IBM

The Linux Services Opportunity

The demand for Linux in all parts of the enterprise is driving the need for systems integration and consulting services

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*It is easy to
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reliability, scalability
and openness.*

1.0 Executive Summary

The impact of Linux® has eclipsed even its founder's wildest dreams. From its
humble beginning as a UNIX® kernel experiment in 1991, Linux has become
the fastest growing operating system in history—with millions of users today.
This fact underscores the confidence that users have placed in Linux. IDC,
a leading market research firm, estimates that nearly 500,000 Linux servers
were shipped in 2001 and forecasts that more than 2 million Linux servers
will be shipped in 2007.[1] This increase reflects a 33.6 percent compound
annual growth rate (CAGR) over the forecast period and is more than twice
the growth rate of competing operating systems. In fact, it is estimated that
Linux will surpass UNIX in annual server shipments by the end of 2003.[2]
IBM estimates that the total server-based Linux market (hardware, software,
storage and services) in 2001 was more than $4 billion, and expects the
market to grow at a CAGR of 35 percent to more than $20 billion by 2006.[3]
Linux has created a discontinuity in the evolution of IT by delivering game-
changing value to the marketplace. Like previous discontinuities, Linux is
creating new business opportunities for new players. For example, more and
more companies are embracing Linux as the platform of choice for e-business
and core business applications. As these applications continue to be deployed
in heterogeneous environments, systems integration and implementation
services will be needed. This need presents a multibillion-dollar opportunity
for systems integrators and consultants.

IBM, the acknowledged global leader in e-business and Linux solutions, is
in a unique position to identify many of the elements that may influence the
Linux market as it evolves. *This whitepaper presents IBM's view of where the
Linux market is today and where it is headed in the next 3–5 years, with a
focus on identifying consulting and systems integration opportunities.*

Compelling value fuels growth. It is easy to understand why users have
so quickly adopted Linux, given its stability, low cost, reliability, scalability and
openness. Linux is compact and inexpensive to implement, and it works on all
popular computing platforms—from embedded devices to enterprise servers.
Applications can be developed on commodity hardware and deployed across a
wide range of systems, including low-cost Intel® processor-based servers.

[1] IDC: Server Forecaster, March 2003
[2] IDC: Server Forecaster, March 2003
[3] IBM: Internal Projections, March 2003

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Most importantly, Linux is comparatively "future-proof." Because of its broad support over a wide variety of the most common hardware platforms today, and the likelihood that it will be supported on the hardware platforms of the future, Linux is a safe bet for developing applications.

Open Linux development toolkits enable fast deployment of new applications. Linux has a built-in affinity for the Internet, which is the glue that integrates many e-business applications. According to IBM research conducted in 2002, companies who are deploying Web servers or e-commerce environments are using Linux for more than 60 percent of these deployments. Linux has established itself as the standard operating system for the Internet. Even greater growth is expected for the use of Linux as the basis of enterprise application-serving architectures. And the future looks bright because Linux is well suited for new on demand applications.

Software vendors see opportunity. Growing user demand and the competitive advantage offered by Linux-based systems has prompted a substantial number of software vendors to offer Linux versions of their products. For example, approximately 33,000 Microsoft® Windows® and Intel developers are currently working with IBM software to build Linux applications.[4] The open source heritage of Linux is part of the attraction for vendors, because it levels the playing field. No one "owns" Linux, so it cannot be used as a competitive threat by any one vendor. Instead, it is a shared technology that everyone can enhance.

Key standards and middleware to support multivendor integration of Linux systems with other enterprise systems are in place, clearing the way for more growth. Linux also is ideal for emerging application areas, such as autonomic computing, wireless/mobile computing and Grid computing.

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Opportunities abound for systems integrators and consultants. Most elements of a complete Linux ecosystem are now in place. Because Linux evolved from scientific and Internet infrastructure application areas, many systems integrators and consultants viewed the Linux market as still developing. But that has changed. Today, there are many examples of successful Linux deployments for business-critical applications. And, as this whitepaper describes, more applications are coming. These applications

[4] IBM: Press release, November 11, 2002

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This year, the market for Linux services opportunities is poised to "take off."

IBM estimates that the Linux services market was $800 million in 2001 and projects that it will grow to nearly $6 billion dollars in 2006, a CAGR of 49 percent over the period.

require greater integration with other enterprise systems, driving a need for more systems integration and consulting assistance. This year, the market for Linux services opportunities is poised to "take off."

The sheer volume of Linux-based deployments that support e-business means that the opportunities for Linux-related services will be significant. IBM estimates that the Linux services market was $800 million in 2001 and projects that it will grow to nearly $6 billion dollars in 2006, a CAGR of 49 percent over the period.

What is the best way to take advantage of this opportunity? Talk to IBM. IBM sees its role as enabling the Linux ecosystem and has developed many technical and marketing programs to help Business Partners build successful Linux-based businesses.

2.0 The Evolution of Linux—Up to Today

Linux was initially deployed for non-mission-critical Web serving and edge-of-network workloads such as Dynamic Host Configuration Protocol (DHCP) servers, file-and-print servers and e-mail servers, and for technical computing centers—both areas have little need for integration and consulting services. In fact, much of the early success of Linux was with prepackaged systems that enabled rapid setup. But now, the value proposition of Linux has driven adoption in many new areas, particularly new mission-critical commercial workloads that need integration assistance. This adoption has spread not only to companies with Linux experience, but also to new Linux users who are hearing the success stories and beginning to recognize the value of Linux.

In 2003, with most CIOs focusing on reducing total cost of ownership (TCO), Linux use is ideally positioned to grow. By consolidating distributed applications onto Linux-based systems, companies can reduce their hardware and software costs, lower maintenance and support overhead, and simplify systems management. Those capabilities, combined with flexibility for the future, is exactly what CIOs are seeking.

From scientific to commercial supercomputing. Early uses of Linux occurred in the high-performance computing (HPC) environments of academic and government research organizations (UNIX strongholds). There, the key drivers for Linux were price/performance, reliability, scalability and the ability to share code and distribute development through

open source resources and the Internet. Today, use has expanded to supercomputer (clustered) applications in the business sector—particularly in life sciences, general pharmaceutical research, automotive design and aerospace analysis. The success of these applications is, in turn, encouraging Linux-based supercomputing in other industries, including risk and fund management in the financial services sector and digital content creation in the entertainment industry.

From Web serving to e-business and other mission-critical applications. Static Web serving accounts for a substantial amount of Linux installations today primarily because Apache, the most popular static Web-serving application, was born in the open source community and is typically used on Linux systems. Key market drivers are the same as for edge applications—flexibility, low cost, high reliability and superior security. In addition, the scalability of Linux on low-cost Intel processor-based and RISC-based servers has become particularly appealing, as Web demands have soared.

Seeing the Linux value proposition demonstrated by many of these Internet systems has given IT departments and software vendors the confidence to use Linux in other Internet-related applications such as e-commerce, supply chain management (SCM) and customer relationship management (CRM). These applications benefit from the same core Linux value propositions as edge applications. Many view Linux as an ideal platform for the diverse requirements of e-business because it supports key Internet standards such as Web services and a broad range of platforms and e-business software. In addition, in-place UNIX skills can be leveraged for Linux system administration.

…the very nature of e-business applications implies heterogeneity and demands standardization, and Linux excels in these areas because of its multiplatform diversity and open development paradigm, respectively.

Importantly, the very nature of e-business applications implies heterogeneity and demands standardization, and Linux excels in these areas because of its multiplatform diversity and open development paradigm, respectively. Linux is attractive to customers in these environments because it best meets their needs.

From network infrastructures to telco networks. The telephony network is the gold standard for reliability and availability. Telephone companies do not deploy new systems internally until they are fully tested and proven completely reliable. Linux-based network infrastructure systems have attracted strong interest from telecommunications equipment manufacturers

and service providers seeking an open platform for their next-generation networks, one that merges the traditional telephone network with the Internet.

As network providers began deploying the next-generation IP-based telephony network, they discovered that finding a more cost-effective way to deploy new services was critical. Rather than internally developing their own services, network providers are now migrating toward commercial off-the-shelf (COTS) applications, a strategic shift made possible by moving to Linux. This shift has led to an industry initiative known as Carrier-Grade Linux. By using off-the-shelf applications, network providers can reuse applications, thereby reducing specialized development costs and shortening time to market.

Carrier-Grade Linux, an initiative to add telecommunications features and "hardening" to Linux, has progressed during the past year with leadership from IBM and the help of Intel, the Open Source Development Lab (OSDL), Nokia, Monta Vista and others.

From early strongholds to the growing commercial space. The use of Linux is growing in its early strongholds—edge applications and high-performance computing applications—but the largest area of future growth is in the commercial sector. Figure 1 depicts this evolution. The opportunities for systems integrators and consultants are primarily in the commercial space because of the need to integrate Linux with the rest of the enterprise. The following sections will elaborate on that opportunity.
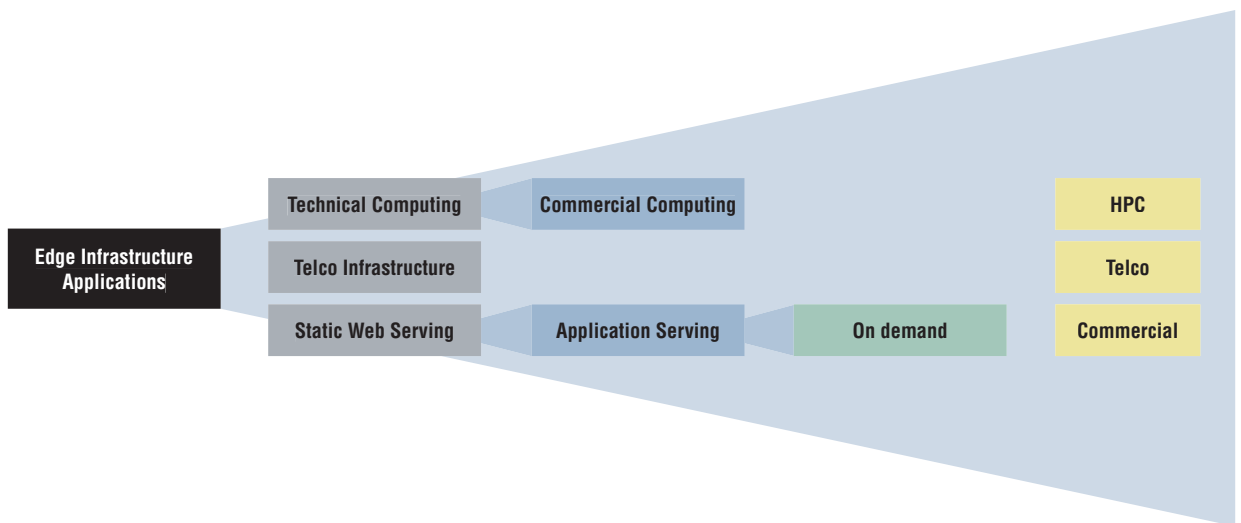
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Edge Infrastructure Applications	Technical Computing	Commercial Computing		HPC
	Telco Infrastructure			Telco
	Static Web Serving	Application Serving	On demand	Commercial

Figure 1: Linux evolution

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The Linux operating system is being adopted as the basis of mainstream commercial environments because of its openness, flexibility, leading price/ performance (through IBM @server systems), reliability, scalability and support from software and hardware vendors.

3.0 Linux Opportunity #1: Application Serving
The concept of application serving has taken hold in enterprise computing. It focuses on Web delivery and provides flexibility through the use of servers optimized for specific tasks. Many applications are being created with three-tier architectures:

Client: Provides access to the application from any Web browser on the user's PC or PDA
Application server: Runs the application on "application server" middleware
Database server: Provides backend database access

The application-serving architecture has the potential to greatly simplify an enterprise IT infrastructure. In particular, several disparate servers can be replaced with a few highly optimized, high-performance clusters running Linux. The Linux operating system is being adopted as the basis of mainstream commercial environments because of its openness, flexibility, leading price/performance (through IBM @server systems), reliability, scalability and support from software and hardware vendors.

At a time when reducing TCO is at the forefront of CIO priorities, the cost-effectiveness enabled by Linux is compelling. Low equipment and software costs are only the beginning. The homogeneity of Linux can reduce complexity, which in turn helps to cut deployment time and reduce administrative costs. The simplicity of Linux adds other benefits, including enhanced reliability and reduced demands on administrative skill sets.

Widespread industry support—thousands of independent software vendors (ISVs) have adopted Linux—is an enormous enabler for commercial Linux-based applications. Both server and software vendors provide products tailored to the application services architectural approach, such as scalable families of symmetric multiprocessing (SMP) servers, server clusters and blade servers—as well as the infrastructure software to run on them.

The major providers of application server middleware (IBM WebSphere®, Oracle application server and BEA WebLogic) support Linux, enabling integration with other enterprise systems. Application availability has skyrocketed in recent years. All major systems management software vendors support centralized Linux administration.

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Today, the Linux market has reached the point at which the market dynamics can support a significant consulting and integration business.

As the value of Linux becomes known, Linux is being deployed into other applications. For example, Linux has proven its value for network infrastructure, and CIOs are finding that those same attributes translate well to their mission-critical environments. CIOs like the TCO advantages and flexibility benefits that Linux brings. It simplifies their design, facilitates enterprise integration, enables faster upgrade and expansion (future-proof) and enables them to leverage their UNIX skills. In short, Linux brings business value and return and that is what is driving customer demand.

At the same time, the two key inhibitors to Linux growth are dissipating. One, the lack of a robust enterprise-class support ecosystem, is actually an opportunity for Linux services providers, an opportunity explored in this whitepaper. The other, user confidence, is growing with each success story.

IBM is helping to grow the Linux ecosystem. IBM offers the industry's most comprehensive portfolio of Linux consultative and support solutions—from hosting for your Linux environment, to a complete technical curriculum available in 20 countries and five languages, to managed operations services—delivered by more than 2,000 Linux-skilled IBM Global Services professionals. More than 4,800 IBM Business Partners around the world are trained in Linux-enabled solutions—a broad base of expertise that you can leverage to help develop highly customized e-business solutions for your customers.

Through IBM Global Services, IBM offers virtually unmatched, comprehensive Linux technical support services. SupportLine for Linux provides 24×7 enterprise-level remote support from trained engineers for fast and accurate problem resolution plus defect support for all major distributions of the Linux operating system.

Today, the Linux market has reached the point at which the market dynamics can support a significant consulting and integration business. The market drivers, enablers and increased momentum are significant factors in the size of this opportunity. The diffusion of market inhibitors also is contributing, opening a significant business opportunity that includes providing application architectural services and integration consulting services.

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4.0 Linux Opportunity #2: On Demand Computing

Linux is expected to play a key role in the next evolution of e-business, which IBM calls on demand computing—the end-to-end, vertical and horizontal integration of all business processes. An extension of Web application services, on demand computing makes all products and services available to anyone, anywhere, anytime.

On demand initiatives address many objectives—access to integrated information, better control of costs and the need to create new business and revenue opportunities. Of course, IT is the vehicle that enables an enterprise to respond far more dynamically to the demands of an always-on marketplace and economy.

Complexity has been the number-one issue of CIOs. Across all industries, more than 40 percent of all IT investments involve efforts to get technologies to work together. Clearly, simplification is needed.

Changing IT systems to support business on demand is a significant challenge—it requires that more fixed IT costs become variable so that they scale with business volume. On demand computing requires IT infrastructures that are flexible, scalable and resilient enough to respond to unexpected surges in use. It also requires quick and easy deployment of new applications to give users immediate access to the resources they need. On demand computing requires integrating distributed, heterogeneous IT resources to work together transparently to support this new "give it to me when I need it" business paradigm.

Computer resources will be virtualized. That is, pools of computing resources, such as storage and servers, will be shared and managed as if they were one large, virtual resource. This functionality will enable IT departments to provide better levels of service by isolating users from the intricacies of how the services are provided (virtualizing the services). Computer resources will have to be self-optimizing, self-protecting, self-configuring and self-healing (what IBM calls *autonomic*) to provide these greater levels of service while lowering costs.

Linux is becoming the de facto operating system for blades because of its small footprint, inherently high reliability and low cost.

Technology drivers

The following emerging technologies are part of on demand computing. Linux is a key element of each one.

Blade servers: The next step toward greater computing power per unit footprint, blade servers are an ideal packaging approach for on demand application-serving architectures. Linux is becoming the de facto operating system for blades because of its small footprint, inherently high reliability and low cost.

Grid computing: Grid computing will be a key foundation for virtualized computing resources. It allows distributed computing resources anywhere to be shared and managed as if they were one large, virtual computer. Idle computing resources can be found in almost every organization:

- Mainframes are idle 40 percent of the time.
- UNIX servers are idle 90 percent of the time.
- Most PCs are idle 95 percent of the time.

Ultimately, data centers will be virtualized. For that to happen, applications must be built from components that can be grouped together dynamically and delivered through a highly reliable infrastructure. We anticipate that Linux will play a central role in this development.

Having these "internal computing utilities" available on demand will help maximize IT resource utilization and lower costs. Then, as virtualization moves into the Internet itself, enterprises will be able to tap into "external utilities," acquiring computing resources and applications from service providers and paying only for what is used.

Grid computing is enabled through open standards led by the open source Globus community. By tapping underutilized computing resources when needed, Grid computing can provide capacity on demand at a very low incremental cost. Increasing the utilization of computing resources lowers TCO.

Autonomic computing: This concept denotes servers that are self-optimizing, self-configuring, self-protecting and selfhealing. When computers can adapt to and manage workload changes in real-time, user satisfaction increases. Obviously, downtime and repair costs also are reduced because of the reduction in human intervention. Like Grid computing and blades, autonomic computing is enhanced through open source software, Linux and a software infrastructure capable of supporting Web services.

Integration technologies—enterprise portals and Web services: In the on demand era, the competitive advantage will go to those enterprises that can provide their customers, suppliers, partners and employees with the right business information when, where and how these communities of interest need it (on demand). An enterprise portal is an integration technology that provides broad access, organization and integration of relevant business information to an enterprise's constituencies. This information, in turn, can be delivered to many different types of devices, including traditional PCs, browsers and PDA/wireless devices. Linux is well suited for this application because it can provide a uniform software architecture for each level of the enterprise—from the PDA/wireless clients all the way up to the largest servers and mainframes. Linux also is ideal for wireless devices because of its small footprint and high reliability.

In the on demand era, enterprises will be connecting to and integrating with other enterprises, other business processes and applications, and billions of computing devices. This integration will require open technical interfaces and standards. Web services are a set of open Web standards that facilitate application interoperability and integration of legacy and custom applications in heterogeneous environments. These standards permit the reusability of Web services—enabled applications, which can help enterprises lower TCO and improve time to market.

5.0 Other Key Factors Driving the Growth and Evolution of Linux

There are additional important market drivers of Linux growth. These drivers gained momentum during Linux's application sharing stage, and we expect them to achieve traction as the industry moves into the on demand era.

Software vendor support. The compelling Linux value proposition is driving user demand for Linux-based applications, and in turn, is leading to increased application support for Linux. As previously stated, thousands of ISVs have already adopted Linux—including ACCPAC, Cadence, JD Edwards, Landmark Graphics, Mapics, eOne Group, Relavis, Sage, Selectica, Synopsys, Trustix and VERITAS. Software vendors such as Borland, Computer Associates, Oracle, SAP, QAD, SAS, jBASE, Covalent, Linux NetworX and VA Software are partnering with companies like IBM and other system vendors to deliver Linux-based applications. Obviously, most software

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Today, nearly every infrastructure software product runs on Linux…

vendors write applications for platforms with strong customer demand. The large number of commercial applications is another indication of the broad support base behind Linux. Consider the following:

- The IBM Global Solutions Directory includes more than 4,200 Linux applications.[5]
- The Evans Developer Survey of 2002[6] showed that, by the end of 2002, 22 percent of all software developers in North America and 23 percent internationally were to have written Linux applications. The survey further indicated that 51 percent of all North American software developers said they will absolutely or probably write Linux applications in 2003 (48 percent internationally).

Additionally, IBM is seeing a marked increase in Linux usage for application serving and vertical industry application environments. We project application ISV support to grow just as it had in earlier stages when Linux was primarily used for network infrastructure environments. Today, nearly every infrastructure software product runs on Linux because customer usage has reached mainstream status for this workload. Signs that ISV enthusiasm is building include the fact that foundational middleware—IBM WebSphere, IBM DB2®, Oracle, BEA, Sun™ iPlanet™ and many others—are now supporting Linux.

Support for the open source community. By virtue of its open source heritage, Linux is viewed as the open operating system alternative. Linux continues to be developed by the open source community, which enables it to be embraced by many vendors. An open source product is a shared asset, not owned by any one vendor. It matures at a rate that is driven by industry and user demands. Linux is therefore supported by thousands of different subsystems and software, making it a true multivendor and multiplatform operating system. Additionally, the open source community is an important vehicle for establishing the standards needed to integrate diverse resources into Linux so that it can deliver new capabilities.

Open standards. As Linux continues to grow and evolve and the on demand vision is realized, the industry will need to operate in an open world. This means open standards—there is no alternative. Why? In the on demand

[5] IBM press release, November 11, 2002
[6] Evans Data Corporation, 2002

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Linux in Financial Services

The Linux operating system is helping financial firms around the world to address the IT challenges of lowering capital and operating costs and simplifying and streamlining their IT infrastructures.

With IT representing a bigger part of a financial firms' overall costs, streamlining IT itself is becoming a key objective. Linux-based servers can deliver both capital and operating cost reductions. First, the operating system itself is very efficient, requiring far less hardware resources than alternatives such as Windows and UNIX.[7] Second, because Linux is available on so many platforms (including all IBM server platforms), financial firms can select the best server to fit the workload. Picking the best server for the job—from Intel processor-based servers to mainframes—will optimize capital costs. But this also enables firms to reduce the number of server operating systems that their staff supports, leading to more effective and efficient administration.

The value proposition of Linux is underscored by the experience of Merrill Lynch. According to Merrill Lynch, "The economic value proposition we've seen in initial Linux deployments sometimes represents a 40 to 50 percent reduction in the total cost of ownership, and that is a value proposition that we can't ignore."[8]

Finally, with reliability acknowledged as a key strength of Linux, financial firms are deploying Linux for mission-critical applications. For example, Linux is running Morgan Stanley's North American market data delivery plant as well as a swaps valuation application for derivatives in the company's fixed income business. For Lehman Brothers, Linux runs the company's automated market-making application and a legacy risk-based application.[9]

environment, enterprises will need to connect to other enterprises, other business processes and applications, and billions of pervasive computing devices. Enterprises cannot replace their legacy applications, data and transaction systems, because doing so would be too costly. Therefore open standards is the only realistic alternative. Currently, four key initiatives will drive the standardization of Linux in the on demand era:

- Linux Standards Base (LSB)
- OSDL Carrier-Grade Linux Working Group
- OSDL Data Center Working Group
- Industry-standard Linux distribution consolidation: Red Hat Linux and UnitedLinux

Linux Standards Base: The goal of the LSB is to develop and promote a set of standards that will increase compatibility among Linux distributions (such as those from MandrakeSoft, Red Hat, SuSE Linux AG, The SCO Group and Sun Wah Linux Ltd.) and enable software applications to run on any compliant Linux system. In addition, the LSB will help coordinate efforts to recruit software vendors to port and write products for Linux. LSB members include; Corel Corporation; The Debian Project; Enhanced Software Technologies, Inc.; IBM; LinuxCare; Linux for PowerPC; MandrakeSoft; Metro Link, Inc.; The Open Group; Turbolinux Inc.; Red Hat, Inc.; SGI; Software in the Public Interest, Inc.; SuSE GmbH; VA Linux; and WGS.

Customers must be able to purchase a mainstream Linux distribution that best suits their needs without fear that their applications will have compatibility problems with applications written for other distributions. LSB assures a customer that their choice of application has been tested against LSB standards and should run properly on any LSB-compliant distribution. Developers and ISVs benefit as well because they can count on their applications running on as many Linux platforms as possible.

OSDL Carrier-Grade Linux Working Group: The OSDL Carrier-Grade Linux Working Group is an industry forum that has been established to promote the use of Linux and open standards−based software components in carrier-grade platforms. The Working Group operates under OSDL and

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[7] Dushyant Shahrawat, "Wall Street Romances the Penguin: The Growing Popularity of Linux," TowerGroup report, September 2002
[8] Risk Waters Group, "Leading the Linux Charge," November 2002
[9] Risk Waters Group, "Leading the Linux Charge," November 2002

Linux in Retail Services

Retail companies are seeking to lower operating costs while providing better service and becoming more accessible through the new methods in which customers want to do business. IT plays an important role in achieving these objectives by enabling new ways of marketing to customers, new sales channels and more streamlined operations.

Retail companies are deploying Linux to streamline their supply chain operations—using Linux as a platform for integrating trading partners into retail planning, ordering and merchandising systems. Linux systems integrate well with other platforms because of the operating system's support for open standards. Retail firms also are deploying Linux for point-of-sale (POS) applications and to enable new sales channels such as kiosks. Because a broad range of computers run Linux—from processors embedded in small devices to mainframes—Linux can be used in many retail configurations.

will focus on collecting requirements for and specifying the architecture of a Carrier-Grade Linux platform. The Working Group also promotes the development of commercial and open source software components to implement the required functionality of the platform.

OSDL Data Center Working Group: The purpose of the Data Center Working Group is to develop and evangelize the road map for a Linux software platform that supports commercial software products and corporate IT requirements. This road map will enable developers to create Linux-based solutions for the data center market segment.

Industry-standard distribution consolidation: Recently, the major Linux distributors came together to provide a single stable, uniform global platform for application development, certification and deployment. Such a platform would allow Linux vendors, ISVs and independent hardware vendors (IHVs) to support a single high-value Linux offering rather than many different versions. Called UnitedLinux, this consortium is comprised of Conectiva, The SCO Group, SuSE and Turbolinux. The collaboration of these four leading Linux distributors will result in an enterprise Linux offering, which is truly global by virtue of the companies' ability to provide local language support, training and professional services, in addition to the support of strategic partners. UnitedLinux will provide one unified Linux code base for IBM's complete @server™ product line (as well as support for other vendors' offerings that are based on Intel technology). This uniform platform, coupled with each distributor's additional packaged applications, enables the rapid development of applications, certification and deployment.

UnitedLinux supports LSB, Linux and GB18030 standards, as well as enabling installations in English, German, French, Italian, Japanese, Korean, Portuguese, Spanish, Simplified Chinese and Traditional Chinese.

Importantly, IBM also has partnered with Red Hat, the world's largest Linux distributor, which provides a wide range of Linux products and services to customers. This alliance combines the knowledge and experience of two global leaders—providing customers with a joint solution for enterprise Linux deployments. It is also worth mentioning that Hewlett-Packard has dropped plans for its own Linux distribution, following IBM's strategy for industry-standard distribution.

In addition to the above efforts, several other Linux-enabled standards support cross-platform integration, which will fuel greater adoption in the commercial sector. These standards include Java,™ XML, HTML, SOAP and UDDI.

6.0 Opportunities for Services Companies

Since its beginnings in the 1990s hosting Internet edge applications, the Linux operating system has experienced skyrocketing demand. Figure 2 shows a compact view of the fan-out of Linux-based applications. Linux use is growing in all four areas, and this chart intends to depict that usage not as an evolution from one application segment to another, but rather as an expanding universe.

The applications in the first column (Internet edge applications) typically have not required much consulting and integration expertise, but the other three areas (static Web serving, application serving and on demand computing) have significant integration needs.
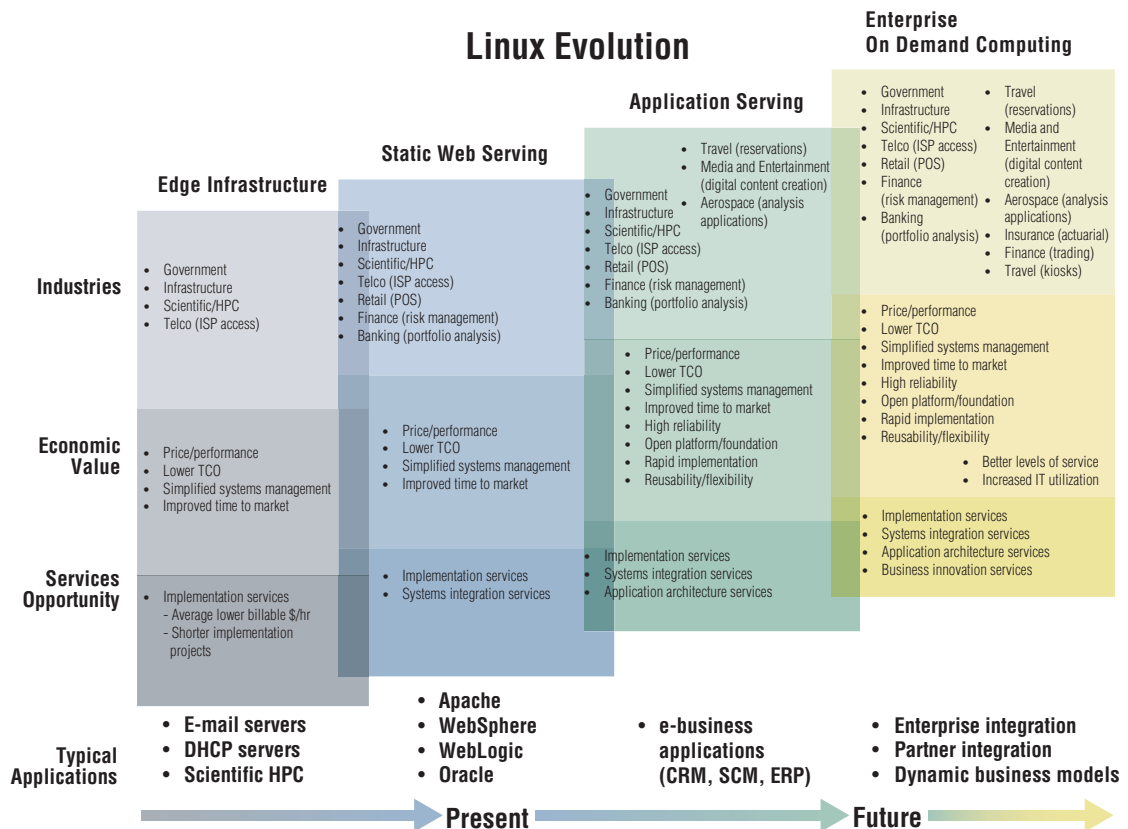
Linux Evolution

Enterprise On Demand Computing

Application Serving

Static Web Serving

Edge Infrastructure

Industries
- Government
- Infrastructure
- Scientific/HPC
- Telco (ISP access)

Static Web Serving Industries:
- Government
- Infrastructure
- Scientific/HPC
- Telco (ISP access)
- Retail (POS)
- Finance (risk management)
- Banking (portfolio analysis)

Application Serving Industries:
- Government
- Infrastructure
- Scientific/HPC
- Telco (ISP access)
- Retail (POS)
- Finance (risk management)
- Banking (portfolio analysis)
- Travel (reservations)
- Media and Entertainment (digital content creation)
- Aerospace (analysis applications)

Enterprise On Demand Computing Industries:
- Government
- Infrastructure
- Scientific/HPC
- Retail (POS)
- Finance (risk management)
- Banking (portfolio analysis)
- Travel (reservations)
- Media and Entertainment (digital content creation)
- Aerospace (analysis applications)
- Insurance (actuarial)
- Finance (trading)
- Travel (kiosks)

Economic Value
- Price/performance
- Lower TCO
- Simplified systems management
- Improved time to market

Static Web Serving Economic Value:
- Price/performance
- Lower TCO
- Simplified systems management
- Improved time to market

Application Serving Economic Value:
- Price/performance
- Lower TCO
- Simplified systems management
- Improved time to market
- High reliability
- Open platform/foundation
- Rapid implementation
- Reusability/flexibility

Enterprise On Demand Computing Economic Value:
- Price/performance
- Lower TCO
- Simplified systems management
- Improved time to market
- High reliability
- Open platform/foundation
- Rapid implementation
- Reusability/flexibility
- Better levels of service
- Increased IT utilization

Services Opportunity
- Implementation services
  - Average lower billable $/hr
  - Shorter implementation projects

Static Web Serving Services Opportunity:
- Implementation services
- Systems integration services

Application Serving Services Opportunity:
- Implementation services
- Systems integration services
- Application architecture services

Enterprise On Demand Computing Services Opportunity:
- Implementation services
- Systems integration services
- Application architecture services
- Business innovation services

Typical Applications
- **E-mail servers**
- **DHCP servers**
- **Scientific HPC**

Static Web Serving Typical Applications:
- **Apache**
- **WebSphere**
- **WebLogic**
- **Oracle**

Application Serving Typical Applications:
- **e-business applications (CRM, SCM, ERP)**

Enterprise On Demand Computing Typical Applications:
- **Enterprise integration**
- **Partner integration**
- **Dynamic business models**

Present → **Future**

Figure 2. The growing areas of Linux-based computing

Linux is an integral component of IBM's open systems strategy: a foundation for e-business infrastructures.

Linux in Automotive Industry

The automotive industry is under intense pressure to reduce costs (such as analysis infrastructure, weight and material costs) and improve their design efficiency (faster cycle times) by optimizing product performance through computer-aided engineering (CAE) simulations. Several major automotive companies have chosen to deploy Linux Clusters on IBM @**server** xSeries servers in their CAE environments because of Linux's strong affinity for high-performance computing (HPC). This solution has enabled the auto companies to reduce TCO through server consolidation and simplified management. Because Linux is built on open standards, this solution also has helped to improve the efficiency of their CAE environments by providing the CAE engineers with the flexibility of platform choice.

IBM believes that its continued commitment to open technologies differentiates it from many competitors who have continued to offer proprietary solutions that restrict the benefits customers can obtain from truly widespread industry support.

Although Linux is a "free" operating system, the services business is likely to be no different than it is with other platforms. Analysts have stated that the pricing of Linux services is similar to other operating systems. Linux is a commodity operating system; however, it does not support a commodity services business. Others in the community consider Linux to be free, not in terms of cost, but rather free in terms of the freedom to use it and to assist in its maturation.

Linux will not be the only operating system in use by enterprises, but it does deliver a very compelling set of attributes for certain applications. Companies are likely to approach their existing integration or consulting partner and ask for help integrating Linux applications. Many IT departments want to be positioned for the future and to leverage the Linux value proposition now.

7.0 IBM's Global Commitment to the Linux Evolution

IBM views its role as helping to build a healthy support ecosystem within the Linux movement. Linux is an integral component of IBM's open systems strategy: a foundation for e-business infrastructures. IBM has built a strong Linux capability within the company and is working with other vendors as well as the open source community to accelerate the growth of Linux usage. IBM has made significant investments in standards setting, technology, products, services and programs for accelerating the growth of Linux and paving the way for Linux's evolution into e-business.

IBM believes that its continued commitment to open technologies differentiates it from many competitors who have continued to offer proprietary solutions that restrict the benefits customers can obtain from truly widespread industry support.

Described below are some of the initiatives IBM has undertaken to help establish Linux as a key enabling technology.

Open source development: Linux is an open source operating system, meaning that the source code is available to anyone, without limitations on use and without royalties. More than $1 billion has been invested, along with the efforts of hundreds of professionals at IBM's Linux Technology Center (LTC). The LTC is a worldwide IBM development team consisting of more

Linux in Government

Demand for greater citizen services, increasing security concerns (such as cyber terrorism), budgetary pressures and the Internet (e-government on demand) are creating new challenges for many governmental IT organizations. As a result, there is pending national legislation, including 66 open source software government proposals in 100 countries (and counting), as well as a wide range of public sector institutions and agencies that have turned to Linux to help address these IT challenges.

For example, many government agencies are leveraging Linux's open source heritage to migrate and integrate a myriad of legacy IT silos onto a common IT architecture to enable collaboration among agencies for better citizen services. Government-funded research labs are using Linux for high-performance cluster computing applications, such as fluid dynamics, nuclear theory and nanotechnology, to drive price/performance and improve quantitative analysis. Several countries are using Distributed Linux to support a wide range of Web applications (such as online voter registration) to satisfy the rising demand from their constituents for e-government on demand. And finally, numerous government agencies are deploying Linux to reduce costs, improve performance and enhance management and security through workload consolidation for file-and-print serving, e-mail infrastructure and Web-serving applications.

than 200 programmers whose purpose is to advance the functionality of Linux across many different environments—including servers, desktops, embedded devices and appliances—by leveraging the vast resources of IBM. The LTC also serves as a center of Linux competency within IBM, providing technical expertise to developers working on Linux-based IBM solutions.

The LTC is actively collaborating with many other leading Linux developers as well as with most of the other systems vendors.

Eclipse: Eclipse is a Java-based open source development platform with a single, unified interface to all its tools. It integrates all development tasks, such as debugging, testing and performance tuning, into one workbench. Eclipse is based on a framework of plug-in modules, making it easy for multiple groups to develop components for the workbench. The extensive selection of tools helps application developers create e-business applications, thereby saving time and money.

Eclipse is important because it does for software tools what Linux does for operating systems. IBM is the leading contributor and supporter of the Eclipse open source initiative, having invested $40 million and made significant contributions in technology, applications and tool development. In less than a year, Eclipse has become the most ubiquitous Java-based application development framework in the industry:

- More than 200,000 developers actively work with Eclipse.
- More than 150 open source projects are based on Eclipse tools.
- More than 175 tool vendors have built or plan to build tools for the Eclipse platform.
- More than 150 corporations are actively involved with Eclipse.

WebSphere: WebSphere is IBM's application server middleware and serves as the underlying universal platform for all of IBM's on demand software. WebSphere is the foundation to develop, deploy and integrate next-generation e-business applications. On demand applications must be built on an IT infrastructure that is flexible and secure enough to meet dynamically changing needs. WebSphere provides this flexibility. It has become a de facto Web application services standard in the industry—a key part of the open, on demand world. To date, more than 9,000 software companies and 1.5 million programmers are using WebSphere.

IBM has enabled all of its major products for Linux, including its servers—the IBM @server xSeries, zSeries,™ iSeries,™ and pSeries™ servers—as well as DB2, WebSphere and IBM connectors and gateways such as DB2 Connect.

WebSphere Studio: WebSphere Studio is an Eclipse-based integrated development environment for application-serving architectures. It is composed of a single integrated set of tools supporting WebSphere, WebSphere MQ, Lotus® Domino,™ Crossworlds,® DB2 and Tivoli®. In addition, because WebSphere Studio is built on the Eclipse platform, a developer can access WebSphere Studio along with tools from other vendors—all from Eclipse's portal-like environment. WebSphere Studio was designed to unify IBM's middleware portfolio around a single, open development environment, thereby making it easier to integrate tools from any source and cutting development costs for customers.

developerWorks: IBM has invested significant resources in providing Linux information to developers. The primary vehicle for disseminating this information is the developerWorks program. One element of the program, the developerWorks Web site, offers free tools, utilities and support that can speed the Linux learning curve and reduce upfront costs.

Product enablement: IBM has enabled all of its major products for Linux, including its servers—the IBM @server xSeries, zSeries,™ iSeries,™ and pSeries™ servers—as well as DB2, WebSphere and IBM connectors and gateways such as DB2 Connect.

In addition to supporting the open source community, IBM also is working with other industry players to accelerate the evolution of Linux. For example, IBM has established strategic partnerships with key Linux distributors UnitedLinux (and its member distribution companies) and Red Hat. UnitedLinux and Red Hat are considered best in class in regard to the quality of their distributions and their presence and commitment to the Linux marketplace.

IBM now offers enterprise-class support with its dedicated Linux Operational Support Services. These services include technical support (previously discussed); consulting and implementation services (such as Open Source Computing Consulting and Linux Solutions for e-business Consulting); IBM Learning Services, which provide a full range of Linux-related education; and IBM Redbooks for Linux, which are "how-to" books written by IBM Linux experts for customers and business partners.

The Linux opportunity has evolved to the point where there are significant opportunities for systems integrators and consultants. These opportunities include business innovation services and applications, systems integration and consulting services.

IBM makes it easy to work together on Linux. IBM offers the most comprehensive Linux Business Partners program in the industry. IBM PartnerWorld-Linux provides a single point of entry into IBM's global resources to enable Business Partners to quickly and efficiently exploit the opportunities of the growing Linux market. This program offers education and certification, technical support, comprehensive enablement and marketing support, and an ecosystem of highly skilled and capable partners to extend a Business Partner's capabilities and enable it to gain a competitive advantage.

8.0 Working Together for Success

Linux is the fastest growing server operating system in the marketplace because of its compelling value proposition. Linux is creating economic value by lowering TCO and increasing the flexibility to respond to business needs. It is particularly relevant in these times, in which getting more done with less is a top CIO priority.

The Linux opportunity has evolved to the point where there are significant opportunities for systems integrators and consultants. These opportunities include business innovation services and applications, systems integration and consulting services. As Linux fans out into more application environments, the opportunities will increase.

For systems integrators and consultants, finding the right partner to help identify and exploit the opportunities presented by Linux is critical. IBM's unique leadership position in both e-business and Linux can be a great asset in building such services. IBM has Business Partner programs in place to help businesses succeed. Combining IBM's Linux expertise with a Business Partner's best practices is a powerful combination, delivering great value to customers.

For more information about Linux and IBM, please visit **ibm.com**/linux.

For details about Linux support offerings from IBM, visit **ibm.com**/linux/support.

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