Accelerating the Adoption of Enterprise Linux Through IBM Software Solutions

An IDC White Paper
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EXECUTIVE SUMMARY

Applications have long been the lifeblood that makes one computing environment more successful than another. The availability of applications can accelerate the early adoption of a new operating environment. At the other end of the life cycle, a robust suite of applications can retain a customer base aboard a platform that otherwise might be considered obsolete. The challenge Linux faces today is making the leap from its early role as an infrastructure solution to a mainstream role as a platform for applications. A robust suite of compelling applications, especially business-critical applications, is a required element for such a move.

The potential is good for this transition to take place. Linux has made remarkable progress in growing its market presence since first becoming available in 1993 and making a humble entry into mainstream use in some markets between 1999 and 2000. The operating system is currently available aboard virtually every major hardware platform and 32-bit and 64-bit processors, as well as a wide variety of low-end embedded processors.

This white paper examines the evolution of Linux as well as IBM's contributions in the software arena. IBM's experience and previous successes with creating a self-supporting ecosystem around a platform, coupled with IBM's motivation to see Linux succeed, suggest that IBM's current investments will result in a strong portfolio of applications, widespread commercial deployments, and, of course, the deployment of more IBM applications, infrastructure software, and hardware.

IDC notes that IBM's presence in this market helps fill some of the voids that exist for a Linux infrastructure software stack today. IBM's solutions include:

- Basic development tools

- Portable application infrastructure components, including Java 2 Enterprise Edition (J2EE) application servers and Java application development tools

- Database engine technology

- Collaborative, email, and groupware software solutions that offer platform-independent deployment

- Management tools

IBM's goal has been to jump-start the adoption of Linux for business-critical applications, and judging by what IBM has accomplished so far, the company is well on its way to building the ecosystem that will sustain Linux long into the future.

THE GROWTH OF LINUX AND ITS EMERGENCE IN BUSINESS

Linux began in the early 1990s as a technical exercise for Linus Torvalds, a doctoral student at the University of Helsinki, and quickly grew into a technical computing solution that was embraced by technically sophisticated users. In many cases, these developers participated in the development of Linux because the operating system offered them an opportunity to tailor a technology to suit their specific needs.

The first deployments that could be categorized as "commercial" grew out of the same research, scientific, and academic communities that were favorable to Linux in its earliest days. Those deployments saw that Linux was used as a workstation or server operating environment (SOE), configured to address a range of technical applications, scientific analysis, and mathematical calculations for members of the research, engineering, scientific, and academic communities.

Not surprisingly, these deployments — which were almost always in technically sophisticated environments — did not require fancy user interfaces because the users were more interested in the data they could process on the system than the look and feel of the operating system itself. Over time, these early deployments led to larger and larger configurations, which ultimately led to loosely coupled parallel processing clusters or grids of systems designed for large-scale compute and modeling workloads. The workloads expanded to include high-performance computing for research, engineering, academic, or digital content creation.

In 1998, Linux began to gain momentum outside the high-performance, technical, and scientific communities. In particular, Linux gained increased acceptance among users that traditionally used Unix because of the considerable similarities between the two environments. Organizations that possessed Unix skills already had the necessary expertise to deploy this low-cost, fully serviceable software aboard low-cost, high-volume systems.

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Since that time, Linux has made significant progress. Today, Linux is found in organizations using a variety of computing platforms, from Windows and NetWare to Unix.

However, despite the success that Linux has experienced over the past few years, IDC studies consistently find that Linux continues to be deployed largely in one of three primary roles:

- **High-performance/compute system.** This traditional form factor of Linux still continues to play a leading role in Linux system deployments. Although high-performance deployments are increasing, the increased visibility and relatively higher volume of general-purpose deployments are attracting great attention. These deployments are increasingly found outside the research, engineering, and academic environments. Organizations in the financial services market are increasingly using multisystem Linux-based configurations for risk analysis or portfolio management and optimization.

- **Infrastructure server.** IDC studies find that the leading usage of Linux today is in the role of a basic infrastructure server. In this role, Linux is often used for print and file services, Web serving, DNS, DHCP, and directory services; routing; network backup services, firewall protection, email serving, forwarding, or antivirus operations; and network security operations.

- **Application deployment.** More recently, IDC has seen increased use of Linux as a platform for applications. The earliest adoption for Linux in this form factor is within organizations that traditionally have developed, deployed, and supported their own proprietary applications. Not surprisingly, such organizations have strong technical development and support skills on staff. Multisite replicated solutions for retail, travel, and healthcare organizations are increasingly based upon Linux.

Market Growth Rates and Projections

IDC data shows overall Linux new license revenue shipments in 2001 to be up by nearly 28% over 2000. This increase was split between strong growth in the Linux client operating environment (COE) new license revenue shipments of 49.7% and nearly flat growth (0.9%) in the Linux SOE new license revenue shipments segment of the market — due largely to significant growth in emerging markets such as Asia/Pacific.

Despite the mixed results, the Linux market segment still was one of the more fortunate sectors during the unprecedented downturn of 2001. Unlike its close cousin, the Unix market — in which shipments declined by 25% and revenue shrank by almost 17% — overall Linux unit shipments were up in 2001 compared with 2000, and revenue experienced a relatively minor decline of 4.7%.

As a result, customers now have more choices and attractive new options for system deployment. IDC forecasts call for Linux SOEs to be one of two platforms to experience growth through 2006. IDC projects Linux SOE shipments will increase by a 2002–2006 compound annual growth rate (CAGR) of 19.7%, while our projections for Unix SOE shipments call for a 2002–2006 CAGR of -0.6%.

This profile strongly suggests that one of the areas in which Linux is poised for greatest success is that of a Unix replacement, or as a supplemental server within a Unix-friendly environment. As a result, it is likely that Linux will compete for new deployments being made at shops traditionally favoring a Unix solution.

Linux as an Application Platform

It is interesting to note that Linux deployment and adoption have, in many respects, paralleled that of Windows nearly a decade ago and Unix a decade before that. Initially embraced and deployed by technical users that support themselves or support smaller departments, Linux has subsequently found a niche in proving basic infrastructure services such as file, print, Web, and network support roles.

It is well documented that the broad availability of packaged application software is one of the most significant drivers of adoption for organizations not currently having strong Unix or Linux expertise. The picture today is the Linux operating system preparing to take the next step in its evolutionary growth by supporting general application workloads, as Unix servers have long done. In fact, the same core infrastructure technologies that have helped enable Unix to expand throughout the enterprise are now available for Linux. These capabilities include shared and global file systems, storage virtualization and sharing technology, scalable hardware architectures, and state-of-the-art database technology.

IDC expects this shortage of applications to be remedied over the next few years, allowing Linux to take its place beside Unix and Windows as a platform for business-critical applications.

Linux is also seen in pilot projects and technology evaluations in many other organizations. Linux is not, however, considered a mainstream choice for all functions in all markets. The availability of packaged software is still a concern in some markets.

Linux Use in SMB and Enterprise Sites

IDC studies have found that Linux is not a phenomenon only among small and large companies. In fact, experimentation and early deployments are occurring in just about all market segments. However, there are anomalies among these broad groups.

During the early years of mainstream Linux adoption (circa 1999), the typical adopter was much more likely to select Linux based on emotional or philosophical reasons. The portion of decisions based on philosophical views today has vastly diminished, replaced by business-oriented criteria including total cost of ownership (TCO), price/performance, and licensing considerations.

Figures 1, 2, and 3 show the evaluation and use plans for Linux in three business segments. Small businesses are defined as organizations with fewer than 100 employees; medium-sized businesses are defined as organizations with 100–999 employees, and large businesses are defined as organizations with 1,000 or more employees. These figures provide snapshots of Linux use plans in 1999, then again in 2001. The samples are compared with one another to see shifts in use plans for Linux.

In all three segments, piloting and evaluation of Linux far surpassed deployment plans. In only the small business segment did piloting/ evaluation plans decrease in 2001 compared with 1999 (see Figure 1). Generally speaking, use plans for both existing and new applications are up for all company sizes.

Figure 1: Linux Use Plans in Small Businesses

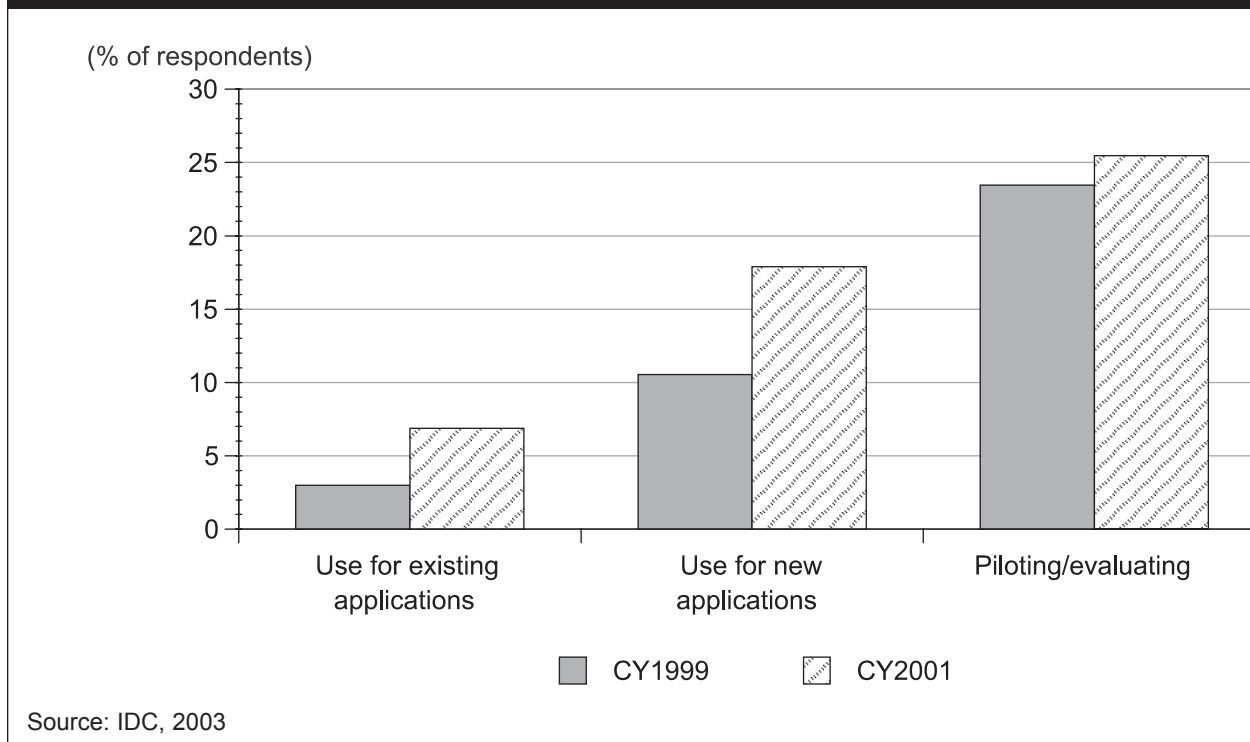(% of respondents)

Source: IDC, 2003
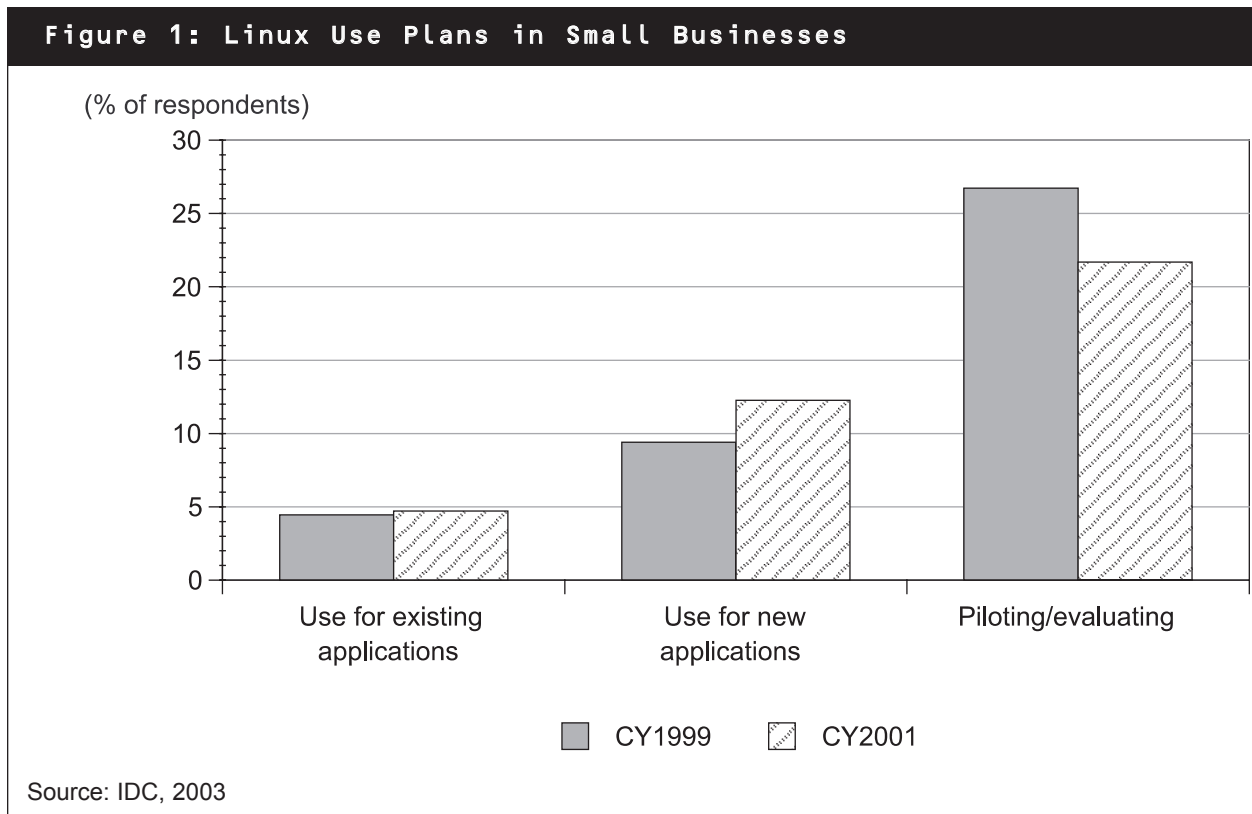
In the small business segment, use plans are growing most rapidly for new application deployment, while 2001 plans for existing applications aboard Linux remain virtually flat with 1999 levels.

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In medium-sized businesses, plans for evaluations remained stagnant, but at a relatively high level (see Figure 2). Plans for new application deployment in medium-sized businesses jumped from 8% to 15%, while plans for existing application deployment remain low. We do not find these trends unusual because users have a tendency to not create unnecessary work by moving existing applications from an existing platform to a new environment — unless the existing platform is unstable, not scalable enough, or deficient in some other way.

Figure 2: Linux Use Plans in Medium-Sized Businesses

(% of respondents)

Source: IDC, 2003
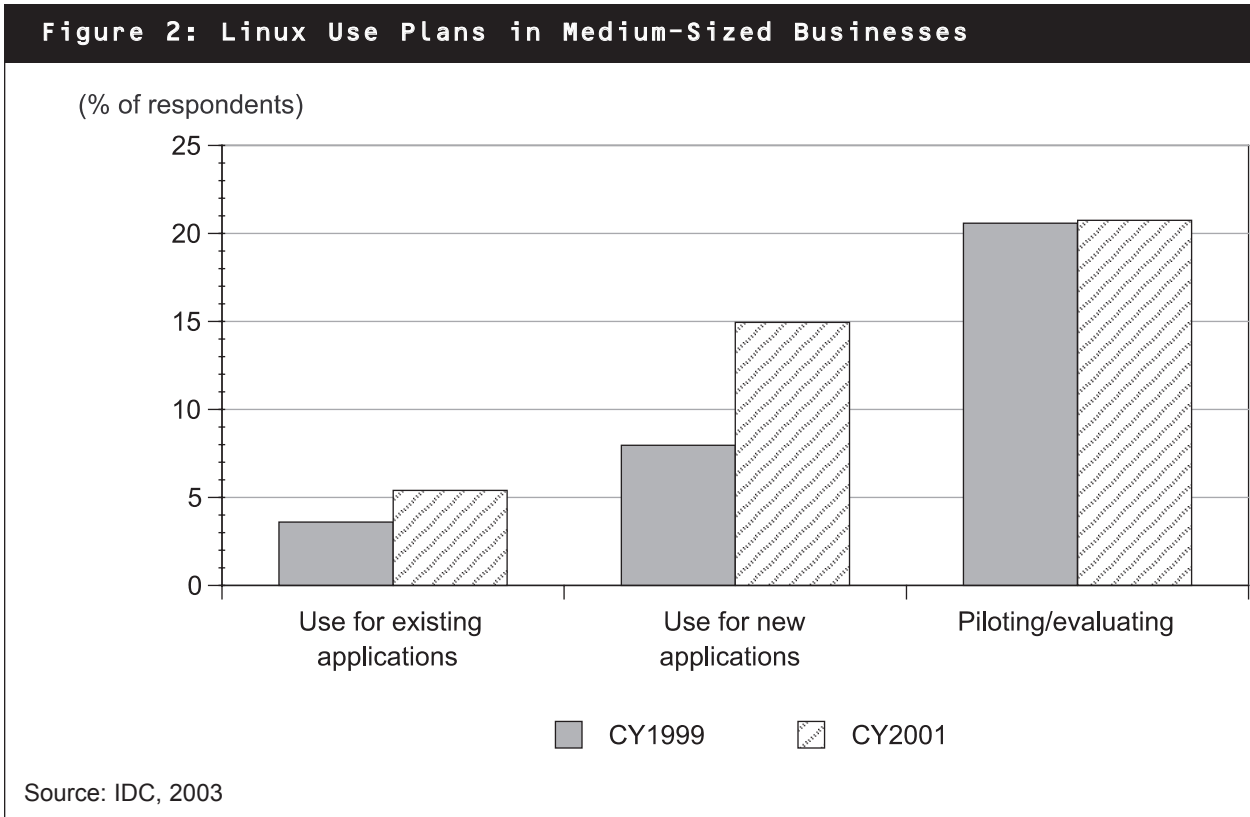
Large businesses present an opportunity both for existing applications and for new applications (see Figure 3). Big businesses continue to expand their evaluation of Linux, suggesting that this market segment is looking for ways to create competitive advantage or to drive down support costs. We find this result interesting but believe that this data suggests that large businesses, in many cases, are interested in leveraging Linux's ability to run on existing platforms. Under this scenario, users could potentially consolidate workloads aboard Linux partitions on existing — and underutilized — high-end hardware, in the process moving applications over to those environments from existing standalone servers.

Figure 3: Linux Use Plans in Large Businesses

(% of respondents)

Legend: CY1999, CY2001

Categories: Use for existing applications, Use for new applications, Piloting/evaluating

Source: IDC, 2003

THE LINUX VALUE PROPOSITION

There are a number of reasons why Linux is an attractive alternative for users. One of the most obvious is the low cost of acquisition and free use rights, often portrayed as an alternative to increasingly onerous licensing terms that some vendors may offer. Although IDC studies find that acquisition costs are a minority cost item when calculating five-year TCO expenses, such costs continue to be viewed as important by end users because they are far more tangible to understand and easy to measure.

But the perceived benefits go beyond just acquisition costs. Figure 4 presents user perceptions of the most favorable attributes of Linux compared with Windows and Unix. This figure shows respondent ratings for the two operating environments in which they were most familiar. In the survey, respondents graded each quality with ratings of superior, comparable, or deficient. These ratings were converted into a numerical scale of 1 to 3, with 3 representing superior.

The data points presented here represent composite (averaged) ratings for Unix, Windows, and Linux. The Unix data is based on results from the three major Unix operating environments — AIX, HP-UX, and Solaris; data points for Windows include both Windows NT and Windows 2000. The final set of data points for Linux covers all distributions in use among study participants.

Figure 4: Most Favorable Attributes of Linux Compared with Windows and Unix

Source: IDC, 2003
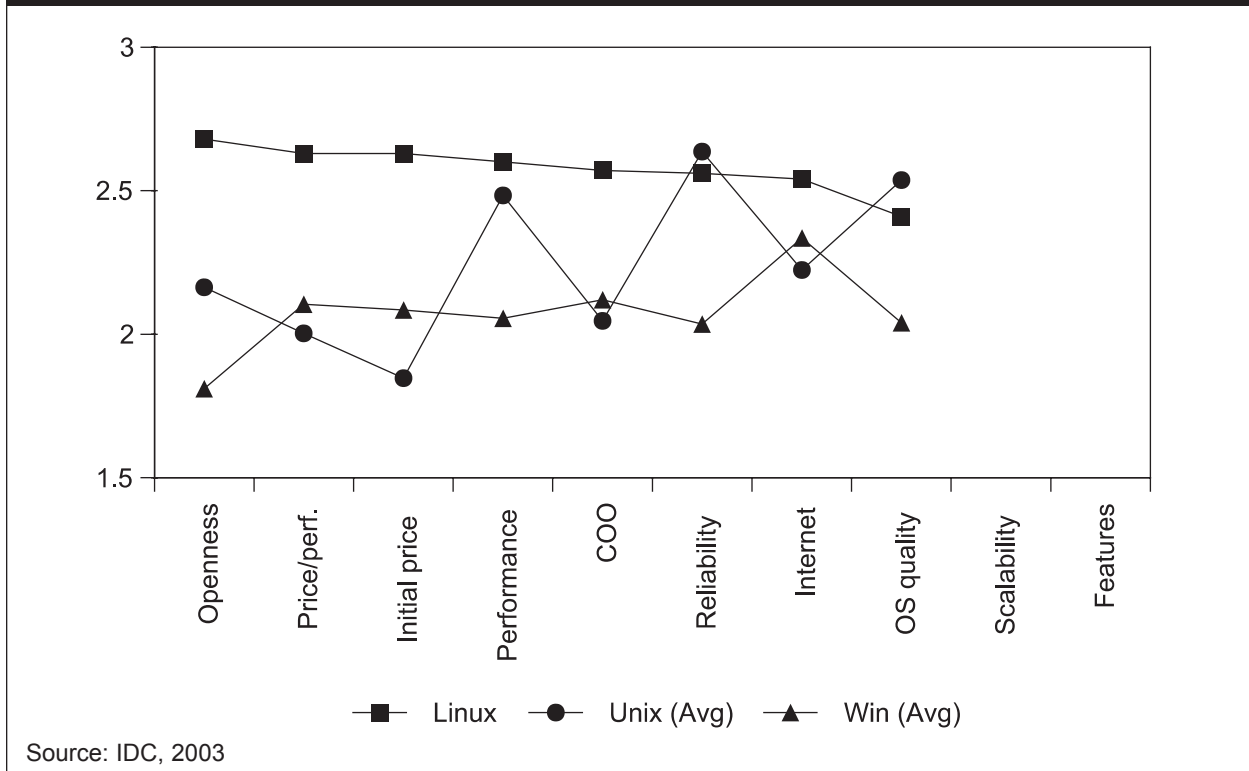
Not surprisingly, Linux led the pack when measured on the basis of attributes directly related to open source software — including openness, price/performance, and initial price. Cost of ownership (COO) was perceived to be better for Linux, although recent studies conducted by IDC have indicated that this is not universally true for Linux.

Of course, sorting by the attributes cited as most favorable for Windows or Unix, compared with Linux, provides a considerably different view. In fact, only one of the 10 attributes cited as most favorable for Windows — Internet/intranet capabilities — also is one of the top 10 for Linux.

Some of the areas in which Windows had the largest margin over Linux — availability of applications, broad acceptance of Windows as a company standard, and ease of use — are not surprising.

Comparing the 10 most favorable attributes of Unix to those of Linux, we see that there is more commonality, with four common attributes on both operating environments' top 10 lists, which underscores the similarity between the two environments.

Not surprisingly, Unix ratings were more favorable than those of Linux in subject areas in which Unix has long been known to be superior to Linux — such as scalability and vendor reputation and the likelihood that a given flavor of Unix is a company standard.

Key Business Drivers for Linux

Beyond factors based on perception, IDC believes that other drivers are contributing to the acceleration of Linux. These factors are often related to the overall goal of lowering costs, expanding flexibility, and creating an environment that is best able to respond to next-generation application needs. Some of those factors include:

- Increasing use of Intel Architecture or Intel-compatible architecture systems as a way to take advantage of high-volume platforms, memory, storage, and network adapters to reduce costs

- Centralizing functions previously hosted on many small systems onto a small number of much larger systems to lower costs of administration, operations, and support

- Purchasing packaged software wherever possible to reduce costs of development and support

- Addressing increasing concern with software licensing issues (Organizations are looking for ways to reduce software costs and asset management complexity and allow themselves greater levels of flexibility and vendor independence.)

Other business drivers usually are derivatives of finding ways to improve organizational revenue or profitability. Some of those drivers are:

- Creation of highly customized, adaptable, and integrated systems that directly face customers

- Use of systems to better understand customer needs, wants, and purchasing behavior

- Ability to access system from any type of access point device, through any network, at any time

Total Cost of Ownership of Linux on Intel

IDC continuously conducts TCO studies. We recently conducted TCO studies on Linux platforms compared with competitive environments. The conclusions of these studies, in general, were as follows:

- Acquisition costs for a Linux-on-Intel solution are generally a very compelling metric when compared with those of a RISC/Unix platform. Ongoing support costs can be similar or better for a Linux platform but are highly dependent upon the precise workload being deployed and the relative density of users supported (measured in total users per workload per server).

- Acquisition costs for a Linux-on-Intel solution are generally lower than those for a Windows/Intel solution; however, ongoing support costs may or may not present a cost advantage. The ongoing costs will vary based on the type of workload deployed, systems management tools used, relative density of users supported, and specific version of the Windows platform that is being used. Newer, more stable and scalable Windows platforms present a far better TCO story than older Windows SOEs such as Windows NT Server 4.0.

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THE EVOLUTION OF BUSINESS APPLICATIONS ON LINUX

Where early use of Linux focused heavily upon high-performance computing, more recent deployment has commonly been for infrastructure services and replicated site applications. Not surprisingly, early users of Linux for replicated site applications are technically sophisticated and more than likely to write some (or most) of their own application packages. Another related group of technically competent users often deploy applications developed by the community of which they are a part. Other early adopters leverage open source application software to build out their basic infrastructure layer atop Linux.

Today, Linux is transitioning into more general-purpose deployments. One aspect of this transition includes replacing lower-end Unix system configurations. Applications — both packaged and custom — are key to this transition.

However, Linux still requires development tools, middleware, and related application packages before it can become fully mainstream. The landscape for software that supports Linux is changing rapidly.

Whereas two years ago the scene was relatively bleak, today an increasingly large portfolio of development tools, applications, middleware, systems management tools, groupware and collaborative solutions packages, and database technology has become available for Linux. In many cases, the tools available today offer good to excellent portability for applications located aboard Unix systems — and in some cases, portability from non-Unix environments directly to a Linux platform.

IBM INFRASTRUCTURE SOFTWARE ON LINUX: TECHNOLOGY AND BUSINESS APPROACH

IBM has embraced Linux as if it were one of its internally developed operating system products. Backing up this perspective, the operating environment is receiving full support from all parts of IBM's software organization. As a result, products originating from IBM's Lotus group, Tivoli systems management organization, and the developer tools group all have been brought over to Linux. For customers, this means that the entire IBM software stack, including the above-mentioned products as well as WebSphere and DB2 are available for and fully supported aboard Linux.

IBM's adoption of Linux extends across all areas of the company. The Server division has Linux enabled all the eServer ranges, from the xSeries Intel-based server to the iSeries and pSeries PowerPC-based servers to the zSeries mainframe. The Services division offers support, training, and consultancy for Linux — as well as the "Linux Virtual Services" offering of Linux on demand. The Linux Technology Center consists of 250 IBM programmers and engineers working full-time on open source projects such as Linux. And IBM has teamed with leading commercial Linux distributors Red Hat and UnitedLinux open industry consortium members (SuSE, SCO, TurboLinux, and Conectiva).

As an early proponent of Linux as a general-purpose business server, IBM has been keenly aware of the application shortage — and the general lack of an application ecosystem surrounding the Linux platform. Because it had many of the required elements and the strong customer encouragement to help develop this market, IBM became one of the earliest commercial players to invest in the Linux infrastructure story outside the base operating system.

The company developed a multipronged approach, with the intent of reaching out to software developers at independent software companies and corporate developers working on internal projects.
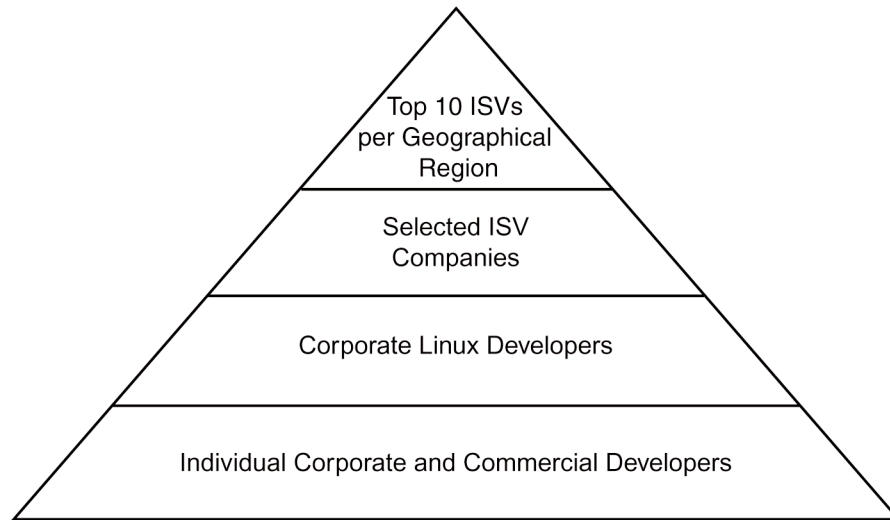
IBM's objective is, of course, not without a return to IBM. By helping develop the market, IBM positions itself as a provider of both infrastructure software and hardware. Early on, IBM decided it would not enter the Linux operating environment market with a distribution of its own. Instead, the company partnered with the leading Linux operating environment vendors and, in turn, has entered into numerous deals for these Linux providers to resell IBM's infrastructure software products. The company hopes to tap markets such as the Linux relational database management systems (RDBMS) software market, which is forecast to increase at a 2001–2006 CAGR of 114%.

BUILDING THE LINUX ECOSYSTEM

IBM's strategy to grow the Linux "ecosystem" begins with its partner programs and its tools offerings. The company has a multipronged strategy to reach all levels of the market. Figure 5 presents the target communities in which IBM is working to develop inroads for Linux. The number of potential partners for IBM increases by a factor of 5 to 10 at each tier as it moves down the pyramid. However, at the bottom tier there is an increase of thousands of times compared with the tier above it.

At the top tier, IBM is focusing on the largest independent software vendor (ISV) partners. Vendors in this category get direct assistance from IBM to help them place their solutions into user organizations. At the next level, IBM is working with ISV partners to deliver applications that customers need aboard Linux systems. At the third tier, IBM works with corporate Linux developers to integrate and utilize IBM's infrastructure software products in their internal development. At the second and third tiers, IBM provides educational incentives for users to move their development efforts to Linux. Finally, at the fourth tier, IBM makes available to the developer community at large its tools and demo versions of its products for development purposes.

Top 10 ISVs
per Geographical
Region

Selected ISV
Companies

Corporate Linux Developers

Individual Corporate and Commercial Developers

Source: IDC, 2003

DEVELOPER SUPPORT

Recognizing that the developer community plays a vital role in designing in technologies such as J2EE application servers, IBM has initiated a number of efforts to support developers. The company introduced and released into open source its Eclipse toolkit.

In May 2002, IBM released a CD that not only had the Eclipse technology but also included DB2 Enterprise Edition, WebSphere Application Server, Lotus Domino, and additional technical content intended to help developers build Web services — under the title "Speed-start your Linux application."

Developers that obtained the CD were eligible to use a free technical support Web site that would help them develop around IBM's products and technologies. To attract a wider developer audience beyond North America and Europe, IBM made the CD and technical support available to programmers in India and released a special Chinese language version to address that burgeoning market.

IBM has shipped 350,000 free CDs out into the industry, many of which were shrink-wrapped with trade publications popular among developer audiences. The company reports that 33,000 developers have registered on the site (which is free but optional), while an unknown number of developers use the site without registering. According to IBM, these registered developers have then created more than 4,200 Linux applications in the first five months of the program. Looking forward, IBM is working to make this technology, together with leading Linux distributions, available.

Partnering Programs

IBM is keenly aware that applications are the lifeblood that makes one platform more successful than another. The availability of applications can create an accelerating effect to speed the early adoption of a new operating environment. At the other end of the life cycle, a robust suite of applications can retain a customer base aboard a platform that otherwise might have been considered to be obsolete.

Among the companies to successfully leverage the applications card is IBM, which was long known for the huge applications portfolio available for its iSeries platform — formerly known as the AS/400 line. One element of IBM's success was its reliance on, and partnership with, independent resellers, system integrators, ISVs, and VARs.

IBM's effort goes a significant step beyond selling piece-parts that can be used in a system configuration or application. The company has aggressively extended its long-successful partner program to cover the Linux platform.

The company's partner program evolved through the years and today is known as IBM PartnerWorld. Year after year, participants in this program continue to play a major role in IBM's overall success in the industry. This model of success was something that other competitors envied and often emulated. For example, partners are responsible for approximately 44% of DB2 sales. At the corporate level, approximately $20 billion of IBM's annual revenue is generated by its business partner community.

Given IBM's understanding of the ecosystem requirements for a successful platform, it comes as little surprise that IBM is leveraging this partner strategy to build solution stacks for Linux platforms. The company initially targeted a small collection of top-tier ISVs, which it successfully recruited into the Linux program. Those players include companies such as ACCPAC, Axiom, eOneGroup, MarCole, Presence Online, Relavis, Sage, SAP, SAS, and Selectica.

With such key players on board, the company has shifted gears and is now targeting the next wave of ISVs. IBM hopes to recruit at least 300 developer companies. To encourage participation, IBM has a program it calls "Start Now," which helps vendors get training and jump-starts their marketing programs into the Linux user community with direct assistance from IBM.

IBM cites 46 ISV solutions that have joined its partner program through that initiative, with 36 of those partners currently supporting Linux. However, IBM's Start Now program is not a scattershot approach. Instead, IBM works with ISVs to select one or two key applications from their portfolios that are most likely to have appeal to the Linux user base. Those applications serve as the test cases for the vendor, where IBM provides porting assistance and marketing assistance and tries to boost the company's momentum with Linux technology.

Taking a look at the IBM software portfolio for Linux can help illustrate just how seriously the company views the Linux opportunity.

IBM's aim with its software portfolio for Linux is to provide an open and comprehensive platform enabling the easy integration, deployment, development, and management of applications across heterogeneous server environments resulting in lower costs and higher performance.

Clearly, with a large software portfolio to enable, and four eServer Linux platforms to support, some products and platforms have been prioritized first. IBM has focused its strategy in two main areas:

- Providing a full J2EE Web services environment for deploying, integrating, and managing applications, starting with Linux on xSeries, then Linux on zSeries, and finally Linux on the PowerPC-based iSeries and pSeries

- Providing a J2EE Web services development environment on Linux for developer workstations

DB2 Family

IBM's database heritage extends back to the original DB2 product developed for IBM's mainframe family of server systems. During the 1990s, IBM extended its DB2 platform technology into the Unix and Windows market segments and supported non-IBM operating environments such as Solaris, HP-UX, and Windows NT/2000 with DB2 Universal Database.

With the emergence of Linux, IBM quickly moved to extend DB2 with native Linux support. DB2 Universal Database for Linux was one of the first major IBM products to be available on Linux, with an evaluation copy of DB2 first bundled on a Linux sampler CD that accompanied Red Hat Linux in 1999. The DB2 Universal Database for Linux product originates from the same source code that is used to generate DB2 Universal Database for Unix on AIX, Solaris, and HP-UX as well as Windows.

The family of DB2 Universal Database for Linux includes products targeted at low-end mobile devices (DB2 Everyplace), general business server environments (DB2 Workgroup Server Edition, DB2 Enterprise Server Edition, and DB2 Connect), and Linux super-computing clusters (DB2 Enterprise Server Edition with DPF option).

In particular, one of the major differentiating factors for DB2 Enterprise Server Edition with DPF option that IBM is promoting is its "shared-nothing" architecture, which has allowed it to achieve near-linear scalability on Intel-based Linux clusters. IDC notes that while this statement is true, the architectural considerations required to build a shared-nothing database require partitioning and for good transactional performance, usually some special application coding as well. These architectural design requirements can increase the difficulty of deploying software, especially packaged software, on such a database structure.

DB2 for Linux is available currently on both xSeries and zSeries systems.

Future plans call for IBM to extend DB2 Universal Database for Linux to both the pSeries and iSeries eServer platforms. These platforms can run Linux in logical partitions in much the same way as is possible for zSeries systems.

Strategy

IBM's stated strategy for DB2 is to "be on every platform." For many customers, DB2 serves as more than just a standalone database; it can also act as a gateway into other data structures, including other IBM DB2 products, as well as Oracle or SQL Server databases.

IBM faces a competitive database environment on Linux, not only from commercial vendors such as Oracle but also from the emergence of open source database products such as MySQL and PostgreSQL. Nevertheless, in 2001, IBM grew its market share to 56%, up from less than 20% the prior year, placing the company at the head of the pack for Linux RDBMS revenue.

IDC notes that this market segment is small on a total dollar basis so substantial market share swings can be created through a limited number of big deals on the part of any given vendor. (For more detail on the RDBMS market, see *The RDBMS Top 10: License Sales Analysis and Market Forecast, 2001–2006*, IDC #28096, October 2002.)

Partner Adoption of DB2

One example of IBM's success with DB2 is open source software advocate VA Software, which moved both the SourceForge.net open source development site and its commercial SourceForge Enterprise Edition product away from PostgreSQL and onto IBM's DB2 technology. The move also included adoption of other IBM technologies including WebSphere Application Server, WebSphere Studio Application Developer, and Tivoli management software.

IBM also cites ERP vendor J.D. Edwards as another win. Although J.D. Edwards was long a close business partner, the company recently standardized on DB2, WebSphere, and Tivoli products from IBM.

J.D. Edwards has recently moved the first of its products over to Linux. The company worked with IBM to move a major customer relationship management (CRM) product aimed at the financial services industry from a BEA/Oracle/Solaris foundation to a WebSphere/DB2/Linux platform.

DB2 is also moving aggressively into the SMB market with IBM's announcement that it will start shipping development-use copies of its Enterprise Server Edition product for Linux with every worldwide shipment of Borland's Kylix rapid application development (RAD) tool.

The partner momentum has also picked up steam as other ISVs, such as SAP, Steeleye, ACCPAC, Sage, Journyx, Legato, and SAS, have moved to support DB2 for Linux.

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WebSphere Family

IBM has positioned its WebSphere J2EE application server technology as a tool for decoupling application dependence upon operating system APIs for several years. The strategy initially was used as a way to build platform-independent applications and as an ideal tool for porting existing applications across a variety of platforms while preserving the business logic those environments have contained within them.

The WebSphere family has evolved into a collection of technologies that range from a portal product to an enterprise-class J2EE application server, a set of development tools, and a collection of business process automation tools.

Products

The WebSphere product family includes the following products:

- **WebSphere Application Server.** This product sits at the heart of the WebSphere product line. It provides a J2EE-compliant development and application deployment platform, including an Enterprise Java Beans (EJB) container, Java Database Connectivity (JDBC), and JavaServer Pages (JSP).

- **WebSphere Commerce Professional Edition.** This product provides the application infrastructure, resources, and business process capabilities to build and deploy Web-based ecommerce for businesses — such as online store fronts for retailers and catalog sales operations conducting basic business-to-business (B2B) processing. This product is positioned for advanced business-to-consumer (B2C) and basic B2B functionality, including advanced order management, targeted marketing, and enhanced product search and advisor capabilities. WebSphere Commerce is considered strategic within IBM's portfolio and is popular because it provides ease of use and ease of application development.

- **WebSphere Commerce Business Edition.** The business edition of this product is also a Linux solution positioned for both the general-purpose Linux market and the enterprise market, providing advanced B2B functionality. The Business Edition includes all the features included in the Professional Edition, plus additional capabilities geared specifically for B2B, such as integrated contract-based personalization, RFQs, and dynamic collaboration. It adds a deeper level of advanced business processing sophistication and integration into the business-to-business direct and indirect models. This product enables businesses to deploy ecommerce capabilities that manage customer-facing business processes throughout the demand chain.

- **WebSphere MQ.** The MQ product family has been around since before application servers existed. Formerly known as MQSeries, WebSphere MQ dominates the market for message-oriented middleware, which provides a bus for messages to be sent between applications. During the past few years, IBM has developed additional products based on MQSeries, including MQWorkflow and MQ System Integrator. Because of the growing relationship between application deployment and application integration, IBM pulled the MQSeries product family into the WebSphere brand last year.

- **WebSphere Application Developer Tools.** IBM's developer tools (for the Intel architecture today, Mac OS and Solaris in the future) reflect the company's commitment to build partnerships with the open source community. IBM released the underlying framework of WebSphere Studio under an open source license last year. Since then, an extensive community has developed around the tool platform, known as Eclipse. IBM has continued to develop commercial versions of the tools as well, including WebSphere Studio Application Developer and WebSphere Studio Site Developer.

- **WebSphere Portal.** This product provides personalized and customizable user access to applications and is available on Linux today.

Strategy

IBM claims good success with the WebSphere product family, particularly among larger customers that are using a server consolidation strategy, using excess capacity on zSeries that they already had and purchasing a WebSphere license on Linux on zSeries. Under that scenario, customers would commonly run the application server on one processor, aboard a virtual machine, and on top of that, run a number of applications. Customers were able to do this under a single license fee. Early reference accounts include Mobil Travel Guide and Air New Zealand.

In parallel, IBM was courting customers that were interested in moving their custom-written applications to Java on Linux to benefit from the cost reduction of licenses.

Late in 2002, IBM brought to market a refresh of the WebSphere product line, version 5. The update covers Linux on Intel and Linux on zSeries. The version 5 update is scheduled for iSeries and pSeries systems in 2003.

Finally, IBM has introduced another member of the WebSphere family, WebSphere Application Server – Express, which targets medium-sized businesses.

Lotus Domino Product Family

Since purchasing Lotus Development Corp. in 1993, IBM has expanded the reach of Lotus groupware and collaborative solutions across all of its product lines. Today, from the zSeries systems on down to the xSeries platform, IBM has a Domino solution available.

Domino was among the first products that IBM software developers ported to Linux. The port, which the company completed in late 1999, provided Domino developers with the opportunity to run their existing applications on a Linux system without requiring changes to that application. This move alone brought thousands of Linux-enabled applications to market.

The latest version, Domino 6, offers policy-based administration for lower management costs, better scalability and reliability, and centrally managed archiving, mail journaling, and antispam control. Domino 6 also supports XML standards along with tighter integration with WebSphere, which makes it easier to create business applications for a Web services environment.

Strategy

In the early days of product availability, IBM focused on selling to the most enthusiastic Linux proponents, many of which were using Linux more for philosophical reasons than because of performance or other business-oriented rationalization.

As the market has shifted to more general-purpose users and IT professionals are selecting Linux when it is the right solution for a given requirement (without regard for personal preferences), IBM has adjusted its market development strategy to mirror this shift. This product also receives particularly strong support from IBM's business partner community.

One of the key components in the Domino architecture is the portable database file structure used, called the Notes Storage Facility (NSF) file. The self-contained nature of the NSF data structure, and its associated scripting language, provides excellent portability. As a result, an NSF file can be moved between diverse operating environments without any special effort. This allows heterogeneous client and server configurations or even the ability to mix Linux servers together with NetWare, AIX, or Windows servers to support a single Domino workload.

IBM continues to position Domino as a corporate messaging and collaboration solution, despite continued competition from SMTP solutions. Although Domino has a SMTP message transfer agent, customers often choose to deploy a third-party or open source SMTP gateway for external connectivity.

Domino for Linux has become a full-fledged member of the Domino family. Part of that family membership includes supporting Domino's application-level clustering/failover technology. This technology allows a user to meld a collection of Domino servers aboard

disparate operating environments into a single functional unit that provides application services to a group of users. This is application-level clustering rather than OS-level clustering as the only application protected is Domino, but this enables the clustering to work across mixed operating system platforms.

IBM cites the "low touch" nature of Domino for Linux as a benefit because IBM's business partners can deploy a Domino for Linux server and then have a low incidence of support calls associated with keeping the configuration operational. Taking that a step further, IBM brought in help from partners such as Legato, which offers backup technology specifically designed for Linux/Domino environments, and Trend Micro, which provides antivirus support.

IBM has been criticized by the open source developer community for its hesitancy to port the Notes client software to Linux. IBM cites the relatively small Linux COE-installed base — which IDC data shows at 2.5% of the worldwide installed base of COEs in 2001 — as one of the key factors holding back such a port. In January 2003, IBM announced that it would be extending Linux support to its Lotus iNotes next-generation Web client, providing on-demand access from Mozilla or Netscape Navigator Web browsers on Linux to Lotus Notes–based functions such as email and calendaring. Finally, recognizing that Microsoft accounts for an ever more dominant presence in the industry, IBM has developed a technology called ADSynch, which allows Linux directory synchronization with Microsoft's Active Directory environment.

Tivoli Product Family

One of IBM's other major acquisitions in the 1990s was Tivoli Corp., acquired in 1996 for $743 million. This acquisition has become the mainstay of IBM's autonomic computing initiative and now has product lines that cover most aspects of systems management.

The goal of Tivoli is to provide support for networks of heteroge-neous systems, and the support of Linux is a required element to reach that mandate. The company's investments over the past sever-al years have focused on the support elements required as Linux transitions from an infrastructure server over to the role of general application server.

Products

Tivoli's products break down into four major business segments:

- **Security Management.** Security products include security management products, authorization and authentication management, and intrusion detection. Individual products include:

  - **IBM Tivoli Identity Manager.** This technology manages the process of assigning user identification. This product came out of IBM's 2002 acquisition of Access 360, a product that offers integration with more than 70 applications.

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- **IBM Tivoli Access Manager for eBusiness.** This product provides authorization and authentication actions (such as single sign-on) across multiple heterogeneous platforms.

- **IBM Tivoli Access Manager for Operating Systems.** This technology complements (but strengthens) security mechanisms that are in Linux to protect system resources such as individual files as well as root account and directory access.

- **IBM Tivoli Risk Manager.** This product manages low-level security software including firewalls.

• **Storage Management:**

- **IBM Tivoli Storage Manager (TSM).** This product offers backup, recovery, and disaster recovery services. It can be used as a general-purpose tool or using IBM-supplied extensions to back up Notes and/or Exchange.

- **IBM Tivoli Storage Resource Manager (TSRM).** This product extends Tivoli's management reach into both traditional direct-attach disk storage area networks (SANs). Using TSRM, customers can optimize and easily track the usage of their storage resources. TSRM allows management activities such as setting use policies and setting/managing quotas.

• **Configuration and Operations Management:**

- **IBM Tivoli Configuration Manager (ITCM).** The software distribution capabilities of ITCM allow users to deploy software to multiple end points as well as collect hardware and software configuration information from computer systems across the entire network all from one location.

- **IBM Tivoli Workload Schedule (ITWS).** ITWS allows users to organize and launch specific workloads as regularly scheduled activities. Because this technology extends to customer application workloads, it can be easily integrated with enterprise applications from Siebel Systems and SAP.

• **Performance and Availability Management:**

- **IBM Tivoli Monitoring (ITM).** ITM allows users to monitor the status of their IT networks proactively, detecting bottleneck and other potential systems problems. ITM sends notifications to the systems administrator and automatically takes corrective steps to resolve the problem. Historical information collected by ITM can be used for reporting and performance analysis and trend prediction.

- **IBM Tivoli Enterprise Console.** The Tivoli family includes capabilities focused on managing performance and event automation for distributed applications, thus improving performance and availability. The Tivoli Enterprise Console provides users with an enterprise-level view of all events that are taking place, enabling root-cause analysis. This analysis typically leads to either automatic responses to events or, if necessary, requests for human intervention.

– **IBM Tivoli Systems Automation.** This is part of IBM's autonomic computing initiative and provides customers with a high-availability solution through policy-based self-healing capabilities to quickly identify failing components and applications and automatically correct or notify the user about the problem.

One additional benefit provided by the Tivoli product suite is that most of the above-mentioned features feed information into the Tivoli Data Warehouse, which allows enterprises to perform networkwide or enterprise-level reporting for the purposes of tracking uptime as well as performance compared with service level agreements that are in place.

Strategy

IBM positions Tivoli and Linux as complementary solutions. While Linux has the potential to lower TCO — in particular, when compared with RISC/Unix systems — the real key to achieving TCO is lowering support staff costs. Tivoli can help customers automate and reduce overall systems management complexity, and Tivoli security products can strengthen the security of Linux. The consistent management approach of Tivoli across heterogeneous platforms also helps to include Linux in businesswide systems management.

KEY BENEFITS AND ADVANTAGES OF IBM SOLUTIONS

IBM was arguably the first large commercial enterprise to recognize and respond to the opportunity that Linux presented when it began moving its portfolio of products to support this new environment in 1999. The solutions stack that IBM offers today provides the following benefits to developers and end users:

- **Well tested.** IBM's software portfolio has a long history of deployment aboard Unix variants including AIX, Solaris, and HP-UX as well as on Windows NT and Windows 2000. Because the Linux products in most cases originate from the same code base as the Unix products, the Linux executables carry forward the same lineage and known reliability that the Unix versions offer.

- **Known scalability.** Like the stability and reliability aspects of these products, IBM's experience with its product portfolio in the Unix world offers known levels of scalability, particularly for technologies such as DB2 Universal Database and WebSphere Application Server.

- **Developer familiarity.** IBM's high software market share aboard all platforms (RDBMS, Web application servers, groupware, and systems management), combined with an extensive partner community, means that there is a large collection of individual developers that are familiar with using IBM's software products in a Unix or Windows environment, experience that transfers very easily to a Linux environment. This leadership is driving a strong ecosystem of application and partner support, increasing solution availability.

- **Support from IBM.** It is clear that IBM sees the success of Linux being in its best long-term interest. But IBM cannot build out the entire ecosystem; it needs partner vendors that bring the business-area or technology-area expertise to create a truly comprehensive and self-sustaining ecosystem. IBM recognizes its contribution can be either financial in nature or that of an accelerant to help bring life to this ecosystem.

- **IBM commitment to Linux.** IBM's support of Linux runs deep within the organization and covers all areas — from hardware to software to services. The company states that it has already invested $1 billion around Linux and continues to make additional investments. In addition, IBM "eats its own cooking," with an increasing number of internal systems running on Linux.

CHALLENGES FACING IBM AND LINUX

Participating in the Linux ecosystem is not without risk and challenge. IBM faces a number of challenges, including:

- **Traditional competitors.** The competitive nature of the Unix market will naturally migrate to the Linux market, particularly because Linux is largely seen by software vendors as "another version of Unix." As a result, IBM can expect (and in many cases, already has) stiff competition from companies such as BEA, Computer Associates, and Oracle. It is not likely that these vendors will cede the Linux market to IBM without a bitter fight.

- **Open source software.** The open source software community holds precious little sacred when it comes to commercial software. Therefore, despite IBM's broad support for the Linux and open source development model, open source projects will likely continue forward that eventually could become competitive to IBM's core software offerings. This is already happening with open source technologies such as MySQL, PostgreSQL, and SendMail. Although IBM recognizes these threats, the company believes that it can maintain its current lead in these product areas.

- **Microsoft and other non-Linux vendors.** While Linux is the trendy topic among IT professionals, Microsoft continues to dominate the COE market and is well on its way toward achieving a dominant position in the SOE market. In 2001, Microsoft captured 93% of COE new license shipments and almost 49% of SOE new license shipments. IDC projections through 2006 show Microsoft retaining a significant but decreasing lead over Linux operating environment shipments.

- **Full application portfolio availability.** Although IBM has done a commendable job moving applications to Linux, not all applications are currently available on every environment. Using the Lotus product family as an example, Lotus QuickPlace, Sametime, Extended Search, Discovery Server, and LearningSpace are not yet supported aboard Linux — even though these products are available aboard Windows, and several of them are available

aboard one or more other operating environments including AIX, Solaris, OS/400, and OS/390. These products are growing in importance to extend the Lotus brand and value for customers that are already using Domino. If they cannot run these other products on Linux, that limitation eventually will become more of a problem.

CONCLUSION AND RECOMMENDATIONS

IDC sees the support and contribution that IBM is offering to third-party ISVs and VARs as a strong indication of the importance of Linux to IBM. Aside from the obvious benefits of IBM's financial and marketing support, participating in this market space has the potential to open new market opportunities to individual software vendors.

IBM's early start and continued focus have given it a leadership position in providing a software platform for applications on Linux. IDC research shows IBM with significant market presence on the Linux platform in many of the market segments discussed in this paper, and having a leadership position on the Linux platform for some of these markets, such as the RDBMS market.

IDC strongly recommends that software developers, both ISV and in-house developers, consider the benefits that Linux can offer today and in the future. The benefits of lower acquisition cost and hassle-free licensing, combined with the availability aboard virtually all volume hardware platforms, make Linux a solution that is worth considering.

CASE STUDIES

Server Consolidation on IBM and Linux Results in Major Benefits for Pinellas County, Florida

Pinellas County Government in Florida has annual revenue of about $1.5 billion. Its operations include Justice, Public Safety, Land and Tax Records, Infrastructure Construction and Maintenance, Building Permits, and Public Records (which can be accessed by the Web), as well as other responsibilities. Its IT Department supports the major institutions of County Government on a budget of about $16 million a year.

The IT Department reevaluated its computing environment because of a number of business issues. For example, its System 390 mainframe was operating at capacity, the computer room was overflowing with racks for NT Servers and freestanding RISC boxes, support and replacement costs for its computing platforms were constantly growing, and the proliferation of Wintel servers with distributed environments was increasingly difficult to maintain. Against this need for change was the fact that the S390 mainframe (and predecessors for more than 20 years) demonstrated superior reliability and scalability. An extension of the county's mainframe data to the Web was already proven in a J2EE environment (WebSphere Application Server and Visual Age for Java).

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The county wanted to leverage its mainframe investment, and the addition of the Linux engine as a part of an upgrade appeared to be the most effective way to meet its objectives. A key goal was to find an operating system, application server, and IDE that would run on every platform used by the county. The county decided to upgrade its S390 to an IBM Z800 running Linux. Usage of Internet access to county records was growing, necessitating an upgrade or replacement of the WebSphere Application Server RISC (AIX) platform. Running WebSphere Application Server under Linux/390 appeared feasible, allowing the RISC/AIX platform to be consolidated. This resulted in considerable cost savings, with the potential savings from eliminating maintenance, support, and replacement easily running "into hundreds of thousands of dollars." The county had already standardized on Oracle, and this move called for a large-scale platform for the databases. The county had implemented Oracle's MVS as an interim solution, but Oracle on Linux 390, with the power of the zSeries machine, appeared to be a feasible enterprise relational database solution.

Although the county had begun looking at savings and expanded capabilities, its value proposition shifted in favor of consolidation. Taking an enterprise perspective meant looking at Linux in addition to zOS. The county viewed Linux as a major part of its future, and it was impressed by IBM's significant investments in Linux. As far as the county was concerned, most major vendors see Linux as an increasingly important part of their future, and because the county was making a major commitment to Linux, it sought a vendor that was doing the same.

The county gives high praise to IBM for its vision of Linux products and accompanying support. In particular, the power of VM allowing multiple Linux virtual servers is a powerful part of the equation. According to Richard Lennon, Manager of Enterprise Services and Support, and Enterprise Services and Support Team Leaders J.D. Ross, Fred Ohr, Dave Holt, and Charles Miyawa, "IBM delivered what they said they would and they provide the level of support to get it done, and their VM support has been critical to our success. It is a great feeling to see our strategy evolve from 'academic' discussions of what might be, to actual implementation. The combination of the z800, zVM, the J2EE architecture, WebSphere, and Linux along with the Oracle database has positioned the county very well for the future."

Wolferman's Enhances Customer Web Experience with IBM Solutions on Linux

Wolferman's is a premium gift catalog company, world renowned for English muffins, scones, crumpets, and other specialty foods. The company has approximately $50 million in annual revenue. Orders come by mail, fax, phone, and the Internet. Online orders have grown substantially in the past two years and now account for 30% of the total. As a largely self-service channel that enables customers to browse through a catalog at their own pace on their own time, online orders typically have a lower processing cost than orders in

which a customer service or telephone agent is involved. For this and other reasons, Wolferman's wanted to expand its online ordering capability.

Since becoming involved in online commerce, Wolferman's had run its Web site on an AS/400 Model 820 from IBM. Its ecommerce software, adequate at first, began showing its age with an increasing order volume. Most of Wolferman's business takes place during the holidays, and last year the company had more than 1 million hits a day at peak season. Its computing infrastructure couldn't handle the traffic, and a substantial number of orders were lost. As a result of having outgrown its system, Wolferman's began looking for an alternative ecommerce solution at the beginning of 2002. The company's objective was to develop a new system that would be more consumer friendly, more efficient, and able to handle the growing traffic.

Wolferman's found a solution through eOneGroup, an IBM business partner. eOneGroup had significant experience in the online catalog industry and offered base ecommerce components that could be tailored to Wolferman's environment. eOneGroup suggested that Wolferman's solution be hosted on the Linux platform running on IBM hardware. Wolferman's is also using IBM DB2, IBM WebSphere, and Java. The result is a Web experience that is more up to date and more consumer friendly. It provides better navigation and handles increased volumes of traffic better than the old solution, resulting in fewer lost orders. eOneGroup recommended Linux because of its reliability and scalability, among other reasons, and because of IBM's deep commitment to Linux. Wolferman's evaluated four other solutions but felt good about eOneGroup because of its relationship with IBM and eOneGroup's cataloging experience. The hardware platform in use consists of xSeries 330s in a clustered environment.

Wolferman's began to develop the new system in June 2002 and went live in November, just in time for the holiday season. The company processed upward of 170,000 orders during the holidays, 30% of them online. This represented a 20% increase in holiday Internet orders from 2001. On its busiest day, the Web site had more than 1.7 million hits. The system was reliable and flexible enough to handle the increased traffic during the holiday period, especially in the weeks leading up to Christmas.

John Butorac, divisional vice president for Wolferman's, says "eOneGroup has been wonderful to work with. They are an IBM business partner and have performed beyond our expectations." He also praises IBM's middleware and hardware, adding that he's "been very pleased with everything we've seen during implementation. Overall, holiday orders were processed very successfully."

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