The preferred method of enabling or disabling repositories under Oracle Linux 6 is to use the `yum-config-manager` command provided in the `yum-utils` package.

If you want to install packages from the OFED repository for a system that is currently running UEK R3 (**x86-64 systems only**), enable the `ol6_ofed_UEK` yum repository. For example, run:

```
# yum-config-manager --enable ol6_ofed_UEK
```

If you want to install packages from the OFED repository for a system that is currently running UEK R4 (**x86-64 systems only**), enable the `ol6_UEKR4_OFED` yum repository. For example, run:

```
# yum-config-manager --enable ol6_UEKR4_OFED
```

3.2.3 About Oracle Linux Installation Media

The Oracle Linux 6.9 Media Pack contains the following ISO images:

- **Oracle Linux 6.9 for x86 (32 bit)** or **for x86_64 (64 bit)**

  This ISO image contains everything needed to boot a system and install Oracle Linux.

- **Oracle Linux 6.9 UEK Boot ISO image for x86 (32 bit)** or **for x86_64 (64 bit)**

  This is the boot ISO image for the Unbreakable Enterprise Kernel.

- **Oracle Linux 6.9 Boot ISO image for x86 (32 bit)** or **for x86_64 (64 bit)**

This is the boot ISO image for the Red Hat Compatible Kernel.

- **Oracle Linux 6.9 Source DVD 1 and 2**

  These ISO images contain the source code for the software packages in the release.

The full installation media for Oracle Linux 6.9 contains three distinct repository sources for the Unbreakable Enterprise Kernel Release 2, the Unbreakable Enterprise Kernel Release 4, and the Red Hat Compatible Kernel.

To configure `yum` to use both the Unbreakable Enterprise Kernel Release 2 and the Red Hat Compatible Kernel repositories from the full installation ISO image, create the file `/etc/yum.repos.d/Media.repo` containing entries similar to the following:

```
[ol6_base_media]
name=Oracle Linux 6.9 Base Media
baseurl=file:///media/ISOimage/Server
gpgkey=file:///media/ISOimage/RPM-GPG-KEY
gpgcheck=1
enabled=1

[ol6_uek_media]
name=Oracle Linux 6.9 UEK Media
baseurl=file:///media/ISOimage/UEK2
gpgkey=file:///media/ISOimage/RPM-GPG-KEY
gpgcheck=1
enabled=1
```

To configure `yum` to use both the Unbreakable Enterprise Kernel Release 4 (**x86-64 systems only**) and the Red Hat Compatible Kernel repositories from the full installation ISO image, create the file `/etc/yum.repos.d/Media.repo` containing entries similar to the following:

```
[ol6_base_media]
name=Oracle Linux 6.9 Base Media
baseurl=file:///media/ISOimage/Server
gpgkey=file:///media/ISOimage/RPM-GPG-KEY
gpgcheck=1
enabled=1

[ol6_uekr4_media]
name=Oracle Linux 6.9 UEK Media
baseurl=file:///media/ISOimage/UEK4
gpgkey=file:///media/ISOimage/RPM-GPG-KEY
gpgcheck=1
enabled=1
```

Adjust the value of the `baseurl` and `gpgkey` parameters to match the mount point of the ISO image on your system. If you do not require one of the repositories, set the value of the corresponding `enabled` parameter to 0.

3.3 Upgrading the Unbreakable Enterprise Kernel

Oracle Linux 6.9 ships with the latest Unbreakable Enterprise Kernel Release 2 for i386 and Unbreakable Enterprise Kernel Release 4 for x86-64. If you upgrade your system from the installation media, there are five upgrade scenarios:

- If the UEK R2 or UEK R4 is not currently installed on the system, only the latest Red Hat Compatible Kernel is installed. The UEK R2 or UEK R4 kernel is not installed.

- If UEK R2 is currently installed on an i386 system, the latest version of the UEK R2 kernel is installed.
- If UEK R2 is currently installed on an x86-64 system and you upgrade using the Oracle Linux 6.9 installation media for x86-64, which do not contain a UEK R2 repository, the latest version of UEK R2 is not installed.
- If UEK R3 is currently installed on an x86-64 system and you upgrade using the Oracle Linux 6.9 installation media for x86-64, which do not contain a UEK R3 repository, the latest version of UEK R3 is not installed, the system continues to boot into the existing UEK R3.
- If UEK R4 is currently installed on an x86-64 system, the latest version of the UEK R4 kernel is installed.

`yum` uses whatever repositories you have configured on your system to upgrade it. You can find the latest UEK R2 packages in the `ol6_i386_UEK_latest` and `ol6_x86_64_UEK_latest` repositories, the latest UEK R3 packages in the `ol6_UEKR3_latest` repository, and the latest UEK R4 packages in the `ol6_UEKR4` repository.

If you want to install the latest UEK R2 kernel on an i386 or x86-64 system, subscribe your system to the `ol6_i386_UEK_latest` or `ol6_x86_64_UEK_latest` channel on ULN, or enable the `ol6_UEK_latest` repository. For example:

```
# yum-config-manager --enable ol6_UEK_latest
```

If you want to update an x86-64 system to use the latest UEK R3 kernel, subscribe your system to the `ol6_x86_64_UEKR3_latest` channel on ULN, or enable the `ol6_UEKR3_latest` repository. For example:

```
# yum-config-manager --enable ol6_UEKR3_latest
```

If you want to update an x86-64 system to use the latest UEK R4 kernel, subscribe your system to the `ol6_x86_64_UEKR4` channel on ULN, or or enable the `ol6_UEKR4` repository. For example:

```
# yum-config-manager --enable ol6_UEKR4
```

3.4 Applying the Update

Once you have set up the ULN channels, Yum repositories, or installation media repositories that `yum` should use, you can update all installed packages by running the following command:

```
# yum update
```

This command upgrades your system to Oracle Linux 6.9.

You can use the following command to update a specific package:

```
# yum update package
```

For example, to update the Z-shell package (`zsh`) enter:

```
# yum update zsh
```

For more information, see the `yum(8)` manual page.

Chapter 4 Oracle-Supported OFED Packages

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The following information describes additional steps specific to Oracle Linux 6 update 9 that may be required to install or upgrade the Oracle-supported OFED packages for UEK R4. This chapter also describes steps to upgrade an Oracle Linux system where the Oracle-supported OFED packages for UEK R4 are already installed.

4.1 Installing or Upgrading Oracle-Supported OFED Packages for UEK R4

For instructions for installing or upgrading OFED packages with UEK R4, please refer to the Release Notes for the most current version of UEK R4 at *Unbreakable Enterprise Kernel Documentation*.

For example, if installing for UEK R4u5, refer to *Unbreakable Enterprise Kernel: Release Notes for Unbreakable Enterprise Kernel Release 4 Update 5*.

4.2 Upgrading to Oracle Linux 7 Update 4 with the Oracle-Supported OFED Packages for UEK R4 installed

The following procedures describe how to upgrade an Oracle Linux 6 system to Oracle Linux 6 Update 9 on a system where the Oracle-supported OFED packages for UEK R4 are already present.

Upgrade using ULN

The following procedure describes how to use ULN to perform an upgrade.

Note

This procedure assumes that you have registered the system with ULN. See *Oracle® Linux: Unbreakable Linux Network User's Guide for Oracle Linux 6 and Oracle Linux 7*.

1. Subscribe the system to the `ol6_x86_64_UEKR4_OFED`, `ol6_x86_64_UEKR4`, and `ol6_x86_64_latest` channels on ULN. By default, the `ol6_x86_64_UEKR4` and `ol6_x86_64_latest` channels are enabled when you register an Oracle Linux 6 system with ULN.

2. Edit the `/etc/yum/pluginconf.d/rhnplugin.conf` file and add the following lines to the end of the file:

```
[ol7_x86_64_UEKR4_OFED]
priority=20
```

3. Install the `yum-plugin-priorities` package from the `ol7_x86_64_latest` channel:

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

4. Apply Oracle Linux 6 Update 9 to the system:

```
# yum update
```

Any Oracle-supported OFED packages for UEK R4 that were already present are updated from the `ol6_x86_64_UEKR4_OFED` channel. If you do not have any of the OFED packages installed, you can proceed to install the packages as described in the installation instructions provided in the Release Notes for the most current version of UEK R4 at *Unbreakable Enterprise Kernel Documentation*.

For example, if installing for UEK R4u5, refer to *Unbreakable Enterprise Kernel: Release Notes for Unbreakable Enterprise Kernel Release 4 Update 5*.

Upgrading by using the Oracle Linux Yum Server

The following procedure describes how to perform an upgrade by using the Oracle Linux yum server.

1. If you updated the server from Oracle Linux 5 or the initial release of Oracle Linux 6, ensure that your system is up to date and that you have transitioned to use the modular yum repository configuration by installing the `oraclelinux-release-el6` package and running the `/usr/bin/ol_yum_configure.sh` script.

```
# yum install oraclelinux-release-el6
# /usr/bin/ol_yum_configure.sh
```

2. Enable the `ol6_latest`, `ol6_UEKR4` and `ol6_UEKR4_OFED` repositories. For example, run:

```
# yum-config-manager --enable ol6_latest ol6_UEKR4 ol6_UEKR4_OFED
```

3. Install the `yum-plugin-priorities` package from the `ol6_latest` repository:

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

4. To apply Oracle Linux 6.9 to the system:

```
# yum update
```

Any Oracle-supported OFED packages for UEK R4 that were already present are updated from the `ol6_UEKR4_OFED` repository on the Oracle Linux yum server. If you do not have any of the OFED packages installed, you can proceed to install the packages as described in the installation instructions that are provided in the release notes for the most current version of UEK R4 at https://docs.oracle.com/en/operating-systems/uek/.

For example, if you are installing UEK R4U7, see the *Unbreakable Enterprise Kernel Release 4 Update 7 Release Notes*.

Appendix A Packages

Table of Contents

The following sections list the packages that have been added to, modified from, or removed from the upstream release, or which have been added to the base release by Oracle.

A.1 Packages Added to the Upstream Release

The following packages have been added to the upstream release:

- `cloud-init`
- `copy-jdk-configs`
- `cpuid`
- `libmicrohttpd`
- `python-boto`
- `python-jsonpatch`
- `python-jsonpointer`
- `python-prettytable`

A.2 Packages Modified From the Upstream Release

The following packages have been modified from the upstream release:

- `abrt`
- `acpid`
- `anaconda`
- `autofs`
- `basesystem`
- `brltty`
- `btrfs-progs`
- `clufter`
- `compat-glibc`

- coreutils
- cpuspeed
- crash
- dbus
- device-mapper-multipath
- dhcp
- dracut
- e2fsprogs
- efax
- esc
- firefox
- firstaidkit
- firstboot
- fuse
- gdm
- glibc
- gnome-desktop
- grub
- grubby
- gstreamer
- httpd
- initscripts
- iproute
- iptables
- irqbalance
- iscsi-initiator-utils
- java-1.7.0-openjdk
- kabi-yum-plugins
- kdeadmin
- kdebase-workspace

- kdelibs
- kde-settings
- kexec-tools
- keyutils
- ksc
- libreoffice
- libreport
- libreswan
- libvirt
- libxml2
- libxslt
- luci
- mkbootdisk
- module-init-tools
- mysql
- net-snmp
- nfs-utils
- nmap
- nss
- ntp
- ocaml-libvirt
- openmpi
- openscap
- openssl098e
- PackageKit
- pam
- pcs
- pilot-link
- piranha
- plymouth

- policycoreutils
- procps
- publican
- python
- python-urlgrabber
- python-virtinst
- ql2400-firmware
- ql2500-firmware
- qperf
- qpid-cpp
- qpid-qmf
- rear
- redhat-bookmarks
- redhat-indexhtml
- redhat-lsb
- redhat-release-server
- redhat-rpm-config
- rhn-client-tools
- rhnlib
- rhnsd
- rpmdevtools
- rsyslog
- samba
- sanlock
- scap-security-guide
- scsi-target-utils
- selinux-policy
- setroubleshoot
- setroubleshoot-plugins
- sos

- system-config-date
- system-config-date-docs
- system-config-kickstart
- system-config-network
- system-config-services
- system-config-services-docs
- system-config-users-docs
- system-icon-theme
- systemtap
- thunderbird
- tog-pegasus
- trace-cmd
- udev
- wireshark
- xfsdump (x86-64 only)
- xfsprogs (x86-64 only)
- xorg-x11-drivers
- xorg-x11-server
- xsane
- xulrunner
- yum
- yum-rhn-plugin
- yum-utils

Unless otherwise noted, changes relate to branding, trademark usage, or user-interface modifications.

A.3 Packages Removed From the Upstream Release

The following packages from the upstream release are not included:

- iprutils
- libehca
- libica

- libreport-plugin-rhtsupport
- librtas
- libservicelog
- libvpd
- lsvpd
- openssl-ibmca
- powerpc-utils
- ppc64-diag
- ppc64-utils
- publican-redhat
- python-rhsmm
- Red_Hat_Enterprise_Linux-Release_Notes-6-as-IN
- Red_Hat_Enterprise_Linux-Release_Notes-6-bn-IN
- Red_Hat_Enterprise_Linux-Release_Notes-6-de-DE
- Red_Hat_Enterprise_Linux-Release_Notes-6-en-US
- Red_Hat_Enterprise_Linux-Release_Notes-6-es-ES
- Red_Hat_Enterprise_Linux-Release_Notes-6-fr-FR
- Red_Hat_Enterprise_Linux-Release_Notes-6-gu-IN
- Red_Hat_Enterprise_Linux-Release_Notes-6-hi-IN
- Red_Hat_Enterprise_Linux-Release_Notes-6-it-IT
- Red_Hat_Enterprise_Linux-Release_Notes-6-ja-JP
- Red_Hat_Enterprise_Linux-Release_Notes-6-kn-IN
- Red_Hat_Enterprise_Linux-Release_Notes-6-ko-KR
- Red_Hat_Enterprise_Linux-Release_Notes-6-ml-IN
- Red_Hat_Enterprise_Linux-Release_Notes-6-mr-IN
- Red_Hat_Enterprise_Linux-Release_Notes-6-or-IN
- Red_Hat_Enterprise_Linux-Release_Notes-6-pa-IN
- Red_Hat_Enterprise_Linux-Release_Notes-6-pt-BR
- Red_Hat_Enterprise_Linux-Release_Notes-6-ru-RU
- Red_Hat_Enterprise_Linux-Release_Notes-6-si-LK

- Red_Hat_Enterprise_Linux-Release_Notes-6-ta-IN
- Red_Hat_Enterprise_Linux-Release_Notes-6-te-IN
- Red_Hat_Enterprise_Linux-Release_Notes-6-zh-CN
- Red_Hat_Enterprise_Linux-Release_Notes-6-zh-TW
- redhat-access-insights
- redhat-logos
- redhat-release-notes-6Server
- redhat-support-lib-python
- redhat-support-tool
- s390utils
- sapconf
- servicelog
- subscription-manager
- subscription-manager-migration-data
- virt-who
- yaboot

A.4 Packages Added by Oracle

The following packages have been added to the base release by Oracle:

- dtrace-modules
- inotify-tools
- kernel-uek (2.6.39 for i386 and 4.1.12 for x86-64)
- libdtrace-ctf
- linux-firmware
- lxc (x86-64 only)
- netxen-firmware
- ocfs2-tools
- oracleasm-support
- oraclelinux-release
- oraclelinux-release-notes

- `oracle-logos`
- `oracle-rdbms-server-12cR1-preinstall`
- `ql2600-firmware`
- `ql2700-firmware`
- `ql8300-firmware`
- `reflink`
- `uname26`
- `yum-plugin-ulninfo`