



# RED HAT® ENTERPRISE LINUX® 4

The defining milestone in the evolution of the enterprise platform

## OVERVIEW

In 2002, it marked the arrival of Linux in the enterprise. In 2003, it matched UNIX for reliability and surpassed it in value. Today Red Hat Enterprise Linux, with the introduction of version 4, has the reliability, performance, and security to signal the end of the proprietary platform in the enterprise.

Red Hat Enterprise Linux delivers the full value of open source. How? Through a common code base from desktop to datacenter, a subscription model that delivers constant value, and a development model that prevents vendor lock-in and fosters innovation.

That's why a study by *CIO Insight* ranked Red Hat the best company in the IT industry at delivering value to customers—#1 at lowering IT costs, #1 at meeting ROI expectations, and #1 at overall value.

The evolution of standards-based computing platforms has reached a defining milestone. As the platform of choice for every major OEM and ISV, Enterprise Linux 4 will accelerate the rapid spread of Linux already underway.

Red Hat Enterprise Linux 4 provides benefits in four key areas:

- **A stable and mature infrastructure based on the Linux 2.6 kernel**
- **Technologies to meet today's security and compliance demands**
- **Productivity improvements from the desktop to the core of the datacenter**
- **Exceptional performance and scalability for both 32- and 64-bit workloads**

## A STABLE AND MATURE INFRASTRUCTURE BASED ON THE LINUX 2.6 KERNEL

Based on the Linux 2.6 kernel, Red Hat Enterprise Linux 4 represents the most stable and mature commercial Linux available. Red Hat proved the enterprise-class readiness of much of the 2.6 kernel technology in the Enterprise Linux 3 release. As a result, Red Hat Enterprise Linux 4 includes mature technology deployed successfully by many Red Hat customers and incorporates a number of key improvements, based on Red Hat's engineering efforts and collaboration with the open source developer community.

## TECHNOLOGIES TO MEET TODAY'S SECURITY AND COMPLIANCE DEMANDS

### SELinux

Red Hat Enterprise Linux 4 is the preferred platform for the most demanding security organizations in the world. Security Enhanced Linux is a completely new subsystem in Enterprise Linux and provides a superior security framework to what is available in traditional commercial IT operating environments. SELinux, developed with the U.S. National Security Agency, implements policy-based mandatory access controls to achieve more fine-grained security measures and greater flexibility compared to discretionary access control mechanisms. Privileges and policies for each service are specified rather than relying on the simple paradigm of users, groups, and a single centralized superuser account. Red Hat Enterprise Linux 4 has integrated SELinux with a dozen common Internet facing services including BIND, Network Time Protocol (NTP), and Apache so that the benefits can be leveraged easily and widely. Organizations with extreme security demands can choose to implement more comprehensive SELinux capabilities across more applications and even impose a strict SELinux policy across every service provided.

# RED HAT ENTERPRISE LINUX

## RED HAT ENTERPRISE LINUX 4—THE FIRST COMMERCIAL PRODUCT TO DELIVER SELINUX—IS THE PLATFORM OF CHOICE FOR THE MOST SECURE ORGANIZATIONS IN THE WORLD.

### Enhanced auditing framework

Red Hat Enterprise Linux 4 incorporates the new standard auditing framework for Linux systems. This framework offers considerable flexibility so that system calls and their arguments can be filtered by user, group, process, and device with a variety of options. This rigorous approach makes robust event monitoring and detection solutions possible.

### EAL4+ Certification

In August 2004 Red Hat Enterprise Linux 3 achieved Controlled Access Protection Profile compliance under the Common Criteria for Information Security Evaluation (CC), commonly referred to as CAPP/EAL3+. Red Hat continues to pursue higher levels of assurance by submitting Red Hat Enterprise Linux 4 for EAL4+ compliance. EAL4+ assures organizations that Red Hat Enterprise Linux has been designed, reviewed, and tested to standard security engineering practices. For more information about Red Hat certifications and roadmap, visit <http://www.redhat.com/solutions/industries/government/commoncriteria>.

## PRODUCTIVITY IMPROVEMENTS FROM THE DESKTOP TO THE CORE OF THE DATACENTER

### Client applications

Red Hat Enterprise Linux 4 includes core desktop applications such as:

- Firefox™, the new web browser that is taking the world by storm
- OpenOffice, a high-productivity, multi-platform, open source office suite
- Evolution™, the most popular email and calendaring solution for Linux

In addition, popular media applications such as Real Player® and Acrobat Reader® are included. Citrix® and the open source Rdesktop application allow users to connect to a Windows terminal server to achieve heterogeneous remote desktop solutions.

Red Hat now delivers support for 15 languages, as well as the most advanced input method technology to handle a wide variety of character formats for international deployments.

### GNOME™ 2.8

The GNOME 2.8 desktop suite and development platform delivers a number of enhancements including:

- Usability improvements for users and administrators of client and server capabilities
- Automatic detection of local servers and removable devices such as USB devices
- Faster interactive response

### Hardware support

Red Hat Enterprise Linux 4 includes a new Hardware Abstraction Layer that provides robust plug-and-play hardware support. Support for a wide variety of new peripherals has been incorporated into Red Hat Enterprise Linux 4.

The Advanced Configuration and Power Interface (ACPI 2.0) enables more rigorous power management and device support. With ACPI new hardware is easily recognized so that installation is much simpler. ACPI also provides power management features that benefit dense server deployments or laptop environments.

### Interoperability

Samba – Red Hat Enterprise Linux 4 includes Samba 3.0 for interoperability with Windows file sharing and printing using the SMB/CIFS standards. The GNOME desktop environment automatically discovers available Windows file shares and print services on the local area network.

Red Hat Enterprise Linux 4 also provides the ability to integrate with Active Directory infrastructures. Active Directory authentication and a Microsoft Exchange® connector have been integrated into Red Hat Enterprise Linux 4.

Red Hat Enterprise Linux 4 is an ideal platform for anyone using NIS, kerberos, NFS, SMB/CIFS, or LDAP across a heterogeneous environment.

### Provisioning through Red Hat Network

Red Hat's system management solution Red Hat Network (RHN) provides enterprise-class technologies for deploying and managing Linux systems. Capabilities for provisioning and deployment have been available since early 2004 and are being used widely to eliminate the administration burden with large installations. These technologies can be used with all releases of Red Hat Enterprise Linux but have been enhanced for integration with the Red Hat Enterprise Linux 4 release.

### EXCEPTIONAL PERFORMANCE AND SCALABILITY

Red Hat Enterprise Linux 4 improves performance and scalability with the following features:

#### Ext3 filesystem and Logical Volume Manager 2 (LVM2)

Ext3, the journaled filesystem used in the vast majority of commercial Linux deployments, is the default filesystem in Red Hat Enterprise Linux. Major enhancements made in Red Hat Enterprise Linux 4 based on the new block reservation capability improve both read and write I/O performance. This enhancement benefits workloads that frequently access large files such as databases. Other Ext3 improvements include a new hash-tree algorithm that enables faster file accesses in large directories and more efficient synchronization and locking to increase SMP performance.

Red Hat Enterprise Linux 4 also includes LVM2, a new version of the logical volume manager, which allows online growth of filesystems for easier management of storage resources.

#### Virtual memory subsystem

Improvements in the virtual memory subsystem have been incorporated into Red Hat Enterprise Linux 4 to better address mission-critical workloads with large memory configurations, such as database deployments. Default parameters have been refined so that virtual memory performance is more deterministic as memory use increases. New features also allow the kernel to map through data structures more efficiently and reduce paging.

**RED HAT ENTERPRISE LINUX IS THE IDEAL PLATFORM FOR 64-BIT COMPUTING. WHEN YOU'RE READY, CHANGE A 32-BIT SYSTEM TO 64-BIT AS PART OF YOUR SUBSCRIPTION. WITH ONE CLICK IN RED HAT NETWORK, YOU GET TWICE THE POWER.**

#### I/O subsystem

Red Hat Enterprise Linux 4 provides a new block I/O layer that improves I/O performance and scalability. This new more efficient implementation requires less overhead for I/O operations and yields performance gains that are particularly noticeable with applications that write large files. In addition, the new sub-system allows larger disk partitions to be used. Red Hat Enterprise Linux 4 includes four I/O scheduler options to optimize system performance:

- *Complete Fair Queue (CFQ) scheduler* – manages I/O requests and bandwidth per process, providing solid performance across workloads that require low-latency and high-throughput demands.
- *Deadline scheduler* – implements a per request model ideal for applications like databases that require frequent disk access.
- *Anticipatory scheduler* – adds heuristics to the deadline scheduler to reorder I/O accesses and increase throughput.
- *No-op scheduler* – performs no reordering of I/O accesses. Optimal for use in a virtualized environment where an underlying scheduler is assumed to be present.

#### Processor scheduler for hyperthreaded and multicore devices

Previous releases of Red Hat Enterprise Linux provided support for hyperthreaded CPUs. Red Hat Enterprise Linux 4 provides a more refined generic logical processor task scheduler that accommodates both hyperthreaded and/or multicore technologies. Hyperthreading enables applications to finish tasks more quickly by executing multiple threads in parallel on a single processor. Multicore capabilities achieve a similar result across multiple processing units in a single physical device.

## SMP and NUMA

A number of scalability enhancements have been incorporated into Red Hat Enterprise Linux 4 that improve performance for applications using threads. These benefits apply regardless of whether hyperthreading is used and what type of machine is deployed—uniprocessor, Symmetric Multi Processor (SMP), or Non-Uniform Memory Architecture (NUMA) machines. Algorithms have been streamlined so that kernel data structures can be accessed more efficiently when they are read and updated by multiple sources.

Non-Uniform Memory Architecture (NUMA) support provides greater performance on multiprocessor systems where memory is partitioned between CPUs or groups of CPUs. This is particularly applicable in high CPU count systems but also provides gains for 2-way Opteron and Itanium processor-based systems. NUMA technology allocates memory for processes more efficiently and a NUMA API provides tighter coupling so that applications can inform the OS where memory should be allocated. This reduces both latency and contention for resources to improve overall application performance.

## PCI Express

Support for the PCI Express interconnect standard enables faster I/O and enables more efficient SMP machines.

## Networking components

Red Hat Enterprise Linux 4 provides support for NFSv.4, the newest version of the NFS (Network File System) protocol. The ability to share and mount other filesystems through the NFS protocol is one of the most critical capabilities in any Linux system. NFSv.4 improves network performance through more refined file locking and by delegating file operations to a client when a file is being accessed solely by that client. NFSv.4 also provides better support for ACLs (Access Control Lists) and other security features.

## RED HAT SALES AND GENERAL INQUIRIES

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## AutoFsv.4

The automounter enables scalable, flexible deployment of network file systems across your enterprise. This latest version of the Linux automounter achieves a new level of performance and stability for mounting filesystems while running mission-critical workloads.

Red Hat Enterprise Linux offers better network response under high loads with the New API (NAPI). The New API avoids congestion by taking advantage of polling as network load increases and returning to an interrupt mechanism as the load decreases. This is particularly useful for systems with Gigabit Ethernet links.

## GCC 3.4

Red Hat Enterprise Linux 4 is built using the latest version of the industry-standard GNU Compiler Collection toolchain. A number of enhancements are provided in GCC 3.4 for ISV developers and those deploying applications. Portability is eased significantly due to greater standards compliance. The toolchain also provides capabilities for 32-bit applications to run on 64-bit systems and yields better overall optimization, particularly on 64-bit architectures. Fortran 95 support has been incorporated to GCC 3.4 as well.

Red Hat Enterprise Linux 4 includes compatibility libraries that enable applications that were previously certified on the versions 2.1 and 3 to run without recompilation. Third-party applications can be certified on version 4 using the existing binary executable with the compatibility libraries or using a recompiled binary that will benefit from the new capabilities in the release.

## SYSTEM CAPACITY LIMITS

Red Hat is continually testing and qualifying Red Hat Enterprise Linux on a variety of systems. Please refer to <http://www.redhat.com/software/rhel/configuration> for the latest information on supported system configuration details like the number of CPUs or the amount of memory supported for each Red Hat Enterprise Linux release.