Building on Your AIX Investment

Moving Forward with IBM eserver pSeries in an e-business World

Jim Hoskins

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by Jim Hoskins

(version 1.2e)

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Hoskins, Jim.

Building on Your AIX Investment

Moving Forward with IBM eServer pSeries in an e-business World / Jim Hoskins

ISBN 1-931644-05-5

Acknowledgements

Many people gave assistance in preparation of this ebook. Some provided information concerning their product area of expertise. Others reviewed the manuscript and provided helpful comments. To all of those who assisted… THANK YOU!!

We would also like to express particular appreciation to Catherine Brohaugh, Eric Buckley, Heidi Dethloff, Kenneth Gray, Laura Hastings, Albert Kopp, Jim McGaughan, Mary Murphy, Allyson Murray, Asa Orsino, Leza Segel, and Bill Smith.

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Introduction

About This eBook

If you are involved with any business or institution that currently uses IBM eServer pSeries, IBM RS/6000 servers, or other brands of UNIX servers, then this ebook is for you. It starts by describing the state of e-business today and where the general business population is in terms of the e-business adoption process. It will help you look inward at your own enterprise to evaluate your current state of e-business adoption. You will see where IBM is headed in terms of the future of e-business and learn how to take full advantage of e-business in your organization. You will learn how to leverage your existing investment in AIX or UNIX computing infrastructure moving forward. You likely will see yourself somewhere in the "Top Ten Things That Tell You It's Time for a Change." Finally, you will read about the actual experiences of Toyota Australia as they moved down the e-business adoption path.

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CHAPTER 1

Assessing the e-business Opportunity

This chapter starts with an introduction to the e-business opportunity and offers a model that describes the various stages of e-business. You will see where most companies find themselves today with respect to e-business adoption and how change can be used as a competitive advantage. Then we will take a look at the IBM vision for the future of e-business—namely, e-business on demand.

The State of e-business Today

The decade of the nineties will surely be remembered as the dawn of the Internet. We need not reiterate here the staggering statistics that describe the growth of the Internet during those years—we have all heard them by now. And we all watched the frenzied growth and subsequent collapse of the ".com" business world which reminded us that the basic rules of business still apply, even when you add Web sites and e-mail to the picture.

The businesses of today now have an unprecedented opportunity as a direct result of the Internet phenomenon. The term "e-business" has

come to stand for the huge array of Internet-related techniques and tools a business can use to move itself forward in all areas. E-business represents the "prime mover" of today's business world, offering virtually unlimited possibilities for the flexible and an inevitable death spiral for those businesses unable or unwilling to take advantage of it. Businesses of all sizes have no choice but to change and adapt or simply fade away.

Perhaps this first decade of the new millennium will be remembered as the time when e-business grew up. While real-world e-business is no panacea, it does enable everything from simple cost savings to complete business process transformation and whole new models for reaching out to customers. There are no shortcuts for getting there, but the opportunities presented by e-business—for businesses of all sizes—have already proven to be remarkable. And we have only just begun.

As with any major change, pursuing an e-business agenda comes with risk. To borrow from a sports analogy, "… you can't get to second base with your foot on first." However, in today's world—the e-business world—the biggest risk is faced by those who do nothing at all.

The e-business Adoption Model

To better understand the way businesses are using the Internet today, consider the model shown in Figure 1.1. In the model, e-business adoption is broken down into three phases.

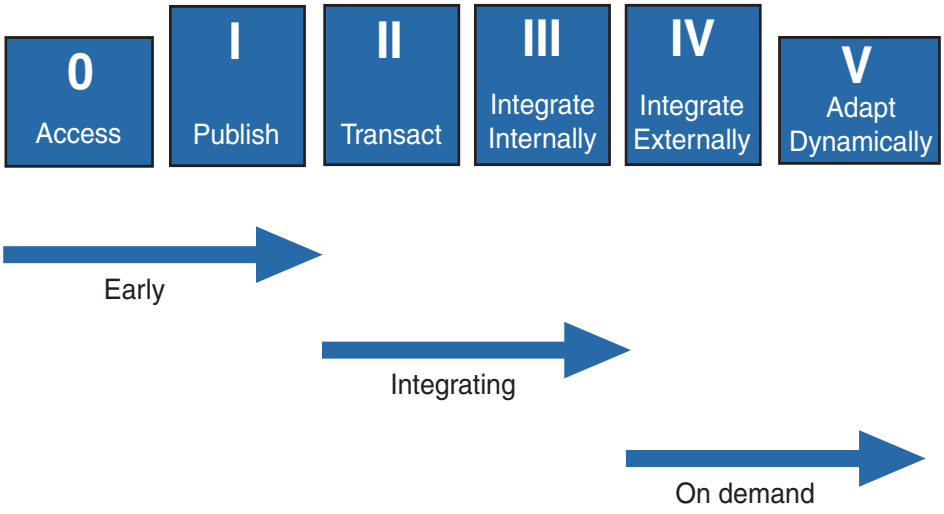

Figure 1.1. The e-business adoption process.

During the "early" phase of e-business adoption, companies begin to create and promote their Web sites as a new way to deliver information about their business, products, and services. The benefit of doing this is that customers can access this information twenty-four hours a day, seven days a week. In this early phase, a business is also able to interact in very basic ways with customers via e-mail and perhaps conduct simple business transactions. An IBM study of some 33,000 enterprises around the world found that about three-quarters are currently in this early phase of e-business.

During the "integrating" phase, a business begins to take the Web presence it developed during the early phase and securely integrate it with other key business systems. That is, the integrating phase enables the smooth flow of information all the way through every key business process within the company. This is called "end-to-end" integration and offers the potential for increased productivity and sales growth. About a quarter of all large firms (over 1,000 employees) and over half of the world's largest companies are in the integrating phase of e-business. IBM has calculated its own savings from e-business integration efforts to be $6.2 billion.

In the "on demand" phase, the focus is on securely extending the "end-to-end" integration model to include systems and processes of those outside the enterprise, including customers, suppliers, and partners. Here a business benefits from additional cost savings, flexibility, increased customer service, and "just-in-time" business models that improve efficiencies. The "on demand" phase also enables a business to adapt to change more quickly and in more meaningful ways—which is one of the most valuable things e-business has to offer. About 5% of all companies surveyed (and 6% of larger firms) are moving into the advanced phase of e-business.

Wherever a business is along the e-business adoption curve, there must be an ever-present effort to move to the next phase. Any business that is not on the move can rest assured that its competitors are (either those that are well known or those that will come out of nowhere). In

this way, a business is like a shark—it must keep moving forward or it will surely drown.

Change as a Competitive Advantage

No matter where a business is along the e-business adoption path, the ability to change can provide a significant competitive advantage. In the early phase of e-business, the need to change may come from a sudden increase in Web site traffic caused by a holiday shopping season or an unexpected current event that suddenly increases interest in a company's products or services. If that company can adapt instantly to this change, its customers get what they need without interruption. If the company can't adapt quickly, then the customers will become frustrated with a sluggish Web site and will simply click over to a competitor.

This ability to respond to change becomes more important the farther down the e-business adoption path you go. When key business processes are fully integrated from end to end, there are many more places from which change can come and many more problems created for inflexible e-business infrastructures. This is precisely why IBM has adopted a company-wide strategy it calls "e-business on demand."

The IBM e-business on demand Strategy

IBM has been laser focused on a concept called e-business on demand ever since its introduction in October 2002. In many respects, you can already see the results of this focus in today's IBM products. And the

$10 billion IBM is committing to e-business on demand means that over time this strategy will increasingly manifest itself in all IBM computer hardware, software, and services. Companies in many industries have already started e-business on demand initiatives.

At its core, e-business on demand refers to a computing infrastructure (hardware, software, and services all working together) that can support today's business needs and enables the migration of a business down the e-business adoption path. While the typical computing infrastructures in use today meet current needs (to a varying degree), they are not prepared to support a highly dynamic, responsive, and integrated business environment—which is exactly where e-business is headed.

So what does this mean? It means that not one more dollar should be spent on any new computer system, software package, development effort, or service contract that doesn't lead to a computing infrastructure that enables a business to head down the e-business adoption path.

In IBM language, that means you need to lead your computing infrastructure purchases and development efforts down the path of e-business on demand. In other words, you need to keep four key principles in mind as you evolve your computing infrastructure over time:

Open Standards

The days of locking in to a specific vendor's proprietary computing architecture are gone. Today, a computing infrastructure needs the flexibility (in vendor choice, in information exchange, in application integration, in application selection, etc.) that comes only when that

infrastructure is built around open standards defined by vendor-neutral standards bodies—standards with names like Java, SQL, XML, and Linux. Most businesses employ more than one type of computer/operating system. Adherence to open standards is what will enable these different types of systems to work together, or "integrate," at a lower cost over time. Other benefits resulting from adherence to open standards include leveraging investments/skills in existing heterogeneous computing infrastructures, speed of deployment for new projects, and freedom of choice. For the same reasons, adherence is also important when selecting storage devices for use in an e-business infrastructure.

Integration

By adhering to open standards, you will be laying the groundwork for the end-to-end integration goal of e-business discussed earlier. This integration of key business processes throughout the inner workings of a business, with suppliers, and with customers is one of the crown jewels of e-business. So businesses should not allow the construction of independent computer solutions (servers, operating systems, middleware, and applications) without giving careful thought to the ability to securely integrate these new solutions (immediately or in the future) with the rest of their computing infrastructure.

Virtualization

With virtualization, what you see is not what you get. That is, the users of the computing infrastructure are insulated from the physical

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- e-business on demand overview and papers
- e-business on demand article published in *Network Magazine*
- Autonomic computing overview, news, library, etc.

constraints that provide that resource, allowing change without user disruption. So here we are, back discussing the need to accommodate change in the e-business environment. Through virtualization, a computer system can dynamically change the amount and type of resources a user receives in concert with the changing needs of that user—without disruption. This dynamic allocation allows users to get the most out of a given computer system, resulting in better service and less wasted resources. Virtualization also is used to "subdivide" a single large computer system into smaller "virtual" computer systems, each perhaps running different operating systems (e.g. AIX or Linux) and applications. This flexibility, along with the reliability afforded by protecting problems in one user's "virtual computer" from disrupting the other users, plays right into the hands of e-business.

Autonomic Computing

"Autonomic" is a term IBM borrowed from the vernacular of the human central nervous system. The goal of autonomic computing is for the computing infrastructure to manage itself just as the central ner-

vous system manages the human body—without our conscious effort. By making computer systems self-optimizing, self-healing, self-configuring, and self-protecting, the costs associated with systems management and unscheduled down time are reduced. The more complex the computing system, the more important autonomic computing becomes. Since complexity goes up as you progress along the e-business adoption path, self-managing the complexity is a critical requirement for computing infrastructures going forward.

e-business on demand is the "blueprint" IBM is using to guide the development of its entire line of products and services including the important IBM eServer and IBM TotalStorage families as we will see next.

The IBM eServer and TotalStorage Strategy

Underlying the IBM e-business on demand strategy is a completely revamped line of servers that fall under the IBM eServer brand and associated storage devices under the IBM TotalStorage brand.

The IBM eServer family includes:

- *zSeries (formerly known as S/390)*

  The zSeries is a line of mainframe servers offering high-end capacity, performance, security, and reliability. They are designed to run mission-critical applications for an enterprise.

- *pSeries (formerly known as RS/6000)*

  The pSeries is a UNIX server product line designed for both traditional business applications and high-performance computing environments. The pSeries can scale up in processing power either by upgrading to more powerful models or by linking (clustering) multiple pSeries systems together to achieve supercomputer performance. The pSeries lines use AIX or Linux operating systems.

- *iSeries (formerly known as AS/400)*

  The iSeries uses the OS/400 operating system, which includes many functions (Universal DB2 database, security, etc.) that often are separate add-on products for most other computers. This helps reduce the total cost of ownership and makes iSeries systems easier to manage than other computers offering similar power. The iSeries also conforms to open standards and can run both Linux and soon AIX under OS/400.

- *xSeries (formerly known as Netfinity)*

  The xSeries servers use from one to sixteen Intel microprocessors to deliver Windows servers with mainframe-like reliability through the IBM Enterprise X-Architecture.

- *Clusters*

  Clusters are not a separate product line but rather configurations of multiple eServer systems connected together through high-speed

links. With clusters, you can combine the performance and capacity of multiple systems while retaining the simplicity of managing them as if they were a single system.

- *Blades*

  The IBM eServer BladeCenter is a highly dense server architecture which delivers high-performance computing in a modular, rack-mounted package. The first blade to be introduced was the HS20, a two-way Intel processor-based server. Additional blade servers, such as a UNIX blade and a storage networking blade, are expected to be introduced later in 2003.

The IBM TotalStorage family consists of disk storage devices, tape drives, optical storage devices, and storage software. There are storage products ranging from simple devices for small businesses to high-end storage systems for large enterprises. TotalStorage hardware is designed based on open standards defined by organizations like the Storage Networking Industry Association (SNIA). As with servers, storage devices that employ open standards provide more flexibility when building and evolving an e-business infrastructure over time. Specialized storage management software helps users deal with issues like information availability, backup, security, and migration of infrequently accessed information to less expensive storage media. We look more closely at the TotalStorage family in Chapter 2.

The IBM eServer and TotalStorage product families are both designed to reduce the total cost of owning and operating a business-critical e-business computing infrastructure (including the hardware purchase price, software licensing, installation, user training, upgrade requirements, maintenance, power consumption, facilities, systems management resources, etc.). According to a study of the operating e-business infrastructures of twenty-four organizations (ITG, December 2002), using eServer systems in an e-business infrastructure can help to significantly reduce total cost of ownership (TCO) over a five-year period. Lower TCO translates into greater return on e-business infrastructure investments.

At the same time, eServer systems also have proven their worth in the highly competitive world of price versus performance. In recent testing, these servers won seventeen of the top positions in a series of thirty industry benchmarks (performance tests) representing five real-world business applications. These eServer systems had more first-place benchmark finishes than the rest of the industry combined. As a result, IBM recently gained market share to pass the combined HP/Compaq company and reclaim its position as the number one server company in the world.

More on the Web

- Perform your own TCO self assessment
- TCO Study (ITG)

IBM has achieved this low TCO and leading price/performance through a four-part strategy that underlies all IBM eServer products.

Application Flexibility

Freedom of choice results in lower costs. Application flexibility offers users a wider choice of pre-packaged application programs from which to choose when they begin looking for business solutions—often resulting in a lower-cost solution. By leveraging open standards and offering more than one operating system choice (including Linux on all eServer systems), the cost of integrating separate application programs is also reduced. The eServer systems are currently in the lead when it comes to supporting both de facto and open standards.

Technology Leverage

IBM has always been and continues to be a technology innovator and leader by hiring good people, making strategic acquisitions and investments, and spending heavily on research and development. IBM has eight global research labs with over 3,000 researchers. Every year for nearly a decade now, IBM has set a new record for the most patents awarded to a single company—more than the twelve largest technology vendors combined. Recent innovations at the chip level include things like silicon-on-insulator chips which can boost performance up to 30%, copper wiring which reduces power consumption and improves reliability through lower operating temperatures and the first dual-processor on a single microprocessor chip (the POWER4). By using these POWER4 chips in an IBM multi-chip module (MCM) you have four chips (eight processors) in a softball-size package. These and other

innovations in the IBM technology portfolio are used in the eServer lines to deliver improved price/performance, capacity, and function. At the system level, the various methods available to grow or "scale up" in performance and capacity also demonstrate innovation. For example, you can simply upgrade to larger models with more processors (vertical growth). Alternately, you can grow horizontally by exploiting virtualization or by linking (clustering) multiple systems together using high-speed links, thus combining the strength of many systems yet managed as simply as one.

Using a feature called dynamic LPAR (covered in Chapter 2), a single eServer can do the job of multiple servers, including running different operating systems simultaneously under the control of the AIX Workload manager. Cryptographic co-processors can be used to help speed the encryption and decryption of information, thus enabling secure (conforming to the strict FIPS PUB 140-1 levels 3 and 4 standards) communications over networks.

Risk Mitigation

The farther you are down the e-business adoption path, the more disruptive it is when a computer system fails or goes down unexpectedly. To minimize the impact to business continuity resulting from downtime, IBM is taking the best ideas and technology from each eServer line and implementing them across all of the other lines. It's an

approach that seems to be working, as demonstrated by a recent study by the Information Technology Group, which followed the actual experiences of eighteen companies over a five-year period. They found that, "using IBM eServer, companies experience better service quality, particularly higher levels of availability. Combined lost revenues and customer lifetime value due to outages, poor response time and other factors range from 4 to 36 times less than that for infrastructures built around Sun, HP and other servers."

Infrastructure Efficiency

Much of the computing infrastructure resources deployed today are underutilized. Businesses are paying for wasted performance, capacity, and human resources, thus increasing total cost of ownership. IBM is focused on enabling its products to more efficiently utilize their performance and capacity with things like capacity on demand, which allows users to switch reserve computing power on and off but pay only for what they use. Dynamic LPAR also provides a way to more efficiently use a server. The term "dynamic" refers to the ability to achieve efficiency by reallocating the computing resources across the partitions on the fly as needed without disrupting operations. Perhaps the ultimate infrastructure will come over time through a model IBM is pursuing called "grid computing," in which computer power is delivered to users just like electricity or water—as a utility.

One Size Does Not Fit All

When IBM revamped its entire line of servers under the eServer brand back in October 2000, it encountered the question, "Why didn't IBM just create one line of servers rather than several (xSeries, pSeries, Blades, Clusters, etc.)?" This question is particularly relevant because IBM is using so much common technology across all IBM eServer lines.

The answer is… "because one size does not fit all." The wide range of environments in which computers are used today are as diverse as… well, … the whole world. Computers are used everywhere from fish markets to nuclear reactors and to manage activities from seaweed harvesting to Mars missions. Just as no single boat hull design or golf club is perfect for every situation, no one server architecture is perfect for every business environment.

In fact, even within a single enterprise it is almost always desirable to use more than one server architecture due to the wide range of needs to be filled. That's why 90% of all enterprises use multiple architectures (and 65% have three or more architectures in use). There is no one perfect architecture for every situation. By mixing and matching the various architectures, you can take advantage of the inherent

More on the Web

- Info on all IBM eServer lines
- IBM TotalStorage
- Printed book: *Exploring IBM eServer xSeries*
- Printed book: *Exploring IBM eServer pSeries*
- Printed book: *Exploring IBM eServer iSeries*
- Printed book: *Exploring IBM eServer zSeries*

strengths of each to build a more flexible and efficient e-business infrastructure.

This, along with the need to preserve much of the investment in computing infrastructure in place today, is the reason IBM chose to move several unique architectures forward into the emerging e-business world.

CHAPTER 2

A Look at the pSeries Line

So far, we have taken a look at today's e-business opportunity and examined the broad e-business on demand, eServer, and TotalStorage strategies central to the IBM vision for the future of computing. From here, we will focus on the IBM eServer pSeries line and how it can be used to build an e-business infrastructure moving forward.

Regarding Environments

The pSeries line is designed to address the computing needs of both high performance computing (HPC) users and those who run more general commercial application programs. HPC applications can be found in business, government, and academic environments in areas such as statistical analysis, geological analysis, molecular chemistry simulations, artificial intelligence, and life sciences. Many HPC applications are best implemented on shared servers or clusters of servers, with each user accessing the cluster via a networked personal computer.

Another type of environment addressed by pSeries servers is that of traditional commercial application programs found in business, govern-

ment, and academic organizations. Again, in these environments, a single pSeries server or cluster of servers is typically shared by multiple users—each working at a personal computer connected to the server on a local area network (LAN). Application programs in commercial environments cover a wide range, from general accounting and order entry to the most advanced database management systems for supply chain management, data mining, and business-to-business transactions over the Internet. Sometimes in the commercial environment, there are also technical business users who, as in HPC environments, use pSeries systems for very demanding workloads such as business statistical analysis, financial analysis, economic simulations, and securities trading. These users will usually be attached to a LAN, allowing them to share programs, data, and peripheral equipment with other users and to access the Internet.

Inside pSeries Servers

To understand the capabilities of pSeries systems, it is necessary to take a quick look at a few key architectural elements inside pSeries servers.

POWER4 and POWER4+

The pSeries line is the third generation of reduced instruction set computing (RISC) products. With the RISC approach, a very simple set of programming instructions is executed at extremely high speeds, resulting in better overall performance.

The pSeries line was introduced using the POWER3 and PowerPC microprocessors. The latest RISC processor generation from IBM—POWER4—was introduced in October 2001 on the pSeries 690 server. The POWER4 design is now used in many pSeries systems.

The POWER4 microprocessor is the first single chip to house two processors, which gives it a significant performance advantage over competitive designs. Over 174 million transistors and a mile of microscopic wiring are able to fit on a single chip through the use of advanced packaging technology (0.18 micron).

The POWER4 uses IBM silicon-on-insulator and copper wiring technologies. These technologies allow the POWER4 to operate 25% faster while generating 25% less heat. Less heat, in addition to copper wiring on the chip, means better reliability. Figure 2.1 shows a wafer containing a group of POWER4 microprocessors ready to be cut and packaged.

The POWER4+ microprocessor is an enhanced version of the POWER4 and was first used in the pSeries Model 650 introduced in November 2002. The POWER4+ used even greater density packaging technology (0.13 micron) to pack in an additional 10 million transistors. The increased density also allowed for still higher operating speeds, reduced power consumption, and reduced heat generation (again aiding in reliability).

More on the Web

- IBM Redbook: *The POWER4 Processor*
- Collection of five papers on POWER4
- POWER4 System Microarchitecture (paper)

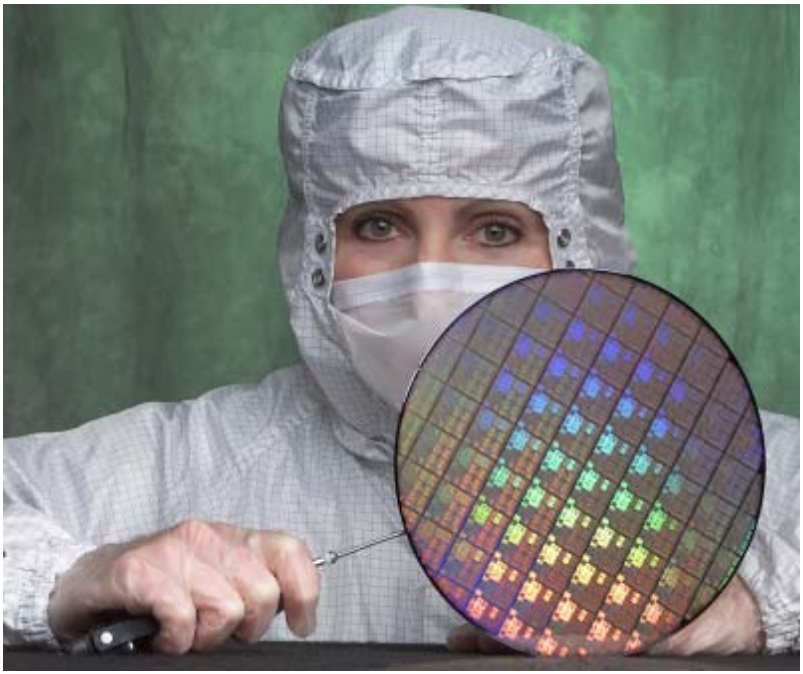

Figure 2.1. A wafer of IBM POWER4 microprocessor chips.

Symmetric Multiprocessing (SMP)

All pSeries systems support the use of multiple processors within a single system to achieve higher levels of performance. All the processors within a pSeries system share the same memory, disk, communications adapters, tape drives, and the like (Figure 2.2). This shared memory model of computing is called symmetric multiprocessing (SMP). The SMP design of pSeries combines functions of both the processor and the AIX or Linux operating systems.

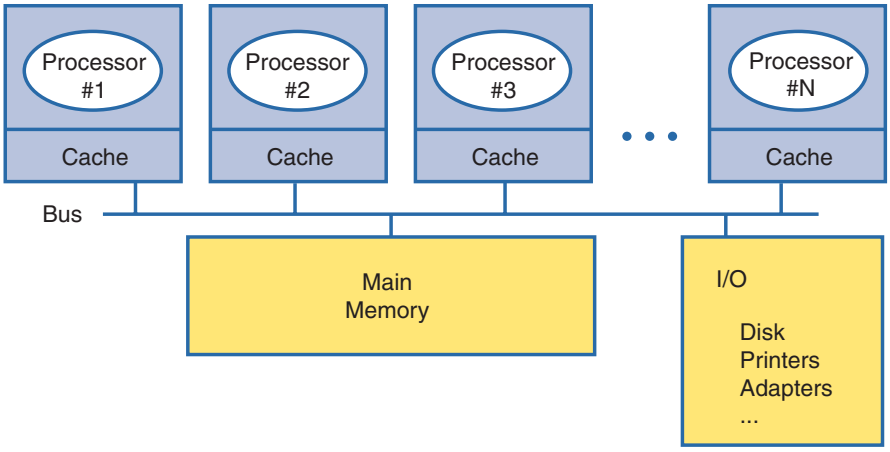

Figure 2.2. Symmetric multiprocessing (SMP).

The SMP implementation within pSeries systems enables several valuable things. First, it affords a business more choices in terms of processing power when selecting a pSeries server for a particular need. And, of course, it allows a business to upgrade the processing power of a pSeries server (by adding additional processors) as the business grows.

Perhaps even more importantly, the pSeries implementation of SMP enables a new type of flexibility and another self-healing function (part of the autonomic computing strategy). The new type of flexibility comes in the form of Capacity Upgrade on Demand (covered next), which allows a business to switch on dormant processors as workloads increase.

The self-healing function of pSeries SMP comes through a function called dynamic processor deallocation. Here is how it works: A dedi-

cated service processor (separate from the SMP processors) constantly monitors and manages the overall health of the pSeries system. If one of the SMP processors shows signs of impending failure, the service processor often can turn off the failing processor and activate a spare processor—all the while keeping the system running smoothly. Then the service processor can literally place its own service call to initiate the needed repairs.

Note that SMP is not the same thing as clustering. With clusters, every processor in the cluster has its own memory, disk, etc., but all are cooperating closely through the high-speed connections between them. This is why clustered configurations are often called "shared nothing" configurations, while SMP implementations are called "shared everything" configurations.

Capacity Upgrade on Demand

Even in stable environments, it is often hard to tell what level of computing power you should buy for a particular situation. While it is less than ideal to buy too much power, it is completely unacceptable to buy too little. This means that most of the time you wind up purchasing more computing power than you need, which by definition means some of that capacity is wasted.

Now factor in the unexpected—acquisitions, a hiring binge to support business growth (i.e., a bunch of new users), a current event that drives masses to your Web site, whatever. So to say the least, it is

difficult to always purchase just the right amount of computing power. This problem is the genesis behind the Capacity Upgrade on Demand (CUoD) function available on some of the pSeries models.

Here is how CUoD works. When you order a pSeries system, you order the CUoD processor option. For example, on a p690, this option has four active processors and four inactive processors (which you don't pay for yet). If, once your p690 is installed and running, you suddenly find you need more processing power, here is what happens:

1. You call IBM and send them your current configuration data over the Internet.

2. IBM sends you an encrypted key over the Internet.

3. You use the key to activate the dormant processors in pairs.

Nothing to install, no hardware to ship, no new contracts to sign; it's just activated and off you go. You are charged only for the additional processors you choose to activate.

Another good thing about having the dormant CUoD processors hanging around falls in the realm of autonomic computing described earlier. The pSeries systems can detect a potentially failing processor, take it off line, activate on the dormant CUoD processors, notify the system administrator, and place a service call, all without user intervention.

To help businesses monitor and plan for performance needs over time, there is the "pSeries performance management for AIX" service (PM/AIX). With this service, registered pSeries systems regularly gather key performance data and send it to IBM for analysis. The business can then customize and review the results of that analysis in graphical form from anywhere over the Internet. From the analysis you can see what resources are approaching maximum capacity (disk, processor, memory, etc.) or are under contention. This helps a business methodically plan ahead for performance needs rather than reacting to performance problems as they arise.

More on the Web

- pSeries Capacity Upgrade on Demand Advantages
- pSeries 670 and 690 CUoD Planning Guide
- pSeries performance management for AIX (PM/AIX) info

Dynamic LPAR

"LPAR" stands for logical partitioning. It refers to a popular function first introduced in IBM mainframe computers and now implemented in pSeries servers. The LPAR function allows you to take a single pSeries server and make it appear to be a collection of independently operating servers. That is, you can define multiple "virtual" pSeries servers within a single "real" pSeries server. You do this by "logically partitioning" the system into virtual servers and then allocate resources (processors, memory, input/output devices, etc) to each virtual server. The largest

pSeries systems can have up to sixteen logical partitions, yet there is only one "real" system to manage.

Each partition can run its own instance of the operating system (AIX or Linux), middleware, and application programs, making each an independent "virtual" server. To complete the picture, each partition can support an independent set of users.

Businesses can use dynamic LPAR in many ways. For one thing, you can move the workloads of multiple UNIX servers onto one partitioned pSeries server. This type of server consolidation can often yield dramatic benefits in terms of reducing the costs associated with floor space, rack space, software licensing fees, power consumption, air conditioning, maintenance, support, etc., while simplifying systems management. Further, using the "dynamic" part of LPAR, you can shift the resources from partition to partition as needed without disrupting users. This is something you can't do with a collection of independent servers, and it makes for more efficient use of computing power.

What if a problem arises in one of the partitions? There is hardware (and firmware) to protect problems in one partition (e.g., a hardware failure or application program failure) from disrupting users in another partition.

Dynamic LPAR can be used to facilitate the testing of new application programs, new operating system versions, new devices, etc. By running a "test partition," you won't disrupt the real (production) users if things don't go well during the testing. This avoids the extra cost of purchasing additional independent servers for testing purposes.

Dynamic LPAR can also be employed to support backup and recovery functions, application programs that require different versions of the operating system, a fail-over backup server function, application programs requiring different time zone settings, and better utilization of scarce or expensive resources (tape libraries, optical storage, high-performance communications adapters, etc.).

IBM eServer systems are not the only ones to implement LPAR. Other brands of computers also offer this function. Be aware that subtle differences in the way LPAR is implemented can affect your ability to benefit from them. See the *More on the Web* inset and read "LPAR for Decision Makers" for more on using LPAR and a description of implementation differences.

More on the Web

- LPAR for Decision Makers (technology paper)
- Collection of LPAR technology papers and links

For a real-world example of how Dynamic LPAR can be used for server consolidation, see the Toyota Australia case study in Chapter 4.

Understanding pSeries Software

Software is the soul of any computing infrastructure. It transforms cold, dark hardware into a functioning facility that can accomplish meaningful work for a business. Good software also help bring order to what might otherwise be a set of disjointed and chaotic activity.

For the sake of discussion, we will categorize software into the three layers shown in Figure 2.3:

- Application programs
- Middleware
- Operating systems.

Let's take a quick look at each.

Application Programs

The top layer in our software model is the application program layer. Application programs do the type of work that makes a computer system valuable to a business, including accounting, financial modeling, making reservations, managing banking transactions, calculating the trajectory of the Hubble space telescope, tracking the test scores for a school system, etc. Typical computer users most often interact directly with application programs.

The two basic types of application programs are custom application programs (specially designed and developed to the specifications of a single customer) or pre-packaged application programs (designed and developed to be sold to a range of customers).

The more pre-packaged application programs available for a given server, the more desirable that server becomes to e-businesses. So IBM has developed partnerships with many independent software vendors to make sure that the pre-packaged application programs they develop can run on pSeries systems (as well as the other eServer lines). Conversely, like any other business, software vendors want to reach as large a mar-

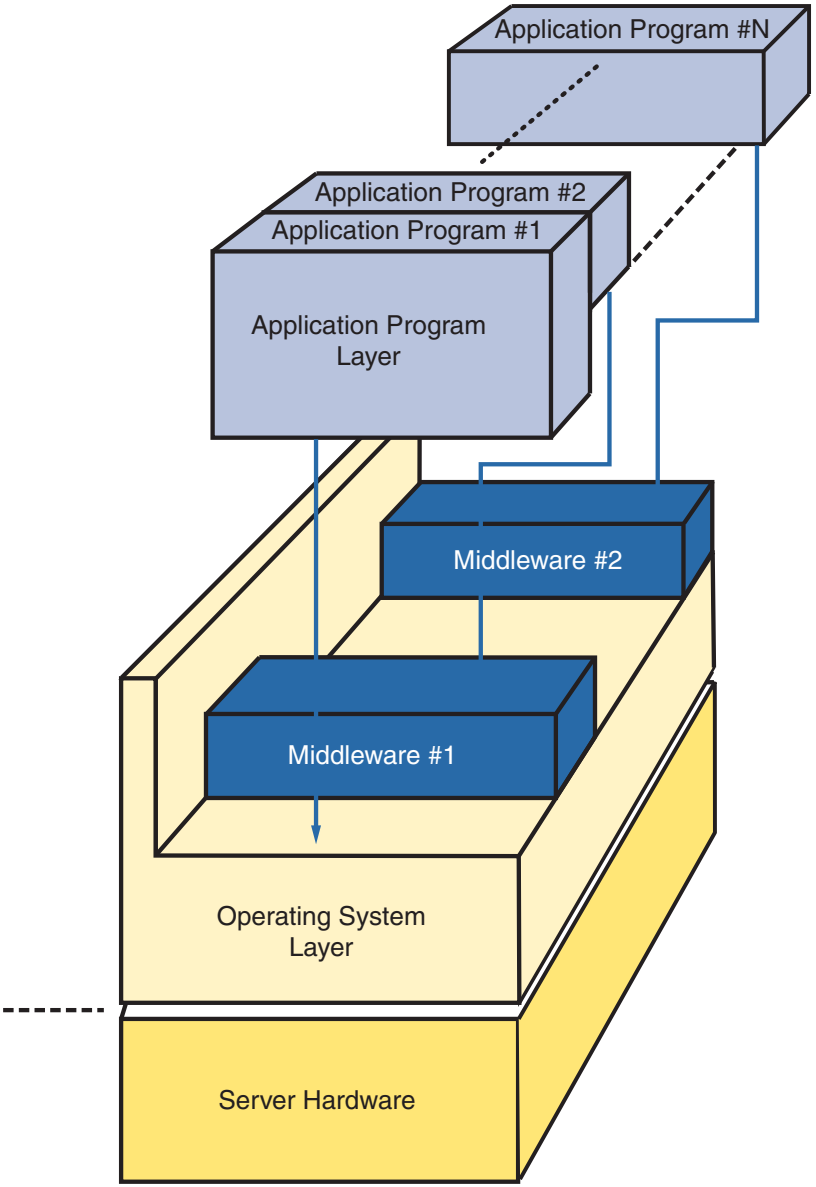

Figure 2.3. The three software catagories.

More on the Web

- Catalog of pre-packaged application programs for pSeries
- Introduction to WebSphere Studio Application Developer

ket as possible with their application program offerings. By developing their pre-packaged application programs on low-cost open standard operating systems like Linux, they can develop the application program once and then deploy it on many different brands of computers that run UNIX. Since pSeries systems run either AIX (the IBM version of UNIX) or Linux, these pre-packaged applications can be deployed on pSeries systems. There are over 10,000 pre-packaged appliation programs available for pSeries systems.

Businesses that develop their own custom application programs for internal use benefit in the same way. That is, they develop their applications on an open standard system (e.g., pSeries running Linux and using WebSphere Developer Studio) and can deploy those applications on almost any brand of open system computer.

Middleware

As you move along the e-business adoption path, there is an increasing need to integrate core business processes across the enterprise (and with the processes of customers, suppliers, business partners, etc.). This means that the typically disparate computer systems (hardware, software, application programs, storage devices, networks, etc.) that support each core business process must be made able to freely share

information with each other. This is the job of middleware—the second layer in our pSeries software model.

Middleware helps application programs freely share information with one another. These application programs might reside on the same server or be connected over a world-wide network. These might be old application programs that have been around for many years (termed legacy application programs), brand new, or more likely a mix of the two. In fact, new e-business application programs increasingly are being designed to take advantage of middleware, which effectively decouples the application program from its underlying infrastructure and thus increases flexibility. Typical users rarely interact directly with middleware.

More on the Web

- WebSphere Software Platform Web site
- DB2 data management software
- Informix data management software
- Lotus software Web site
- Tivoli Web site

Important tools for pSeries in the middleware layer include:

- The WebSphere family of products, which enables the type of end-to-end integration promised by e-business.
- Database products like DB2 and Informix, which manage large amounts of information efficiently. These products are often used to implement large data warehouse projects.
- Lotus Notes and Domino, which provide advanced communication and collaboration functions.
- Tivoli, which is used to manage complex computer infrastructures.

Operating Systems

The operating system software layer manages the details of the computer hardware to keep things running smoothly while providing services to both the middleware and application program layers. Typical users rarely interact directly with operating systems.

Operating systems are a key part of the IBM e-business toolkit. By offering different operating systems across all eServer lines (AIX and Linux), the options when a user searches for pre-packaged application programs are far greater, as stated earlier. More application flexibility means eServer systems are more valuable to users. In addition, eServer operating systems implement many of the advanced functions that provide the technology leverage, risk mitigation, infrastructure efficiency, and total cost of ownership that are basic to the IBM eServer strategy. Let's take a quick look at the two operating systems available for pSeries servers: AIX and Linux.

AIX

The AIX operating system is and will continue to be the premier operating system for pSeries servers. AIX combines the basic functions of the UNIX operating system with many enhancements, some developed by IBM and some designed by other companies and academic institutions. AIX adheres to the many open standards that have been developed to make systems from various vendors more compatible and to facilitate information interchange between systems from different manufacturers.

More on the Web

- IBM AIX Web site
- UCLA's library of public domain software for AIX
- AIX Affinity with Linux (technology paper)
- Instant Messaging for AIX (technology paper)

Because the AIX operating system conforms to many open standards, pSeries servers are open systems. This means that the AIX operating system conforms to open standards (programming interfaces, communications protocols, and so on) defined by independent standards bodies rather than using an IBM proprietary set of standards not generally adhered to by other computer manufacturers. As discussed earlier, adherence to open standards is an important characteristic when building an e-business computing infrastructure because it offers more options when selecting e-business applications, easier integration of different types of computers, etc.

AIX implements and supports the key functions within pSeries systems like Capacity Upgrade on Demand, Dynamic LPAR, SMP, dynamic processor and memory deallocation, etc. AIX version 5L brings with it many enhancements, including an affinity for Linux application programs and instant messaging. There are thousands of application programs available that run on a pSeries system and AIX.

Linux

In addition to AIX, pSeries systems can also run the Linux operating system (as do all eServer systems). Linux is a relatively new phenomenon in the operating systems world. It is the most successful product arising from the Open Source Initiative, which encourages program-

mers around the world to improve, adapt, and redistribute their software. This Open Source concept is gaining enormous interest as it is producing quality results in a fraction of the time required for more traditional software development.

Initially, Linux was thought of as an experimental environment rather than a serious business operating system because it lacked a warranty or guaranteed support. But now the growth of several distributors of Linux and suppliers of Linux services has helped to increase corporate support for the Linux environment. Linux has proven to be a low-cost, high-performance, secure, and highly reliable operating system. Because of this and a natural affinity for the Internet, Linux is quickly moving into the mainstream. According to IDC (March 2002), Linux is expected to grow at a compound growth rate of 37% between 2002 and 2005, making it the fastest-growing operating system on the planet.

IBM has fully embraced Linux and Open Source software as key components in taking e-business to the next level. IBM has invested over $1 billion in Linux and has more than 5,000 employees working on Linux in research, services, development, porting centers, sales, and marketing, etc. IBM is currently shipping over fifty software products on Linux across its DB2, WebSphere, Lotus, and Tivoli families. Some 4,700 IBM business partners support Linux-enabled software. Further, IBM is working with over 250 software developers in the Open Source community to advance Linux. With this level of effort, it's no surprise that IBM was the fastest-growing Linux vendor last year.

IBM clearly believes that Linux will help enable the long-term growth of e-business by providing an open standard operating system that can harness leading-edge technologies and simplify user choice. Linux will help ensure software interoperability across heterogeneous servers.

More on the Web

- Introduction to Linux and links
- Open Source Initiative Web site
- Introduction of Linux for pSeries (technology paper)
- Linux for IBM eServer pSeries Web site
- Overview of Linux for iSeries and pSeries (SuSE)
- History of Linux on CNN.com

By using the LPAR functions of pSeries systems (covered earlier), you can run one or more instances of Linux along with AIX on a single pSeries server. This provides a low-risk way to test and deploy Linux application programs on a pSeries server while still running production AIX application programs.

pSeries Model Specifics

The IBM eServer pSeries line of servers covers the range from entry servers all the way to high-end, data center-class systems previously associated only with mainframe computers. The line can be broken down into four basic categories:

- Entry models
- Midrange models

- High-end models
- Cluster 1600 configurations.

Entry Models

The smallest pSeries servers are designed primarily for small to medium-sized businesses. For example, the pSeries Model 610 is a one-way to two-way symmetric multiprocessing server based on the POWER3-II microprocessor. There are two models of the 610: the model 6C1 rack-drawer server and the model 6E1 tower configuration. Larger companies may select the p610 for situations where many small systems must be deployed in many separate locations, as in chains of retail stores. Figure 2.4 shows the packaging and summarizes the entry pSeries models.

Midrange Model Specifics

Next are the middle tier of pSeries servers designed for things like transaction processing, Web serving, Java applications, etc. The pSeries Model 650 is a good example of a midrange system. The p650 is based on the POWER4+ microprocessor, which accounts for its performance advantage over other midrange pSeries systems with a similar number of processors. It is a rack-mounted system intended for Web hosting or for use as an application server. Dynamic LPAR support allows the p650 to help with testing and migration issues while also enabling small server consolidation projects. The p650 has done very well in benchmark tests against competitive products. See the *More on the Web* inset

a) b)

Model	Package	Processor (Speeds in MHz)	Number of Processors	Relative Performance
610	6C1 Rack 6E1 Deskside	64-bit POWER3-II	1 to 2	1.19 to 2.27
620	6F0 Deskside 6F1 Deskside	64-bit RS64 IV	2 to 4 2 to 6	1.91 to 5.85 1.91 to 8.23
630	6C4 Rack 6E4 Deskside	64-bit POWER4(+)	1 to 4 1 to 2	1.69 to 7.71
640	B80 Rack	64-bit POWER3-II	1 to 4	1.00 to 4.01

- pSeries Express Configurations
- Take an animated/virtual tour of the pSeries 610, 630, or 640.

Figure 2.4. IBM eServer pSeries entry Models: a) rack drawer package b) Deskside package.

for details on p650 performance test results. Figure 2.5 shows a model 650 and summarizes the mid range pSeries models.

Model	Package	Processor (Speeds in MHz)	Number of Processors	Relative Performance
650	Rack	64-bit POWER	4+ 2 to 8	3.59 to 16.88
655	Rack	64-bit POWER4	4 to 8	8.44 to 10.57
660	6M1 Rack	64-bit RS64 IV	2 to 8	3.71 to 13.28
	6H0 Rack		2 to 4	1.91 to 5.85
	6H1 Rack		2 to 6	1.91 to 8.23
670	Rack	64-bit POWER4	4 to 16	6.93 to 24.46

- pSeries Express Configurations
- Details of SPECweb99 performance test results for pSeries model 650
- Detailed description of SPECjbb2000 performance benchmark test
- Details of SAP performance test of pSeries 650 (SD2-tier)
- Detailed SPEC performance test descriptions and results for pSeries and others

Figure 2.5. IBM eServer pSeries Model 650 and midrange summary table.

High-End Model Specifics

The most powerful pSeries servers are datacenter-class systems optimized for the most demanding environments such as large databases or complex high-performance computing environments. The most powerful server of all pSeries systems is the Model 690, announced in October 2001. It was the first pSeries server to use the POWER4 processor and offers up to 32-way SMP configurations with 256 GB of main memory capacity. The multi-chip module (MCM) packaging technology of the POWER4 architecture enables configurations optimized for large database environments or high-performance computing (HPC) markets. HPC configurations have fewer processors (only up to 16-way), but since fewer processors share the Level 2 (L2) and Level 3 (L3) cache memories, performance on floating-point intensive benchmarks is excellent. The p690 was also the first pSeries system to implement dynamic LPAR. Figure 2.6 shows the model 690 and summarizes the high-end pSeries models.

Cluster 1600

The IBM eServer Cluster 1600 is not a product per se, but a name under which all of the AIX operating system-based clustering technologies (pSeries servers, interconnect options, and software products) may be ordered and managed. Cluster 1600 is the logical extension of the preceding RS/6000 SP technologies, which allowed hundreds of processors to be combined in massively parallel systems, such as Deep Blue (the system that defeated chess master Garry Kasparov in 1997)

Model	Package	Processor (Speeds in MHz)	Number of Processors	Relative Performance
680	Rack	64-bit RS64 III/IV	4 to 24	5.6 to 27.65
690	Rack	64-bit POWER4	8 to 32	12.72 to 50.56

- Take an animated/virtual tour of the pSeries 690.

Figure 2.6. IBM eServer pSeries Model 690 and high-end summary table.

and ASCI White (the world's fastest supercomputer in 2000 at Lawrence Livermore National Lab). Initially, the servers in RS/6000 SP configurations were specially designed and packaged SP nodes based on the same PowerPC and POWER architectures as those used in RS/6000 servers. Over the past few years, support emerged for attaching pSeries and RS/6000 servers as "nodes" in an SP configuration. Now, Cluster 1600 allows users to integrate pSeries servers, existing SP nodes, and high-speed interconnect technologies in unified systems with a single point of control running either the Parallel System Support Programs (PSSP) or Cluster System Management (CSM) software.

More on the Web

- *Cluster 1600 Facts and Features*
- IBM Cluster 1600 Web pages

IBM TotalStorage

In the past, storage devices by themselves were considered to be just another part needed to build a server. Rarely was storage thought of as an independent and strategic tool for business. Today in the e-business world, that has changed. E-business is the driving force behind an ever-increasing demand for more storage at a lower cost with higher levels of availability to gain strategic competitive advantage. The trend in storage technology is moving away from the traditional storage devices attached directly to servers in favor of independent storage devices that

attach directly to a network. Since the proliferation of storage devices also makes it increasingly difficult to manage storage, specialized storage management software is also becoming more and more strategic to e-business infrastructures.

In IBM terms, hardware items like disk storage systems, tape libraries, and optical drives fall under the IBM TotalStorage brand. Disk storage devices range from small disk drives to complete storage systems like the Enterprise Storage Server that offers up to 55.9 TB of disk storage. Most of the disk storage devices attach directly to networks (called network-attached storage) like the rack-mounted NAS 100 shown in Figure 2.7.

As for tape devices, there is everything from a simple tape drive to the Enterprise Tape Library, which can manage up to 6,240 tape car-

Figure 2.7. The IBM TotalStorage NAS 100 is a network-attached storage device.

tridges full of information. TotalStorage optical storage includes everything from a simple CD-ROM drive to the 3995 Optical Library, which can store 2.682 TB on optical media. There is also specialized software used to manage storage devices and the information they contain.

Storage devices hold the information that is the life blood of any business. This information must be made readily available to users of various servers running various operating systems. This is necessary to perform the integration of core business processes and gain competitive advantage through e-business. Clearly, the same discussions of reliability, autonomic principles, virtualization, performance, integration, open standards, etc., that surround server selection are equally important when you select the storage devices you will use to build your e-business infrastructure.

To see an example of how storage is critical to an e-business infrastructure, consider what happened at Whirlpool Corporation, headquartered in Benton Harbor, Michigan. Whirlpool, a large manufacturer of home appliances, once had a far-flung computing infrastructure with local data centers scattered around the world—each with its own servers, storage devices, application programs, networking, etc. To reduce costs and improve operations, Whirlpool consolidated the local data centers and put all corporate users on one global network. Some older in-house application programs were retired in favor of key enterprise software suites, including SAP (enterprise resource

planning functions) and Siebel (supporting their customer call centers and field service operations). As part of the project, most of Whirlpool's transaction processing was consolidated into one large data center located in Benton Harbor, using four large mainframe servers and over 500 stand-alone UNIX (including pSeries) and Windows NT servers.

These changes resulted in significant annual savings in networking and data center costs, but Whirlpool had yet to achieve the full benefits from its consolidation efforts. They had not upgraded their aging storage infrastructure, and the response times for their SAP real-time order processing were slowing. The process of backing up the information on their old storage devices to their tape library servers was causing bottlenecks. Their overnight batch-processing window was expanding and was getting closer to interfering with daily "live" operations. In short, the storage component of their infrastructure was not up to the task.

Whirlpool solved their storage problems by moving off their slow storage devices. On the mainframe side, they migrated their information from RAMAC Virtual Arrays to three large IBM TotalStorage Enterprise Storage Servers (called Sharks). As a result, increases in batch processing throughput ranged from 40% to 80%, and Whirlpool had their batch-processing window back under control. The upgrade to Sharks also improved response time for the SAP users by 21% in their European operations and 25% in North America. To support the many UNIX and NT servers, Whirlpool moved away from direct-attached storage devices and implemented storage area networks, giving them

the flexibility to allocate and re-allocate storage as the server needs change. According to Jim Haney, Whirlpool's VP of architecture, "Instead of giving everybody only 30% or 40% of the free disk space on a server and wasting the rest, we'll be able to optimize utilization across the storage complex." Over time, Whirlpool intends to support both mainframe and UNIX/NT servers with storage area networks and share the same storage and tape backup devices for both.

More on the Web

- Info on IBM TotalStorage
- Several papers on storage technology (IBM Research)
- More on Whirlpool's e-business projects

CHAPTER 3

Migrating to pSeries—Why Bother?

In this chapter we take a practical look at some common situations that drive an organization to make a change.

Starting Point: AIX or UNIX?

If you have already invested in a UNIX computing infrastructure (based on pSeries servers, RS/6000 systems, another brand of UNIX server, or a mixture), you already have several advantages when you make your move to the pSeries on your way along the e-business adoption path.

First, you are already using an operating system that was born and bred in an open standards environment. Another advantage of starting from a UNIX base is that the move to a pSeries is straightforward. First of all, the chances are that whatever applications you are now running are available on a pSeries running either AIX or Linux. (Remember, pSeries can run either or both at the same time.) Another plus is that the users and system administrators of your current UNIX world will feel right at home on a pSeries, so you preserve your investment in knowledge and experience.

Okay, so the move from an RS/6000 or UNIX environment to a pSeries will be straightforward. But then there is the all-important question, "Why bother?" And it's a good question. To examine this question, you must start by thinking about your own business environment. When you do, you may see in your reflection one or more of these "Top Ten Things That Tell You It's Time for a Change."

The Top Ten Things That Tell You It's Time for a Change

Here is the challenge for you. See if any of these "Top Ten Things That Tell You It's Time for a Change" apply to your organization.

Number 10: You don't have a solid partner

Traveling down the e-business adoption path is not always an easy thing to do by yourself—especially if your resources are constrained due to tough economic times. So you need to have a place to turn for help when you need it. Maybe it's some simple technical support matter, or maybe you need help developing and executing a comprehensive e-business plan. In either case, if your current computer vendor is unable or unwilling to help you succeed, you need a new partner. Life is too short and dollars too scarce to follow someone down the e-business path—when they don't even know where they are going. If you see yourself in this situation, it's time for a change.

IBM will make the case that they have more experience than any other vendor in helping businesses plan and execute e-business projects.

Their Global Services division (more on them later) has worked on over 30,000 real-world e-business projects with customers (not counting their own internal projects). They have an Advanced Business Council in which IBM Distinguished Engineers work directly with leading companies to develop e-business solutions based on real situations.

Another alternative is to tap the resources of the IBM Business Partner network consisting of over 60,000 firms. This is often a cost-effective alternative when you need ongoing support.

Sometimes it makes sense to have more than one partner for a particular project. For example, when broadcast company Swedish Television in Stockholm needed a new digital media management system, they had IBM Global Services team with Swedish business partner Ardendo, which specializes in digital media management networking. Additional support for this project was also provided by IBM Silicon Valley Labs as well as IBM Digital Media Labs in Bethesda, Maryland. The resulting benefits included a 25% gain in workflow productivity, significant savings in total cost of ownership, and increased viewer satisfaction.

Whether you turn to IBM or someone else, if you don't have a solid partner, you need to make a change.

Number 9: There are walls between users and the information they need

This point refers to the integration element of a sound e-business computing infrastructure. Depending on where you are along the e-business adoption path, you may have some work to do here. Perhaps

you have multiple UNIX servers running multiple UNIX application programs, but they are unable to share information with one another. Or, more likely, you have a mixture of UNIX and non-UNIX systems running application programs that can't share information with each other. If this is the case, you have the classic "islands of automation" blues. People can't efficiently get the information they need, when they need it, and how they need it. Your organization has (or will) hit a wall, hindering your progress down the e-business adoption path. What's the answer? It's called enterprise application integration. This is a process enabled by tools that allows you to enable the free flow of information between disparate application programs, thus tearing down the "wall" between that information and the people who need it.

The pSeries' ability to run AIX or Linux means there is a very good chance that you are using versions of the application programs that can be consolidated onto a single pSeries server. You can also use the WebSphere middleware tools (covered earlier) to enable the free flow of information between the application programs, thus enabling you to integrate the core business processes they support. Only then you will have found your way out of the "islands of automation" blues and take a step down the e-business adoption path.

Number 8: You feel trapped in a proprietary world

Many computing infrastructures in use today have evolved from a time when it was commonplace to buy proprietary hardware and software architectures (i.e., those not adhering to the open standards of today).

As a business tries to move down the e-business adoption path on these infrastructures, it will quickly find that the choices in servers, storage devices, operating systems, middleware, application programs, enterprise integration solutions, etc., may be limited. Fewer choices typically translate into less-than-ideal solutions at a higher cost. Compare this to an open standards environment where there are more options at a lower cost, and you can see how one company (the one in the open standards world) has a competitive advantage.

If you are feeling locked in to a proprietary environment, the answer may well be to accept it and make the change to an open standards server. The pSeries and its AIX operating system is a definitive open standards environment. As the IBM version of UNIX, AIX was born and bred in an open standards environment, so by default, you have in AIX a very open platform from which to launch down the e-business adoption curve.

And then there is Linux, the other open standards operating system that can run on pSeries. Linux is experiencing phenomenal growth right now due to its low cost, excellent performance, and natural affinity for the online world, to name just a few of the many good reasons.

If you put off making the change and invest more in your proprietary infrastructure, then you will be wasting that much more money when you eventually make the change. And make no mistake: If you pursue the e-business adoption path, you will eventually wind up mak-

ing the change to an open standards computing infrastructure; as the saying goes, "You can pay a little now or pay more later." If your business is not pursuing an e-business agenda, then update your resumé.

Number 7: Much of your computing power is wasted

As mentioned earlier, much of the computing resources deployed today are underutilized, leading to higher costs. IBM is focused on enabling the eServer lines to more efficiently utilize their performance and capacity with things like Capacity Upgrade on Demand and Dynamic LPAR—both covered in an earlier chapter. These two functions work together to help ensure two things:

1. You have enough computing power available to the users who need it, when they need it.

2. You aren't paying for more processing power than you actually need.

Dynamic LPAR allows you to allocate and reallocate computing power to match the needs of users without causing disruption. Capacity Upgrade on Demand allows you to have spare processing power on hand but not pay for it unless you actually need it.

If you are missing either piece of this puzzle, it may be time for a change.

Number 6: Your systems go down too often

Back in the days of the Ford model "T," auto owners had to be amateur mechanics to keep their "horseless carriage" running smoothly. Of course, today's automobiles are way more complicated than these early ones. At the same time, the reliability of our automobiles is also way more vital for most of us now because we have woven cars into the very fabric of our everyday lives. That is, we have moved down the "automobile adoption path." As complexity increased, auto designers had to turn to computers to manage the complexities of gas mixtures, real-time performance monitoring and optimization, critical event timing, adaptation to changing environmental conditions, security—you name it. The same is true for almost any system. As you increase function and performance, the systems necessarily become more complex.

Of course, the same is true with an e-business computing infrastructure. As you progress down the e-business adoption path, you are weaving that infrastructure into the very fabric of your business. To achieve the greater level of value held out by the e-business opportunity, you have to contend with greater complexity. Just like the designers of the automobile, computer designers have added additional computer technology to… computer… systems to help the systems manage themselves better. This is the heart of the IBM autonomic computing initiative—that is, to build systems that leverage things like specialized service processors and advanced software to allow a computer system to be self-optimizing, self healing, self-configuring, and self-protecting.

Looking back, the RS/6000 line (and other UNIX systems) had some level of autonomic computing (e.g., memory error detection and correction). If you looked hard enough, you could probably find some autonomic elements in the Model "T." However, in all of these cases, what worked for the past will not be adequate for the future. As a business moves down the e-business adoption path and gains the enormous benefits to be had, the complexity of its computing infrastructure will grow—and so will the need for autonomic computing. That is why autonomic computing is such a big push for all of the IBM eServer lines.

As mentioned earlier, a core IBM strategy for all eServer systems is to mitigate the risk posed by system outages. The pSeries line has implemented things like dynamic memory and processor deallocation (discussed in Chapter 2) to help keep the systems running in the event of hardware failures.

Number 5: You're out of computing power

Maybe your business is growing quickly. Maybe your company just made an acquisition or has started hiring new employees, thus adding users to your world. Maybe you need to add a new application program to solve a new business need.

Whatever the reason, businesses often find their computer system becoming slow and sluggish or unable to hold all of the information being generated. When you find yourself in this spot, what you need is

more computing power and capacity. Okay, so what's the most economical way to get it?

That depends. Maybe a simple model upgrade will do… for awhile. Maybe not. Here again, a business needs to take the long view. Investing more money in a dead-end product line, even if it solves your problem for a period of time, may not be the smartest move in the long run. The money spent for the model upgrade might well be better spent on updating your e-business infrastructure with the latest technology. Granted the "new technology" approach might cost more at the time of purchase. But it may be the better investment over, say, a five-year period when you look at the total cost of ownership. See "Number 2" below for more on this way of looking at cost.

The high levels of performance offered by pSeries systems is well documented in recent performance testing efforts (i.e., benchmarks). For example, the pSeries Model 650 was determined to be the best 8-way performer of all the systems tested (SPECweb99 and SPECjbb200 tests). The technological magic behind these pSeries performance numbers is things like the first dual-processor microprocessor chip (POWER4+), which houses 184 million transistors running at 1.45 GHz. Still need more power? Try the pSeries Model 690 or, better yet, link a group of pSeries systems together in a Cluster 1600 configuration and see what happens.

Later, when you are on the pSeries and you grow some more, you can "turn on" additional processors through Capacity Upgrade on

Demand, upgrade to a larger pSeries model (vertical growth), or add additional pSeries systems to your cluster (horizontal growth) and combine the strength of many systems to achieve supercomputer performance yet manage the cluster as if they were one system.

To help you keep a handle on performance needs over time, you can choose to activate the "IBM eServer pSeries performance management for AIX" service (PM/AIX) covered earlier.

If your storage infrastructure isn't meeting your needs, then the IBM answer is the IBM TotalStorage family of devices (covered earlier). This family of disk and tape storage products can be used with any eServer and with many non-IBM servers. Some storage devices are attached directly to a server, but more often they are stand-alone devices on a network. As we saw earlier in the Whirlpool case study, an inadequate storage performance and capacity can hold back your entire e-business infrastructure.

Number 4: You can't find the right application program

Things change and you are faced with a new set of requirements you must meet. If the best pre-packaged application program for the task won't run on your computing infrastructure, it may be time for a change.

One of the key strategies IBM has behind the pSeries line is application flexibility. Since pSeries can run AIX or Linux, there is a sea of pre-packaged applications already out there from which to choose. As mentioned earlier, IBM has many alliances with top application pro-

More on the Web

- IBM eServer Solution Connection—online catalog of application programs

gram developers in order to ensure a steady stream of solutions is available for pSeries.

As for finding the right solution, the IBM eServer Solution Connection is one source that can help you locate pre-packaged application programs based on your requirements. Here you can use search functions to find specific types of application programs, consultants, solution value reports, etc. You can also request a no-fee business assessment and find things like performance benchmarks, technology papers, customer references, events, promotions, education, implementation guides, technical manuals, etc. Once an application program has been successfully implemented on eServer systems in real-world businesses, it is given the IBM ServerProven designation.

However you do it, finding and selecting the right application programs is critical as you move down the e-business adoption path.

Number 3: Too many systems to manage

Another tool you can use to help achieve enterprise application integration while saving money is termed "server consolidation." Here, you take a group of disparate (or even similar) servers and operating systems (each requiring its own systems management effort, maintenance contracts, periodic software/hardware upgrades, etc.) and move the application programs and data they offer (e.g., collaboration, Web

serving, transaction processing, etc.) onto one larger server. By doing so, you wind up with one system to manage, one maintenance contract, one set of periodic software/hardware updates… and probably extra floor space to boot.

But wait, you have different types of servers running different application programs requiring different types of operating systems—how can you move all that incompatible stuff to one server? To get to the answer, each application program has to be considered, one at a time. The first question to ask is, "Do we really need this particular application?" Most of the time the answer will probably be "yes," but once in a while it will be "no" and so you simply take that one out of the picture and don't spend any time moving it forward into your new e-business computing infrastructure.

When the answer is "Yes, we must have that application program," then you have to consider your options. First, contact the software vendor and see if a version is available that will run on a pSeries under AIX or Linux (both of which can be running on a single pSeries system). If not, you can look for competitive application programs that might do the job as well or better. Often, competitive application programs can import the data from competing products to help ease the migration.

If there is no AIX/Linux version of a key application program and no desirable alternative solution, you may not be able to consolidate

that particular application program onto the new server. So leave it where it is for now. Dropping from five servers to two (rather than to one) would still yield many of the same benefits and would still be a step in the right e-business direction.

Earlier, we covered the fact that pSeries systems can use their Dynamic LPAR function to logically subdivide a single server into several, each running a different instance of AIX or Linux. By doing so, you have multiple "virtual" servers housed within one pSeries server. So you effectively get the function and inter-user protection of having separate servers with the advantage of having only one server to manage and maintain. Later, if one "virtual server" needs more processors, disk storage, etc., you can make the change on the fly without disrupting operations.

More on the Web

- Case study of an IBM internal server consolidation project

To help ease system management tasks, pSeries servers feature a front-accessible serial interface for personal digital assistants (PDAs). Using IBM System Network Analysis and Performance Pilot software, network administrators can quickly and easily conduct system setups, perform network configurations, and monitor performance anytime anywhere.

Want a real-world example? Colgate, one of the largest SAP deployments in the world, consolidated seventy Sun servers down to thirteen pSeries 680 servers. In Chapter 4, we will see a more detailed example

of server consolidation at Toyota Australia, where they consolidated eight servers onto two pSeries systems.

The point is, when it comes to servers, "less is more."

Number 2: You need to reduce costs

A recent Gartner survey of businesses revealed that 2002 computer technology budgets grew only about 1.5% over 2001, while from 1999 to 2000 budgets grew at near double-digit rates year to year. Going forward, those responsible for managing the computing infrastructure for businesses are not likely to see a cloudburst of new funding for e-business projects falling onto their desks. Yet the e-business world will steadily march on at its typical light-speed pace, and companies will have to find a way to do more with less.

One way to attack this problem is to reduce the costs of your existing computer infrastructure to make those funds available for new e-business initiatives. This brings us back to a discussion about reducing the total cost of ownership—one of the key strategies for all eServer lines. As was described earlier, recent studies have demonstrated that eServer systems have the lead in total cost of ownership (considering acquisition cost, software cost, operating cost, maintenance, etc.). The total cost of ownership of pSeries systems was shown to be about one-half that of similar *SUN* servers and about one-third that of HP systems.

The pSeries servers have several characteristics that lend themselves to cost-reduction projects, as we have seen. The Dynamic LPAR function enables and simplifies server consolidation projects, which saves money. The price/performance ratios of pSeries servers make them a cost-effective choice for meeting new needs as they arise This is augmented by the capacity on demand function, which allows a business to safely operate closer to the maximum capacity of a pSeries server, which means you are not paying for computing power you don't need.

Projects that aim at reducing the total cost of ownership can often demonstrate the kind of solid return on investment potential needed to get funding in even the most trying economic times… because they save money.

Number 1: Things are running just fine the way they are…

It is both difficult and risky to advance down the e-business adoption path if your information technology team is busy day and night responding to urgent problems. Who can methodically plan and execute the integration of core business functions when your servers keep going down, you are over budget, and your users increasingly complain about slow response time? If you and your team are needing to react to urgent problems all day, every day, you will probably see yourself in one of the other "Top Ten Reasons to Make a Change." You have some work to do to gain control of your situation before you can move forward.

On the other hand, if you have things under control, then you are in an excellent position to pull your team together and start planning your next strategic step down the e-business adoption path and toward a new competitive advantage. Chances are you will come up with several key projects that can move your business forward.

Keep in mind that the biggest risk in today's e-business world is doing nothing at all while your competitors (known and unknown) are working to gain the upper hand through their own e-business push.

CHAPTER 4

A Tale of Server Consolidation—Toyota Australia

In this chapter, we look over the shoulder of Toyota Australia as they plan and implement a server consolidation project. In this project, Toyota takes the work of eight servers and various storage devices and moves it to two pSeries systems and a TotalStorage server with the help of Global Services. This chapter is adapted from a report prepared by IBM and Toyota about the project.

About Toyota Australia

Located outside Melbourne, Toyota Australia (a subsidiary of the Toyota Motor Company) manufactures and distributes automobiles, engines, and components to supply 255 domestic Australian dealers, as well as 33 export markets in the Asia-Pacific region. With manufacturing facilities producing 100,000 new vehicles per year, the company is a consistent leader in the Australian automotive market—ahead of several large global competitors (Figure 4.1). "Australia is Toyota's longest-established offshore manufacturing base and one of its most successful markets," says James Scott, manager of Information Technol-

Figure 4.1. Assembly line at Toyota Australia.

ogy (IT) Infrastructure for Toyota Australia. "We have led our market for six of the ten years between 1990 and 2000."

Examining the Need

Toyota Australia's corporate IT systems (predominately SAP) had grown significantly over a four-year period, and its legacy hardware was no longer capable of serving its current and future needs. "We ended up with a fragmented infrastructure and increasing costs," explains Scott. "We were managing eight servers, six separate tape drives and many hard disk arrays—and we had to keep buying new hardware as we ran out of space." To remain a leader in the market, Toyota Australia de-

cided to implement a solution that could provide easier scalability, improved disaster recovery capabilities, and a lower total cost of ownership (TCO). "By consolidating our systems onto a single platform with cost-effective scalability and improved responsiveness, we felt that we could achieve a far better growth position," Scott says. And because the company had several upcoming business initiatives—potentially requiring significant infrastructure expansion—the ability to expand was essential.

The Solution

IBM helped the automotive company consolidate its disparate systems onto two pSeries 690 machines running AIX and connected to an IBM FAStT500 Storage Server. "IBM Global Services Australia brought in a team of specialists to migrate our legacy systems—including our entire SAP implementation—to our new IBM platform," explains Scott. "From our perspective, it was virtually a turnkey solution that has provided us with full redundancy and 50-percent faster disaster recovery." Currently, Toyota Australia runs its production system on one pSeries Model 690, and its development and disaster recovery operations on a second, from a remote data center facility. Leveraging the logical partitioning (LPAR) function, Toyota Australia has constructed several fully redundant partitions between its two pSeries systems, thus enabling a level of security and cost-effective scalability unavailable on its previous platform.

The Results

Toyota Australia's new IBM solution is already deriving cost and time savings, according to Scott. "Since the migration, we have lowered our TCO and estimate that over the next four years our IBM eServer platform can help us save up to AU$7 million in hardware and facilities management costs," he says. "We have also measured faster run times for many important jobs." Scott reports that these time savings included cutting down to three minutes a supply chain job that previously required two hours, and reducing the time to complete a material costing job that typically had lasted ten hours down to only two hours.

Eyes on the Road Ahead

In addition to reducing TCO and shortening job run times, Toyota Australia is taking advantage of the self-optimizing and self-configuring capabilities of the IBM pSeries system—key features of an on-demand operating environment. "The on demand scalability of our IBM pSeries systems enables us to fast-track our critical initiatives," reports Scott. "We can respond dynamically to new demands by implementing additional LPARs with minimal additional investment, allowing us to speed up time-to-market and strengthen our market leadership position."

Consolidation of a computing infrastructure represents a significant and often unrecognized opportunity for businesses today. This is especially true when using pSeries to consolidate complex UNIX infrastructures, as was the case at Toyota Australia. Such consolidation projects

More on the Web

- Toyota Australia

offer potential to benefit in three important ways: First, consolidation offers an opportunity to save money by reducing the total cost of ownership. Second, it allows a business to simplify its infrastructure and incorporate systems and procedures that improve reliability. Finally, well-planned and executed consolidation projects result in the additional benefit of increased flexibility. While this benefit often is the most difficult to quantify, it is also the one that offers the greatest potential. That's because improved flexibility, the ultimate goal of an on-demand strategy, allows a business to respond to change more quickly and more meaningfully. In today's e-business world, being flexible can make the difference between thriving growth and declining market share.

**(Note from the legal department: This customer story is based on information provided by Toyota Australia and illustrates how one organization uses IBM products. Many factors may have contributed to the results and benefits described; IBM does not guarantee comparable results elsewhere. References in this publication to IBM products or services do not imply that IBM intends to make them available in all countries in which IBM operates).

CHAPTER 5

Getting Help with Your e-business Plan

There is help available in various forms to help you assess your current situation, define and prioritize e-business projects aligned with business goals, develop detailed implementation plans, and implement those plans. In this chapter, we will look at just a few example places you can turn for help.

IBM Global Services

Efficiently navigating the e-business adoption path can be a difficult task—especially in more complex environments. That is why the IBM Global Services division is the fastest-growing part of the company. Global Services is the consulting arm of IBM, consisting of about 165,000 employees in 160 countries actively helping businesses plan and implement e-business projects. Global Services has worked with customers of almost every size in almost every industry as they've moved through the stages of e-business—over 30,000 e-business engagements so far. No other e-business consulting firm has such a

broad mass of engagements. It's worth noting here that in October 2002, IBM purchased PricewaterhouseCoopers—a major business consultancy—and rolled it into IBM Global Services as its Business Consulting Services (BCS) group.

Business Partners

IBM has a network of more than 60,000 business partner firms that can help businesses move down the e-business adoption path. These are independent information technology businesses that are certified by IBM. By choosing to work with a business partner, you still have access to IBM resources augmented by the often local and specialized knowledge of the business partner. Oftentimes, it makes sense to use the combination of a business partner and IBM Global Services.

More on the Web

- IBM Global Services information
- Search for IBM Business Partners
- Solution Assurance Advantage Offering
- Technical Support Advantage Offering
- Capacity Advantage Offering
- Availability Advantage Offering
- IBM Global Financing

IBM eServer Advantage Offerings

Other help is available through the IBM eServer Advantage program. When you buy any eServer, you become eligible for these offerings which include:

- Solution Assurance Advantage—provides Web access to pre-packaged application programs and services to help you select and implement e-business solutions

- Technical Support Advantage—provides a portfolio of services to help you learn about, choose, and implement e-business solutions based on business requirements

- Capacity Advantage—helps you deal with unpredictable growth in computing requirements

- Availability Advantage—helps you maximize the availability of your e-business infrastructure

- Financing Advantage—helps you examine alternatives for funding e-business projects of all sizes to help lower costs, reduce obsolescence, and improve cash flow.

About the Author

Jim Hoskins is the founder of Maximum Press—a premier publisher of books, ebooks, Web content, and special reports that help businesses apply technology profitably. He has been involved with the design, implementation, and education of technology for over seventeen years. He is the author of many articles, books, and ebooks covering a wide range of technology and e-business topics. Jim spent over a decade with IBM designing computer systems and in the field helping businesses design and implement real-world solutions. He is the author/editor of the popular ***Exploring IBM*** series of books, which has sold over 350,000 copies in twelve languages. Jim has a degree in electrical engineering from the University of Florida and resides in Gulf Breeze, Florida, with his wife and five children.

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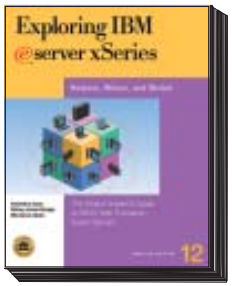

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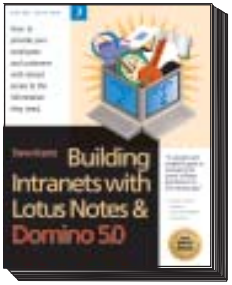

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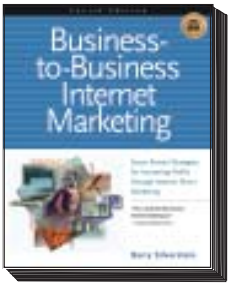

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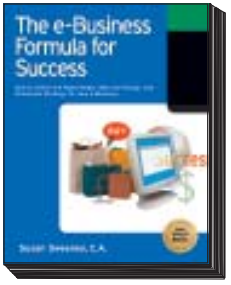

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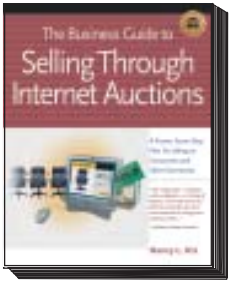

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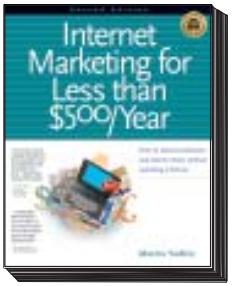

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