



# RED HAT ENTERPRISE LINUX 5.5 TECHNICAL OVERVIEW

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## Abstract

This paper provides a high-level summary of the primary enhancements included in the fifth update to the Red Hat Enterprise Linux 5 platform.

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## OVERVIEW

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In March 2010, Red Hat released the fifth update to its Red Hat Enterprise Linux 5 family, Red Hat Enterprise Linux 5.5. This release builds upon the strong enterprise foundation of the Red Hat Enterprise Linux 5 release stream, and augments it with support for a major new generation of processor hardware. By carefully ensuring that application interfaces are compatible with earlier Red Hat Enterprise Linux 5 releases, customers are able to utilize the new features and newly supported hardware without any disruption to their already-certified application stacks. This offers customers the “best of both worlds” – the ability to capitalize on the new features and functionality, such as the performance and efficiency of leading-edge hardware, while preserving application stability and compatibility, enhanced interoperability with Microsoft products, and new tools and utilities that users have requested.

This paper highlights the major enhancements in Red Hat Enterprise Linux 5.5, but does not attempt to be a comprehensive itemization. In addition to the features described, Red Hat Enterprise Linux 5.5 also contains a number of bug fixes, security enhancements, and minor features. Complete details on the update are provided in the Release Notes. As mentioned above, all of these enhancements are implemented such that they ensure application compatibility with earlier releases, and that system stability and performance are maximized. The paper will start with a description of new hardware features, followed by a description of virtualization enhancements, and will close with a high-level summary of some other important new features.

## HARDWARE ENHANCEMENTS

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Unquestionably, the most exciting enhancement in Red Hat Enterprise Linux 5.5 is the support and performance optimization provided for the new hardware systems, and processor chipsets with supporting base-board components. Specifically, the release features support for the Intel® Xeon® processor 7500 series (formerly code named Nehalem-EX) and AMD's Opteron™ 6000 Series platform (formerly code named Magny-Cours), as well as support for IBM's new POWER7 processor. These systems truly do usher in a new era of highly scalable computing. To put this into perspective, consider that previously a server configuration with 64 processors and 1 TB of memory would consist of a power hungry “big iron” system occupying a full height rack of equipment. In contrast, as Red Hat Enterprise Linux 5.5 ships in March 2010, our hardware partners are delivering certified systems in a 4U form factor that offer the same level of scalability. Even more stunning is the fact that individual blade servers will be able to scale to 32 processors and 512 GB. This increase in capacity isn't a typical “speed bump,” rather, it's a major evolutionary step.

The hardware is, of course, only half the story because without the companion operating system support and performance optimization, the hardware benefits would not be realized in practical customer deployments. Here are a few examples highlighting the optimizations implemented by Red Hat in cooperation with its hardware partners. An advantage of the collaborative open source development model is that Red Hat's operating system experts can work very closely with their peers in the hardware vendor community to build support for the latest hardware features.



- **Memory Allocation optimizations** - this latest generation of hardware is categorized as NUMA (Non-Uniform Memory Architecture), meaning that the time it takes to access regions of memory differs on a per-CPU basis, based on its locality. Red Hat Enterprise Linux 5.5 incorporates a substantial number of topology awareness enhancements to ensure that the fastest memory regions are allocated per process.
- **Scheduler optimizations** - identify the most efficient CPU on which to run a process. This is a complex tradeoff that balances the most efficient reuse of processor caches with effective workload distribution across a large pool of CPUs based on topology awareness.
- **Power efficiency** - system optimizations automatically run processes on the smallest possible subset of CPUs, thereby allowing unused CPUs to enter lower power states.
- **Reliability** - enhancements that provide mechanisms to more precisely pinpoint system faults, trap errors, create highly available configurations, and take corrective actions. Such capabilities were previously the exclusive purview of exotic high end systems - and are now for the first time available on commodity systems.

## VIRTUALIZATION

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From a practical perspective, many current enterprise workloads are not able to fully utilize large scale systems with 64 processors and 1 TB of memory. Enter Red Hat's virtualization capabilities: the standalone Red Hat Enterprise Virtualization hypervisor and management station, and the integrated virtualization provided by Red Hat Enterprise Linux. Both of these products provide workload consolidation capabilities that allow the new hardware systems to really shine. And Red Hat Enterprise Linux 5.5 provides a number of virtualization enhancements and optimizations. For example, a customer testimonial for the new Nehalem-EX system running Red Hat Enterprise Linux 5.5 describes how a massive lab of 10,000 systems will be consolidating down to 256 systems.

The major focus of virtualization optimization in Red Hat Enterprise Linux 5.5 involves I/O performance enhancements – notably in the network and disk stacks. There are a variety of I/O optimizations that enable virtual guests to more directly access the device hardware, rather than incurring the overhead of indirect access through the hypervisor. This is accomplished by utilizing hardware features such as SR-IOV, VT-D, and PCI-passthrough. As a testament to the effectiveness of the I/O optimizations, Red Hat Enterprise Linux is the only operating system capable of saturating a 10GigE network adapter from a virtual guest. Another example of I/O- and virtualization-related optimization is “hugepage” support, which allows virtual guests to efficiently allocate and use large memory pools – a typical use case for database workloads.



These scalability and I/O enhancements significantly reduce the virtualization overhead for I/O bound workloads, typically to just a few percent. This opens the door for virtualization to be a practical deployment model for a whole new class of application workloads—including database, file serving, and high transaction rate messaging middleware. These workloads can now benefit from the consolidation efficiency and flexibility that virtualization offers.

Red Hat Enterprise Linux 5.5 is an ideal virtualization foundation that can enable hundreds of virtualized guests, Linux and Windows, in same environment, to be consolidated on a single commodity host system. And not just wimpy guests either, but guests that can be configured with 32 processors and 512 GB of memory, and deliver performance that is essentially identical to non-virtualized environments, even with I/O bound applications.

## TOOLS AND UTILITIES ENHANCEMENTS

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In addition to the hardware and virtualization features included in Red Hat Enterprise Linux 5.5, there are also a large variety of fixes and enhancements to many of the other operating system components. This section is a brief summary of the highlights.

- **Interoperability advancements**

- **OpenOffice** - has been updated to version 3.1, providing support for the Microsoft Office 2007 and OOXML formats.
- **Samba** - version three of this file and print sharing subsystem has been enhanced for Windows Server 2008 R2 interoperability.

- **Infrastructure enhancements**

- **Freeradius** - updated to version 2.1 providing 802.1 certificate support
- **PostgreSQL** - updated to version 8.4 affording performance enhancements
- **LVM** - the Logical Volume Management storage suite has been augmented to provide hot sparing for mirror journals, enabling automatic replacement or removal of failed logging devices.
- **Kernel tracepoints** - have been added in the network and signal subsystems. These provide pre-configured diagnosis points that have been integrated with the SystemTap tracing tool.

- **Development tool features**

- **SystemTap** - profiling and tracing utility has been augmented to better support C++ application probing. An unprivileged mode that permits use by non-root users has also been added.
- **GDB** - debugger has been enhanced for better C++ application monitoring as well as independent thread debugging.
- **Valgrind** - memory tracking toolset benefits from performance speedups and enhanced detection of race conditions and memory leaks.



## CONCLUSION

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Red Hat Enterprise Linux 5.5 continues the progression of the Red Hat Enterprise Linux 5 family by providing industry-leading enablement for the ground-breaking new hardware systems and processor chipsets with their supporting baseboard components.

Red Hat Enterprise Linux customers will be able to deploy Red Hat Enterprise Linux 5.5 on the latest generation of hardware, fully optimized, on the first day of system availability in March 2010. Complete application compatibility across all Red Hat Enterprise Linux 5 updates means that customers can take advantage of the significant performance and scalability enhancements provided in 5.5 without having to rebuild and re-certify their application stack—and so harness the true value of the Red Hat Enterprise Linux ecosystem. Customers can securely deploy Red Hat Enterprise Linux 5 with the knowledge that the most stringent levels of application compatibility and stability are safeguarded with their certified solution stacks.

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