Linux and Intel-Based Servers

A Powerful Combination to Reduce the Cost of Enterprise Computing

An IDC White Paper
Sponsored by Red Hat and IBM Corporation

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Executive Summary: IDC Insights into Red Hat Linux and IBM Customers

IDC performed baseline interviews to compare the total cost of ownership (TCO) of Linux on Intel servers to that of Unix on RISC servers. The positive results achieved by Linux in that study led to a joint request from Red Hat and IBM to further understand the TCO and return on investment (ROI) for customers using both firms' offerings.

The original study identified a distinct TCO advantage for Linux on Intel servers over Unix on RISC servers for both Internet/intranet/extranet and collaborative workloads. These workloads are defined on page 4 of this document. The RISC/Unix TCO was 1.8 times higher than that of Linux in the Internet/intranet/extranet workload and 5.5 times higher than that of Linux in the collaborative workload.

Linux on the Intel platform has emerged as a viable alternative to RISC/Unix for mission-critical enterprise computing. For enterprises with the right mix of requirements and skill, Linux offers tremendous potential to lower costs associated with supporting application workloads. Backing that statement are the results of a study conducted on the cost of computing, which showed Linux with a lower cost of ownership versus competitive RISC/Unix environments.

Our more recent study confirms the results of the earlier study and provides strong validation of the conclusions drawn. On average the companies interviewed for the study that made data available for this study realized an average ROI of 504% when assessed over a three-year time frame at a discount rate of 10%. In most cases, the payback of the initial investment in hardware and software was achieved in less than three months.

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Executive Summary: IDC Insights into Red Hat Linux and IBM Customers (continued)

IDC conducted the new research, which was requested by Red Hat and IBM, in early 2003. We gathered both TCO and ROI information by the use of an interview guide developed specifically for the project. Data was gathered and analyzed about staffing, support by function, expenditures, costs, growth rates, deployment, benefits achieved, and downtime. The length of the interviews ranged from slightly more than 20 minutes to nearly 90 minutes. The interviews were conducted with senior IT managers and staff in a diverse set of organizations.

IDC conducted in-depth interviews with seven companies in North America and Europe that had migrated their server platforms to a number of Red Hat Linux releases including Red Hat's Advanced Server (now known as Red Hat Enterprise Linux AS) and running on IBM xSeries Intel-based servers and utilizing IBM middleware software such as, WebSphere, DB2, Lotus, and/or Tivoli. The goal of the interviews was to assess the business benefits generated by migration. While each company realized value in different ways, in general the benefits were as follows:·

- Reduced costs for hardware, OS, and third-party software
- Reduced costs for IT staff through greater efficiency and ease of administration
- Increased revenue opportunity from higher reliability and quicker time to market

The research's overall message is that Linux and Intel-based offerings offer advantages to many enterprises. The combination of Red Hat Enterprise Linux and IBM's platform hardware and middleware software should be part of a prudent evaluation for enterprises looking to achieve the benefits listed above.

To realize the potential of Linux, enterprises must take the first step to pilot Linux and then build a vision for longer-term deployment that may include expanded application or infrastructure workloads supported by new systems or redeployed systems running Linux.

The original study concluded that the key to realizing the benefits of Linux in the enterprise begins with a careful consideration of where to deploy Linux, understanding why to deploy in these roles, managing expectation, and monitoring results. Success requires good alignment between the requirements of the workload, the capabilities of the IT organization, and the attributes of Linux (cost, performance, reliability, manageability, applications, availability, and vendor support). Considering these factors, we found that Internet/intranet/ extranet and collaborative computing show promise of early and continued Linux adoption in many enterprises.

These findings were reinforced by the new research, which indicates that Linux on Intel-based servers is moving beyond these workloads into what are seen as mission-critical applications. The case studies featured in this IDC White Paper show this expansion.

Some of the highpoints of the individual interviews include:

- "…made its decision because of a combination of Red Hat Linux price performance and its mission-critical reliability with IBM enterprise applications."
- "…able to significantly reduce software licensing fees and hardware costs … deploy services 60% faster … reduce downtime by an extraordinary 73%."
- "We chose the best-in-class products and vendors to serve our customers … hardware, software, and support …"

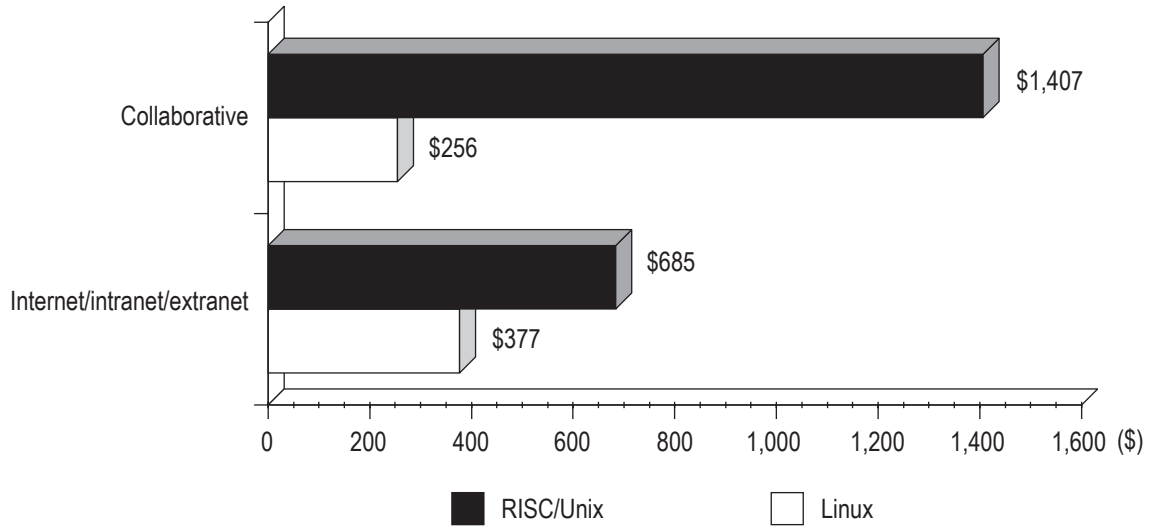
Executive Summary: IDC Insights into Red Hat Linux and IBM Customers (continued)

- "Red Hat and IBM's commitment to open source solutions coupled with sophisticated support infrastructures made our choices easier."
- "… xSeries … cut equipment expenditures by 40% … reduced spending another $35,000 in third-party software … deploy services 25% faster …"
- "… implementations calling for fast deployment, high transaction throughput, and handling complex algorithms …"
- "… solution must be based on technology that was highly available, highly reliable, and highly supportable."
- "… 33% reduction in downtime … staff reallocation … consolidation of third-party software …"
- "… need to deploy Java-based Web portal applications … chose IBM and Red Hat solution based on price/performance, reliability, and the ability to add processors to meet planned growth."

The primary research results of this new set of interviews appear throughout this IDC White Paper in shaded boxes entitled *IDC Research: Red Hat and IBM Customer View.*

IDC's original study on Internet/intranet/extranet and collaborative workloads found significantly lower cost of ownership for Linux. To arrive at this important conclusion, we compared the total cost of ownership (TCO) of Linux on Intel architecture (IA) servers and RISC/Unix servers. Associated costs with Linux are not only dramatically lower for the hardware and software, as you might expect, but also comparable or lower for staffing — which you might not expect. With staffing typically the largest component of overall IT solution costs, this finding has important implications for IT planning. In summary, Linux provides a lower-cost platform for these workloads, especially in the first year of deployment. In the case of Internet/intranet/extranet workloads, Linux delivers a 1.8 to 1 cost advantage over RISC/Unix and a 5.5 to 1 cost advantage for collaborative workloads (see Figure 1).

Figure 1: TCO Comparison Between Linux and RISC/Unix
(US$ per year, per user for 1,000 supported users)



Source: IDC, 2003

Playing out this scenario, we believe that enterprises with the right mix of workload requirements and in-house skills will realize a significant reduction in the cost of computing by deploying Linux.

Beyond directly lowering cost for the workloads on Linux, visible deployment of Linux in an enterprise also provides the astute IT manager with a powerful tool for negotiating more favorable prices from other suppliers of hardware and server operating environments (SOEs).

OVERVIEW

Many factors contribute to the selection of one operating system over another to fill a given business need. Some of these factors, such as availability of applications and IT staff expertise, experience, and comfort with a given operating environment, will help narrow the selection process quickly. Other factors, such as TCO, can provide a compelling reason to choose between two competitive solutions offering similar operating environments and application solutions.

IDC conducted a study comparing the TCO for Linux on Intel systems with that of proprietary RISC/Unix systems from several leading vendors. Although different at the hardware level, these two SOEs present a significant number of similarities, including similar base operating environment capabilities, compatible user interfaces, command line interfaces, commonly used shells, similar scripting languages, similar utility and infrastructure support, and an increasingly compatible set of application programming interfaces.

This IDC study evaluates the TCO for each of two popular workloads in conjunction with the underlying operating system. It considers the cost of acquisition and ongoing support and maintenance for each workload independent of one another and of other workloads that may be present on a given system.

Workloads Defined

The workloads studied include the Internet/intranet/extranet and collaborative categories. IDC research identified these two workloads as early successes among Linux customers and likely short-term prospects for other potential users.

Internet/Intranet/Extranet Workloads

The first workload considered is Internet/intranet/extranet, which includes internal and external firewall operations, Web serving and Web caching operations, business-to-business Web operations, and business-to-consumer Web operations.

Collaborative Workloads

The second workload considered is collaborative, which includes applications that enable groups of users to work together by sharing information and processes. Collaborative workloads include integrated collaborative environments, which provide a framework for electronic collaboration (typically within an organization) based on shared directory and messaging platforms.

The core integrated functionality areas are email, group calendaring and scheduling, shared folders/databases, threaded discussions, and custom application development. Centralized IT staff generally performs administration and customization. Collaborative workloads also include messaging applications, such as standalone email. Additionally, this category encompasses instant messaging, unified messaging, and other team-oriented collaborative applications.

Linux has a strong TCO story for Internet/intranet/extranet workloads, and the survey results offer a highly compelling comparison between collaborative workloads and RISC/Unix systems.

IDC Research: Red Hat and IBM Customer View: Aitana SBS (www.aitanasbs.com)

Aitana SBS (Software Business Solution), is headquartered in Valencia Spain. Aitana licenses its primarily collaborative software solutions and also offers them as an application service provider (ASP). The company recently moved its hosting business to some of its 20 IBM xSeries 200 and 220 servers using WebSphere Application Server, DB2, and Lotus Domino on Red Hat Linux. Aitana made its decision because of the combination of Linux price performance and its need for mission-critical reliability with IBM enterprise applications.

Aitana SBS, a member of Premier IBM PartnerWorld and a winner of IBM's Business Partner Award, offers IT solutions appropriate to particular business areas, including system management, communications, and ecommerce. Building on its expertise with Lotus Domino and WebSphere and its overall knowledge of IT systems and networks, it has established a solid base of customers — more than 100 enterprise-level customers and growing.

Aitana discovered benefits in three areas. It was able to significantly reduce software licensing fees and hardware costs. Because the applications run natively over Linux, Aitana was able to deploy services 30% faster, which reduced internal development costs and resulted in getting revenue producing services to the market faster. Finally, Aitana was able to reduce downtime by an extraordinary 73%. Better uptime means higher-quality customer service.

IDC's TCO Model

The purchase price of hardware and software alone provides little indication of total life-cycle cost for an IT solution. IDC believes that TCO includes not only hardware and software costs but also all of the staffing costs associated with acquiring, maintaining, and removing an IT asset from the organization. For many workloads, staffing represents the majority of the ongoing TCO.

IDC's TCO model organizes the costs to acquire, maintain, and replace an asset into three stages: procurement, use, and disposition. A number of activities occur during each of these stages:

- Procurement includes making the lease or purchase decision, generating requisitions, and receiving the equipment.
- Use includes activities such as setup, training, and technical support.
- Disposition, at a minimum, includes removing the equipment (e.g., server or PC) from the work area and transferring data and applications to the replacement equipment.

Costs of external communications, media, power, and floor space are assumed to be very similar between the two configurations and, therefore, are factored out of these TCO calculations.

Both hard and soft dollar costs are associated with each of the specific activities in the asset's life cycle. Combined, these costs represent the total life-cycle cost of an IT asset. Because the number of users supported varies by operating environment, IDC's calculation process averages the number of users to 1,000. All data was normalized to 1,000 users by allocating additional costs for multiple systems or removing costs associated with excess capacity for support services and hardware/software acquisition in accordance with the number of users supported on a system supporting a given workload. The figures are stated in U.S. dollars per year, per user for 1,000 supported users. (See the methodology shown in the Appendix for more information.)

This concept of full life-cycle support cost (from acquisition planning through final disposal) is particularly relevant when measuring Linux TCO. Linux server costs are highly competitive due to the low acquisition cost of Intel architecture server hardware and the Linux operating system. Furthermore, Linux is usually bundled with many of the system services and applications required for the workloads under consideration, which increases the cost advantage of a Linux solution.

The study considered both staffing cost (support, administration, maintenance, and user support) and server cost (hardware, software, and installation) for the two environments. To measure IT staffing cost, IDC created a baseline model that organizes the cost to own, maintain, and replace an asset into 13 life-cycle activities. The costs were tabulated and adjusted for staff members' multiple responsibilities and for system workload sharing to determine TCO cost on a per-year, per-user basis. The process included a step to normalize the acquisition and support costs of various system-size configurations to a per 1,000-user basis. The staffing costs were then combined with the server purchase price, amortized over a one-year period. Ultimately, this data was used to generate a per-user, per-year TCO based on 1,000 supported users.

Under this front-loaded approach, all server hardware, software, and installation costs were allocated to the first year's cost. Although this raises average first-year TCO levels, both platforms evaluated in this study were compared using the same methodology. IDC believes the life expectancies of RISC/Unix and Intel/Linux hardware and SOE software are similar in nature, justifying this comparison.

This original study also does not take into consideration support contracts that may be in place to cover software or hardware. This cost area was not evaluated for several reasons. First, annual expenditures on software or hardware support contracts can vary greatly depending upon the level of assistance a given organization may need for a specific platform. Second, this expense is a tangible cost item that most companies can easily identify without elaborate calculations. Finally, this expense is generally an incremental cost that adds to the annual TCO figure, but it won't have significant impact on ongoing support costs or on hardware acquisition, software acquisition, and installation costs.

IDC Research: Red Hat and IBM Customer View: Support Contracts

IDC did ask questions regarding support contracts in the new research. Organizations that characterized their usage as "mission critical" or as having usage requirements that called for higher reliability/availability/supportability (RAS) capabilities spoke highly of the support offerings from both IBM and Red Hat. Red Hat's Enterprise Subscription Model offered directly by Red Hat or through IBM includes maintenance and support along with the operating system. Both IBM and Red Hat offer a complete array of complementary consulting, integration, and support services, which customers can utilize, as needed, for their overall Linux solutions.

These service offerings provide an important foundation for Linux's movement up market into more demanding business-critical workloads.

The study identified Linux as offering a distinct TCO advantage over RISC/Unix on both Internet/intranet/extranet and collaborative workloads. The ratio of Unix and Linux costs for Internet/intranet/extranet use was 1.8 to 1, with RISC/Unix TCO running 80% higher than that of Linux. In the collaborative workload study, Unix to Linux cost was 5.5 to 1, with RISC/Unix total annual per-user cost running at 5.5 times that of Linux.

IDC Research: Red Hat and IBM Customer View: Automatos (www.automatos.com)

Automatos, headquartered in Cupertino, California, is a remote management service provider, delivering agent management, capacity planning, and performance analysis services to corporate customers.

Automatos targets its offering at the midmarket. These organizations have increasingly complicated networks. Automatos provides sophisticated online management solutions and services that can be used and understood by their existing staffs without the addition of high-priced, specialized network experts. Organizations are able to meet the needs of their networks, such as problem notification, asset management, configuration performance management, and software metering, with Automatos' solutions and services.

Automatos delivers its solution in a challenging environment. It must perform and perform well. The company recently decided to standardize on an enterprise-grade server optimized for databases, so it migrated its applications to IBM DB2 running on Red Hat Linux Advanced Server (Red Hat Enterprise Linux AS). Automatos saw these technology choices as "best-in-class" decisions. It chose the "best-in-class products and vendors" to serve its customers.

Automatos is committed to serving its customers. Being an Internet-centric service provider, it needed to be able to provide reliability supported by service level agreements (SLAs). Automatos has end-to-end availability of 99.994%. The company cannot tolerate any weak links in its solution supply chain.

Having a worldwide client base, Automatos needed an operating system that could be maintained remotely over the Internet. Having fewer than 100 employees, Automatos appreciated that the client systems often required only one day to deploy and were so efficient and reliable that the company was able to reduce IT staff by 20%.

Mission-critical solutions (with demands for 24 x 7 x 365 reliability/availability/supportability) supported by mission-critical products and vendors (DB2 and Advanced Server and IBM and Red Hat) met the company's decision criteria.

Automatos states that its strengths are based on a technology that is multiplatform, multilanguage, Internet centric, self-serviced, simple to deploy, 100% automated, cost effective, conclusive, and comprehensive. Its commitment to IBM and Red Hat is an important part of what allows this strong assertion.

DETAILED COMPARISONS

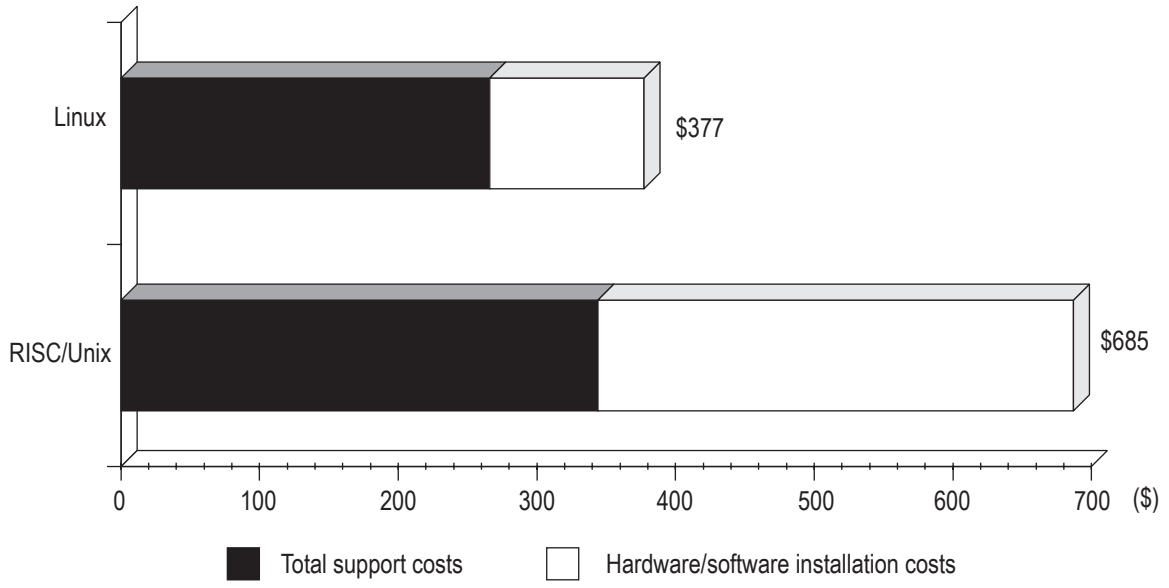
Internet/Intranet/Extranet Workloads

Figure 2 presents the TCO comparisons between Linux and RISC/Unix workloads as determined by this study. First-year TCO comparisons show RISC/Unix cost at $685 per year, per user for 1,000 users. By comparison, Linux cost was found to be $377. These TCO values present RISC/Unix systems with a first-year TCO that is 80% higher than that of Linux.

The study found that the mean number of servers running Internet/intranet/extranet workloads varied from 12.2 systems for RISC/Unix to 3.1 systems for Linux. In other words, the average RISC/Unix shop had far more systems running that supported this workload than did the average Linux shop. User-per-workload counts varied dramatically as well, with the mean number of users supported by a RISC/Unix Internet/intranet/extranet workload at 7,597, while the Linux users-per-workload mean for this same metric was only 1,150.

It came as a surprise that the mean number of users supported on this workload aboard Linux systems was far lower than the mean number found on RISC/Unix servers supporting this workload. Why would this be the case? One possibility is that Linux is still a relatively new SOE used in larger organizations and, therefore, has not expanded its reach to support the broad numbers of users that RISC/Unix does today.

Figure 2: TCO for Linux and RISC/Unix Internet/Intranet/Extranet Workloads *(US$ per year, per user for 1,000 supported users)*



Source: IDC, 2003

This dramatic difference apparently is one metric that helps close the gap in TCO between RISC/Unix and Linux systems, probably due to the economies of scale the RISC/Unix configurations can provide. As the average number of Linux users supported (on this workload) increases, the findings of this study suggest Linux may also realize this economy of scale and extend its TCO advantage, as seen in other workload types. The advances in scalability of Linux over the past couple of years, including the release of numerous products based on newer kernels in both 32- and 64-bit implementations and the availability of IA-64 hardware, will play a supporting role in growing Linux's scale-out story.

IDC notes that because of the close proximity of the release of early Linux SOE products built using the Linux 2.4.x kernel to the study interviews, it is unlikely at that time that most study participants were currently using versions of Linux built on the Linux 2.4 kernel. The introduction of 8-way systems with 16GB of RAM could suggest that Linux is a fit for some of today's truly enterprise-class applications.

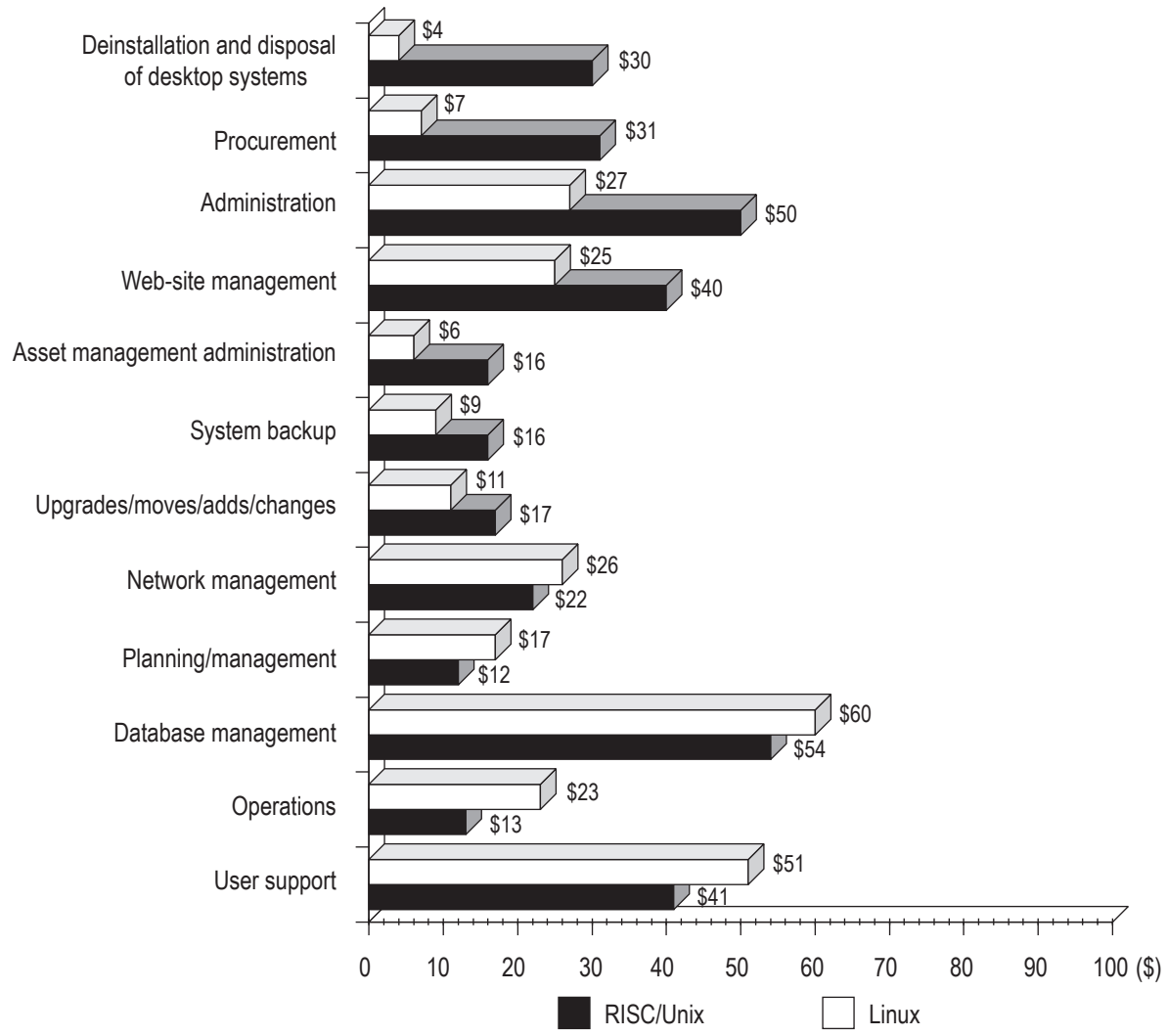
Support Cost Comparisons

It is interesting to compare areas with significant differences between these two platforms. Figure 3 and Table 1 present summary TCO comparisons on a line-by-line basis for Internet/intranet/extranet workloads.

Starting from the top of Figure 3, we note that disposal of a Linux server is considerably less expensive than that of RISC/Unix platforms because the "disposal" process associated with an IA-32 server is to recycle it into another in-house use, possibly with a different operating system. For example, when an IA-32 server running NetWare, Unix, or Windows is retired, it may find another use within the organization as a file/print or communications server running Linux rather than being discarded. By comparison, retirement of a proprietary RISC platform is likely a more complex and more permanent operation.

Likewise, procurement staff costs also strongly favor Linux. Presumably, the lower costs associated with procurement of Linux are related to the standard nature of Intel hardware. Acquiring a platform to support the Linux operating system is comparable to acquiring an Intel platform for use with Windows or NetWare. As a result, procurement may be as simple as "adding one more" to the open purchase order.

Figure 3: Detailed TCO for Linux and RISC/Unix Internet/Intranet/Extranet Workloads *(US$ per year, per user for 1,000 supported users)*



Source: IDC, 2003

Administration costs on the Linux system are roughly half those of the RISC/Unix system because of higher incidence of multiple workloads aboard RISC/Unix and its generally more complex configuration (including enterprise resource planning [ERP], database, and other complex workloads), whereas a Linux server's workloads will often be less complex in nature (print and file, Web serving, Internet, and network infrastructure workloads). Although this study sought to measure administration costs associated with a single workload, a more complex system configuration and more complicated workloads have the potential to raise the administration challenges even for unrelated workloads.

One of the highest individual cost areas for the Internet/intranet/extranet workload came from database management support because most environments that are supporting Web operations likely either are using a Web content management system that is based on a database or have some interaction with a database for authentication purposes, dynamic content generation, or archive retrieval.

Table 1: Detailed TCO for Linux and RISC/Unix Internet/Intranet/ Extranet Workloads *(US$ per year, per user for 1,000 supported users)*

Cost Area	Linux	RISC/Unix
Deinstallation and disposal of desktop systems	4	30
Procurement	7	31
Administration	27	50
Web-site management	25	40
Asset management administration	6	16
System backup	9	16
Upgrades/moves/adds/changes	11	17
Network management	26	22
Planning/management	17	12
Database management	60	54
Operations	23	13
User support	51	41
Total support costs	**266**	**342**
Per-user server hardware/software/ installation costs	111	343
Total one-year cost of ownership	**377**	**685**

Source: IDC, 2003

Otherwise, Linux and RISC/Unix TCO are remarkably consistent from a staffing-support consideration in this workload. The big differentiation for Linux and RISC/Unix TCO in an Internet/intranet/ extranet workload is the acquisition cost for hardware and software.

Subsequent Years

During the first year, total support costs, platform, software acquisition, and installation costs ran 80% higher for RISC/Unix than for Linux. Given the one-year hardware-software amortization considered under this study, in subsequent years, Linux versus Unix TCO falls back to a more competitive level of $266 versus $342 per year, per user, with the Unix environment TCO running 28% higher than that of Linux. Subsequent-year costs are shown in Figure 2 (discounting "hardware/software/installation costs"). IDC notes that few companies amortize the cost of hardware and software investments over a one-year period and that there will likely be some hardware or software support contracts with key vendors that will influence the actual results any end-user company will experience.

IDC Research: Red Hat and IBM Customer View: Determine Software (www.determine.com)

Determine Software, headquartered in San Francisco, is a leading Web-based contract management application service provider (ASP). It serves the needs of Global 2000 companies with significant buy-side contractual obligations and agreements. Determine delivers control and efficiency over the entire contract life cycle, enabling increased market capitalization through contractual savings, reduced processing time, increased compliance management, and reduced financial risk.

Determine Software is migrating its 23 custom Unix servers to Red Hat Linux running over IBM xSeries 360 and 440 servers. The company projects that it will not only cut its equipment expenditures by 40% ($3.3million) and reduce spending another $35,000 in third-party software, but it will also deploy services 25% faster. Determine has found that being quicker to market will increase sales by 15%. Additionally, the company has identified that the xSeries is highly reliable and has sufficient capacity yet remains inexpensive. This combination has enabled Determine to deploy its applications behind its client's firewall, something it could not afford to do before. This ability opens up significant opportunities for additional customers and "tens of millions of dollars of additional potential revenue."

Determine Software has leveraged its membership in IBM's xSP Prime Program for Developers to gain access to IBM's Solution Center to test its offerings. Having access to what it sees as an "enablement center" — both equipment and knowledgeable staff — has facilitated its product enhancements and accelerated its development and release cycle. xSP Prime gives Determine Software's experts access to IBM experts in business, technical, and "go-to-market" areas.

Determine Software offers service level agreements (SLAs) to its clients as part of its commitment to superior performance and service. The company sees its choices of technology — Red Hat Linux and IBM xSeries — as proof of that commitment. Both choices fit its decision criterion of having the capability of meeting mission-critical needs. Determine demands solid performance from its platforms, application server software, network infrastructures, and vendors. Its choices allow it to be more responsive to these dynamic needs. The company feels less restricted and bogged down in "administrivia" with its new platforms. Determine can use its time and energy to stretch and test new ways to optimize its operations and service to customers.While continuing to serve the needs of the Global 2000, Determine Software is positioning itself to meet the needs of what it describes as the midmarket. Its product, services, and technology choices support that plan.

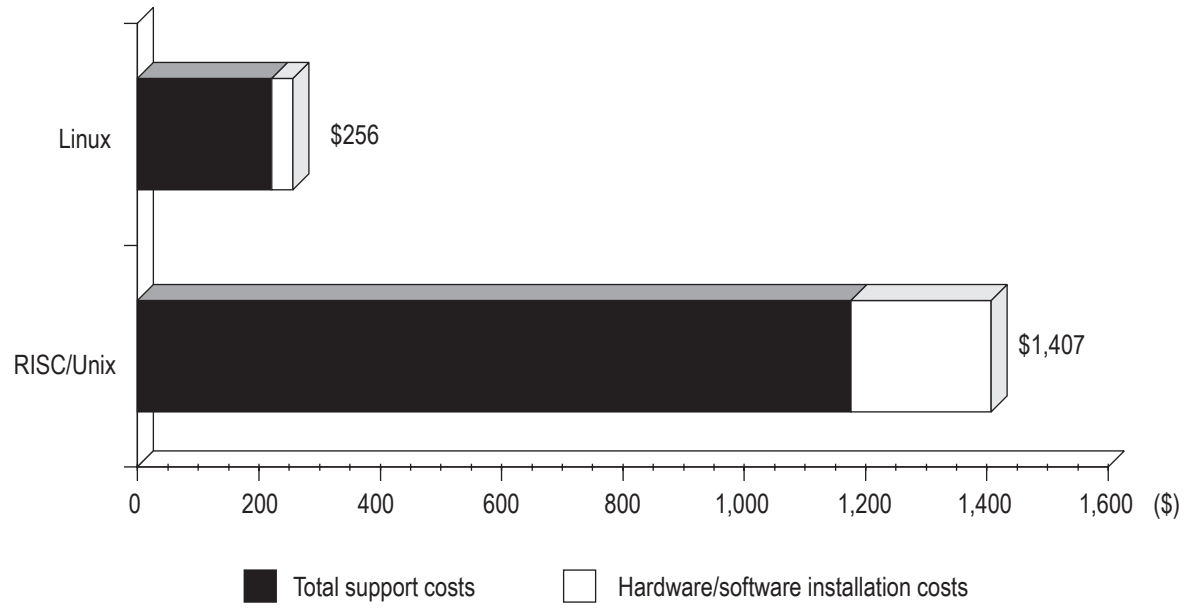
Collaborative Workloads

Figure 4 compares TCO values for collaborative workloads on Linux and RISC/Unix. At the roll-up level, the cost for one-year TCO for Linux, based on a 1,000-user load, is $256 per year, per user. By comparison, RISC/Unix one-year TCO is $1,407 for a similar support level. These values show the first-year TCO level for RISC/Unix systems costing 5.5 times that of Linux.

The study found that the mean number of servers running collaborative workloads varied from 11 systems for RISC/Unix to 4.1 systems for Linux. In other words, the average RISC/Unix shop had far more systems running that supported this workload than did the average Linux shop. However, the user-per-workload ratio was nearly equal, with the mean number of users supported on RISC/Unix collaborative workloads at 4,802, while the Linux users-per-workload mean for this same workload was 4,558.

Considering the relative difference in the mean number of systems, with study participants citing on average nearly three times the number of RISC/Unix systems versus Linux, but a virtually identical mean number of users supported on this workload, we found that Linux clearly has a significant advantage over RISC/Unix in this workload. Supporting an equal number of users with fewer systems contributes to the TCO advantages of Linux (see Figure 5 and Table 2).

Figure 4: TCO for Linux and RISC/Unix Collaborative Workloads
(US$ per year, per user for 1,000 supported users)



Source: IDC, 2003

But there are other likely contributors to the TCO advantage realized by Linux systems with collaborative workloads. Across the spectrum of staffing costs, with the exception of procurement and operations, staffing costs for Linux were down anywhere from 6% to 50% of the staffing cost of RISC/Unix systems supporting a comparable workload.

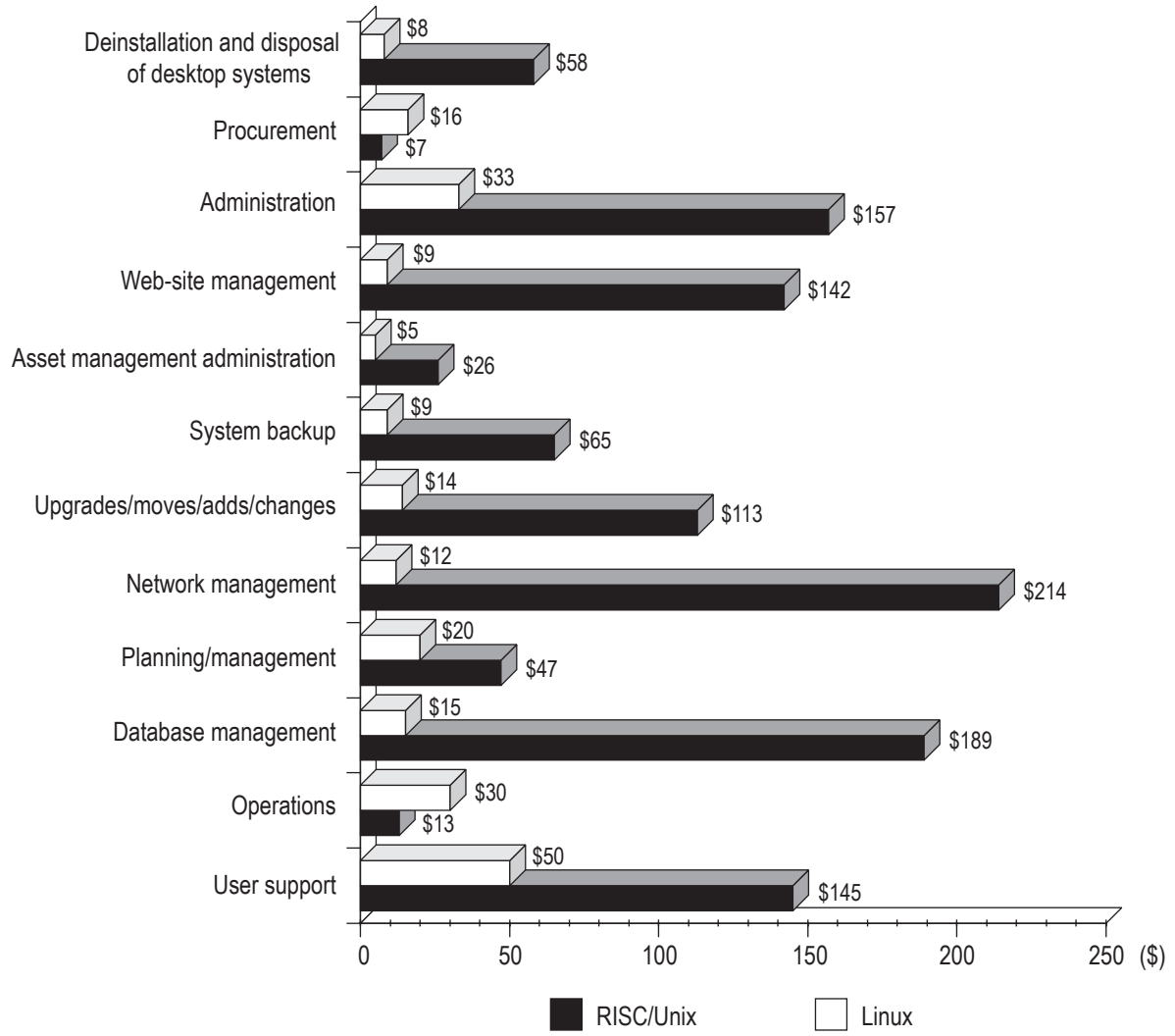
It is informative to compare the dramatic TCO results illustrated by the collaborative workloads to the more competitive results found in the Internet/intranet/extranet workload study. IDC believes that the higher overall utilization of Linux systems supporting collaborative workloads in this study results in increased efficiency of supporting the Linux systems.

It also appears that as the number of users per workload approaches similar levels, Linux TCO expenses fall at a faster rate than the declines experienced by RISC/Unix configurations. This is partly due to the easy access to industry-standard IA hardware, the broad availability of Linux software, and the more simplified workloads typically supported by Linux.

Database management costs were considerably higher for Unix than for Linux when supporting collaborative workloads. Comparing the collaborative workload results to the database management support costs on the Internet/intranet/extranet workload, we see a different scenario. In the Internet/intranet/extranet workload, the comparison was that of a less than fully utilized system (Linux) that supported, on average, 1,150 users versus Unix with, on average, 7,597 supported users on that workload — yet database management support costs were close to equal. Current implementations of larger and more complex database applications running Oracle9*i* RAC over Linux were not part of the original study.

In the collaborative workload, Linux and Unix average numbers of supported users were effectively equal, at 4,558 and 4,802, respectively, while database management support costs differed by a factor of more than 12 in favor of Linux.

Figure 5: Detailed TCO for Linux and RISC/Unix Collaborative Workloads *(US$ per year, per user for 1,000 supported users)*



Source: IDC, 2003

IDC believes there are two factors at work here. The first factor is that the more comprehensive use of Linux improved TCO on database management support costs (and on other cost areas).

The second factor is that Unix systems may be more likely to have Lotus Notes or Domino installed than Linux (which often is deployed with Sendmail), which creates a secondary database management system (DBMS) environment to manage.

Other support areas, such as network management, show considerably higher support costs for Unix compared with Linux. Network management costs include those for system restore and network reconfiguration. IDC believes this difference relates to the relatively more complex workloads being supported by the Unix environments. Also, larger Unix systems are more likely to be part of a more complex infrastructure (such as a cluster, or they are providing critical services to other servers) that makes the network management aspects of the system more complex and, therefore, more costly.

Table 2: Detailed TCO for Linux and RISC/Unix Collaborative Workloads *(US$ per year, per user for 1,000 supported users)*

Cost Area	Linux	RISC/Unix
Deinstallation and disposal of desktop systems	8	58
Procurement	16	7
Administration	33	157
Web-site management	9	142
Asset management administration	5	26
System backup	9	65
Upgrades/moves/adds/changes	14	113
Network management	12	214
Planning/management	20	47
Database management	15	189
Operations	30	13
User support	50	145
Total support costs	**221**	**1,176**
Per-user server hardware/software/ installation costs	35	231
Total one-year cost of ownership	**256**	**1,407**

Source: IDC, 2003

Subsequent Years

Linux was quite impressive versus RISC/Unix in its first year and subsequent years of operation. During the first year, platform and software acquisition and installation costs on a per 1,000-user basis were $35 per user for Linux versus $231 per user for RISC/Unix.

By comparison, total RISC/Unix support costs (excluding hardware, software acquisition, and installation costs) were 5.3 times those of Linux, or $221 per year, per user compared with $1,176 for RISC/Unix. Subsequent-year costs are shown in Figure 4 (discounting "hardware/software costs"). Because hardware/software/installation costs are a relatively small component of the first-year TCO, subsequent-year costs will be equal or slightly more favorable for Linux.

IDC Research: Red Hat and IBM Customer View: eMarket AG (www.emarketag.ch)

eMarket AG, headquartered in Zurich, Switzerland, was established in 2000. eMarket AG is a software developer and Web application service provider, serving the needs of the motor vehicle market, healthcare providers and hospitals, the tourism industry, and Web agencies. The company defines it core competency as content management systems (CMS). CMS applications manipulate large amounts of data and demand performance, scalability, and interoperability.

In mid-2000, eMarket AG moved its leading ebusiness product to an IBM Java environment. eMarket AG uses WebSphere Application Server on Red Hat Linux as its applications server and DB2 Universal Database on xSeries Server 350 and Netfinity 5500 to meet its database requirements.

eMarket AG uses its organizational expertise and creative choices of technology to serve the needs of its clients. Red Hat's and IBM's commitment to open source solutions, coupled with sophisticated support infrastructures, made the company's choices easier.

Recent client implementations calling for fast deployment, high transaction throughput, and the handling of complex algorithms were well met by the combination of IBM and Red Hat offerings. eMarket AG found that the more scalable, higher-performance WebSphere Application Server/DB2 Universal Database implementation resulted in 35% more page views and a considerable increase in annual revenue. Thanks to Red Hat Linux and WebSphere's vertical scalability, eMarket AG has also eliminated another $150,000 per year in hardware costs and achieved massive savings in third-party software and operating system costs.

CONCLUSION

Linux on the Intel platform offers a lower-cost alternative to RISC/Unix for the workloads analyzed in this document. These study results do not suggest that Linux will offer lower TCO than RISC/Unix on every workload or at every level of system configuration. However, when used with key workloads, such as Internet/intranet/extranet or collaborative applications, Linux has the potential to offer significant cost savings for enterprise computing.

Not coincidentally, other IDC studies found these workloads to be among the most popular workloads for Linux. Other popular Linux workloads include security and firewall, file and print services support, and software development on technical workstations.

The fact that these workloads offering TCO benefits aboard Linux are supported by open source application packages suggests that other workloads that are broadly supported by open source applications may also be attractive for enterprise users. As these other workloads increase in popularity for Linux, TCO benefits may emerge for those workloads as well.

Linux vendors are moving quickly to further improve Linux's position as a growing SOE. Initiatives are under way to extend the reliability and scalability of Linux — Department of Defense Common Operating Environment (COE) certification of Red Hat Enterprise Linux and the previously mentioned 8-way systems with 16GB of RAM are tangible evidence. Equally important, numerous technologies are being developed to further simplify the process of managing Linux server software through services from a wide variety of vendors including IBM and Red Hat. IDC believes these services will ultimately have a positive impact on the TCO associated with Linux across most common workloads.

This study has shown that enterprises with the right mix of workload requirements and in-house skills can realize a significant cost reduction by using Linux for workloads today. This deployment can be accomplished in-house or with the help of professional services provided by consultants knowledgeable in Linux use and deployment.

Today, two workloads have been identified that offer TCO savings. In the future, it is likely that other workloads, such as firewall and security, will offer comparable benefits to companies that proactively manage their environments.

IDC Research: Red Hat and IBM Customer View: Exxcom (www.exxcom.com)

Exxcom, headquartered in Bedfordshire, England, provides a range of short-term and ongoing telecommunications management services to organizations of all sizes in the United Kingdom and Europe. These analytic telephone line traffic services and billing consolidation services offer a cost-effective review of the performance and utilization of its clients' telecommunications infrastructure systems, together with a breakdown of costs by type, even down to individual transactions.

Exxcom emails its clients their total telcom costs each month — fixed and mobile call charges, line and equipment rentals, pager charges, and so forth. Exxcom's clients can also log on and view their information in a custom format that best fits their needs — even down to the individual employee level. Consolidated views of multiple sites apportioned by cost centers are available. Automatic notifications can be made based on established criteria.

Exxcom must handle a great deal of data, analyze that data, and provide that information back to its clients in a timely and consistent manner. Although it provides a leading-edge service, Exxcom used a combination of legacy software and paper-based reports; however, its customers demanded an Internet-based reporting and information system.

The solution had to be based on technology that is highly available, highly reliable, and highly supportable. Exxcom's commitment to providing the right information to the right people in the right format upon demand called for those attributes. The solution was IBM Netfinity 6000R and now xSeries servers deploying DB2 for Linux on Red Hat Linux.

Exxcom appreciated the low cost of the solution from the start, paying less than $5,000 per server for hardware and software. These low initial costs multiplied to $60,000–80,000 as Exxcom doubled its customer base last year and is on pace to serve 5 to 6 times as many this year. Intelligent decisions about technology have resulted in its small staff being able to serve 2,000% more customers without adding personnel and at the same time delivering 20% higher availability.

Exxcom's decision criteria were well thought out. It demanded functionality, stability, and overall cost of ownership advantages in its selection of a database. DB2 was its choice. The company demanded no less from its choice of operating systems. It wanted robustness, scalability, and cost-effectiveness. Red Hat Advanced Server was its choice.The right technology decisions have positioned Exxcom for the future. Because it is on a fast track for growth, Exxcom has benefited most from being able to set up new customers and sites in one-quarter the time required in the past. The company estimates that it has increased new revenue sources by £2.5 for every £1 spent.

IDC Research: Red Hat and IBM Customer View: Mercury Insurance Group (www.mercuryinsurance.com)

Mercury Insurance Group, headquartered in Los Angeles, is one of the leading independent agency writers of automobile insurance and one of the fastest-growing auto insurers in the United States.

Due to the increasing obsolescence of its installed server base, Mercury Insurance, with operations in California, Florida, Georgia, Texas, Illinois, Oklahoma, New York, and Virginia, chose to move its operations to 65 IBM eServer x440 running Red Hat Linux, including Red Hat Enterprise Linux Application Server. Mercury needed to deploy Java-based Web portal applications to support sales employees as well as independent agents. It chose the IBM and Red Hat solution based on its price/performance, reliability, and ability to add processors to meet planned growth.

The total solution includes IBM storage servers, DB2 database, Tivoli management software, and WebSphere Application Server platform in a Red Hat Linux operating environment. Results have been positive. Reduced hardware, software development, and staffing costs have reinforced the validity of the solution decision.

APPENDIX

Methodology Overview of the Original Study

A total of 142 telephone interviews were conducted with IT managers at companies with a minimum of 100 employees who are familiar with the details of staffing, systems configuration, and application software for the servers at their site.

On average, the 142 companies included in our survey reported annual revenue of $2.4 billion. Industries represented in our survey include manufacturing (15%), business services (13%), telecommunications (11%), government (10%), education (6%), healthcare (5%), transportation (5%), retail/wholesale (5%), finance other than banking and insurance (4%), insurance (4%), utilities (2%), nonprofit (2%), and other services (17%). The study results presented in this document represent platform demographics as shown in Table 3.

Table 3: Number of Survey Participants for Studied Workloads

Workload Type	Linux	RISC/Unix
Internet/intranet/extranet	50	30
Collaborative computing	30	32
Total	80	62

Source: IDC, 2003

Survey Instrument

The survey instrument, which averaged 23 minutes in length, was administrated with the use of a computer-aided telephone interviewing (CATI) system. A pretest of 30 interviews was conducted to test the survey instrument for flow, length, and question clarity. We spoke with individuals who are knowledgeable about their organization's use and management of PCs and servers and could provide a top-line view of their organization's current PC and server systems installed, including staffing requirements and system workload for both clients and servers.

Quotas were established based on the server operating environment and primary server workload. To allow comparisons between segments, we instructed respondents to answer the survey questions based on just one server operating system and workload, even if more than one was present.

Staff Cost Calculations

To capture staffing cost information, we asked respondents to quantify the human resources dedicated to the various operational tasks involved in server environments. The operational tasks investigated include those listed in Table 4.

Table 4: Operational Tasks Studied for TCO Calculations

Task
Administration
Asset management administration
Database management
Deinstallation and disposal of desktop systems
Installation
Network management
Operations
Planning/management
Procurement
System backup
Upgrades/moves/adds/changes
User support
Web-site management

Source: IDC, 2003

The staff tasks listed in Table 4 consist of the day-to-day activities (including related skills-maintenance training time) for the following specific activities:

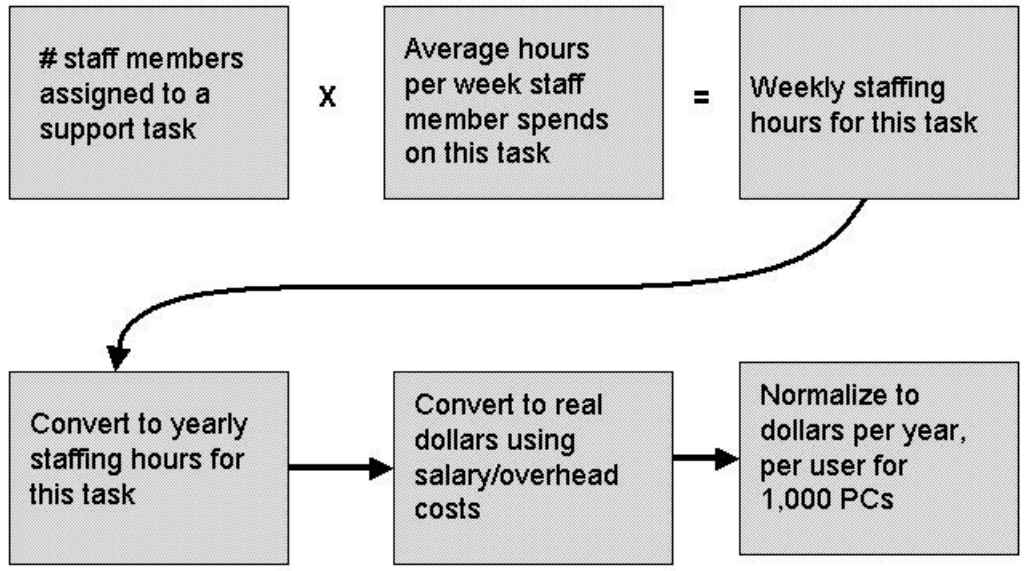
- **Administration.** This category includes system-level operations, including activities such as adding or deleting users and setting and resetting user passwords. IDC notes that sites that invest more time and resources in tracking and maintaining system information (location, configuration) as well as user information (password, location, department) can have lower administration costs.
- **Asset management administration.** The asset management administration category includes tracking IT equipment (configuration, location, business unit, financing terms) and maintaining records of adds, moves, and changes.
- **Database management.** For the purposes of IDC's TCO studies, IDC defines database management as creating, adjusting, and allocating database resources related to the workload being studied. IDC believes that standardization of server and database vendors can reduce costs in this area. These factors contribute to less downtime and faster recovery from downtime.

- **Deinstallation and disposal.** At the end of a system's life cycle, there are residual costs associated with decommissioning a system, including the removal of the equipment from the workspace, removing cables and attached peripherals, and erasing sensitive data and applications. Disposal also involves removing equipment from the organization. Previous IDC research indicates that sites that have asset management practices in place, including asset tracking, standardized upgrade practices, and scheduled replacement cycles, typically have lower deinstallation and disposal costs. Additionally, companies that lease PCs and servers also experience lower disposal costs.
- **Installation.** Installation includes setup and configuration of desktop systems and servers. Previous IDC research indicates that sites that standardize on fewer vendors and fewer supported configurations experience lower installation costs. Supporting fewer configurations and models helps to minimize integration issues and avoids incompatibilities of items such as components and drivers. For the purpose of this TCO study, we included installation costs with first-year hardware and software acquisition costs.
- **Network management.** Network management includes tasks such as configuring network hardware, fault detection, and server recovery. Lower costs can result in network management due to an accurate account of devices on the network, including configuration and allocation, that allows for more efficient servicing and equipment replacement.
- **Operations.** The operations category covers such tasks as job scheduling, print management, and report formatting and distribution. It also covers routine interaction with applications for provisioning purposes.
- **Planning and management.** Operations under IT planning and management includes determining platform upgrade paths, time of upgrades, and installation and take-out schedules. IDC's past research indicates that sites that spend more time up front on planning benefit from lower costs.
- **Procurement.** The procurement process involves activities such as researching and making a lease/purchase decision, ensuring requested equipment complies with company standards, obtaining authorizations, generating requisitions, and receiving the equipment. IDC believes that organizations that standardize on fewer technology (server and software) vendors spend less time on purchasing; therefore, they have lower costs. This results in less contract negotiation and management. Also, sites that lease equipment may benefit from the procurement services provided by leasing companies.
- **System backup.** System backup includes daily operations related to server storage backup and recovery operations, including managing storage devices that are used in the backup process.
- **Upgrades/moves/adds/changes.** This category includes the staffing costs only to upgrade/move/add/change PCs and does not include the cost of upgrades to hardware or software.
- **User support.** This category includes responding to help desk calls and desktop-oriented troubleshooting in general. IDC believes that maintaining a limited number of installed vendors and supported configurations reduces complexity and cost in computing environments. Additionally, past research indicates that sites that manage assets and maintain an inventory with specific hardware, software, and network configuration data for each user can achieve lower user support costs than sites that do not track this information effectively. This type of data provides IS support staff with system information, saves time, and reduces visits to the user's desktop in resolving problems, thus lowering overall support costs. In some cases, the problem can be resolved over the phone, avoiding time-consuming visits to the user's desk.
- **Web-site management.** IDC defines Web-site management as Web server management; content management; posting, updating, and deleting of Web content (but not the creation of content); hyperlink maintenance; managing/monitoring Internet service provider [ISP] relationship(s); security; reporting Web statistics; and customer support.

Tallying Staff Support Hours

The study methodology followed the process identified in Figure 6, where study participants were first asked to quantify the number of staff members who participate in each of the support tasks listed in Table 4. Study participants were then asked to estimate the average number of hours per week that each staff member spends providing the type of support being measured.

Figure 6: Staffing Cost Calculation Process



Source: IDC, 2003

Weekly staffing person-hours were then calculated by multiplying the number of staff members by the average number of support hours spent each week, which results in the weekly staffing hours required for covering this support area. These hourly totals were then projected on a full-year basis.

Finally, the full-year hourly total was converted to dollar costs by multiplication with average salaries (including benefits) for their particular job description. Salaries and overheads are based on countrywide averages to eliminate any regional differences. The output from that calculation yielded average annual staffing costs.

Because the number of users supported varied by operating environment, IDC averaged the number of users to 1,000, and all data was normalized to 1,000 client PCs (users). This averaging was accomplished by allocating additional costs for multiple systems or removing costs associated with excess capacity for support services and hardware/software acquisition in accordance with the number of users supported on a system supporting a given workload. If a single system could support only 500 users, allowances for acquisition costs of two systems and double the number of related support hours were factored into this total. The figures are stated in U.S. dollars per year, per user for 1,000 supported users.

Hardware and Software Costs

Survey respondents were asked to provide the average purchase price of the typical Linux or RISC/Unix server, running either a collaborative computing or Internet/extranet workload, including the hardware and bundled software. (These costs include all software licensing fees and software support costs.) The system costs captured represent "as acquired" costs. They do not allow for upgrading or other hardware/software expansion costs because considering the result of such system reconfiguration would potentially

affect both the number of users supported by a given system and staffing costs, thereby requiring a complete recalculation of the baseline TCO for that system. IDC then added installation costs to come up with total hardware acquisition, software acquisition, and installation costs.

These acquisition costs were considered in their entirety for the first-year TCO calculations. This approach allowed IDC to recognize those costs without attempting to conduct a detailed analysis of ongoing hardware or software upgrade and maintenance operations. IDC could then focus the subsequent-year component of this study specifically on staffing support costs.

Because the number of users supported varied by operating environment, IDC averaged the number of users to 1,000, and all data was normalized to 1,000-user environments. The figures are also stated in U.S. dollars per year, per user for 1,000 supported users.

Once full costs were calculated, IDC segmented the sample based on an average workload rating on a per-system basis to allow for prorating of costs associated with supporting multiple workloads on a single system. Using workload data collected in IDC's Server Workloads study, on average, 48% of Linux servers in use are single-workload systems, and 45% of RISC/Unix servers are used as single-workload systems. The remaining systems, 52% of Linux servers and 55% of Unix servers, are running multiple workloads. Additionally, the Server Workloads study found that the average number of distinct workloads for Linux and RISC/Unix systems (that are known to be supporting multiple workloads) is 5 and 7, respectively.

This workload deployment was used to allocate costs as either 100% attributable to the studied workload or as a component workload of a more complex deployment. For single-workload systems, 100% of the hardware, software, and staffing costs were allocated to the TCO tally, while multiple workload systems were prorated to apply only the cost associated with a portion of the total workload that was consuming system resources. In the case of Linux servers, because the average multiple workload involved five tasks, 20% (one-fifth) of the system costs were allocated to the TCO total. At the same time, RISC/Unix servers were typically running seven distinct workloads, 14% (one-seventh) of the costs associated with multiple-workload systems were allocated to the TCO total.

Study Sample and Salary Conversions

Several lists were used as the sample for this study. The majority of the sample was pulled from a *NetworkWorld* subscriber list of IT managers. Red Hat, sponsor of this study, provided two separate lists for Linux users; a list of fewer than 200 "enterprise" customers and a list of 2,000 people who had visited **www.redhat.com** and downloaded a previously published IDC white paper on TCO. The *NetworkWorld* list also provided interview subjects for the Linux user segment. Geographic demographics for study participants were limited to North America.

Salary data used to calculate staffing costs came from a number of sources, including *Informationweek*'s National IT Salary Survey (approximately 20,000 IT professionals), *Computerworld*'s 14th Annual Salary Survey, TechTarget.com Salary Survey (10,608 IT professionals — 3,306 HP Unix, 1,852 Solaris, 5,450 Windows), and *NetworkWorld*'s Salary Survey (1,700 IT professionals). Cost savings projected in this paper are IDC estimates based on survey data. Our survey did not attempt to summarize best practices. It did capture an average estimate of costs and savings for medium-sized and large organizations in the United States. The findings in this report are based on the results of the 142 phone interviews conducted with sites running Linux or RISC/Unix servers.

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