
POWER
RESET
Appro 1122Hi

64-bit Linux servers prove their mettle in our Web-server performance tests, but choose your software carefully

Little Big Iron

WITH THE ARRIVAL of the AMD Opteron and Intel Itanium, commodity servers built on these processors have joined proprietary RISC systems from IBM, Sun Microsystems, Hewlett-Packard, and others in the 64-bit landscape. With prices starting at just over $2,000, Opteron and Itanium systems — running Linux or Windows — are already carving out a niche in high-performance computing clusters, where they are used to run compute-intensive scientific- and financial-modeling applications. Eventually they will replace their 32-bit forebears in corporate datacenters, and clusters of them may even challenge 64-bit Unix systems costing hundreds of thousands of dollars.

How long this will take depends on software vendors, who must rewrite their applications for the new 64-bit CPUs. Many operating systems are already available for Opteron and Itanium. In addition to Red Hat Enterprise Linux AS 2.1, which supports Itanium, and SuSE Linux Enterprise Server, which supports both Itanium and Opteron, there is an Itanium version of Windows Server 2003, and Itanium and Opteron versions of Turbolinux Enterprise Server 8. Databases such as IBM DB2 and Oracle 9i, and application servers from IBM, Oracle, and BEA Systems should begin to be available this year. But enterprise app vendors, with the exception of SAP, have been slow to commit to a road map of support.

Ultimately, the appeal to business software vendors and customers alike will depend on performance. Compared to the previous generation of 32-bit systems based on AMD's Athlon MP and Intel's Xeon MP, the Opteron and Itanium CPUs support much more memory per processor, higher-speed connections between memory and the CPU, and faster interprocessor communications. To

BY LOGAN G. HARBAUGH PHOTOGRAPHY BY MARK JOHANN

what extent do these advantages translate into real performance gains? To find out, I looked at Web server performance on four 64-bit Linux systems, including an Itanium 2 server from HP and Opteron systems from Appro, Newisys (a company partly funded by AMD), and Pogo Linux.

There are many other types of benchmarks that could have been used here, but all are subject to various problems, including finding code that will run on both Itanium and Opteron processors; that is optimized for 64-bit operation; and that is not associated with some major player. Because system and database benchmarks are typically oriented to a specific type of hardware or operating system, I compared the systems based on Web server performance, using the industry-standard Apache Web server, which was included as part of the standard release of Linux on all four systems, as well as Zeus Technologies' Zeus Web Server.

The Appro 1122H bested the competition in price and performance.

Load testing these Web servers on the four systems produced interesting results. First, Web-server performance on these systems was substantially better than on the 32-bit Xeon hardware I compared them against, suggesting that IT shops would benefit from migrating their Web server farms to 64-bit systems today. Second, Apache performance on Itanium was abysmal compared to Zeus performance; if you're considering Itanium for Web serving, go with the Zeus Web server. Third, the performance differences between Apache and Zeus on Itanium point to the need for software that not only runs on 64-bit hardware, but is optimized for it.

Finally, regarding the four systems tested, all proved to be solid machines. Among the Opteron units — all 1U boxes — the Appro and Pogo Linux systems offer great value and horsepower for the price, while the Newisys offers a more substantial feature set, including a management card and hot-swap SCSI drives. The Itanium-based HP system, a 2U box, offers great expandability and redundant everything, albeit at a higher price.

Three Little Opterons

The Opteron has one advantage over the Itanium: It can run 32-bit applications in native mode, while the Itanium runs 32-bit applications in emulation mode. This means legacy 32-bit applications will run slower on the Itanium than on Xeon systems or Opteron. It also means that applications can be ported to Opteron gradually, weaving in 64-bit support compo-

Appro 1122H

Appro International appro.com

VERY GOOD 7.3

Performance (25%)	9
Scalability (25%)	7
Availability (20%)	6
Management (10%)	7
Serviceability (10%)	6
Value (10%)	8

COST: $2,295 as tested

BOTTOM LINE: **The Appro 1122H produced the highest numbers in our performance testing. It also scored points with an easy-entry case, the inclusion of rack-mount rails, and the lowest price tag in our review. This system is ideal for clustered environments.**

Integrity Server rx2600

Hewlett-Packard hp.com

VERY GOOD 7.9

Performance (25%)	6
Scalability (25%)	9
Availability (20%)	8
Management (10%)	9
Serviceability (10%)	9
Value (10%)	7

COST: Starts at $5,401; $20,293 as tested

BOTTOM LINE: **HP's Itanium-based rx2600 is an enterprise-oriented system with rock-solid engineering, redundant features throughout, lots of expandability, and all parts geared for performance. With its hefty price tag, the rx2600 is more suitable for deploying one or two higher-reliability systems than for clustering.**

Newisys 2100 Server

Newisys newisys.com

VERY GOOD 7.5

Performance (25%)	8
Scalability (25%)	8
Availability (20%)	6
Management (10%)	8
Serviceability (10%)	8
Value (10%)	7

COST: $2,995 recommended price

BOTTOM LINE: **The Newisys 2100 is not directly available from Newisys, but from resellers. It offers a substantial feature set, including hot-swap SCSI drives, four Ethernet interfaces, two PCI slots rather than one, and a management blade that adds remote management capabilities.**

PerformanceWare 1264

Pogo Linux pogolinux.com

VERY GOOD 7.1

Performance (25%)	7
Scalability (25%)	7
Availability (20%)	8
Management (10%)	6
Serviceability (10%)	6
Value (10%)	8

COST: $2,489 as tested

BOTTOM LINE: **The PerformanceWare 1264 offers excellent value from an established Linux server vendor. The system's case does require a screwdriver to open, and drives are neither hot-swap nor easily removable, but craftsmanship and performance are good.**

64-Bit Linux Servers

HP's Itanium-based Integrity Server boasted the richest feature set by far and price tag to match, but the three Opteron systems had the edge in performance.

	CPUs (NUMBER AND TYPE)	CLOCK SPEED (GHz)	RAM STD/MAX (GB)	DRIVE INTERFACES	NETWORK INTERFACES	POWER SUPPLIES	PCI-X EXPANSION SLOTS	LINUX DISTRIBUTION	LINUX KERNEL	PRICE
APPRO 1122H	2 Opteron	1.6	2/16	2 ATA	2 10/100/1000	1	1 133MHZ/64-bit	SuSE Linux Enterprise Server 8	2.4.19-SMP	$2,295
INTEGRITY SERVER RX2600	2 Itanium	1	4/24	3 Ultra320 SCSI RAID*	2 10/100, 1 10/100/1000, 1 1000 Fiber	2*	4 133MHZ/64-bit	Red Hat Enterprise Linux AS 2.1	2.4.18-E.12 SMP	$20,293
NEWISYS 2100 SERVER	2 Opteron	1.8	4/16	2 Ultra320 SCSI*	2 10/100, 2 10/100/1000	1	1 133MHZ/64-bit, 1 66MHZ/64-bit	SuSE Linux Enterprise Server 8	2.4.19-SMP	$2,995**
PERFORMANCEWARE 1264	2 Opteron	1.6	1/16	2 ATA	2 10/100/1000	1	1 133MHZ/64-bit	SuSE Linux Enterprise Server 8	2.4.19-SMP	$2,489

NOTES: *HOT-SWAPPABLE COMPONENT **RECOMMENDED PRICE FOR OEM SYSTEM

nent by component, without requiring a wholesale rewrite before deployment.

Each of the three Opterons I tested ran SuSE Linux's Enterprise Server, while the Itanium system from HP ran Red Hat's Enterprise Linux AS. All four systems came with Apache installed; I also installed Zeus Web Server 4.2r2, which is optimized for both Opteron and Itanium.

The Appro 1122H is a value-oriented 1U server, available with two 1.6GHz or 1.8GHz Opteron processors, up to 16GB of RAM, one or two ATA or SCSI drives, and two 10/100/1000 Ethernet interfaces. My test unit came with two 1.6GHz processors, 2GB of RAM, one 80GB ATA hard drive, and SuSE Linux Enterprise Server already installed.

The Appro system produced the best performance by a slight margin across all my tests — despite having the lowest price tag of the bunch. The case is nicely put together and required no tools to gain entrance. It was the only system that included rack-mount rails, which were well-engineered. On the downside, the power button is tiny and hard to press, and the keyboard and mouse ports were not labeled.

The next-best performer was Pogo Linux's PerformanceWare 1264. Pogo Linux has been specializing in Linux systems for several years, and the PerformanceWare 1264 is typical of their product line — well-engineered with no frills. At $2,489, it's nearly as affordable as the Appro system, and it's solidly in the middle of the Opterons in performance. As tested, the system included two Opteron 1.6GHz processors, just 1GB of RAM, a 40GB ATA hard disk, and two 10/100/1000 Ethernet ports.

HP's Integrity Server rx2600 lagged slightly in performance but scored highly with extras.

The PerformanceWare was the only one of the four systems that required a screwdriver to open the case, and the only one with drives that couldn't be removed without opening the box. The interior of the system is laid out well, with solid airflow controllers and dual fans.

Interestingly, although the Newisys 2100 Server had faster processors, a faster hard drive, and more RAM than the others, it recorded the lowest performance of the three Opteron systems, though only by 2 percent to 3 percent in most of the tests.

Partly funded by AMD, Newisys has been working in close cooperation with AMD to create reference motherboard and chassis designs. Newisys systems are not available directly from the manufacturer but can be purchased from a number of resellers, including Colfax International, ProMicro, and RackSaver.

The Newisys 2100 has a surprising number of enterprise-class features for a system under $3,000. These include hot-swap SCSI drives, four Ethernet interfaces, an extra PCI-X slot, and a management processor.

Accessible through its own Ethernet interface, and running a separate Linux kernel, the management blade can reboot the system, monitor system components, and inventory hardware and software on the system. A small LCD on the front of the

When running the Apache Web server, the Opterons showed a clear advantage over the Itanium system.

Newisys box shows the status of the management system and allows control of its basic features. If the management processor is set to get an IP address from DHCP, the LCD shows what the address is, making the process of getting to the system the first time much easier.

Pulling up the rear in my Web server performance tests, but not far behind, was the Itanium-based HP Integrity Server rx2600, a 2U, enterprise-oriented server with lots of expandability and redundancy. My rx2600 came configured with dual 1GHz processors, 4GB of RAM, three hot-swap 36GB Ultra320 10K SCSI drives, a RAID controller, four Gigabit Ethernet ports, two 10/100 Ethernet ports, HP's iLO (Integrated Lights-Out) management processor, dual hot-swap power supplies, hot-swappable fans, and Red Hat Enterprise Linux AS. This system will soon be shipping with the newest 1.3GHz and 1.5GHz flavors of Itanium; it's also available with HP-UX or Windows Datacenter Server.

The management processor allows full access to the system, including the

Enterprises Answer the 64-bit Question


SUNY's Russ Miller

SCOTT STUDHAM is running a massive chemistry modeling program at the Pacific Northwest National Laboratory in Richmond, Wash., and he is relying on 64-bit Linux to do the job.

Studham, the technical lead of the lab's molecular science computing facility, part of the U.S. Department of Energy, uses a $24.5 million supercomputer to crunch enormous volumes of data for rapid environmental analysis of chemical spills or the seepage of radioactive waste.

The supercomputer is actually a giant cluster of Itanium-based Hewlett-Packard systems running Linux, using 1,900 Itanium chips in more than 950 nodes with 12GB of memory in each node. Begun in May 2002, the cluster was upgraded this summer with the latest Itanium 2 processors.

"We now have the eighth most powerful computer system in the world, all of it on Linux," Studham says. Linux was an easy choice, he adds. "It was the most cost-effective option for us."

The first niche 64-bit Linux is finding is with IT managers overseeing high-performance computing tasks, thanks to the compelling combination of low-cost open source software and commodity-priced 64-bit power. "There are high-performance computational research facilities at academic institutions, and at financial institutions, that use software for risk analysis and equity management that are very interested in 64-bit Linux," says Dan Kusnetzky, a system software analyst at Framingham, Mass.-based IDC. "What we are seeing is a microprocessor that brings that kind of computing down to a lower-cost platform that may lead people who wouldn't have considered it before to now find it interesting."

At State University of New York at Buffalo, Russ Miller is weighing which 64-bit Linux system to deploy at the university's Center for Computational Research, where he is director. The supercomputing center includes a cluster comprised of 300 Dell PowerEdge 2650 servers, each with dual Intel Xeon processors running Red Hat Linux.

"We are going to be evaluating 64-bit Linux," Miller says. "We have a variety of systems including multiple Dell clusters, [and 64-bit systems from] Sun and IBM. We will be exploring commodity systems based on Itanium and Opteron, based on operating systems we can work with in the community, i.e. Linux. With Linux, we can put work out in the community so the user-base can do preliminary version testing and development of code."

Besides organizations running high-performance clusters, enterprises typically are not yet ready for 64-bit Linux. "We just moved over to [32-bit] Linux, but I don't see us using 64-bit Linux for two years," says Jorge Borbolla, CIO of AutoTradeCenter, a Mesa, Ariz.-based online car-auction company, which recently implemented a Hewlett-Packard ProLiant-based Oracle 9i RAC system to run its business applications on Red Hat's Enterprise Linux AS 2.1 operating system.

Nevertheless, Studham believes enterprises with less-intensive computing needs will naturally progress to 64-bit Linux. "We used to have 16-bit programs and we went to 32-bits," he says. "At some point we had to have 64-bits. Eventually it will be normal to use 4GB of memory, and when we get there it will be normal to run [systems on] 64-bits."

— Jack McCarthy

ability to perform BIOS upgrades, monitor all internal components, power the system on or off, reboot it, and inventory hardware and software. One slight negative: The rx2600 uses USB ports for keyboard and mouse, which could cause problems for datacenters with existing KVM-switch infrastructures.

Rapid Response

To gauge the performance of these systems, I tested the loads the Apache and Zeus Web servers would support before bogging down, using RadView Software's WebLoad 5 running on Ixia's TXS4 Load Module to simulate up to 1,000 simultaneous users. I also ran the same Web servers on a dual Xeon 2.8GHz server to create a baseline. The table below shows the number of virtual clients that were required to generate round-trip times of over than five seconds with Zeus and over two seconds with Apache.

	APACHE		ZEUS	
	Clients	Time	Clients	Time
Appro	451	5.06	500	2.13
HP	150	5.02	470	2.07
Newisys	601	5.35	500	2.18
Pogo	746	5.28	458	2.02
Xeon	107	5.08	372	2.11

These results are a great advertisement for the Zeus Web server. Not only did Zeus respond much faster than Apache for a given number of clients, it handled much greater loads than the Apache server — even 1,000 virtual clients only produced four-second response times. In addition, it's stable at much higher loads than Apache, and even at high loads produces very uniform results: Raise the number of virtual clients and the response time goes up in a very predictable fashion.

Will Linux Kill the Proprietary Server?

Dinosaur doomed to extinction?

IT MAY NOT be politically correct to say, but 64-bit Linux running on commodity hardware powered by AMD and Intel won't smite the classic midrange dinosaurs. The Linux camp, of course, says it can, citing low price and an open architecture. But the tightly coupled hardware/software design and lockstep evolution of the classic 64-bit behemoths offers advantages that Linux can't — and won't — match.

Take a look at the top contenders. Sun's Solaris server running on a Sparc processor is the company's flagship and the industry's most visible 64-bit system. IBM similarly touts its two Power4-Based eServer families, the iSeries (formerly AS/400) and the pSeries (formerly RS/6000). The iSeries runs a proprietary operating system called OS/400; the pSeries can run either Linux or AIX. IBM and Sun are aggressively improving their 64-bit platforms (see "Built, and Priced, Like a Battleship," page 33).

These systems share a tight integration of hardware, operating systems, drivers, and management tools, which even the closely held Apple Macintosh lacks. With complete control over every stage of development, all these midrange systems are scalable and extensible. You'll pay (oh, how you'll pay), but these are bet-the-business types of servers that simply won't let you down.

That's not to say that there's no culling of the midrange herd. The third major player in the proprietary 64-bit space is Hewlett-Packard, and its platforms' days are numbered. HP is aggressively trying to nudge its Alpha and PA-RISC customers toward its Itanium 2-based servers running either HP-UX or Linux.

By contrast to these tightly engineered Unix systems, 64-bit Linux suffers from the built-by-committee curse. It runs great, but it was designed without regard to the hardware. The idea of a single, unforked Linux kernel may be great for compatibility with common, off-the-shelf hardware but not for optimizing the OS for a specific server design. So, yes, Linux is fantastic, but each distribution is a collection of distinct code modules rather than a single, carefully designed platform. You get portability and enthusiasm, but are those enough?

Because they don't have to worry about little things such as cross-platform compatibility, the IBM and Sun (and HP) teams have a tremendous advantage in designing and building their 64-bit proprietary platforms. They can describe specific technology road maps, deliver on specific schedules, and incorporate new technologies without waiting for public consensus or even industry standards. Furthermore, they can guarantee that their solutions will work, backing their promises with hard-core SLAs.

Linux will always be more affordable and compatible, and it will end up with the lion's share of the market. But there's no way that Linux can ever offer the tight coupling of OS and hardware provided by those purpose-built midrange alternatives. For some customers and applications, the business case for that tight coupling won't ever go away.

— Alan Zeichick

The Newisys 2100 Server combines snappy performance and a rich feature set.

With Apache, on the other hand, response times, hits per second, and throughput numbers varied wildly with loads starting at 100 clients. Zeus produced very uniform results up to 1,000 clients.

With the Apache Web server, the Opterons showed a clear advantage. The HP Itanium system started producing long round-trip times at a load of fewer than 300 clients, while the Opterons were able to sustain loads above 800 with reasonable round-trip times. When running Apache, the Pogo Linux box performed the best among Opterons, followed by the Newisys and then the Appro, in spite of the Newisys having faster processors and more RAM.

When running the Zeus Web server, the performance of the HP Itanium system was — while still slower — very close to the three Opterons, an indication that Apache on Red Hat Linux was not as optimized for the Itanium as Apache on SuSE Linux was optimized for the Opteron. (With more complex test suites, where each client was making multiple requests including large graphics, the HP fell a little further behind.) The Opterons all had Apache 1.3.26-105 installed, while the HP Itanium ran Apache 1.3.27-2. The table below shows the results running the Zeus Web server under 1,000 virtual clients.

	Hits/Second	Round-Trip Time
Appro	2,916	3.91
HP	2,827	4.01
Newisys	2,838	3.99
Pogo	2,873	3.93

The lesson for anyone looking to squeeze real 64-bit performance from

Application Vendors Ponder a Port

WHEN WILL mainstream business applications come to 64-bit Linux on commodity hardware? Next month, next year, or maybe never, depending on whom you talk to. With the notable exception of enterprise software vendor SAP, based in Germany, most major software vendors are watching the 64-bit Linux market unexcitedly and refusing to speculate as to when they plan to jump in. If SAP is any indication, they'll most likely jump on Itanium first.

"It's very important for us to have a business case before we move forward and commit to porting to another platform du jour," says Jim Metcalf, director of foundation technology strategy at the SAS Institute, the Cary, N.C., maker of BI software. "Our view is that it's still early days for this market. ... We are not getting a lot of customers that are asking for 64-bit Linux running on the Itanium chip."

And this despite the fact that SAS already has a 32-bit Linux offering and that analytics applications are prime candidates to take advantage of the extra capacity that 64-bit Linux and Intel's Itanium chip would offer. "You've got a tremendous amount of memory address space [with 64-bit Linux] that you can use when it comes to crunching the big problems," Metcalf notes, adding that making real-time BI queries against large in-memory databases could be one of the more compelling uses of 64-bit Linux on Itanium.

So when will SAS jump on the 64-bit Linux bandwagon? "If we start to see the Oracles and SAPs, the ERP and database vendors, move in and run natively on these platforms, we'll work in conjunction with them," Metcalf explains. "It's a chicken and egg thing."

PeopleSoft, based in Pleasanton, Calif., plans to port its business applications to 32-bit versions of the Linux OS on both Intel and IBM hardware, but it has not announced any plans to port to 64-bit Linux on Itanium or Opteron, according to Technology Product Manager David Sayed. "Customers are saying, yes, the time is right for mission-critical applications on Linux," he says. But the main areas in which he's seen 64-bit uptake are database servers, and scientific and engineering applications that require large amounts of number crunching.

Although Oracle is not yet porting its applications to 64-bit Linux, the Redwood Shores, Calif.-based company has decided to lead with its database server (as has IBM with DB2). "Our approach will be a staged one," says Oracle Applications Vice President Greg Seiden. "The first to go to 64-bit will be the database; that's where we see the greatest benefit in the near term." Why? He points to a larger address space and more headroom on the database side, which will enable more concurrent users.

Seiden predicts that Oracle's next major application release

Pogo Linux's PerformanceWare 1264 runs a close second to Appro in price-performance.

an Opteron or Itanium system is to make sure your applications are not only 64-bit capable, but optimized for 64-bit, as the Zeus Web server is. And of course, those planning to run Web sites on Itanium clearly should do so on Zeus, rather than Apache.

Other conclusions? In general, the tests show the Opteron has a slight edge over Itanium, at least for now. Among all my tests, the greatest difference between the highest-performing Opteron and the Itanium is about 20 percent. With the 1.3GHz and 1.5GHz Itanium 2 processors due by the time you read this, the advantage should be moving to the Itanium. In addition to increasing clock speed, the new chips double the L2 cache size to 6MB, compared to the 3MB in the HP Itanium system I tested.

Regardless of whether you choose Opteron or Itanium for Web serving, you'll reap huge performance gains over 32-bit Xeon or Athlon. Even Apache on Itanium showed a 40 percent improvement over the performance of the dual Xeon system I used as a baseline.

Web server requests don't stress an entire system as much as some other tasks. Opteron and Itanium systems should demonstrate even greater performance gains when handling very large databases, for example. Nevertheless, Web server performance is a good general indicator of the kinds of gains possible with 64-bit hardware and 64-bit code.

We should all look forward to the day when the applications we're running now are available and optimized for Opteron and Itanium.

WAITING FOR THE APPLICATIONS

ORACLE
Porting database to 64-bit Linux now; no plans for apps

PEOPLESOFT
Recently announced plans to support 32-bit Linux

SAP
Porting entire product line to 64-bit Linux in 2003

SAS
BI vendor is waiting for the application vendors

will be a 64-bit Linux product. "We're watching the market to see what the adoption is going to be, the price point of [commodity] 64-bit hardware, and so on," he explains. He notes that a 64-bit set of Oracle's applications would actually be a new build, not a migration, and says he thinks major business applications will not appear on 64-bit Linux and Itanium until 2005. "I don't see anybody jumping into porting to 64-bit Linux," he says, possibly because 32-bit Linux works well. "We're very fond of Linux," he adds. "The performance we have on the 32-bit Linux platform is fabulous."

Unlike its competitors, SAP has decided to go full speed ahead on porting all its applications to 64-bit Linux on Itanium, but is awaiting interest from hardware partners IBM, HP, and Dell before committing to Opteron, according to Manfred Stein, the company's Linux lab and Unix platform product manager. The development effort, which began three years ago, has resulted in a phased rollout of products for the new platform this year, starting with 64-bit R3 ERP, with customers currently in production, and the addition of products such as CRM, business warehouse, and SCM (supply-chain management) solutions this fall. "By the end of the year, we will have the whole product line available" for 64-bit Linux on Itanium, he says.

Stein says SAP sees key performance advantages to the 64-bit Linux platform, including simpler administration, because the SAP applications can take advantage of more physical memory. At most, 32-bit Linux applications can use 2GB to 3GB of memory, he explains, which means you can only give 10MB each to 300 or 400 users firing on one server. By contrast, the 64-bit Linux kernel can support up to 64GB of memory, which makes large batch jobs such as end-of-month invoicing and data analysis much more manageable. "You're doing the work of thousands of users at the same time," he explains. "This enables us to run much larger jobs ... you simply have no limitations there anymore."

Stein says SAP hopes to make 64-bit Linux on Itanium a mainstream platform in two or three years. He notes that it only took three years from the time SAP introduced 64-bit apps on Unix in 1999 until it announced it was dropping 32-bit Unix support in 2002. If customers buy 64-bit Intel-based hardware in bigger batches next year, he says, 64-bit will be the only Intel Linux platform SAP will be supporting in three to four years.

— David L. Margulius

PLATFORMS

Linux Servers Advance on Enterprise

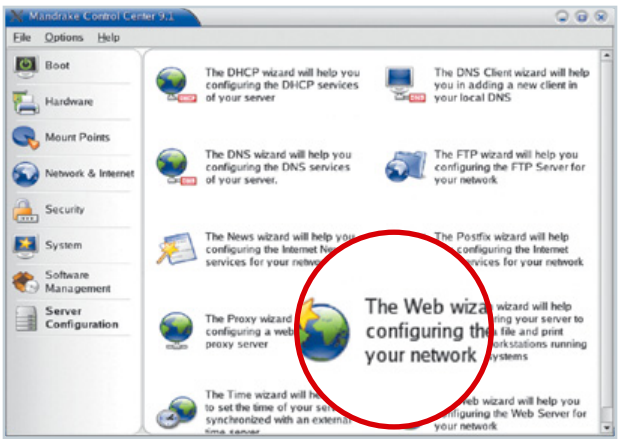
Vendor-added enhancements accelerate evolution

BY LOGAN G. HARBAUGH

LINUX IS WORKING its way into datacenters and has great penetration as a Web server. The allure of the open source OS is clear: Administrators can take a very inexpensive distribution, add assorted server software, apply all the necessary patches, configure the system for good security, and end up with a great enterprise server platform.

For those with less Linux experience or without the resources to pull everything together, several stable, secure enterprise server releases from the major Linux vendors are available. I recently tested four: Mandrake Linux ProSuite 9.1, Red Hat Linux Enterprise Server ES 2.1, SuSE Linux Enterprise Server, and Turbolinux Enterprise Server 8.

All four vendors offer substantial features in their enterprise versions — features not included in the standard distributions. The included software apps are not necessarily the latest editions; the vendors selected the most stable, bug-free versions. These servers also boast enhanced manageability and scalability. None, however, stands out as a clear winner, although each has some bragging points.



Mandrake ProSuite 9.1 offers an excellent set of GUI management tools. The Web wizard makes configuring the Apache Web server particularly easy.

Red Hat offers the widest variety of support options and additional features, from the basic $349 version to the $2,499 Enterprise Server AS version, which adds load balancing, clustering features, and the promise of one-hour turnaround on support. SuSE supports the broadest variety of processors. Turbolinux offers most of the features of the SuSE version but adds some nice utilities of its own. And Mandrake offers a very nice suite of GUI administration tools that will appeal to those with less Linux experience.

The Linux Landscape

The solutions I looked at share some common ground in key areas. All installed easily and without problems on a variety of systems, including two dual-processor Xeon systems. None had problems detecting dual processors, nor with any of the disk drives, HBAs (host bus adapters), NICs (network interface cards), graphics cards, and monitors. This is a big step forward from just two years ago.

Further, all the distributions provided support for various boot loaders and boot sectors, making them compatible with Windows in a dual-boot environment.

The distributions also included all the server applications necessary to set up shop, including the Apache Web server and PHP (Hypertext Preprocessor) extensions, SMTP (postfix and sendmail), MySQL or Postres SQL database servers, OpenLDAP directory server, and Kerberos security, to name but a few.

Yet not all Linux servers are created equal. Support is a key differentiator between enterprise server and nonenterprise offerings. All the vendors provide premium support for their respective solutions, but deciphering the various support options, both included and optional, can give you a headache.

Security also warrants scrutiny, and each vendor says that its enterprise server code is more carefully audited for vulnerabilities.

These OSes lack management consoles; each application or server has a separate management application, or may not have one at all, thus requiring that text files be

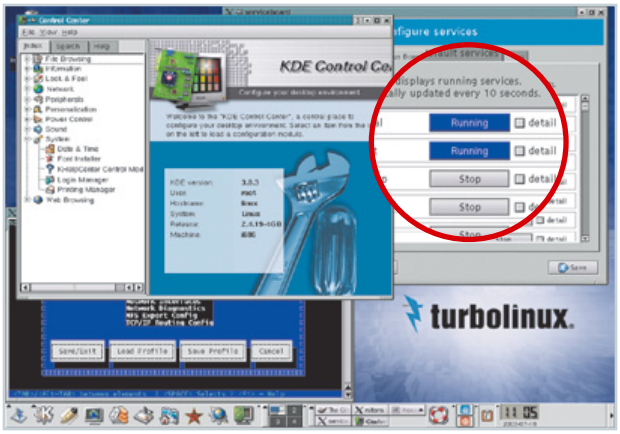
Any of these servers will offer everything you're looking for. Your decision will likely be based on familiarity or support in your area.

edited to change settings. Each distribution addresses this differently, providing utilities to start and stop services such as Apache, DNS, or DHCP, if not to configure them. Mandrake has a very nice set of utilities for configuring most of the servers you might want to run.

Documentation is another area where the distributions vary considerably. All of the tested products offer online documentation, which may not be of much comfort if you're having trouble getting the system to work. SuSE and Mandrake offer extensive printed documentation. Red Hat provides a slim, 100-page installation guide. I didn't receive Turbolinux's printed documentation.

Another interesting area to look at is compatibility with applications. All the distributions have RPM (Red Hat Package Manager) installers that will install applications packaged in the popular format.

In addition, Red Hat and United Linux have relationships with software vendors to ensure that third-party applications will run well on their systems. Oracle is a member of United Linux, whereas Red Hat has relationships with a great many hardware and software vendors, including Oracle, Dell, IBM, and others. Mandrake is not as well-known in this arena, however it recently announced a relationship with Hewlett-Packard to provide desktop systems.



Turbolinux Enterprise Server 8 offers the service-board management application for configuring services. Server applications can be stopped, started, and configured as with Windows.

Mandrake Linux ProSuite 9.1

Mandrake's server platform reflects its desktop orientation, with the latest versions of the KDE (K Desktop Environment) and Gnome GUIs, and a very nice set of GUI tools for configuring Apache, DNS, DHCP, and other servers, as well as a firewall. Mandrake Linux ProSuite 9.1 is the least expensive product in the review at $199, although Mandrake also has a Corpo-

Mandrake Linux ProSuite 9.1

MandrakeSoft mandrakelinux.com

VERY GOOD 8.4

Manageability (20%)	9
Reliability (20%)	7
Setup (20%)	9
Documentation (15%)	9
Scalability (15%)	8
Value (10%)	8

COST: $199

BOTTOM LINE: ProSuite 9.1 offers a GUI environment that will appeal to administrators with little Linux experience. Most admin tasks can be completed in the GUI, rather than requiring command-line utilities or editing configuration files. It also offers a full set of server applications, including load balancing.

Red Hat Linux Enterprise Server ES 2.1

Red Hat redhat.com

VERY GOOD 7.9

Manageability (20%)	7
Reliability (20%)	8
Setup (20%)	9
Documentation (15%)	7
Scalability (15%)	8
Value (10%)	8

COST: $799

BOTTOM LINE: Red Hat is the U.S. standard for Linux, boasting the greatest number of partnerships with third-party vendors, an excellent support organization, and a large development team. The more expensive AS version includes Itanium support, load balancing, and clustering.

SuSE Linux Enterprise Server

SuSE suse.com

VERY GOOD 7.8

Manageability (20%)	7
Reliability (20%)	8
Setup (20%)	8
Documentation (15%)	9
Scalability (15%)	7
Value (10%)	8

COST: $749

BOTTOM LINE: SuSE is not as well-known in the United States as it is in Europe. However, because SCO has discontinued its Linux business, SuSE seems to be the best-known of the United Linux companies in the United States. United Linux offers an excellent server package, good security, and an enterprise focus.

Turbolinux Enterprise Server 8

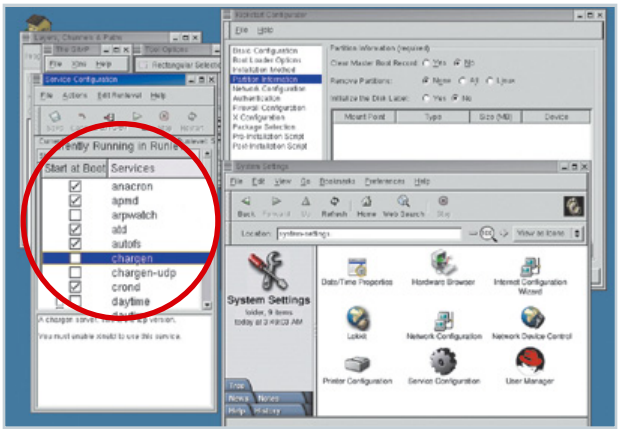
Turbolinux turbolinux.com

VERY GOOD 7.6

Manageability (20%)	7
Reliability (20%)	8
Setup (20%)	8
Documentation (15%)	7
Scalability (15%)	7
Value (10%)	9

COST: $749

BOTTOM LINE: Although not well-known here, Turbolinux offers the same base United Linux feature set as the SuSE offering. It's a good choice for companies with a presence in both the United States and Asia, due to extra Asian localization features and support structure in Japan, Korea, and China.



Red Hat Enterprise Server ES defaults to the Gnome 1.4 GUI. The Service Configuration application allows the administrator to start and stop server services, just as Windows Server does.

rate Server for $749 with a year of unlimited support.

The installer is very comfortable for the non-Linux administrator. It offers a security selection up front that allows you to select standard, high, higher, or paranoid; that applies a minimum security necessary for server configuration; and that allows selection of server packages, graphics packages, and GUI software from the start. This makes it easy to configure a text-based Web server or a complete file/print/Web server with GUI. The distribution also includes Webmin for remote administration via browser.

At the end of the installation, it offers an Internet update to get the most recent versions of server, drivers, etc. After the initial installation, Mandrake offers mailing lists of security and OS updates. Mandrake is also the only distribution to include the Apache 2.0 rather than the 1.3 version supplied by the others.

It also includes a complete workstation DVD packed with the most up-to-date and full-featured office and productivity software. The single DVD makes it easy to install all the workstation applications from one source, instead of managing multiple CDs.

Last but not least, the ProSuite 9.1 includes an evaluation version of IBM's DB2 Universal Database for Linux, the DrakSec security manager, and an anti-virus tool. Advanced utilities such as RFBDrake (for a remote frame buffer configuration/launcher tool) and URPMI (for automated installation of software packages) makes administration and configuration of services a snap.

Support includes 90 days of Web support with a 48-hour response window and phone support for five incidents, also good for 90 days.

Red Hat Linux Enterprise Server ES 2.1

Red Hat Enterprise Linux ES 2.1, priced at $799, is one of two enterprise-oriented Linux distributions from Red Hat. The other, Red Hat Enterprise Linux AS 2.1, is priced from $1,499 and includes SMP (Symmetric Multiprocessing) support for more than two CPUs, support for more than 4GB of RAM, clustering capabilities, Web farm load-balancing capability, and Itanium compatibility.

The ES installer provides a choice of three levels of security during setup. You can select a server installation that installs all the server packages, or a custom package selection that allows you to select which servers you want to enable.

When the system is started, Red Hat provides the Kpackage Manager to see what packages are installed. After the software is registered, the Red Hat Network provides access to updates of both system software and applications. One odd quirk: The standard installation of the Mozilla browser will not work on the Red Hat site to access the registration area. You have to force a reinstall of the browser to add all the necessary SSL capabilities.

Red Hat includes old ver-

Lining Up Linux Servers

Although Mandrake boasts the most feature-rich server in the bunch, they all carry their own strengths and weaknesses into the server room.

	KERNEL	GNOME	KDE	AMD64 SUPPORT?	ITANIUM SUPPORT?	JOURNALING FILE SYSTEMS	PXE SUPPORT	CLUSTERING	LOAD BALANCING	OTHER PLATFORMS
Mandrake ProSuite 9.1	2.4.21	2.2	3.1	Yes	Yes	Yes	Yes	No	No	n/a
Red Hat Enterprise Linux ES 2.1	2.4.9-e.12	1.4	2.2	No	Yes	Yes	Yes	AS version only	AS version only	n/a
SuSE Linux Enterprise Server	2.4.19	2.0.6	3.0.3	Yes	Yes	Yes	Yes	No	Yes	IBM iSeries, pSeries, zSeries, S/390
Turbolinux Enterprise Server 8	2.4.19	2.0.6	3.0.3	Yes	No	Yes	Yes	No	Yes	n/a

sions of KDE and Gnome; in fact, it's the only distribution that still features Gnome 1.4, which is much buggier than the 2.0 release. It is also the only distribution that defaults to Gnome as the GUI.

Both also support asynchronous I/O so that applications don't need to pause after issuing read I/Os, increased SMP granularity (especially in the SCSI I/O subsystem for better disk performance), SMP scheduler enhancements, enhanced support for more than one gigabyte of memory, and enhancements to improve database performance.

The Standard Edition provides a full year of support and a one year subscription to Red Hat Enterprise Network for updates and security patches. It also includes a full boxed set of CDs and printed documentation. The AS version includes a one-day response time on Web support and one hour on phone support. A full year of updates is also included.

SuSE Linux Enterprise Server

SuSE provided much of the installer base code for all the United Linux variations, and the installer works well. It automatically detected all the hardware in our systems, with the exception of one Samsung LCD monitor.

The YaST2 installer, shared with the Turbolinux distribution, doesn't provide as many choices for preconfiguring security or selecting which servers will be installed as do the other two distributions. But it certainly does an adequate job, and the YaST2 configuration manager provides a nice monolithic program for determining which products are installed, for adding additional services, and for updating products.

After installation, only basic services run by default; this is to keep the system secure. The Services control utility makes it easy to start and stop servers and to determine whether they start upon booting or are started manually.

SuSE offers a number of extensions to its Enterprise Server platform, including a collaboration suite, OpenExchange, Lotus Domino server, and a telecom-oriented release. SuSE also provides the widest base of support for systems other than the Intel x86, including Itanium; Opteron; IBM iSeries, pSeries, and zSeries; and IBM S/390. It also supports as many as 32 processors with support for the Unisys 7000 system.

SuSE and Turbolinux both include journaling file systems, POSIX (Portable Operating System Interface for Unix) support, IP load balancing via LVS (Linux Virtual Server), support for Intel Hyper-Threading, MXT (Memory eXpansion Technology) and PCI hot-plug IBM and Compaq controllers. They also have support for asynchronous I/O so that applications don't need to pause after issuing read I/Os, SMP scheduler enhancements, enhanced support for more than 1GB of memory, and enhancements to improve database performance.

SuSE Linux Enterprise Server is priced at $749 and uses the United Linux code base. Support includes one year of maintenance and updates, around-the-clock e-mail and phone support with a two-hour turnaround time for premium support, or around-the-clock e-mail and phone support with a four-hour turnaround time for standard support.

Turbolinux Enterprise Server 8

Turbolinux is a member of the Asia-based United Linux consortium, with offices in Japan, Korea, and China. It offers some specialized language support for those

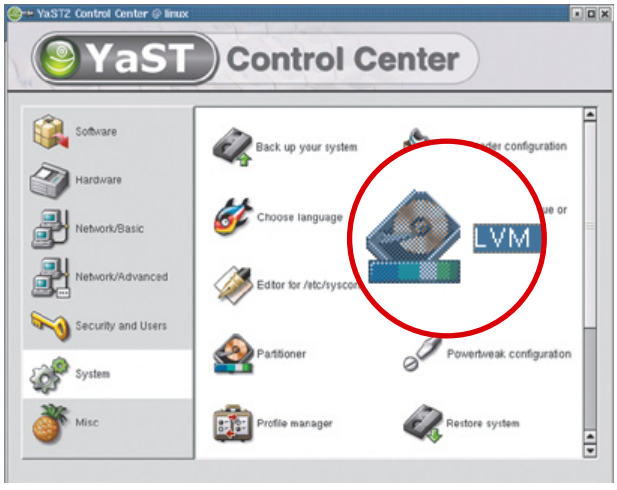
2.6 Kernel Will Burst With Features

The 2.6 kernel will incorporate several improvements to the core OS. Some of these features are available in current enterprise editions via add-ons from the vendors.

FORTHCOMING 2.6 KERNEL IMPROVEMENTS	IN ENTERPRISE EDITIONS NOW?	OVERVIEW
Multithreading, memory handling, SMP improvements	Currently unavailable in any servers reviewed	The new 2.6 kernel will include better distribution of loads across multiple CPUs and better handling of large amounts of memory.
Processor support	Mandrake, SuSE, Turbolinux support Opteron; Red Hat supports Itanium; none support PowerPC	With the 2.6 kernel, editions will support Opteron, Itanium, and PowerPC. Until more 64-bit versions of applications are available, the utility of this feature is lessened.
Scalability through 0(1) scheduler	Available in Red Hat AS, SuSE, and Turbolinux	0(1) scheduler improves scalability to 16 CPUs or more. SuSE and Turbolinux use the 0(1) scheduler and support up to 32 processors. Red Hat ES only supports two processors, but the AS version includes the 0(1) scheduler.
True asynchronous I/O	Available in all servers reviewed	Allows applications to continue an operation without waiting for a disk write to finish.
Journaling file systems enhancements	Available in all servers reviewed	Includes improved file-system performance and four journaling file systems.
Improved threading for POSIX	Partially available in all servers reviewed	Servers include enhanced POSIX libraries, but improvements will enhance the performance of large, multithreaded applications.
Enhanced high-bandwidth networking support with TCP segmentation offload support	Currently unavailable in any servers reviewed	Supports network interface cards that offload TC processing from the CPU
Zero-copy network file-system support	Available only from SuSE and Turbolinux	Speeds backups by accessing networked backup devices as if they were local.

areas. In most other ways, it is very similar to the SuSE Enterprise Server, with the same YaST2 installer, support for the same platforms and most of the same utilities and application versions. One minor ding: The YaST2 installer was not available through the menus after the install; I had to start it from a console window.

The Turbolinux Mongoose installer includes software RAID support via LVM (Linux Virtual Machine) or evms (enterprise volume management system), support of installing on a machine with more than 4GB of memory and a hyper-threading CPU, and TFDisk — a graphical partitioning tool. Turbolinux also includes Webmin, a browser-based remote administration tool.



The SuSE Linux Enterprise Server YaST2 installer simplifies adding software to the server. The LVM software RAID manager simplifies creation and management of software RAID partitions.

Like SuSE's offering, Turbolinux Enterprise Server 8.0 is priced at $749, uses the United Linux code base, and has the same kernel and base OS. SCO Linux, also a United Linux member, is not included because the company recently discontinued its distribution and support for Linux in the wake of its suit against IBM.

Sixty-day, five-incident OS installation support, and a year of updates are included.

All four products offer a stable release, a good set of features and server applications, and extended functionality. Although Mandrake scored highest in our test, any of the products reviewed will offer everything that administrators are looking for. Your decision will likely be based on familiarity or support available in your area.