

Amazon.com

Migration from Unix to Red Hat Linux

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MARCH 2002 In its 2001 third-quarter regulatory filing, Amazon.com reported that its technology and telecommunication expenditures were down \$17 million or 24% from the amount it had spent a year earlier. This decline was due in part to the company's shift to the Red Hat Linux operating system.

"The decline in absolute dollars spent ... primarily reflects our migration to a Linux-based technology platform that utilizes a less costly technology infrastructure as well as general price reductions for data and telecommunications services due to market overcapacity," Amazon.com said.

Amazon.com is an excellent example of a company eager to cut costs and still provide an exceptional customer experience by using the open source operating system as an alternative to proprietary software and as a means to significant reductions in hardware costs. The Seattle-based merchant also showcases several other benefits of migrating its operating system from RISC/Unix to Linux on Intel.

Vital Statistics for Amazon.com

From Amazon.com Inc. Statement of Operations (in thousands)	Three Months Ending December 31	
	2001	2000
Net sales	\$1,115,171	\$972,360
Income (loss) from operations	\$14,525	(\$322,096)
Technology and content (T&C)	\$52,325	\$69,791
T&C as a percent of net sales	4.7%	7.2%

Vital Statistics Regarding Amazon.com Deployment of Red Hat Linux	
Scope of implementation	Across the majority of IT systems
Benefits of Red Hat Linux to Amazon.com	Millions of dollars in estimated savings in hardware per year due to migration from RISC/Unix to Linux on Intel solution
	Enhanced stability, reliability, and scalability across hundreds of servers through a partnership with Red Hat Professional Services
	Ease and speed of implementation
	Excellent technical support
	Steady operations

Background and Challenge

As the world's most prominent etailer, Amazon.com compares its IT infrastructure with a traditional retailer's floors and stores — that is, its IT infrastructure serves as the platform for all sales, marketing, and customer service. Amazon.com substitutes technology for real estate, asserting that, over time, technology gets cheaper while land and physical stores grow more costly. Amazon.com considers its ecommerce system more valuable than the brick and mortar of its competitors.

In the past year, Amazon.com implemented Red Hat Linux, which led to substantial savings in operating costs. The company is in a state of constant upgrades to its IT systems, replacing a significant number of servers each year. In 2000, as part of this annual upgrade, Amazon.com decided to migrate all applicable servers (based on the availability of applications) from Unix to Linux. The etailer's strategic goal was to lower the total cost of ownership. Because Linux runs on commodity Intel hardware, Amazon.com expected to benefit from lower-cost servers as a result of the migration.

Amazon.com's MIS department and management at large favored Red Hat because of the depth of its Linux expertise and its strength in the market. Recent IDC research shows that Red Hat holds a 54% market share among Linux vendors.

Implementation and Deployment

Amazon.com faced several unique challenges in its migration to Red Hat Linux. The store runs on an impressive number of servers and experiences seasonal spikes in traffic and demand. The sheer number of servers presents a daunting task. Amazon.com posed an architectural requirement to be able to build and manage all servers with the press of a button. Also, Amazon.com needed to make the switch relatively quickly, given that it decided to migrate in January 2001 and needed to complete the task in time for the start of the crucial holiday shopping season in the fall.

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Amazon.com employed Red Hat's Kickstart architecture for Linux, which allowed the retailer to develop a large number of tools for configuration and package management. Amazon.com ported all of its Unix code in about 90 days, and it simultaneously switched over 100 servers per week. A significant number of major systems, such as customer-facing systems, middleware, mail, and backup, now run on Red Hat Linux. Amazon.com put everything it could on Linux in time for the important 2001 holiday rush.

"The port was surprisingly painless. Not too many modules had to be redone. Our engineers were quick to 'speak' Linux because they already knew Unix. Each group, such as shipping and the distribution center, ran its own migrations, which sped the implementation by distributing the tasks," said Joe Barker, senior systems engineer and leader of Amazon.com's Linux program. "Ninety days was staggering," he added.

Benefits of Linux

Using Red Hat Linux, Amazon.com has the flexibility to buy hardware — most importantly, servers — from any vendor selling Pentium-based servers. Previously, Amazon.com had to purchase servers from a single vendor of its Unix-based servers.

The greatest outcome of changing server suppliers was the plummeting cost of servers. "We found ourselves replacing boxes costing \$60,000 with new ones priced at about \$10,000, saving \$50,000 per server," Barker said. Therefore, this change alone represents a significant contribution to the bottom line and is a major factor behind the company's momentous reduction in technology and content as an operating expense.

"When calculating the economics, most people focus on free licenses, saving about \$500 per box. This is trivial compared to the savings from Linux versus Unix servers," Barker said. This was one of a handful of cost-cutting measures that occurred in the same time frame as Amazon.com moved to its first profit.

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The ability to use lower-priced hardware from multiple vendors yields several additional benefits. With Red Hat Linux, Amazon.com no longer has to rely on a single hardware vendor. Instead, the retailer is open to multiple Intel-based hardware vendors. The retailer can switch and mix and match hardware while it benefits from vendors leapfrogging each other in price and performance.

From an operational viewpoint, though, one of the best benefits of Red Hat Linux is that nothing changed. "It allowed Amazon.com to maintain the same procedures and processes in place throughout our history. We not only achieved this with a relatively painless migration, but we are able to maintain this claim due to Red Hat Linux's robust operating system," Barker said. "And the company has continued providing the high-quality customer experience it has become known for."

Support Required

Technical support from Red Hat has been particularly helpful, even when problems fall outside the Red Hat Linux software domain. In one situation, Amazon.com encountered a bug right after upgrading to a new version of Red Hat Linux. Amazon.com immediately consulted Red Hat's 24 x 7 engineering support team. Even after the companies discovered that the problem was unrelated to either Linux or Red Hat, the software vendor continued to quickly and efficiently help Amazon.com.

Within 24 hours of receiving the bug report, Red Hat had replicated Amazon.com's operating environment, simulating Amazon.com's situation from Red Hat headquarters 3,000 miles away. "Amazon.com would not have been able to determine the source of the bug without Red Hat's help in diagnosing the problem," said Amazon.com's Senior Systems Engineer Matthew Corddry, who is responsible for many aspects of the retailer's Linux implementation.

Lessons Learned and Future Plans

Amazon.com's example indicates that it would be surprisingly easy and beneficial for many firms to switch from Unix to Linux. Savings made possible in hardware costs are compelling for many companies. The transition is relatively easy, given the similarity of the programming languages used for the two operating systems. Many tools are available through the open source community. Red Hat has provided invaluable technical expertise to Amazon.com and many other enterprise firms.

Many companies, especially those doing business on the Web, have Unix on some servers and are at least considering Linux. Red Hat Linux interfaces well with Unix and therefore is a safe platform for Web retail, supply chains, netmarkets, and other ecommerce applications, even in an environment with both Unix and Linux.

Amazon.com has found that this migration is very important for preparing for the future, availing itself of opportunities for greater efficiency. Red Hat Linux is a good platform for Amazon.com's supply chain today, and Barker feels it will become a bigger benefit in the near future. Also, the platform gives most companies a fairly easy IT entry into ecommerce and supply chains because they don't need new hardware. Using the retail philosophy that "technology is cheaper than real estate," Amazon.com creates savings to pass on to its customers. Red Hat Linux might well become an important component of that philosophy.

IDC believes that many companies will migrate at least partially from Unix to Linux in the coming years and enjoy the same benefits as Amazon.com.