



Mission Critical Operating System Red Hat Enterprise Linux With PRIMEQUEST

With rigorous security, high quality, and good scalability, Red Hat Enterprise Linux is a best-in-class mission critical operating system. Fujitsu provides an entire system support using mission critical PRIMEQUEST servers and Red Hat Enterprise Linux.

Misunderstandings about Linux

In enterprise servers UNIX has been seen as the standard mission critical OS. Many customers believe non-UNIX OS based systems do not qualify as enterprise platforms. They are likely to believe Linux quality, performance, and security is lower than UNIX OS.

Fujitsu knows Linux is one of the best mission critical OS because it has been selling Enterprise Linux with PRIMEQUEST for enterprise systems since 2005. This datasheet shows how Fujitsu and Red Hat can offer high-level security, high-quality, and high scalability platforms using the combination of PRIMEQUEST and Red Hat Enterprise Linux.

What Red Hat Enterprise Linux and PRIMEQUEST from Fujitsu can offer to enterprise customers

- (1) **High level security**
It is no exaggeration to say that Red Hat Enterprise Linux is a safer OS than AIX and HP-UX. In comparisons using NIST's database ^(*1), it has fewer security weakpoints than AIX or HP-UX. With fewer security weak points, hackers have much less opportunity to find backdoors to enter a PRIMEQUEST system.
- (2) **High quality**
The combination of PRIMEQUEST and Red Hat Enterprise Linux creates a high quality server. Fujitsu knows this through customer experience.

One of the largest telecom service providers in Brazil, Vivo, and the third largest stock exchange in the world, Tokyo Stock Exchange, use PRIMEQUEST and Red Hat Enterprise Linux. Both of the systems have been operated without disruption from their installation.

Linux source code is being maintained by over 6,000 programmers (average in period 2005 to 2010). Such peer review by thousands of eyes, maintains the open source OS high quality.

- (3) **High scalability**
Resource scalability is comparable to high-end UNIX servers.

The combination of PRIMEQUEST and Red Hat Enterprise Linux supports up to 8 CPU chips/160 threads and 4TB memory. With such resource expansion its performance excels. Red Hat Enterprise Linux 6 has further improved its I/O throughput performance by 3.3 times of Red Hat Enterprise Linux 5.5.

*1 National Institute of Standards and Technology (NIST) manages the National Vulnerability Database, which records security problems and measures for all commercial OS.

Features and benefits

Main features	Benefits
<p>The most rigorous OS</p> <ul style="list-style-type: none">■ Fewer vulnerabilities and lower average vulnerability severity than UNIX OS■ Practical hack prevention well-blended in to the OS –application code change or re-compilation is required■ No Trusted Extensions required as high security features are already embedded in Red Hat Enterprise Linux	<ul style="list-style-type: none">■ Just choosing Red Hat Enterprise Linux frees customers from security threats■ Upgrading security does not require extra costs for application changes or system reconfiguration
<p>High quality</p> <ul style="list-style-type: none">■ Proven the highest quality based on no entire system downs caused by OS problems■ Problems related to both applications and OS can be detected at an earlier stage of their development, than UNIX OS. Application programmers can find problems related to OS more easily with Linux than with UNIX because the availability of Linux source code is very helpful	<ul style="list-style-type: none">■ Choosing PRIMEQUEST and Red Hat Enterprise Linux means a no system down server platform■ Application problem prevention is easier with Red Hat Enterprise Linux
<p>High performance and scalability</p> <ul style="list-style-type: none">■ Performance growth has skyrocketed with Red Hat Enterprise Linux 6, with 3.3 times the I/O throughput of Red Hat Enterprise Linux 5.5	<ul style="list-style-type: none">■ Ability to enjoy high enterprise application performance with the latest Red Hat Enterprise Linux OS
<p>Development and administration expertise around the Globe</p> <ul style="list-style-type: none">■ Rich human resource pool of application development and administration personal which has doubled in four years	<ul style="list-style-type: none">■ No concerns about seeking application developers and system administrators
<p>Entire system support</p> <ul style="list-style-type: none">■ Fujitsu is able to support the entire system including server hardware, OS, virtualization products, storage products, and cluster software. Support for PRIMEQUEST and Red Hat Enterprise Linux are included. Red Hat Enterprise Linux has a sufficiently long support period.	<ul style="list-style-type: none">■ Swift root-cause resolution of problems by collaboration between Fujitsu and Red Hat■ Fujitsu can help you solve complex system problems that are server hardware and software product related■ Long OS support can help you sustain your system's high reliability and security

Topics

Charms of Linux

Linux has been attracting programmers around the world. Its programmer population has doubled between Jan. 2006 and Jan. 2010, while the HP-UX programmer population has changed little during the ups and downs of the same period. Customers who have chosen Linux for their server platform are in a favorable position for acquiring well-trained programming resources, so they can enjoy more cost-efficient development.



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Where did this difference come from?

Linux is a sum of continuous voluntary activity by many individuals and organizations. According to Linux Foundation's report titled "Linux Kernel Development How Fast it is Going, Who is doing it, What They are Doing, and Who are Sponsoring it" (*1), 6,311 individuals and 656 organizations have participated in at least one of 25 releases from 2005 March (kernel version 2.6.11) to 2010 July (kernel version 2.6.35). No other commercial OS has such huge kernel development human resources. Linux continues with its release of OS enhancements version around once every 2.6 months. It's no doubt, they are the core of growth.

Fujitsu's and Red Hat's Contributions to the Linux Community

Fujitsu and Red Hat have been dedicated to upgrading the Linux kernel's quality and functionality so that the OS can be widely used with commercial systems. This has had special focus on mission critical systems. Red Hat modified and added 12 per cent of Linux kernel source code at kernel version 2.6.30. This was the largest contribution of all organizations. Fujitsu's contribution was the 9th largest in the same kernel version.

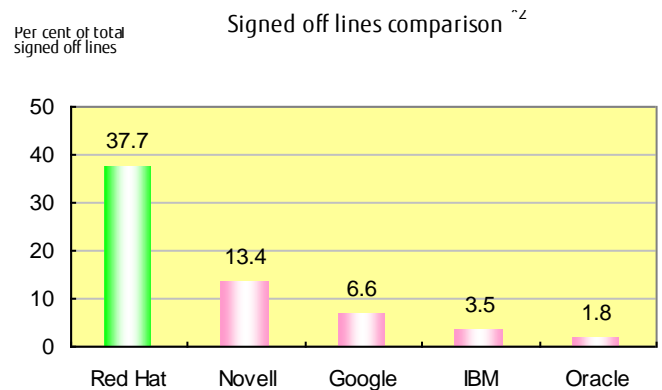
These contributions were not limited to development, but included sustaining Linux's high quality. Red Hat well understands that "source code review" plays a crucial role in sustaining software quality at the highest level. "Source code review" is a process of discussing program logic on a step-by-step basis to eliminate software problems.

The Linux kernel is finalized through the review processes below:

- The entire kernel is divided into over 100 sub-system trees
- One maintainer is assigned to manage each sub-system tree
- Maintainers sign off modified or added lines one by one

Linux Foundation defines the "sign off" as "A statement that the patch is legally incorporated into the kernel."

Red Hat signed off 37.7 per cent of all source code lines signed off in kernel version 2.6.30. This was the largest contribution of all organizations ~3 times that of Novell, ~6 times that of Google, ~11 times that of IBM, ~20 times that of Oracle.



*1 For further details, please refer to the report below. http://www.linuxfoundation.org/docs/lf_linux_kernel_development_2010.pdf

*2 This graph refers to "Who is Reviewing the Work of Linux Kernel Development, How Fast it is Going, Who is doing it, What They are Doing, and Who are Sponsoring it?"

High Security of Red Hat Enterprise Linux

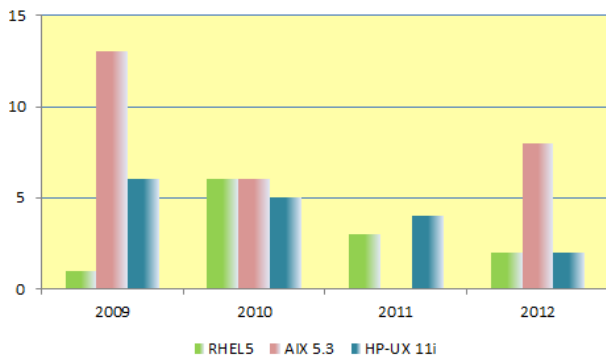
Red Hat Enterprise Linux is a high-security OS. According to the National Vulnerability Database (NVD) *1 of the National Institute of Standards and Technology (NIST), Red Hat Enterprise Linux 5 has less vulnerability than AIX5.3 or HP-UX 11i. This is the consistent fact about security problems managed by the US Federal agency in the period 2009 to 2012.

- (2009) One vulnerability records for Red Hat Enterprise Linux 5, 13 records for AIX 5.3, 6 records for HP-UX 11i
- (2010) 6 vulnerability records for Red Hat Enterprise Linux 5, 6 records for AIX 5.3, 5 records for HP-UX 11i
- (2011) 3 vulnerability records for Red Hat Enterprise Linux 5, no record for AIX 5.3, 4 records for HP-UX 11i
- (2012) 2 vulnerability records for Red Hat Enterprise Linux 5, 8 records for AIX 5.3, 2 records for HP-UX 11i

Table Number of Vulnerability Transitions (2009 - 2012)

	2009	2010	2011	2012	Four year total
RHEL 5	1	6	3	2	12
AIX 5.3	13	6	-	8	27
HP-UX 11i	6	5	4	2	17

Figure Number of Vulnerability Transitions (2009 ~ 2012)
Number of vulnerabilities



*1 For the NVD, visit <http://nvd.nist.gov/>

Based on vulnerability severity scored by NIST, the average for Red Hat Enterprise Linux 5; 5.53 is much lower than that for AIX5.3 ;7.0 and HP-UX 11i ;5.87.

- (2009) 5.0 for Red Hat Enterprise Linux 5, 7.47 for AIX5.3, 5.95 for HP-UX 11i
- (2010) 4.47 for Red Hat Enterprise Linux 5, 7.35 for AIX5.3, 6.02 for HP-UX 11i
- (2011) 7.13 for Red Hat Enterprise Linux 5, no record for AIX5.3, 6.2 for HP-UX 11i
- (2012) 6.55 for Red Hat Enterprise Linux 5, 6.0 for AIX5.3, 4.55 for HP-UX 11i

This result means the impacts of the security threats are lower for Red Hat Enterprise Linux5 than for AIX5.3 and HP-UX 11i. Fewer vulnerabilities and lower impact of the vulnerability mean rigorous security in Red Hat Enterprise Linux.

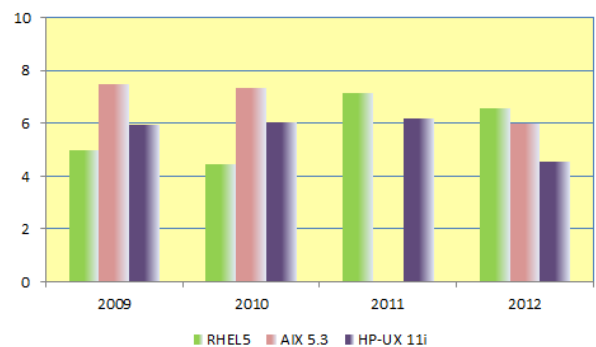
Looking at these facts from another aspect, you will find Red Hat Enterprise Linux has quality comparable to or higher than that of AIX5.3 and HP-UX 11i. In actuality, system hackers repeatedly exploit system weak points.

Table Average Severity Transitions (2009-2012)

	Average	2009	2010	2011	2012
RHEL 5	5.53	5	4.47	7.13	6.55
AIX5.3	7	7.47	7.35	-	6.0
HP-UX 11i	5.87	5.95	6.02	6.2	4.55

Figure Average Severity Transitions (2009-2012)

Average severity

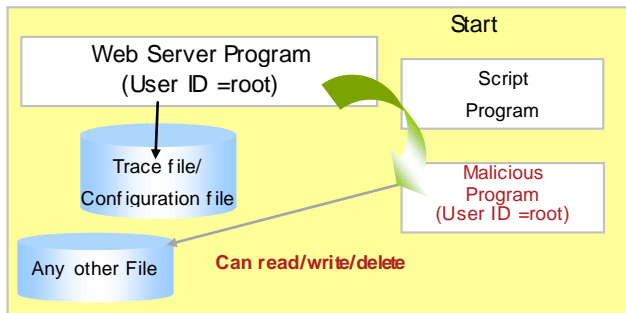


Secure systems require less vulnerable OS. But the reverse is not always valid. Adding to Red Hat Enterprise Linux' high quality is its hacking prevention mechanism which is simple to implement. Some UNIX OS also have security mechanisms for expelling hackers. But customers have to pay high costs for this higher security – for instance, the urging of customers to modify their applications to follow secure Roll Base Access Control. This is because applications must follow the new account policy to enable the enhanced security.

By contrast Red Hat Enterprise Linux is able to prevent hacking without application change.

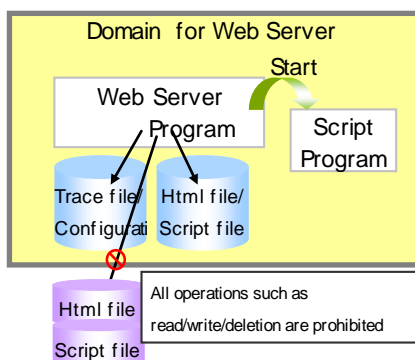
- (Type Enforcement) Application is assigned a portion of file system called Domain
- (Role Based Access Control) Users are assigned a privilege for accessing the Domain – writing, reading, executing

Let's take Web server for an example. Typically hackers steal the highest-privilege root account the Web server is using and change the file content maliciously. Many web servers access configuration or trace files using the root account, so they are easy targets for hackers. UNIX OS security mechanism urges customers to use another set of user accounts with limited privileges. No root account can be used there. So application rewriting is required for higher security.



By choosing Red Hat Enterprise Linux, you can just define the Web server Domain and expel hackers from your backyard. Actually, you only have to define the Web server configuration, trace, and html files in the Web server Domain. Then, accesses to files not on the Domain is rejected even if a hacker steals the root account from the Web server

So, even if a hacker intrudes on the Web server, the worst-case damage is restricted to the Web server.



High Quality of Red Hat Enterprise Linux

Fujitsu prides itself that PRIMEQUEST and Red Hat Enterprise Linux are the best blend for high quality operation. In the survey period from the launch of PRIMEQUEST in 2005 April to 2011 June, no customer using PRIMEQUEST in combination with the Red Hat Enterprise Linux has experienced a "severity one" problem caused by the Linux OS. That means Red Hat Enterprise Linux has the proven highest reliability which has not experienced a series system interruption in combination with PRIMEQUEST.

From its system commencement in 2008, the Tokyo Stock Exchange has been using PRIMEQUEST as its transaction platform. Its stable operation is a boon to that customer.

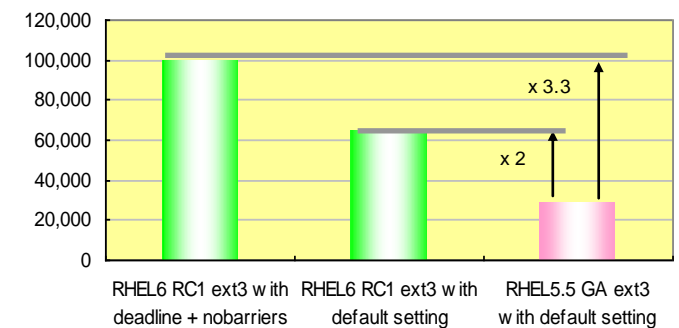
Linux smart problem analysis tools support its high quality. Fujitsu has helped in the development of those tools including kdump.

High Scalability of Red Hat Enterprise Linux

- I/O throughput

Red Hat Enterprise Linux 6 improve I/O performance compared to version 5.5. Red Hat Enterprise Linux 6 has almost double the I/O performance. Tuning the disk I/O access parameters can grow I/O throughput further. The I/O throughput of Red Hat Enterprise Linux 6 can grow up to 3.3 times of Red Hat Enterprise Linux 5.5. The 3.3 times performance improvement is a result of parameter settings. I/O Elevator = deadline and deactivation of file system I/O barriers.

File Access Throughput Comparison of RHEL 6.0 and 5.5



*1 For details, refer to the following Red Hat report.

http://www.redhat.com/f/pdf/2010_AIM_Reference_Architecture_V1_11-2010.pdf

Fujitsu's Entire System Support

Server technology innovation, like virtualization, affects server maintenance. The upside is cost-efficiency through use of server virtualization. The downside is the resulting "who-supports-what" problem. If virtualization products, guest OS, and server hardware are all supported by different vendors, who will take responsibility for isolating the problem and escalating it to relevant vendor?

Fujitsu's unchanging policy of customer cares greatly eases such pain. Fujitsu is able to provide total system care, including server hardware, OS, virtualization products, storage products, and cluster software.

Fujitsu's entire system support can also be distinguished from the one-stop services many vendors are insisting they can offer.

First, Fujitsu can resolve system problems concerning multiple products at the earliest possible time. Fujitsu incorporates quality assurance of the entire system in its production processes before delivery. By use of high load and long-run tests, any complex system problems can be easily detected. Knowledge obtained from such tests is shared with all members of the Fujitsu Group. You as the customer can therefore receive the best of care and support for your entire system from Fujitsu.

Second, Fujitsu can be your best advisor in planning long-term stable and growth capable systems. With its rich variety of products including as mission critical server, OS, cluster software, and virtualization products, Fujitsu can suggest the best choice for meeting your demands for high-availability, performance, and flexibility.

Fujitsu's support service (including Red Hat Enterprise Linux) is also result of Fujitsu's broad and deep knowledge of server, OS, virtualization products, and cluster software.

- Fujitsu can offer emergency measures for system rescue
- And technical advice on avoiding system problems including compounded product problems

Fujitsu can deliver adequate long-term support for Red Hat Enterprise Linux.

More information

Fujitsu platform solutions

In addition to Fujitsu PRIMEQUEST 1800E2, Fujitsu provides a range of platform solutions. They combine reliable Fujitsu products with the best in services, know-how and worldwide partnerships.

Dynamic Infrastructures

With the Fujitsu Dynamic Infrastructures approach, Fujitsu offers a full portfolio of IT products, solutions and services, ranging from clients to datacenter solutions, Managed Infrastructure and Infrastructure-as-a-Service. How much you benefit from Fujitsu technologies and services depends on the level of cooperation you choose. This takes IT flexibility and efficiency to the next level.

Computing products

www.fujitsu.com/global/services/computing/

- PRIMERGY: Industrial standard server
- SPARC Enterprise: UNIX server
- PRIMEQUEST: Mission-critical IA server
- ETERNUS: Storage system

Software

www.fujitsu.com/software/

- Interstage: Application infrastructure software
- Systemwalker: System management software

More information

Learn more about Fujitsu PRIMEQUEST, please contact your Fujitsu sales representative, Fujitsu business partner, or visit our website.
www.fujitsu.com/primequest/

Fujitsu green policy innovation

Fujitsu Green Policy Innovation is our worldwide project for reducing burdens on the environment. Using our global know-how, we aim to resolve issues of environmental energy efficiency through IT. Please find further information at:
www.fujitsu.com/global/about/environment/



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