



Chicago Mercantile Exchange Uses Red Hat Enterprise Linux to Double Daily Trades and Halve Hardware Costs

Executive Summary

For the Chicago Mercantile Exchange (CME), time is literally money. The more trades the futures exchange can complete in a day, the more money it makes. That is exactly what's happened since the CME initiated its migration from legacy Sun Solaris UNIX systems to Red Hat Enterprise Linux in early 2004. The futures exchange doubled the number of daily trades performed electronically from nearly 1 million in August 2003 to 2.2 million in October 2004 on its CME Globex electronic trading platform. The increase in daily trades spurred a significant revenue spike..

The switch to Red Hat Enterprise Linux yielded other tangible dividends as well: Red Hat Enterprise Linux has delivered a twofold increase in performance and enabled the CME to save 50% on overall capital expenditure hardware costs in calendar year 2004.

The transition from an almost wholly UNIX-based trading environment to Red Hat Enterprise Linux has been relatively smooth—so smooth, in fact, that the CME has bested its own migration projections. The company's original migration plan called for it to have 20% of its UNIX systems switched to Red Hat Enterprise Linux by year's end. To date, 35% of the systems have transitioned to Linux, and the CME anticipates it will have 40% or better moved over to the Red Hat Enterprise Linux distribution by year's end.

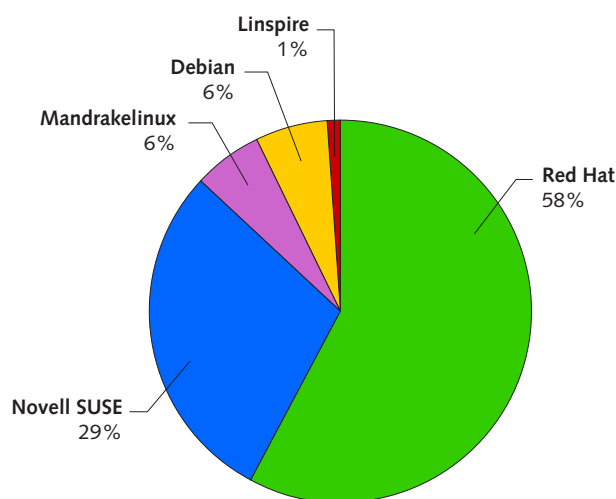
The CME chose Red Hat Enterprise Linux over rival Linux offerings because of Red Hat's proven track record for technical excellence and superior service and support. The CME's reasons for selecting Red Hat as their Linux provider reflect the majority consensus of Linux users. The latest independent joint Yankee Group/Sunbelt Software poll of 1,000 IT administrators worldwide revealed that the Red Hat Enterprise Linux distribution was the number-one choice of customers. A convincing 58% of the respondents ranked Red Hat Enterprise Linux as their number-one choice for Linux distribution software. That figure bested the number-two competitor, Novell's SUSE Linux, which was selected by 29% of users—by an almost 2-to-1 margin.

Exhibit 1

Red Hat Enterprise Linux Is Users' First Choice

Source: The 2004 Yankee Group/Sunbelt Software Survey

If your company plans a significant Linux deployment, which will it choose as its primary Linux distribution vendor?



Note: Turbolinux = 0%

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I. Introduction

It's no accident that Red Hat's market share rose throughout 2004. Linux has made great gains, particularly in the server market, during the last 18 months and now commands 20% market share, according to the Yankee Group/Sunbelt Software September 2004 poll of 1,000 IT administrators worldwide (see Exhibit 2).

The same poll found that Dell, HP and IBM were users' top three choices—in that order—for Linux OEM hardware vendors (see Exhibit 3).

An earlier independent Yankee Group/Sunbelt Software survey showed that Red Hat's market share was at 46% in April 2004. When the Yankee Group conducted its second independent survey in September, it showed that Red Hat's popularity among users had increased by 12% in 6 months. Novell's SUSE Linux distribution made similar gains, increasing its presence from 18% to 29% among enterprises during the same period. But despite the enormous amount of publicity Novell received for its January 2004 acquisition of Germany-based SUSE, Novell still lags significantly behind Red Hat in deployments. This is due mainly to customers' view—including the CME—that Red Hat offers the more fully evolved Linux distribution and offers more comprehensive technical service and support.

Exhibit 2 Microsoft Rules Server OS Market, but Linux Mounts Strong Challenge

Source: The 2004 Yankee Group/Sunbelt Software Survey

What is your company's primary server operating system?

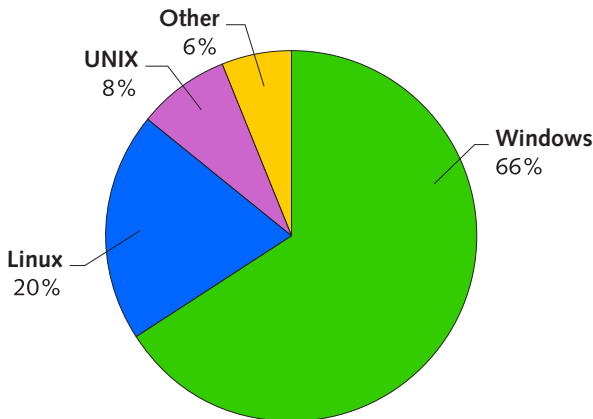
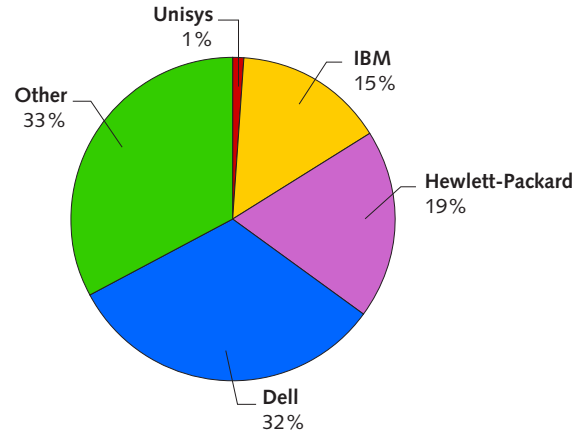


Exhibit 3 HP and Dell Are Top User Choices for Linux Hardware

Source: The 2004 Yankee Group/Sunbelt Software Survey

If your company plans a significant Linux deployment, who is your primary Linux hardware vendor?



The CME's chief technology officer, Charlie Troxel, said the futures exchange evaluated both Red Hat and SUSE. "Our decision to go with Red Hat ultimately came down to their longevity [in the market] and their superior service and support. Red Hat was more of a known commodity and more mature and they have top-level support," Troxel said. He added that, in the months since the CME began implementing Red Hat Enterprise Linux and needed support, it has gone "right to the Red Hat developers," bypassing the traditional first and second level telephone support venues.

The Yankee Group/Sunbelt Software independent survey data further indicated that both the Red Hat and the Novell gains came at the expense of smaller Linux distributors, such as Mandrakelinux, Turbolinux and Debian, and lesser known Open Source distributions.

It's clear from Yankee Group survey responses and first-person in-depth customer interviews that enterprises such as the CME base their Linux purchasing decisions on a number of key criteria, including:

- Demonstrable, proven performance, reliability and scalability of the core Linux distribution kernel
- Viability of the Linux distribution vendor (i.e., experience)
- Aftermarket technical service and support

Red Hat scored high in each of these areas when the CME performed its due diligence assessment and pilot testing, according to Troxel.

II. Data and Analysis

The CME's decision to opt for Red Hat Enterprise Linux reflects the high regard in which Red Hat and its product suite are held by the thousands of corporate customers that are now pursuing a Linux strategy.

Typically, corporate customers investigating the merits of a switch to Linux, or those that opt to migrate, are driven by a desire to cut UNIX hardware costs. Troxel said the CME was no different. The futures exchange did its homework and realized it could purchase five HP Intel-based machines for the same price as a single SPARC server. But before committing to a Linux solution, the CME put the software through a rigorous set of tests and measurements to ensure that the trading exchange's stringent requirements for pricing, performance, scalability, ease of use, ease of deployment and reliability were met.

The CME conducted a thorough review of nearly all the well-known Linux distribution vendors. "We quickly concluded that everyone but Red Hat and Novell's SUSE were too small to accommodate our heavy data transaction processing needs," Troxel said. What tipped the scale in Red Hat's favor was its breadth and depth of experience in the marketplace and service and support, he added. "In 2003, SUSE's North America support team consisted of only a few people—that wasn't enough for us," Troxel observed.

During the testing phase, the Red Hat Enterprise Linux distribution running on HP Intel-based servers showed a 3-to-1 performance advantage over the Sun Solaris implementation running on a RISC-based SPARC server. "When we eventually transition to Itanium-based technology, we'll realize a 6-to-1 performance advantage," Troxel said.

Usability was another factor that worked in Red Hat's favor. Troxel said that Red Hat Enterprise Linux was easy to install and deploy. "Having it running in the lab, it seemed that our people were doing things faster and accomplishing more on Red Hat—we have 800 production servers in the electronic trading environment, of which everything was UNIX."

"This was all good news to the CEO." He said, "Congratulations and let's move over [to Red Hat Enterprise Linux]."

Chicago Mercantile Exchange Background

The CME is based in Chicago and has very high requirements for service and performance. It's the leading U.S. futures exchange. It employs 1,200 people globally, although most are based in Chicago. Its products include futures and options on futures contracts designed to assist commercial enterprises worldwide in managing price risks associated with the risks of supply and demand. The CME's roots are in the agricultural industry. The commodities business, on which the exchange was founded as a not-for-profit organization in 1898, includes such items as pork bellies, live cattle and lumber. Today, that represents only about 1% of the CME's overall revenue.

The CME's four basic product lines are interest rates, stock indexes, foreign exchange and the aforementioned agricultural commodities. It incorporates foreign exchange and includes the CME S&P 500 and NASDAQ-100 stock index futures.

The CME also owns its own Clearing House and thus can guarantee, clear and settle every contract traded through the exchange. In 2003, the CME realized \$335 trillion in notional value (futures contracts), equal to more than \$1 trillion each trading day. The CME's clearing operation—which actually clears the futures trades—nets \$1.6 billion daily.

Troxel said that given the sheer volume of the trades and the enormity of the daily revenue and notional value, the underlying technology infrastructure must be rock solid, delivering near 100% uptime to support the CME's nearly 24/7 data management and transactional processing needs.

Transitioning to Linux

Before commencing the conversion to Linux, the CME had close to 1,500 UNIX servers. It was not dissatisfied with Sun Microsystems' Solaris performance or with Sun's technical service and support. Initially, the futures exchange's interest in Linux was primarily driven by the need to contain and cut soaring hardware costs.

CTO Troxel and Joe Panfil, director of distributed computing who spearheaded the Linux deployment, began examining Linux distributions as far back as 2002, but "got really serious about testing it" in early 2003. The first pilot application was implemented in late 2003. Panfil and Troxel were sold on the potential benefits of Linux, but first they had to quell the internal partisanship debates being waged by the UNIX administrators and Linux proponents.

"We did have a lot of Sun loyalists in our administration group who faced off against the Linux proponents," Troxel recalled. He resolved the issue by giving a speech to the entire administration team about how it could work in their favor to "have two areas of expertise" on their resumes. "We were pleasantly surprised to find that many of our in-house developers had tons of experience with Linux application development, which is an extremely useful skill these days," Troxel said.

As the CME implemented the Red Hat Enterprise Linux pilot applications, it set criteria in the aforementioned key areas:

- Performance (the efficiency of the highly intensive data transactional processing)
- Reliability
- Security
- Red Hat technical service and support

Panfil and Troxel were both hands-on during the testing and development process. They were impressed with the performance of Red Hat Enterprise Linux in the labs. They hoped for the same outcome following deployment in a live production environment—and got it.

Red Hat Benefits

Panfil said that the CME's most immediate return on investment (ROI) was the anticipated reduction in capital expenditure outlay for hardware purchases and hardware maintenance.

"We've saved 50% on hardware costs during calendar 2004, and that's very significant because CME's rate of growth is huge. If we had continued to be a sole-source Sun shop, we estimate we would have spent \$4.5 million to upgrade Unix hardware; by switching to Red Hat Enterprise Linux on Intel-based servers, we spent just under \$2 million," Panfil reported.

Although the CME's initial Linux migration driver was the ability to replace the more expensive Sun 4 CPU SPARC hardware with Hewlett-Packard DL360, 2 CPU servers to lower hardware costs, the move to Red Hat Enterprise Linux started yielding performance dividends. Panfil said he was surprised by the "major benefits" the CME achieved with Red Hat Enterprise Linux running on HP Intel-based servers under the same workloads as the Sun Solaris SPARC machines.

There was no way to gauge performance accurately ahead of time, Panfil explained, because the applications simply do not behave the same way on UNIX RISC-based machines as they do on commodity Intel-based systems. "There's no guaranteed predictability; the proof is in the performance in a production environment," Panfil said.

The CME's goal was to speed trading transactions. "If we shave milliseconds off the round trip, it makes the customer happy, and it makes us happy because we're able to do more trades," Panfil said.

The Red Hat Enterprise Linux platform deployment was part of CME's effort to reduce the "1,800 millisecond (1.8 seconds) time it took to complete a trade several years ago to a mere 150 milliseconds—or less than half a second—now. Consequently, the average daily volume [of trades] at the Chicago Mercantile Exchange has gone from just less than 1 million in 2000 to approximately 2 million in 2004."

Troxel and Panfil also praised the Red Hat Enterprise Linux distribution for its "lean, mean and efficient" core operating system kernel and its TCP/IP stack. Troxel and Panfil said they've loaded Red Hat Enterprise Linux "onto old x86 servers and it still runs very efficiently."

"Red Hat has an extremely fast, efficient and reliable kernel package. And if we did encounter a problem, Red Hat always had a patch available," Troxel said.

Panfil noted that the Linux TCP/IP stack is much more efficient for the CME's high transactional data processing than the legacy Solaris OS. "We have orders coming in at a fast pace and price quotes going out at an equally fast clip. There is no doubt that Red Hat Enterprise Linux and its TCP/IP stack on Linux handles trades and responses much better than our prior systems," he said.

Reliability and uptime also increased measurably. "The standard deviation on trade completion is only about 50 milliseconds with Linux and that's very good," Panfil said. Additionally, the CME, like most trading exchanges, has increased its electronic trade volume substantially. In 2000, approximately 15% of the CME's trades were done electronically; as of October 2004, that figure is 68%. That makes network uptime and security crucial.

"We didn't expect uptime to increase noticeably, but it did—by about 20 to 30%—and we're extremely pleased," Troxel said. He noted that an outage of even 3 to 5 minutes could result in tens of millions of dollars in lost business.

As the CME fine-tunes its Red Hat Enterprise Linux systems and applications, it hopes to complete transactions in 100 milliseconds. Although the difference in a half-second response to the virtually instantaneous response may not be all that perceptible to the actual user on a trade-by-trade basis, at the end of a day it adds up.

"The traders who perform the automated trades know the difference when they realize they've been able to do 20 to 30% higher volume," Panfil said.

Smooth Transition

The transition to Red Hat Enterprise Linux has been relatively smooth and seamless, and devoid of major migration woes. When some application interoperability issues did arise, they were resolved quickly as the CME's major Linux vendors HP, Red Hat and Oracle engineers worked cooperatively to troubleshoot and solve the problems.

As a result, the CME bested its own internal goals, which called for the futures exchange to have 20% of its legacy Solaris UNIX systems converted to Linux by the end of calendar year 2004. The Chicago-based exchange already has transitioned 35% of its systems to Linux and now estimates the conversion will be 40% completed by year's end. That's an aggressive upgrade, but "it's been made possible by the stability, efficiency and performance of the Red Hat Enterprise Linux systems running on HP Intel-based servers," Troxel said.

The number of routine daily administration chores likewise has declined in the Linux networks.

III. Conclusions

The Chicago Mercantile Exchange's CIO, CTO and network administrators all agree that Red Hat Enterprise Linux has lived up to its promise.

"We're 1 year into our Linux conversion, and we're confident this is the right direction and that it's working well for us. Our electronic trading volume has increased 100% since this time last year to more than 2 million trades per day, and we've accomplished this with an increased commitment to Red Hat Enterprise Linux," Panfil said.

CTO Troxel said he's "looking forward to the continued evolution" of Linux, driving the Chicago Mercantile Exchange's economies of scale and electronic trading functionality to new levels in the coming year.

The Yankee Group

World Headquarters

31 St. James Avenue

BOSTON, MASSACHUSETTS 02116-4114

T 617.956.5000

F 617.956.5005

info@yankeegroup.com

Regional Headquarters

North America

31 St. James Avenue

BOSTON, MASSACHUSETTS 02116-4114

T 617.956.5000

F 617.956.5005

info@yankeegroup.com

951 Mariner's Island Boulevard, Suite 260

SAN MATEO, CALIFORNIA 94404-5023

T 650.522.3600

F 650.522.3666

info@yankeegroup.com

EMEA

55 Russell Square

LONDON WC1B 4HP

UNITED KINGDOM

T 44.20.7307.1050

F 44.20.7323.3747

euroinfo@yankeegroup.com

For More Information

T 617.956.5000

F 617.956.5005

E-mail: info@yankeegroup.com

Web site: www.yankeegroup.com

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