



An Oracle White Paper  
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## Fast, Modern, Reliable: Oracle Linux

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## Introduction to Oracle Linux

Oracle Linux brings the latest Linux innovations to market, delivering extreme performance, advanced scalability, and reliability for enterprise applications. Oracle Linux offers a choice of two Linux kernels:

- The Unbreakable Enterprise Kernel, based on a recent mainline Linux kernel – for those who want to leverage the latest features in Linux combined with tested performance and stability. It is installed and booted by default.
- The Red Hat Compatible Kernel, compiled directly from Red Hat Enterprise Linux. It is also installed by default and can be selected at boot time.

This means you have a choice at boot time: a system optimized for running Oracle software or strict RHEL kernel ABI (kABI) compatibility. Binary kernel modules built for any RHEL 6 kernel will also load on any Red Hat compatible kernel released for Oracle Linux 6.

Oracle's Unbreakable Enterprise Kernel is included as the default kernel in Oracle Linux 5.6 (and newer) and Oracle Linux 6. Oracle recommends the use of Oracle Linux with the Unbreakable Enterprise Kernel for all enterprise applications.

### Free to Download, Use and Distribute

True to the open source philosophy, Oracle has provided Oracle Linux software as a free download since it was first released. Anyone can download the binaries, installation media and the source code for free without a support subscription.

Oracle Linux DVD images (ISOs) can be obtained from the Oracle Software Delivery Cloud at <http://edelivery.oracle.com/linux>. Oracle provides free access to the individual RPM packages via public yum repositories from <http://public-yum.oracle.com/>. Source and debug information packages are available from <http://oss.oracle.com/>.

A new set of ISO DVD images is made available for every minor release (e.g. Oracle Linux 5 Update 6 or Oracle Linux 6 Update 2) of Oracle Linux. Therefore, users of Oracle Linux will be at most one update release behind even if they do not purchase any support contract.

In addition to that, Oracle Linux is available in the form of virtual machine images for Oracle VM Server for x86 and Oracle VM VirtualBox. With [Oracle Linux JeOS](#) (Just Enough OS) – a secure, pre-packaged, small-footprint Oracle Linux image for x86 and x86-64 that is freely redistributable and fully supported – developers and ISVs can easily build [Oracle VM Templates](#).

Oracle VM Templates are pre-installed and pre-configured software images which eliminate installation and configuration costs, reduce ongoing maintenance costs, and help organizations achieve faster time to market and lower cost of operations.

### Extensively Tested and Certified

Oracle invests significantly in testing and releasing critical bug fixes faster, making Oracle Linux a better option for enterprise deployments.

Packages released by Oracle as part of Oracle Linux undergo a long testing cycle which includes the routine testing of the full software stack with the help of the Oracle Validated Configurations test suite to ensure that the underlying operating system behavior is correct in all circumstances. Oracle's industry-leading QA team has worked with strategic customers for many years, and this depth of experience has helped build an extensive and ever-growing test matrix of real-life workloads.

Oracle Linux is [certified for compliance with the Linux Standard Base](#) (LSB Version 4.0), which greatly reduces the costs involved with porting third-party applications to different distributions, as well as lowers the cost and effort involved in after-market support of those applications.

[Oracle Validated Configurations](#) are pre-tested, validated architectures with software, hardware, storage and networking components together with documented best practices for deployment. They offer guidance to customers deciding what should be run as a full system with an Oracle Database running on top of a Linux operating system, in turn running on top of hardware, and at the same time listing the most effective set of tuning parameters for their setups (for both kernel and Oracle Database), as well as workarounds for known problems. Oracle Validated Configurations include a full range of products, with the entire hardware-software stack tested.

Besides testing with Oracle products, we've also been working with key vendors such as AMD, Brocade, Cisco, Dell, EMC, Emulex, Fujitsu, HP, IBM, Intel, NetApp, QLogic, and many others, representing a wide range of server and storage product vendors, to make sure that a variety of fully integrated stacks are tested. See [the certified hardware list](#).

Oracle and its strategic partners offer and recommend these configurations to enable end-users to deploy fully tested solutions to achieve standardization with high performance, scalability and reliability while lowering infrastructure costs and speeding up deployment.

In general, many Unix OS vendors test their product in-house, focusing on testing the operating system specifically with the hardware and the associated enterprise software that runs on it, and doing so provides enough confidence in their product. However, in the case of Linux there are a large number of choices, forcing the distribution vendors to heavily rely on companies like Oracle to do the testing.

Such testing has been happening for many years and Oracle has been building out a very large test suite for this purpose, which runs everywhere. The full test suite for Oracle products on Linux (the Oracle Linux Test) runs 24/7 on thousands of systems at Oracle and is freely available for download from <http://oss.oracle.com/projects/olt/>. These tests are designed to verify stability and correct behavior of both the operating system and the Oracle applications running on top of it. The test suite includes installation, functional, stress and destructive tests, which are executed under varying workloads types (I/O intensive, CPU intensive, for instance) with various database sizes. Several parameters are varied during the full run of the test suites, which also include crash scenarios in Oracle Real Application Cluster configurations.

## Oracle Linux with the Unbreakable Enterprise Kernel

Traditional enterprise Linux distributions are mostly based on outdated, three-to-four-year-old kernels.

In September 2010, Oracle announced the new Unbreakable Enterprise Kernel for Oracle Linux as a recommended kernel to deploy with Oracle Linux 5 or Red Hat Enterprise Linux (RHEL) 5.

The Unbreakable Enterprise Kernel was introduced to deliver the latest innovations from upstream development to customers who run RHEL 5 or Oracle Linux 5 in the data center.

Oracle Linux with the Unbreakable Enterprise Kernel can be run directly on bare metal or as a virtual guest on Oracle VM. The latest release, Unbreakable Enterprise Kernel Release 2 is based

on the mainline Linux kernel version 3.0.16 and boasts a wide range of new features and improvements relevant for enterprise workloads. It includes optimizations developed in collaboration with Oracle's Database, Middleware, and Hardware engineering teams to ensure stability and optimal performance for the most demanding enterprise workloads. For example, Oracle Linux is used as the base operating system for the Oracle Exadata, Exalogic, Exalytics systems, Big Data Appliance. Oracle engineers developed a number of enhancements and improvements to make Linux perform better on these large systems, namely in the area of scalability, memory management and better Infiniband support. See the following section about "" in this document for more details. All contributions and patches from Oracle on top of the mainline kernel are open source and [available in this git tree](#).

Key benefits of using Unbreakable Enterprise Kernel include:

- Tested and recommended by Oracle
- Easy to install — no need to reinstall the operating system
- Existing applications run unchanged
- Extreme performance, especially for large systems
- Improved virtualization
- Fine grained control over memory and CPU resources
- Improved power management
- Improved application uptime
- Faster problem resolution
- Avoids silent data corruption

Oracle's build and QA systems for the Oracle Database and many other Oracle products use Oracle Linux with the Unbreakable Enterprise Kernel exclusively. Furthermore, Oracle Linux with the Unbreakable Enterprise Kernel is now used in all benchmarks on Linux that Oracle participates in. Some benchmark results that were run using Oracle Linux include:

- [Oracle Weblogic Server Standard Edition Release 10.3.4 on Cisco UCS B440 M1 Blade Server](#)

- [Oracle Weblogic Server Standard Edition Release 10.3.4 on Dell PowerEdge R910](#)
- [Oracle Linux Delivers Top CPU Benchmark Results on Sun Blades](#)
- [Oracle Delivers Record Performance Result for a Two Processor Intel-Based System with TPC-C Benchmark](#)
- [Oracle Extends Performance Leadership with x86 World Record on TPC-C Benchmark](#)

Oracle highly recommends deploying Oracle Linux in your environment, especially if you are running enterprise applications.

## Features and Performance Improvements

Oracle Linux includes many enhancements, including bug fixes to improve virtual memory performance, network and disk I/O performance as well as improvements for large NUMA (Non-Uniform Memory Access) systems. With the latest Unbreakable Enterprise Kernel Release 2, there are major improvements to the scheduler, memory management, file system layers or the networking stack. In addition to performance improvements for large systems, Oracle Linux contains many new features that are relevant to Linux running in the data center.

### Virtualization enhancements

The Unbreakable Enterprise Kernel Release 2 includes improved support for running Oracle Linux as a guest VM in both para-virtualized and hardware-virtualized configurations. The same kernel image is suitable for both "bare-metal" installs as well as guest installations in virtual machine environments, which makes it easier to migrate Oracle Linux installations between physical and virtual environments.

### Transparent Huge pages

This feature better utilizes the memory management capabilities of modern CPUs, by organizing the kernel memory in 2 MB pages instead of 4 kB. This reduces the overhead involved in managing memory pages significantly. Frequently accessed virtual addresses for memory-intensive workloads can be better cached, making page-table walks much faster. Also, this is more flexible and less error-prone than having to set up huge pages with tlbfs manually.

### Cgroups Improvements

Cgroups give administrators fine-grained control over resource allocations, helping to make sure that applications get what they need to deliver consistent response times and adequate performance. The Unbreakable Enterprise Kernel Release 2 added new controllers that allow to control disk bandwidth allocation and to set upper read/write limits to a group of processes. It also includes a new feature that supports "process grouping", allowing to change the way how the process scheduler assigns shares of CPU time to each process. This can improve the responsiveness of applications under certain load conditions.

### Memory Compaction

This feature reduces external memory fragmentation in a memory zone by trying to move used pages into a new big block of contiguous pages. This makes it easier for the Linux kernel to allocate bigger chunks of memory. The amount of I/O required to satisfy a huge page allocation is reduced significantly.

### Btrfs

Oracle Linux with the default Unbreakable Enterprise Kernel R.2 includes the first production Btrfs filesystem. Btrfs provides a flexible way to manage underlying block devices, without needing a separate volume manager. Btrfs also supports lightweight copies/clones of files or directories with snapshots as well as online data compression. Some of the key features of Btrfs include: Extreme scale, up to 16 Exabyte volume size, Simplified administration, Online adding and removal of devices, defragmentation and scrubbing, Optimized for SSD, Supports mixed device types, Billions of sub volumes and snapshots Transparent compression, Built in RAID, data integrity (checksums)

### **Latest Infiniband Stack (OFED) 1.5.1**

OpenFabrics Enterprise Distribution (OFED) implements Remote Direct Memory Access (RDMA) and kernel bypass mechanisms to deliver high-efficiency computing, wire-speed messaging, ultra-low microsecond latencies and fast I/O for servers, block storage and file systems. This also includes an improved RDS (reliable datagram sockets) stack for high speed,

low latency networking. As an Infiniband Upper Layer Protocol (ULP), RDS is used to send IPC datagrams (up to 1MB) reliably, and is used currently in Oracle RAC and Exadata/Exalogic products.

### **Receive Packet Steering and Receive Flow Steering**

Overall networking performance has been improved – especially at high loads – due to the inclusion of receive packet steering. RPS distributes the load of received network packet processing across multiple CPUs and ensures that all packets for a specific IP address/port combination are handled by the same CPU core. This allows protocol processing (e.g. IP and TCP) to be performed on packets in parallel and avoids performance penalties that can occur due to the resulting cacheline bouncing. This solution removes a bottleneck where a single CPU core could be saturated from processing network interrupts. This feature has been back-ported from the mainline Linux 2.6.35 kernel.

To enable receive packet steering, you have to place a CPU mask into `/sys/class/net/xxx/queues/rx-0/rps_cpus` where xxx is your interface name. The CPU mask takes the same form as the masks for the taskset command.

For example:

```
echo 0x55 > /sys/class/net/eth0/queues/rx-0/rps_cpus
```

Receive Flow Steering (RFS) can be considered the second stage of receive packet steering. Developed by Tom Herbert at Google, RFS is an extension of RPS that makes sure that now that processing of network packets is happening in parallel, it's done in a coordinated fashion.

Instead of performing an IP/Port match, it is doing an application match, directing the flow of traffic to where the application is waiting for it. If an application issues some system calls that trigger network packets to be sent and received, its footprint will be logged to the CPU currently executing it and any incoming packets for this application will always meet up on the same CPU, thus improving CPU locality and minimizing the performance penalty.

This is more directed than receive packet steering alone. Together with RPS, this can result in tremendous performance improvements – Oracle-internal tests have shown 50% faster IP over Infiniband results on a two socket system.

### **Advanced support for large NUMA systems**

The Unbreakable Enterprise Kernel includes a number of additional patches to significantly improve performance on NUMA systems with many CPUs and cores. These include:

- A patch to list message signaled interrupts (MSI) for each device in the sysfs file system. Before, when MSI-X mode was enabled for a PCI device, there was no entry in sysfs that displayed the IRQs. The interrupts were only displayed in `/proc/interrupts`, but it was impossible to determine which interrupts were used by which device when there were multiple identical devices in the system. With the help of a modified `irqbalance` utility, this ensures to keep IRQs on NUMA local CPUs.
- Reduced runqueue lock contention by making improvements around IPC semaphores. This patch tries to reduce the runqueue lock contention by ordering the wakeups based on the CPU the waiting process was on when it went to sleep.

### IO affinity

This is a feature in the block layer for controlling the IO completion CPU of either all requests on a queue, or on a per-request basis. A sysfs variable (`rq_affinity`) is exported which, if set, migrates completions of requests to the CPU that originally submitted it. This can have a fairly large impact on performance, especially on large NUMA machines.

IO affinity is turned on by default, but it can be controlled via the tunable in `/sys/block/xxx/queue/rq_affinity`

Example to enable it:

```
echo 1 > /sys/block/sda/queue/rq_affinity
```

### Improved asynchronous writeback performance

The process of writing out “dirty” (modified) memory from the Linux kernel page cache to the disk is called “writeback”. It is performed by the `pdflush` kernel thread, based on configurable values defined in `/proc/sys/vm`. Depending on the amount of data and the storage sub-systems involved in this activity, the previous implementation had some drawbacks. A new flushing system was designed and developed by Oracle engineers, which addressed these deficiencies and improved the performance for various workloads:

- Per-device asynchronous dirty page writeback. The pdflush subsystem was replaced with dedicated threads on a per-device basis. This allowed buffered writeback to scale to much faster storage.
- Per-device buffered write accounting. The accounting for dirty pages has been reorganized, removing stalls and inefficient writeback when devices of different speeds are mixed together.

### SSD detection

The kernel block layer will detect devices that claim to be fast, solid state storage and tune itself accordingly. The result of this detection can be found in:

```
/sys/block/xxx/queue/rotational
```

Where xxx is the block device. Echoing a 0 or a 1 into this file will force the value to off or on. When assuming a device is an SSD, the block layer will try harder to immediately dispatch the IO to the device, which helps to better scale and improve IO throughput and latency.

### Database Smart Flash Cache

Oracle Database 11g Release 2 introduced a new database feature: Database Smart Flash Cache. This feature is available on Oracle Solaris and Oracle Linux and allows customers to increase the effective size of the Oracle database buffer cache without adding more main memory to the system. For transaction-based workloads, Oracle database blocks are normally loaded into a dedicated shared memory area in main memory called the System Global Area (SGA). Database Smart Flash Cache allows the database buffer cache to be expanded beyond the SGA in main memory to a second level cache on flash memory. The Sun Storage F5100 Flash Array and the Sun Flash Accelerator F20 PCIe Card provide a natural fit for Oracle Database Smart Flash Cache and offer an excellent opportunity for end users to take advantage of this new functionality.

Online Transaction Processing (OLTP) environments are expected to benefit from this technology. It is appropriate for new Oracle Database deployments with IO-intensive workloads as well as existing environments with main memory constraints and IO-bound applications. Benefits can include both increased transaction throughput and improved application response times.

Oracle Database environments with the potential to make effective use of this technology include: workloads with repeated short transactions where many users access the same data, storage systems that exhibit intensive disk read activity, and systems under heavy main memory pressure that prevents more memory being allocated to the SGA buffer cache.

This feature is expected to primarily benefit read-mostly and read-only workloads. It is also supported in Real Application Cluster (RAC) environments – Database Smart Flash Cache can be applied to individual RAC nodes as required.

### **Task Control Groups**

TCG can track and group processes into user-defined cgroups so that the operating system can treat them as whole and perform scheduling, accounting, and resource allocation accordingly. For example, using TCG, you can associate a set of CPU cores and memory nodes to a group of processes that makeup an application or a group of applications. This enables subnetting larger systems, more fine grained control over memory, CPUs and devices, and isolation of applications.

### **Hardware fault management**

Hardware fault management helps to avoid system crashes and improve application uptime.

Oracle Linux includes support for Advanced Error Reporting. The AER kernel driver allows the kernel to gather error information from PCI Express devices if errors occurred, to report these errors to the administrator and to perform error recovery actions. When an error occurs, the driver captures the error and a message will be printed on the console or a log file.

Machine Check Exception (MCE) is a feature of AMD / Intel 64 bit systems which is used to detect an unrecoverable hardware problem. MCE can detect:

- Communication errors between CPU and motherboard
- Memory errors, e.g. ECC problems
- CPU cache errors

mcelog is a daemon to handle MCE events on x86-64 machines running Oracle Linux. It accounts and logs CPU and memory errors, supports triggers on error thresholds, and can

predictively offline memory pages and CPUs based on error trends. It should be run as a daemon on any x86-64 Linux system. The mcelog package is included in the distribution and will add an hourly cron job to `/etc/cron.hourly/mcelog.cron` upon installation, to check for new MCEs. If mcelog locates a MCE, a log message will be written to `/var/log/mcelog`. This is useful for predicting server hardware failures before an actual server crash occurs.

### **Power management features**

The Unbreakable Enterprise Kernel is tickless. In the tickless kernel, timer interrupts are performed on demand rather than at a predetermined frequency. This allows the CPUs to stay in a low power state when the system is idle, reducing overall power consumption.

By supporting Aggressive Link Power Management (ALPM), SATA links to disks that are currently idle are being put into a low-power mode on SATA controllers that support the AHCI specification. The controller automatically puts the link back into active power state when new I/O requests are being scheduled.

### **Data integrity features**

T10 Protection Information (T10-PI) enables applications or kernel subsystems to attach metadata to I/O operations, allowing devices that support T10-PI to verify the integrity before passing them further down the stack and physically committing them to disk. Data Integrity Extensions or DIX is a hardware feature that enables exchange of protection metadata between host operating system and HBA and helps to avoid corrupt data from being written, allowing a full end-to-end data integrity check. For more details on preventing silent data corruption using Oracle Linux, see [this whitepaper](#).

### **Oracle Cluster File System 2 (OCFS2)**

Oracle Linux includes full support for the [Oracle Cluster File System](#) (OCFS2), an open source cluster file system included in the mainline Linux Kernel. OCFS2, the Oracle Cluster File System has been further refined and improved in Unbreakable Enterprise Kernel R.2. It now implements allocation reservations, which help to reduce file system fragmentation significantly. The hole-punching code was optimized: portions of a file can be marked as "unwanted" and the associated storage will be released much faster now. The introduction of discontinuous block groups helps speeding up the allocation of disk space on fragmented file systems. Earlier versions of OCFS2

had its own heartbeat for each mounted volume, which caused a lot of overhead on servers with a large number of OCFS2 mounts. This has now been changed to what is called a "global heartbeat", where there is only one heartbeat/disk/network for all mounted volumes.

The Unbreakable Enterprise Kernel includes OCFS2 version 1.6. New features include:

- JBD2 support
- Extended attributes
- POSIX ACLs
- Security attributes
- Metadata checksums
- Indexed directories
- REFLINKs

For more details, see the [OCFS2 1.6 User's Guide](#)

### **Latencytop**

Latencytop helps to identify where latency in the system is affecting the performance of an application. The point is to locate a resource that is either busy or non-responsive. It is included in Oracle Linux – for a description of this utility, please see [this article](#) on the Oracle blogs.

### **New fallocate() system call**

fallocate() is a new system call which will allow applications to preallocate space to any file(s) in a file system. Applications can get a guarantee of space for particular file(s) – even if later the system becomes full. Using this method of allocation can dramatically speed up the creation of large files such as those used for virtual machine images.

### **Strict Binary Compatibility**

Tremendous effort has gone into assuring that there is no divergence from the original Red Hat source code, given that the main goal of Oracle Linux and the Oracle Linux Support program is to not fragment the Linux code base, but to improve Linux quality and support.

Oracle Linux is built from the very same source code as Red Hat Enterprise Linux (RHEL). There are approximately 2,600 packages in the distribution. A byte-by-byte comparison of the source code against RHEL will reveal no difference, the only changes being the removal of trademarks and copyrights.

The Oracle Linux source code is recompiled into binaries and made available for download and produced into CD images. Oracle also applies a number of bug fixes on top of the original code. These fixes are critical for customers to have as soon as possible in their production deployment.

The Linux operating system is a modular system in which the kernel interacts with the hardware and controls and schedule access to resources on behalf of applications. Applications run in what's called *user space* and only call a stable set of system libraries to ask for kernel services. Figure 1 is a simplified diagram of the Linux operating system. Using the Unbreakable Enterprise Kernel instead of the Red Hat compatible kernel changes only the box labeled "Kernel." – and nothing changes in the "user space".

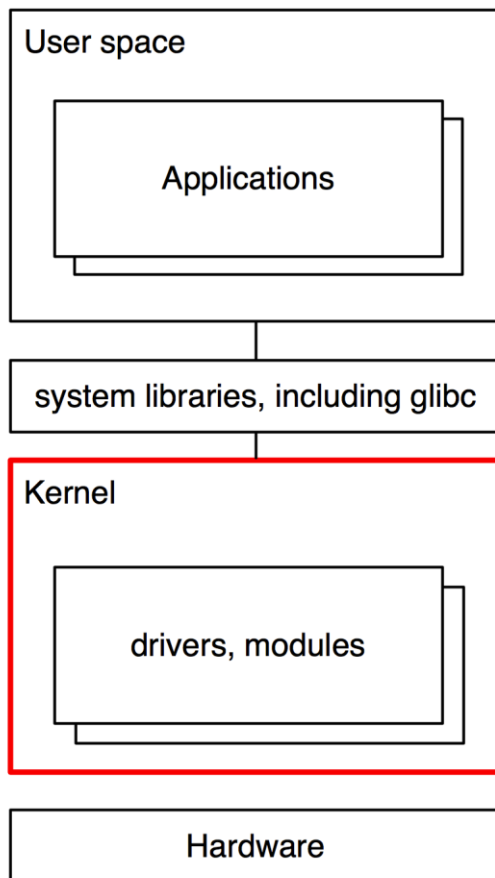


Figure 1. The Linux Operating System

As you can see, using a different kernel does not change system libraries such as *glibc*, the interface that nearly all applications, including Oracle Database use. The *glibc* version in Oracle Linux 6 is 2.12, regardless of the kernel version you run underneath.

The `sysctl` infrastructure to control kernel settings is also unchanged when you use the Unbreakable Enterprise Kernel.

In contrast, device drivers and other kernel modules are tightly coupled with the kernel and will usually have to be recompiled when a new kernel is introduced.

### Fully Compatible Updates and Errata

Oracle synchronizes bug fixes at regular intervals with RHEL to maintain full compatibility. Whenever a new version of an individual package (an errata) gets released by Red Hat, not just as part of an update release, the corresponding package for Oracle Linux is made available very quickly, in a matter of hours. If a package has no trademarks and no Oracle specific patches, it will simply be recompiled and reissued for Oracle Linux immediately after going through testing.

If a package has trademarks or Oracle Linux specific changes, Oracle will examine the source code and compare it against the bug fixes that have been already applied and released as part of Oracle Linux. If the Oracle patches are still relevant, then they are reapplied, but if the problems have been fixed in the Red Hat version, whether in the same or in a different way, the Oracle specific patches are dropped and the package recompiled (always checking for trademarks and copyrights issues) and released as part of Oracle Linux via the Unbreakable Linux Network (ULN).

For official updates of existing major releases, for example RHEL 6 Update 1, Oracle re-bundles the Red Hat patches in the update and reissues them as Oracle Linux 6 Update 1, including free ISOs, almost immediately.

Bug fixes and security errata are delivered via ULN and announced via the [el-errata mailing list](#).

As a new major RHEL release is issued, there is usually the need to do some additional testing before Oracle can consider it an official Oracle Linux version since Red Hat does not conduct Oracle related testing. For instance, when RHEL 5 was released, Oracle ensured that the corresponding Oracle Linux product had been well tested before issuing its own version of it, since in the past, we've discovered critical bugs and fixed them during this process.

## Zero downtime updates with Ksplice

[Ksplice](#) is an exciting new addition to the Oracle Linux Premier Support subscription.

Now available as part of Oracle Linux, it updates the Linux operating system (OS) kernel, while it is running, without a reboot or any interruption.

Only Oracle Linux offers this unique capability, making it possible to keep up with important Linux updates without burdening you with the operational cost and disruption of rebooting for every update to Linux.

Ksplice allows system administrators to deliver valuable patches with lower costs, less downtime, increased security, and greater flexibility and control.

## Third Party Solutions

Partners including , ISVs and other third party vendors strongly endorse and support Oracle Linux. Oracle has a long history of working with industry-leading companies such as AMD, Brocade, Cisco, Dell, EMC, Emulex, Fujitsu, HDS, HP, IBM, Intel, NEC, NetApp, Qlogic and many others. See the [Partner Endorsements page](#) and [certified hardware list](#) for more details.

No re-certification is necessary for Oracle Linux, because of the compatibility between Oracle Linux code and RHEL code, therefore anything that was certified on RHEL is also certified on Oracle Linux.

- [Discover detailed comparisons of Oracle Linux and Red Hat Enterprise Linux and certification information for partners.](#)

If customers have an application deployed on Red Hat Enterprise Linux, it will continue to run “as-is” on Oracle Linux. From a software vendor and a hardware vendor point of view, Oracle certifies and supports all the applications that are certified on RHEL. Many software vendors certify and support their software on Oracle Linux, including BMC, Computer Associates, EMC, Quest, SAP, Sungard, and Symantec.

For a detailed overview of the considerations and best practices for certifying RHEL-supported applications with Oracle Linux read the following technical articles:

- [Certification with Oracle Linux 6](#)
- [Certification with Oracle Linux 5](#)
- [Certification with Oracle Linux 4](#)

## Oracle Linux Support Program

Oracle delivers enterprise-class support for Oracle Linux and the Unbreakable Enterprise Kernel with premier backports, comprehensive management, cluster software, indemnification, testing and more. Oracle supports Oracle Linux and Red Hat Enterprise Linux installations at significantly lower cost than competing vendors. From operating system to applications, Oracle provides support for the full software stack running on Linux.

[Oracle Linux Support](#) leverages Oracle's support infrastructure and provides a premier level of scope, experience, and quality. Oracle has more than 30 years of experience providing enterprise-quality support, and we serve the needs of our customers with a worldwide 24/7 support organization consisting of more than 7,000 professionals in 145 countries.

Oracle is the only vendor in the industry that offers a complete Linux-based solution stack – applications, middleware, database, management tools, operating system and hardware. With Oracle as your Linux support provider, you have a single point of contact for all your support needs. Oracle is committed to delivering high quality, comprehensive, and integrated support solutions to help ensure that organizations succeed with Oracle Linux.

Oracle's [Sun Server systems](#) include Oracle Linux support. When you purchase Oracle's Sun x86 systems with Premier Support for Systems, Oracle Linux Premier support is included (as well as support for Oracle VM and Oracle Solaris). Read more about [Oracle Premier Support for Systems](#) and [Oracle Premier Support for Operating Systems](#).

Many of Oracle's database support analysts and applications developers are used to working with Linux, and the talent and experience of Oracle's support organization is reflected in numerous awards, including Service and Support Professionals Association (SSPA) Awards.

Complete support for the complete software and hardware stack has other advantages in addition to the technical expertise of Oracle's support professionals. When a customer logs into MyOracleSupport, (Oracle's issue tracking system) they can see all their issues, whether related to the Linux OS or any Oracle products, and the same diagnostic tools that are used to pull information from systems running Oracle products are also used for the Linux OS as well.

## Oracle's Linux Commitment and Leadership

Oracle has a dedicated Linux operating system development team in house, and a large number of the engineers are community members and are fully focused on making Linux operating system contributions, rather than the Oracle products.

The Oracle Linux engineering team focuses on contributing enterprise-class functionality to the operating system. All the development done by the team is performed in collaboration with the upstream maintainers and the Linux community directly, and integrated in the upstream repositories from the start.

Oracle's involvement with Linux began in 1998, when Oracle Database Release 8 became the first commercial database to be ported to that operating system. Even though there was a still relatively small amount of interest in Linux at the time, it was already used for development and testing environments and Oracle recognized its potential as a viable operating system.

In 2002, a program called Oracle Unbreakable Linux was launched, underscoring Oracle's commitment to Linux as a viable enterprise operating system. Under this program Oracle started providing direct support for the Linux operating system for customers running Oracle products, with the endorsement of Red Hat and Novell. Any fixes in the OS produced by Oracle for priority one bugs were contributed back to the vendors on whose distribution they manifested and incorporated in their official Linux releases.

Oracle also created a fully open source Linux Cluster File System – Oracle Cluster File System (OCFS) – which was geared towards helping Oracle Real Application Clusters adoption with Oracle 9i. The second version of this, [OCFS2, was the first cluster file system to become part of the Linux mainline kernel](#) (in version 2.6.16). At the time, Oracle also started sponsoring the Linux security evaluations, because they are important for government contracts and some customers require such level of certification.

Within the company, there are scores of Linux production deployments as well, making Oracle itself a significant Linux user. Oracle Linux is Oracle's Linux development and production environment, with thousands of production systems running Oracle Linux and several thousand developers using it as their development platform.

Learn more about [Oracle's support, commitment, and leadership with Linux](#).

## Conclusion

Oracle is the only vendor in the industry that offers a complete Linux-based solution stack – applications, middleware, database, management tools, operating system and hardware, along with a single point of support. Users of Oracle Linux benefit greatly from the latest Linux innovations as well as rigorous testing with real world workloads. The availability of free DVD images and binary RPM packages from the public yum repositories make it easy to evaluate, use and distribute Oracle Linux without buying support subscriptions. Third party applications do not need to be re-certified with the Unbreakable Enterprise Kernel in Oracle Linux.

## References and Additional Resources

For more information about Oracle Linux, please access the following resources:

**Oracle Linux Home Page**

<http://www.oracle.com/linux>

**Download Oracle Linux**

[edelivery.oracle.com/linux](http://edelivery.oracle.com/linux)

**General FAQ on Oracle Linux**

[oracle.com/us/technologies/027617.pdf](http://oracle.com/us/technologies/027617.pdf)

**Oracle Validated Configurations**

<http://www.oracle.com/technetwork/topics/linux/validated-configurations-085828.html>

**Oracle Linux and Oracle VM Certified Hardware**

<http://linux.oracle.com/hardware-certifications>

**Purchase Oracle Linux support**

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<http://www.oracle.com/us/technologies/linux/025994.htm>

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<http://oss.oracle.com/ol6/docs/RELEASE-NOTES-GA-en.html>

**Oracle Technical Contributions to Linux**

<http://www.oracle.com/us/technologies/linux/026042.htm>

**Unbreakable Linux Network**

<http://linux.oracle.com/>



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