

WHITE PAPER

Linux in the Mainstream: Growing Deployment of Business-Critical Workloads

Sponsored by: Red Hat

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IDC OPINION

Linux is one of two operating systems that rode the x86 server market over the past decade and established itself as a mainstream solution for supporting deployments of business-oriented application workloads. This upward progression has led Linux to its current role as a platform capable of supporting — and being used for — business-critical workloads on a broad variety of hardware architectures.

- ☒ Today, Linux is seen as a platform suitable for new deployments of enterprise application software of all scales and of all levels of business importance. Customer deployments have grown to include a variety of workloads, remarkable growth that started from humble origins when Linux was considered a fringe solution.
- ☒ Linux continues to be the fastest-growing operating system when measured on the basis of percentage growth of new subscriptions and revenue growth; it is apparent that customers are finding business value with Linux solutions.
- ☒ Today, database workloads are growing quickly on Linux and complement the related business applications that already had a natural affinity with it. IDC sees Linux emerging as a solution for other critical solutions, including those mandating adherence to service-level and application performance commitments.
- ☒ Application software providers, including the industry's largest ISVs, now see Linux as a platform that is essential to support and proactively promote deployment. Most major ISVs support Linux as a deployment vehicle.
- ☒ Customers often make a bold move to Linux, frequently from Unix servers, as typified by a \$15 billion media and telecommunications company that moved to adopt Red Hat Enterprise Linux (RHEL), highlighted in this IDC White Paper.

IN THIS WHITE PAPER

This IDC White Paper takes a look at the growth of Linux as a server operating system and how deployment form factors have changed over time. Today, commercial Linux has become a key platform across many workloads. This paper considers both workload data and the ecosystem that has grown up to support the opportunity for Linux deployments, including application software, application development and deployment software, and infrastructure software.

SITUATION OVERVIEW

Linux and Business Computing

Change Is the Norm in High Tech

The tech industry has seen many stunning changes in the past 25 years, but few can rival the dramatic change to the industry that Linux has ushered in. Much like the disruptive server operating environment products that preceded it, Linux changes the playing field in multiple ways. Two of the key attributes of Linux are the availability of multiple competitive Linux distributions and the availability of Linux on multiple hardware architectures.

The availability of multiple Linux distributions, including paid commercially supported subscriptions and nonpaid versions that can be similar to or, in some cases, identical to the commercially supported distributions, means that customers see Linux as having less potential for vendor lock-in. While IDC believes that any commitment to an operating system of any sort — Linux or otherwise — constitutes a form of lock-in, the availability of alternative products that can be embraced without enormous migration costs is an attractive value-add that comes standard with Linux. Further, IDC sees Linux providing a cross-architecture standardization layer that no other operating system can provide. Linux is widely used in current public cloud offerings, providing additional deployment flexibility for customers without further vendor lock-in.

The second benefit of Linux is more significant than it sounds at first: Linux is available on multiple hardware architectures. In fact, Linux is arguably the most broadly ported operating system that has ever existed. Today, the operating system runs aboard every major architecture, including, at the high end, IBM's System z and Power Systems, Oracle's SPARC architecture, and, of course, x86 platforms from a multitude of vendors around the globe.

IDC finds that many customers often have two types of distributions in use: Linux distributions that are commercially supported and nonpaid, noncommercially supported Linux. While some customers have a mix of a commercial product and a true nonpaid product such as Debian or Fedora Core, IDC research finds that it is not uncommon for a customer to use subscription-supported Linux on some portion of its Linux deployments, but it may also use instances of the same product that are not covered by a paid subscription support package.

It is IDC's belief that most customers are best served by using commercial subscriptions to support the vast majority, if not all, of their Linux distributions so that IT staff can focus their expertise on business-specific value-add activities rather than supporting the Linux kernel directly. This is particularly true for Linux servers supporting business-critical workloads. (See related IDC White Paper, *Understanding Linux Deployment Strategies: The Business Case for Standardizing on Red Hat Enterprise Linux*, IDC #227903, April 2011.)

Nevertheless, customers often mix a commercial distribution with a closely affiliated noncommercial distribution, such as pairing up Red Hat deployments with Fedora Core deployments or CentOS deployments, or SUSE Linux Enterprise with openSUSE.

The deployments of no-cost Linux distributions typically complement the paid subscription copies, but they often will support less critical workloads.

Compared with Windows, Linux brings forward some of the favored attributes usually associated with the Unix market, where multiple commercial versions of the operating system provide good application portability across a multivendor environment, reducing the potential for hardware and operating system vendor lock-in.

Compared with Unix, Linux opens up broad access to the attractive price points and multivendor hardware solutions available in the x86 server market while preserving a Unix-like configuration, management, and reliability experience. As a result of the availability of Linux aboard commodity-priced x86 server hardware, we have seen a corresponding detrimental impact on the traditional RISC/Unix market.

The Maturation of x86 Servers

Compatibility and attractive price points for Linux are only part of the story, though. The rest of the story is enabled by the hardware itself. A new generation of x86 servers, based on Intel Xeon 7500, Intel Xeon 5600, and AMD Opteron processors, are on the market from server vendors worldwide. The new systems, introduced in 2009, with many enhancements since then, combine higher socket counts (four-socket and eight-socket systems) with higher core counts (using quad-core processors, six-core processors, and eight-core processors). These dense computing systems are generally outfitted with more memory and more I/O capacity than one-socket or two-socket servers, and they generally support higher numbers of virtual machines (VMs) per physical server.

Besides the greater density for the computing platform itself, many of these new servers include more built-in business critical features, such as redundant hardware components (in case any one of them fails); hot-swappable components for quick replacement without rebooting; more efficient power and cooling; and alternate pathing for I/O (which provides an alternate path for data transfer) to reduce I/O contention and to avoid I/O bottlenecks. These kinds of features were routinely built into scalable datacenter servers — and they are now finding their way into x86 server designs.

In addition, some server vendors are adding special circuits to control system management; these electronics can isolate problems or help reallocate resources in case some hardware components fail. Again, these kinds of innovations in x86 server technology build on years of experience in datacenter server engineering. As such, they will enable x86 servers to take on a greater range of business-critical workloads. And in the event that any physical server fails, or in the event of an outage (e.g., power outage, network outage), the server workloads can be shifted to alternative servers for continued processing.

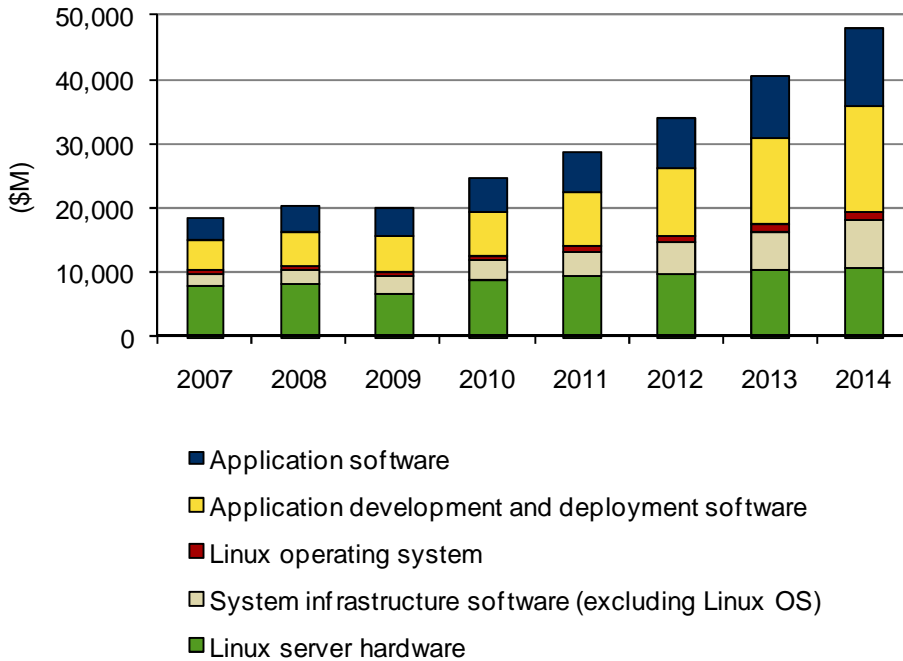
Linux and Open Source Software Ecosystem

Figure 1 illustrates the growth of the Linux ecosystem through 2014. The economic meltdown of 2008 caused a pause in growth of the overall ecosystem during 2009. However, the ecosystem rebounded nicely in 2010, and our forecasts remain strong

for the long-term success of Linux and layered software solutions on the Linux operating system.

FIGURE 1

Worldwide Linux and Open Source Software Ecosystem Revenue, 2007–2014



Notes:

Software revenue is from the IDC Software Market Forecaster, November 2010.

Server hardware revenue is from the IDC Server Tracker, March 2011.

Source: IDC, 2011

Figure 1 includes the following elements:

- Linux server hardware revenue, which includes factory revenue associated with the sales of servers that are sold where Linux is deployed as the primary operating system either at the factory or in the channel
- Linux operating system revenue, which is primarily server operating environments–related revenue
- System infrastructure software, which is defined by IDC to include systems management software, security software, storage software, as well as virtualization and clustering software

- ☒ Application development and deployment software, which includes information and data management software (including RDBMS software), development tools, development life-cycle products, application deployment software (including application serving, transaction, and middleware software products), and data analysis software
- ☒ Application software, which includes collaborative application software, content management software, ERP software, customer relationship management (CRM), supply chain management, manufacturing applications, and engineering applications

Workload Relationships for Linux

Shipments alone tell only one part of the overall story. To fully understand the transitions that Linux is going through, one needs to look back at previous entrants in the operating environments market.

When Unix workstations arrived on the market in the 1980s, they were seen as a technical solution for designers and engineers. However, those users had a tendency to generate massive amounts of data that ended up being stored on a Unix file server. It took years for Unix to break into commercial use, despite being tested in such a demanding environment, and even then its breakthrough was due to the high-performance attribute and resulting price/performance benefit, not the availability of applications. Ultimately, this led to broad adoption of RISC/Unix systems. The application portfolios did in fact follow, and ultimately the Unix platform offered a compelling solution for shops that had skills to support a Unix environment.

By comparison, Windows followed a different path to mainstream adoption. Instead of Windows proving its capabilities through high performance, the low cost of the operating system and of the associated x86 hardware drove the price/performance ratio to where it had never been before. Windows was a solution that departments could afford and could configure and manage without IT support, leading to a proliferation of Windows installations. Windows NT began shipping in 1993, and the operating system rode the wave of low-cost x86 hardware into a key role in corporate deployments. However, from an application perspective, Windows first established itself successfully as a print/file server and in support of collaborative workloads, specifically email.

Linux has followed a slightly different trajectory and gained its initial entry not through ad hoc departmental adoption but rather through quiet endorsement by IT professionals who adopted Linux before there was CXO-level approval for the technology. However, like the appeal of Windows, much of the appeal of Linux comes from the affinity between the commodity x86 server platform and the inexpensive nature of the Linux operating system. The first workloads that Linux has addressed successfully have been basic infrastructure workloads that historically were supported by Unix servers or Windows servers.

Figure 2 brings forward the view of workload splits for Linux server operating environment new license shipments (paid and nonpaid combined).

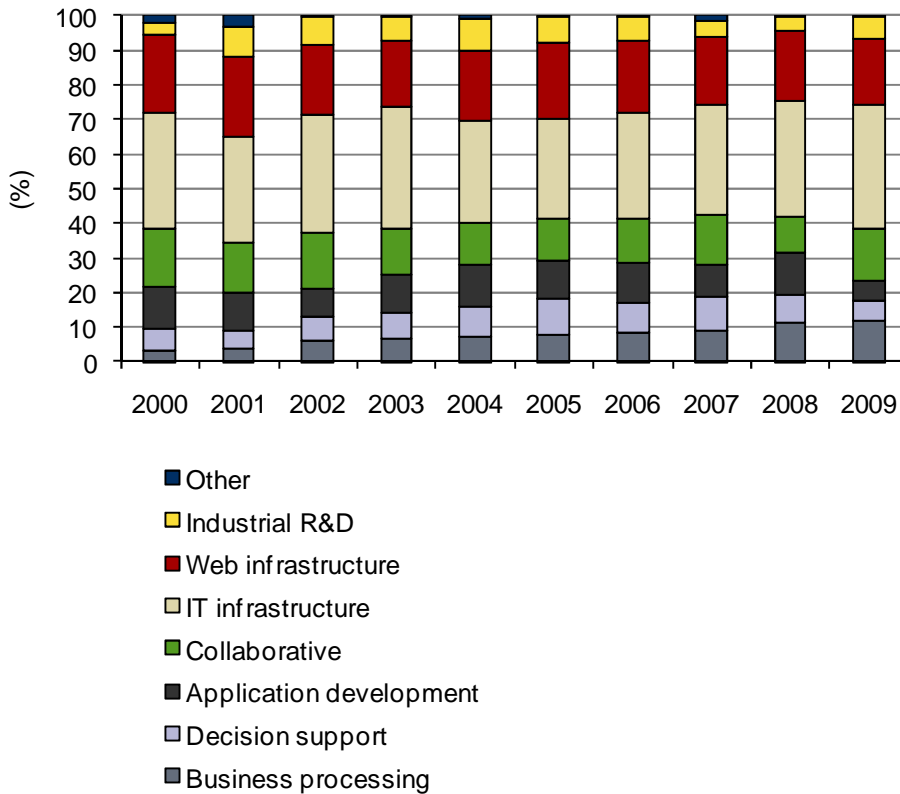
As depicted in Figure 2, the bread-and-butter workload for Linux continues to be infrastructure services, as Web infrastructure and IT infrastructure services account for more than 50% of total Linux shipments. While the number has remained relatively stable (between 50% and 56% of the Linux total) during the past decades, this workload type is one of the key deployment scenarios for Linux moving forward.

One key growing area — key because of the significant pull-through of associated software sales and services — is business-oriented workloads. Business processing, which covers critical enterprise applications including ERP and CRM, grew from 3.3% in 2000 to 11.9% in 2009.

IDC believes the growth in commercial workloads is a natural evolution, one that was not possible until the basic infrastructure was in place to support those applications. Given the strong installed base of Linux as an infrastructure server, providing Web application services as well as database and related middleware capabilities, the stage has been set for continued growth of business applications on Linux.

FIGURE 2

Linux Server Operating Environment Workload Shares, 2000–2009



Note: Data is from the IDC Server Workloads Study, 2010.

Source: IDC, 2011

The data presented in this white paper incorporates all platforms supporting Linux into a single view. Underlying this top-level data is the expectation that the workloads depicted will vary by platform. High-end platforms, such as IBM's System z and Power Systems as well as RISC systems supporting Linux from Sun and other companies, are more likely to support business-critical workloads, while volume x86 server platforms are likely to capture the vast majority of the infrastructure and Web-oriented workloads, in addition to a share of the business workloads.

Finally, it is important to keep in mind that workload shares alone do not tell the whole story. It is necessary to look at unit shipment volume in conjunction with shares to fully understand the effect on the Linux market. In other words, given the growing nature of the Linux operating systems market, even workload segments that are flat (or even contracting) in share are still likely to be growing in overall unit volume.

FUTURE OUTLOOK

Some Historical Context

Linux's penetration of platforms, workloads, markets, and use cases would have been hard to predict. Looking back 10 years, IDC saw Linux as having a great deal of potential to change the dynamics of the industry, but Linux went further than we might have expected back then.

In 1999 we wrote, "The application software and middleware software community is rushing to support Linux, led by companies that compete most directly with Microsoft. IBM, for instance, has embraced Linux in a big way, shipping Linux versions of DB2, WebSphere, and its VisualAge for Java development tool during 1999. IBM's Lotus subsidiary delivered Lotus Domino for Linux just before yearend. Endorsements by major players such as IBM, Dell, and Compaq automatically raise end users' confidence levels in a given technology and help address 'lack of business application software' objections." (See *Server Operating Environments: 1999 Year in Review*, IDC #21219, December 1999.)

The transitions that followed in 2001 and 2002, with the dot-com bust, led to change in economic conditions that, when combined with the growing maturity of the x86 architecture, led to an irreversible shift in industry dynamics favoring the adoption of Linux.

Looking Forward

The broad, industrywide momentum that Linux has created will continue unabated, with little potential for dramatic shifts (up or down) in market share in the traditional enterprise, midmarket, educational, and governmental market sectors. The primary competitor for Linux will continue to be Windows.

Some of our key expectations for trends that will affect Linux include the following:

- ☒ **Virtualization as a driver.** The industry is currently experiencing modest growth of server sales, but operating system deployments continue unabated, thanks to the power of virtualization. Given the integration of the Kernel-based Virtual Machine (KVM), growth of Linux virtual machine deployments will likely accelerate and will

broaden the overall footprint of Linux in the industry. Combining Linux with a strong virtualization infrastructure will lead to an environment better suited to manage more critical commercial workloads. In addition, the use of Linux aboard IBM Power and mainframe systems provides another virtualized deployment platform that adds to choice and deployment scenarios for customers.

- ☒ **Cloud computing.** Today, the most-discussed transition affecting Linux — and its competitors — is the movement to cloud computing. IDC notes that cloud computing is experiencing a hyperactive marketing push — not unlike the hype cycle around server virtualization four years ago. While we believe that cloud computing is very much a real paradigm shift that will impact all customers over time, most customers (excluding small businesses) in general will adopt cloud computing as an extension to internal virtualization. As a result, it is critical to have a strong virtualization story and a smooth virtualization-to-cloud story — a story that Linux already has today. Many of the early public cloud offerings were built using Linux and other open source software solutions as a foundation.
- ☒ **Greenfields do exist.** There is considerable excitement about how public clouds present an opportunity that is tailor-made for Linux. While that is true where next-generation applications are concerned, and for large-scale software-as-a-service providers, existing applications, many of which currently run on Windows, are much harder to migrate to a Linux and open source software-based cloud infrastructure.
- ☒ **Continued growth of high-importance workloads.** A significant portion of the business application workloads that have moved to Linux have come from Unix migrations. Recent IDC research has found that the movement off of Unix servers will likely accelerate over the next few years and will incorporate ever-higher value workload types. Considering that the high-value workloads have been among the most unlikely Unix applications to move, the next wave of migrations will help bolster the deployment of Linux (and Windows) for line-of-business applications and large databases. Customers with custom or highly customized applications are more likely to move to Linux than Windows because of the easier migration.
- ☒ **Unix migrations won't be the sole driver** for Linux application growth. Aboard the Unix platform, business processing accounts for between 20% and 27% of new deployments. However, because the overall volume for Linux is so much higher than the overall volume for Unix, the surprising effect is that a lower percentage of business processing workloads still account for a larger number of deployments. In fact, the comparison is dramatic: In 2010, paid and nonpaid Linux server operating environment deployments accounted for 3.5 times the number of paid and nonpaid Unix server operating environment deployments, or 2.4 million Linux server operating environments compared with 679,000 Unix server operating systems deployed. Today, this growth is increasingly originating from organic growth of the Linux installed base.
- ☒ **Workloads to consider deploying.** IDC believes customers should continue to look at Linux as a good candidate for new business workloads. Customers already deploy database systems and are moving forward with ERP, CRM, and other mission-critical business applications. We believe collaboration software, one of the bigger market segments where Linux plays a comparatively small role, is a good candidate for customers to consider.

CHALLENGES/OPPORTUNITIES

Challenges

- ☒ **Size and stickiness of the application portfolio.** Customers typically have a substantial installed base of applications and will weigh the benefit of a migration to Linux against the risk of the migration, the cost of the migration, and the length of payback for the migration. Unless the payback can be justified in an acceptably short period of time, the argument to "stay the course" is hard to fight.
- ☒ **Continued competition by Windows.** Microsoft has long competed for Unix migrations, and it will continue to do so. Microsoft's Unix migration initiatives are nearly as applicable to Linux as they are to Unix. While it is unlikely that a customer will migrate from Unix to Linux then consider yet another migration to Windows, if past behavior is any indication, Microsoft will be looking to tap the Linux installed base to fuel its business in the future.
- ☒ **Linux won't automatically inherit the cloud.** Next-generation applications won't necessarily have a dependency on the Windows .NET framework, something Microsoft understands and is moving to address. The company has set its sights on having its cloud solution, Windows Azure, support a variety of open source runtime environments to compete with Linux-based cloud solutions. Ultimately, cloud computing will be defined not by the openness or proprietary nature of the software that makes up the cloud but rather by the cost, performance, and service levels that are delivered by the cloud.

Opportunities

- ☒ **Affinity with Unix installations.** Linux shops often have a common heritage — that of a Unix background — and given the transferability of skills from Unix to Linux, it is a natural expansion for a shop to move from Unix to Linux. Add to that the portability of applications from one environment to the other, and it not only is natural but also makes good business sense.
- ☒ **Linux is a key solution for most non-x86 platforms.** The graying of IT professionals with skills for supporting IBM's large systems, including the System z with z/OS and the Power Systems running i (i5/OS) or AIX, and the lack of emerging applications that run natively on these systems make Linux a natural fit for these platforms. IT shops are able to hire fresh developer talent that knows Linux and put that talent to work on these scalable and reliable platforms.
- ☒ **The growth of business workloads on Linux.** Where there is market growth for applications, it is probable that the ISV community will be supporting those applications with fresh releases and new functionality to address changing market conditions.

CONCLUSION

Linux has already established a solid position in the industry and can be expected to expand its footprint within all workload types. The shift in workloads to continue favoring business-oriented applications will continue, although the magnitude of the

shift on a percentage basis is likely to be outstripped by the growth of Linux itself during the current period of platform investment that the industry is experiencing.

IDC believes that Linux is a viable platform for Linux deployments favoring business workloads and believes that customers that are using Linux today should be looking at the potential for new deployment scenarios.

CASE STUDY

Media and Communications Giant Dials Up Red Hat for Critical Workload Support

It was 2008, and the U.S. economy was tanking. Directly impacted by the consumer and advertiser spending pull-back, this media and communications company found itself scrambling to consolidate and recentralize operations to adjust to the changing business conditions.

Traditionally a conservative company from an IT perspective, the \$15 billion organization realized it needed to break some traditional IT adoption models, and that required it to think outside the box. Part of that thinking included a move to embrace Linux on x86 server hardware. "The recession changed a lot of things for us," said the IT manager responsible for Unix, Linux, and storage at the company's headquarters operations.

Conveniently, the company had already been evaluating a possible move to Linux. With about 40 aging Sun Solaris servers supporting critical business workloads, the IT department watched nervously as Sun's business was contracting, under pressure from competitors left and right. Some of the applications supported by this group are accessed daily by up to 40,000 of the company's 60,000 employees, although under certain circumstances when temporary workers are hired, that number can surge to as many as 80,000 total employees. The applications include back-office solutions, IT infrastructure, and core communications infrastructure that supports various field operations. This includes using BIND to provide external DNS services.

The IT staff was concerned, however, that any savings realized through licensing and hardware might be paid back into the cost of subscriptions for Linux. But the alternative meant paying for hardware and operating system support on the Solaris machines. Because the existing Sun hardware needed replacement, the time had come to renew that commitment for another six years — or make what felt like a bold move to reduce costs. The company made a decision to move to Red Hat Enterprise Linux.

Although the timing overlapped, the Oracle acquisition of Sun played no role in the original decision to move to Red Hat Enterprise Linux. "We already had made a decision. That acquisition has done nothing but accelerate our interest in moving," said the IT manager. "[We were] pretty invested with Sun on the server space, and the last year and a half, what we have observed, particularly in the hardware space [are] higher support costs, more rigid restrictions, and limitations for how we can get support for the systems we do have. On commodity hardware, we can get support from warranty. Then, after that, there are many service providers for maintenance," he added.

Today, the company has moved the majority of its Unix servers to RHEL and has 48 physical and virtual RHEL servers, with a dozen SPARC servers still in production use, slated for future migration. Among the applications moved was an Oracle/PeopleSoft ERP application that is considered a mission-critical solution. The company has also moved Oracle RAC database instances over to RHEL.

"Before we made the decision, there was some FUD [fear, uncertainty, and doubt] around running mission-critical apps on Linux," said the IT manager. "[We] heard some anecdotal comments about [the] stability of RAC on Linux versus Solaris. But the capex and opex savings were too significant to ignore, even if we had to spend more time supporting the instances. What we found is [instability] is not the case. There have been some learnings, but they are not related to the ability of the operating system to handle that kind of mission-critical load, or that the operating system is less mature."

The IT staff also supports about 1,000 physical and virtual Windows instances on another 500 x86 servers and uses VMware as its virtualization engine. The company has been working with Red Hat Enterprise Virtualization (RHEV) in its lab, but at this point, it does not plan to introduce a second virtualization engine into its environment.

The company's experience so far has been good. There have been a couple dozen cases entered over the past two years — everything from general questions to actual support issues — but the company said that none of the issues have been particularly serious. The biggest complaint is that the Red Hat support lines are not always able to answer questions in a single call.

The biggest problem the company has run into is learning the Linux release and service pack naming. "In the Solaris environment, we were much more focused on whether we were running version 8 or 9 or version 7, and the ability of that version to be compatible with the application you had," said the IT manager. "When we moved into the Red Hat space, we had to get much more granular with their versioning. In an app farm, some apps might need RHEL 4.7 and others need 5.2. That was the most significant thing."

He added, "We do believe in standardizing our technology. [The] most significant reason is so that we can maintain the amount of human resources that we need, and we don't have to bring in additional talent all the time because of some new service we run. And since we had seen the success of our ERP migration, we are being encouraged to continue that strategy."

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