IBM

AS/400e e-business Handbook

A Technology and Product Reference

- Build and deploy Web-based applications for a competitive advantage
- Extend your business critical AS/400 applications to the Web
- Discover AS/400e for extreme e-business solutions

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AS/400e e-business Handbook: A Technology and Product Reference

June 2000

Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix F, “Special notices” on page 269.

First Edition (June 2000)

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Preface

This technology and product reference guide targets IBM marketing personnel, business partners, and AS/400 customers who are looking to extend and expand their information server into e-business. It positions e-business on the AS/400e against other solutions in the marketplace. Plus, it describes how the AS/400e system competes in the business-to-business and business-to-consumer marketplace.

This book shows the solid potential of the AS/400 system in each facet of e-business solutions. By reading this handbook, you'll gain a broad understanding of how the AS/400e serves in an e-business environment. In addition, you'll learn how to sell the AS/400e for e-business solutions, including Web presence, dynamic data, and as a transactional site.

This handbook also addresses the needs of both the technical Chief Information Officer (CIO) and the Chief Executive Officer (CEO) of businesses run by AS/400e servers.

The team that wrote this redbook

This redbook was produced by a team of specialists from around the world working at the International Technical Support Organization Rochester Center.

YesSong Johng is a Principal Consultant at Keane Inc. He has 16 years of experience with IBM, specializing in the System/38 and the AS/400 system. For four of those years, he was assigned to the International Technical Support Organization (ITSO) Rochester Center where he wrote extensively and taught IBM classes worldwide on all areas of AS/400 openness and communications. He is currently assigned to the Technology Solutions Center (TSC) at IBM Rochester to provide technical marketing support for AS/400. His responsibilities include e-business, Virtual Private Network (VPN), and Enterprise Resource Planning (ERP). YesSong served as the technical project leader for this project.

Susan Powers is a Senior I/T Specialist at the International Technical Support Organization, Rochester Center. Prior to joining the ITSO in 1997, she was an AS/400 Technical Advocate in the IBM Support Center with a variety of communications, performance, and work management assignments. Her IBM career began as a Program Support Representative and Systems Engineer in Des Moines, Iowa. She holds a degree in

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Toru Kawashima is a program manager, working for the AS/400 brand in IBM Japan. He educates AS/400 sales personnel on how to explain the strength and the value propositions of the AS/400 system to their customers about AS/400 trends and directions, OS/400 capabilities, and AS/400 architecture. He is involved face-to-face with customers and prospects to explain the AS/400 advantages and server of choice as an e-business server. He has a plan to produce a Japanese version of this AS/400e e-business handbook upon his return from the ITSO assignment.

Thierry Petit is an AS/400 Sales Specialist in IBM Belgium/Luxembourg. He holds a degree in Sciences Commerciales et Financieres from the Institut Superieur Lucien Cooremans (Brussels, Belgium), a degree in Education Sciences from the Institut Superieur Lucien Cooremans (Brussels, Belgium) and a degree of Bachelor of Law from the ISEC (Brussels, Belgium). He taught IBM classes in the EMEA Sales Center on AS/400 Sales and Marketing before joining the AS/400 Brand in Belgium/Luxembourg. His areas of expertise include e-business on the AS/400e platform.

Stephen Quan is an Advisory I/T Specialist in the AS/400 Techline organization in IBM Canada. He has five years of experience providing pre-sales support to AS/400 marketing specialists and business partners. He holds a degree in mechanical engineering from the University of Toronto and a Master of Business Administration from McMaster University in Hamilton, Ontario. His areas of expertise include e-business and hardware configuration for the AS/400 system.

Suehiro Sakai recently completed an assignment in the ITSO Rochester Center, where he was a member of the e-business team. He wrote extensively and taught IBM classes worldwide in all areas of AS/400 communications for five years with the ITSO. He has since re-joined the AS/400 Brand team in IBM Japan as an AS/400 Solution Specialist.

Matthias Schmidt is a sales and marketing specialist and is the Director of Operations at ASTECH Solutions Inc., located in Aurora, Ontario, Canada. He has four years experience selling and implementing various e-business related IT projects. He holds a degree of Bachelor of Business Administration from Wilfrid Laurier University (Waterloo, Ontario). He has written extensively on connecting the AS/400 system to the Internet for many leading industry publications.

Kristin Zibell is a software engineer at IBM in Rochester. She is an information and Web designer who specializes in user-centered design and information usability. She holds a Bachelor of Science degree in Scientific and Technical Communication with an emphasis in cognitive psychology from the University of Minnesota-Twin Cities. Her areas of technical expertise include AS/400 hardware and Internet protocols like TCP/IP, SMTP, PPP, and FTP.

A special word of thanks to YesSong Johng for his leadership and knowledge of e-business. His consultation during and after the project helped reshape this book to its present form.

Thanks to the following people for their invaluable contributions to this project:

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- Send your comments in an Internet note to redbook@us.ibm.com

Part 1. What is e-business and why with the AS/400 system

Part 1 explains:

- What e-business is
- What the IBM approach is to meet the clients' needs to build and maintain their e-business Web sites
- What users should and can expect from their e-business implementation
- Why the AS/400 system can be the product of choice in many cases

This part is written mainly for CEOs or business decision makers from a customer perspective. It is also beneficial to the marketing or the sales force from the IBM or business partner perspective.

Chapter 1. e-business on the AS/400 system

Since its inception as a U.S. Defense department special project in the late 1960s, the Internet has become an economic and social phenomenon. It does not overstate the case to declare that companies today must, in some manner, conduct business on the Internet or they will go out of business. However, at a minimum, without e-business participation, they will miss a large opportunity and be at a disadvantage to competitors who are Web enabled.

This redbook reviews the role of the AS/400e server in this new technology area and the various tools and methods available for implementing e-business solutions on the AS/400e.

1.1 The transition to e-business

There are many factors involved in the success of a business and industry, in general, that support today's emphasis of electronic information. This section highlights Internet (business) growth and models for developing a successful e-business.

1.1.1 Internet: Tremendous growth

The Internet fire is fueled by the nature of the technology (anytime and anywhere) and by a real growth in usage. Online shopping sales in the 1999 Holiday Season totalled $7 billion. 25 million shoppers spent an average of $200 online while Christmas shopping. In addition, online shoppers were very satisfied with the experience. In an Andersen Consulting survey, only 4% of respondents said they would not shop online next Christmas. 72% said they would continue to shop for additional items in 2000.

Growth also occurs geographically as more people get online. In fact, an IDC study found that 25% of Western Europeans are now online and 5% have made online purchases. As Internet costs decrease overseas, this foreshadows a similar explosion to what has happened in the U.S.

More information

For more information on the studies cited here, refer to the following Web sites:

- **Jupiter Communications**: Online Holiday Season Study
  `http://www.jup.com`
- **Andersen Consulting**: Problems Unlikely to Deter Net Shoppers
  `http://www.andersenconsulting.com/news/`
- **IDC Research**: European Internet and e-Commerce Ready
  `http://www.idcresearch.com/Press/default.htm`

1.1.2 New business models

e-business is much more than buying and selling over the Web. It is a new business model where the traditional business processes merge with Internet technologies in business-to-business and business-to-consumer applications. e-business is about business change and evolution, not just technology, even though the technology makes much of it possible.

By harnessing Internet technologies to extend the reach and range of your business, you can respond more quickly to market shifts, cut product development cycles, enhance teaming within your organization, reach new markets, and serve existing customers better. The AS/400e is designed to help you gain a competitive advantage by moving quickly and efficiently into e-business.

1.1.3 e-business development

Almost all organizations and businesses follow a similar process to build their Web presence. This process is on-going. It begins with a Web presence, which moves to a dynamic site, and finally to a transactional site. This redbook follows this process as a structure to present the various tools, technologies, processes, framework, and models. The phases are discussed in Chapter 2, “Building e-business sites: Phased approach” on page 49.

1.1.4 Chapter objectives

The first objective of this chapter is to review key e-business concepts and terminology so that you have a clear and concise understanding of various terms and concepts. It is common place in the media and for technology companies to use e-dropping: what do all the “e”s stand for anyway? There

are key concepts fundamental to understand these new technologies and to enable a discussion of their relative importance or impact on your business.

The second objective is to provide an overview of key IBM framework and analysis models to understand and explain the components of an e-business solution to customers and potential clients, as well as to design solutions for them. This helps identify places to apply these technologies to modernize and improve various business processes and transactions. It also helps identify key requirements for a successful application of the technology and supports the case for the AS/400 system as a major e-business player.

This chapter also looks at where AS/400 customers are today and some of the challenges and opportunities they have when implementing these new technologies. This final portion of the chapter highlights and sets the stage for the rest of this redbook, by introducing the topics covered in the remaining chapters.

1.1.5 Target audience

The target audience of this e-business handbook is AS/400 customers, IBM marketing representatives, and IBM Business Partners. This chapter can help these audiences understand e-business so they can discuss it with people in their organizations and with prospects. It offers the fundamental information needed to understand e-business in general terms.

IBM and Business Partner marketing and sales representatives should use this chapter and handbook as a sales aid that can be left at the customer site, to remind them that the AS/400 system plays a major part in e-business and Internet-based applications. Customers can use this chapter and handbook as a guide to e-business, with details specifically on the AS/400 tools, technologies, and processes available to put your AS/400 system and applications on the Web.

1.2 Understanding e-business: Key concepts to know

This section reviews e-business terms and concepts that are often confusing because of their broad use to describe such a broad topic.

1.2.1 Definition of e-business and e-commerce

What is *e-business*? e-business is a business process transformed to leverage WWW (Internet, intranet, and extranet) technology for business benefit. It is about using the Internet infrastructure and related technologies to enable business anywhere and anytime.

e-business is not a technical issue, but rather a business issue that leverages the Internet infrastructure that exists as the delivery vehicle for a variety of goods and services. This includes typical business transactions such as providing goods and services for sale, access to product and service information, marketing and sales, and communications with customers and suppliers.

What is e-commerce? E-commerce is the act of selling products and services on the Internet. It is *one* element of e-business, the primary element. It concerns itself with business-to-business and business-to-consumer selling of products and services. E-commerce is typically implemented as some form of an electronic store (e-store).

1.2.2 The electronic impact

As for any major change, society needs time to get used to Internet capabilities. However, e-business is already changing the way society works. We are seeing a shift from a vision to something increasingly pervasive. For example, consumers expect to find a Web site for a particular organization. Otherwise, they think the company is not legitimate. A customer or a supplier can refuse to do business with you because you are not “connected”. At first, it was just by e-mail, but now this includes self-service Web sites and online ordering.

Global reach of Internet technology

The reach of the Internet is getting broader. Have you noticed that your mobile phone is ready to handle Internet communications? Do you know that your future refrigerator will be a communications platform to help you maintain the refrigerator itself and to help you to shop when you need it, so you know at anytime what you have at your disposal in the deep freezer? This is reality, no longer just a vision. This is called *pervasive computing*. It is the idea of putting powerful computer chips and functions into everyday things such as cars or household appliances.

As the Internet becomes increasingly common, the technology and commerce and social uses of the technology are racing forward. Huge investments are being made to support the increasing Web traffic as current Internet resources are being stretched to the limit. For example, IBM is involved in several next-generation Internet projects, including Internet2, a project which could create main arteries for the Internet that will be 1,000 times faster than today. This will make entirely new ways of using the Internet possible.

A good example is the cinema industry. Today, you can check out a movie through the Web. However, because of the limitation of the Internet resources (the bandwidth), you can't download it instantly. With Internet2, a new channel will be open for distribution of movies: the Web.

1.2.3 The characteristics of e-business

In the late 1960s, the U.S. Department of Defense Advanced Research Projects Agency began funding an experimental wide area computer network that connected important research organizations in the U.S., called the ASRPAnet. The original goal of this network was to provide better collaboration and communication between research sites, share scarce computer resources, and serve as a backup communication channel in case of a national emergency. Since that time, the Internet, as it is now known, has transformed itself in many ways from the hardware and protocols used to communicate to the type of work being done over it.

Transition: Community to commercial

The language used to discuss the Internet now and in the past, helps tell the story of transition that has happened. Articles and discussion groups were filled with words like community, sharing, education, information, democracy, and people. These words have slowly changed and have been replaced by such words as e-commerce, consumer, e-retailer, anytime, anywhere, information database, target audience, and subscriber base.

Availability: 24 x 7 operations

Like it or not, the easy going days of the Internet are gone. Today's Internet is becoming the backbone for commerce and communication in the 21st century. The Internet is now open for business non-stop 24 hours a day, 7 days a week (24x7). It is accessible from almost anywhere. Security concerns are being addressed rapidly. Customer driven products and services are offered at excellent prices. This electronic culture spans across languages and borders.

Security

Recent denial of service attacks on leading Internet companies, such as Amazon.com, e*Trade, Datek, eBay, Yahoo, CNN, and Buy.com, has brought security issues to the front pages of the popular media. Standards and technology such as SSL encryption, digital certificates, SET, encrypted e-mail, and firewall, provide protection against such attacks. Additionally, server security including vulnerable features and access points need to be managed by the system administrator. The AS/400e system provides the full set of communication and transaction security methods, as well as industry leading server security. The server security is based on an object model that

prevents viruses and closes loopholes found on other servers. The government C2 security rating validates the AS/400e system security.

1.2.3.1 e-business security checklist

With the highly publicized hacking incidents in February 2000, a meeting was held of government and IT industry leaders to determine proactive measures to reduce the likelihood of security-related incidents. Senior vice president and group executive for the IBM Technology Group, Nicholas Donofrio, stated, “The recent denial of service attacks are strong reminders that security needs to be the priority of every online business.”

IBM security experts advise that companies use the following checklist to evaluate their online security practices:

- Implement a thorough and aggressive security policy that is reflected through your business, including firewall configuration access controls and employee communications.
- Conduct a security awareness campaign to regularly remind employees of their security responsibilities (using Web-based certification or regular e-mails, for example).
- Install a firewall on outside and internal borders (between Human Resources and engineering departments, for example). Be sure to change the default settings, which can be easily defeated.
- Use intrusion detection software. This is like having burglar alarms and motion detectors, but for your network. Just as with the firewall, it’s important to have intrusion detection on external and internal networks.
- Distribute antivirus software. The best antivirius systems have an easy, effective update mechanism to ensure thorough coverage.
- Establish rules for password selection. Determine very clear guidelines for passwords (such as “six characters with at least one numeral”) and an easy way to verify whether a password is acceptable. Passwords should also be changed periodically.
- Perform security audits on a regular basis. These should be unannounced and random, some electronic, some physical, some stealthy, and others blatant. The ultimate goals of these audits are to get into the target system, access valuable data if possible, and determine if the intrusion was even noticed.
- Designate someone as the main network security contact and determine clear procedures for reporting and responding to security issues. Employees should clearly understand who to report incidents to and should report all incidents that seem to breach the security policy.

- Ensure that the system administrator stays abreast of security advisories and makes security-related changes in a timely manner. These are the people on the front line, so they need to be as proactive as possible and in a position to react quickly to security issues.
- Have a clear policy for action when an employee leaves for any reason. Actions to take quickly include disabling the former employee's building and computer access, deleting or redistributing their computer accounts, and changing all passwords and access codes they may have known.

1.2.4 e-business is hot

The business environment, as a whole has changed. Globalization, deregulation, and competition are now common terms used by almost every business. The business world is now global and is highly competitive with companies competing across national boundaries. The term "global" includes: global markets, global customers, global suppliers, global shareholders, and global opportunities. Consequently, customers are becoming more sophisticated, have more options than ever before, and are more demanding of businesses. Figure 1 illustrates the forces that have fragmented national markets and changed the business environment.

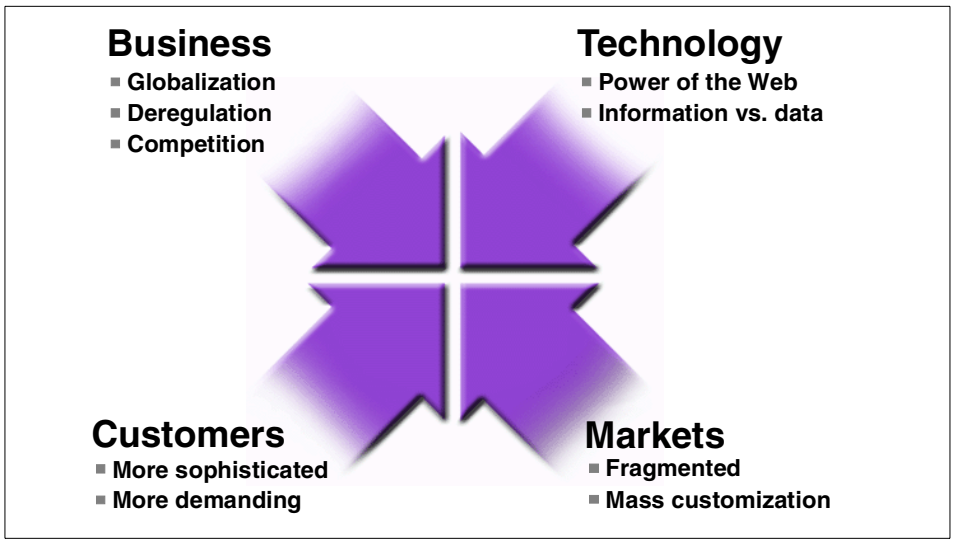

Figure 1. Why e-business? The changing business environment

Four years ago, amazon.com did not exist! Today this online book shopping site exists only in cyberspace, with over three million titles, expanding their activities into music, video, and gifts. They are open all day, every day, all

year, shipping to 160 countries, and serving over 1 million customers with a market capitalization of about $22 billion. Today, we cannot avoid references to the .coms (Dot Coms - as they are referred to on Wall Street). It is a part of everyday life.

1.2.4.1 Fast adoption rate: Consumer and business

The Internet has had the fastest adoption rate of any new medium in history. It has taken less than five years to get 50 million people connected worldwide. It took radio 38 years, and television 13 years to reach the same audience.

A 1999 IDC study entitled *Lotus Notes Agent of Change: The Financial Impact of Lotus Notes on Business* (`http://www.idc.com`) found that almost 25% of suppliers are already online. 67% have started commerce initiatives to build a lead in market share. Figure 2 shows us that 95% of retailers will sell via the Web, with about 50% in the next year.

Note

The IDC study mentioned in this section is available on the Web from the IDC Research home page at: `http://www.idc.com`

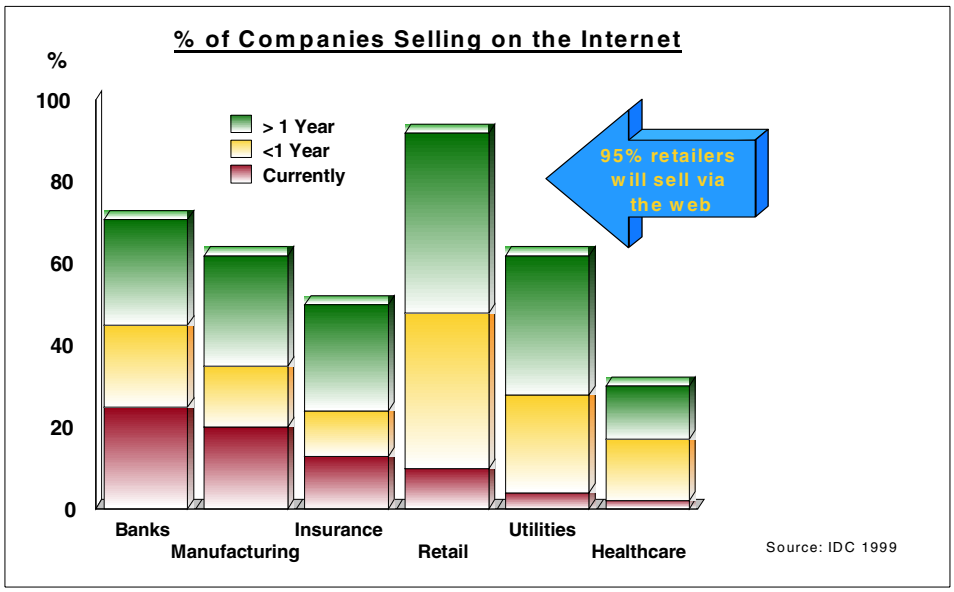

Figure 2. Selling through the Web is transforming industries

In 1999, an IDC paper reported that the business-to-business model for e-commerce will reach 9% of the total business-to-business trade.

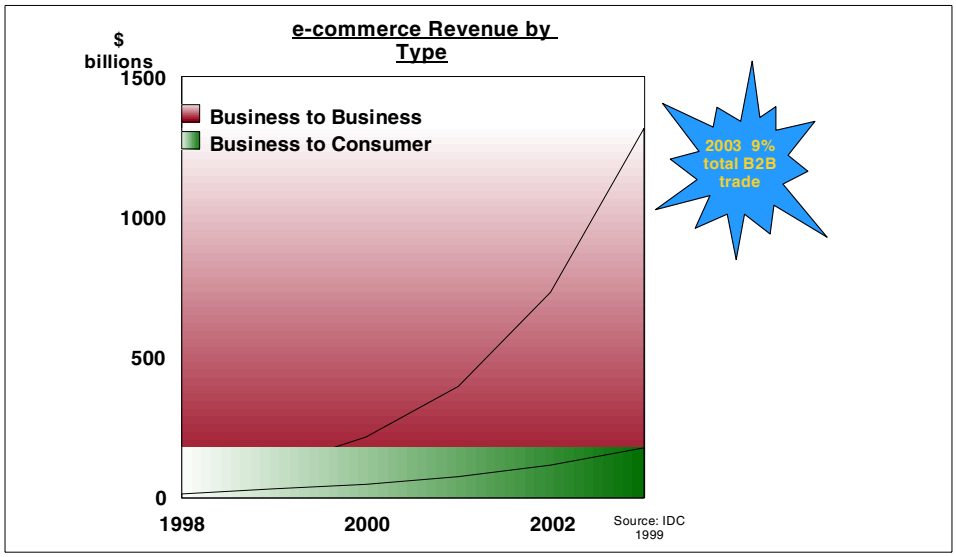

Figure 3. E-commerce revenue business-to-business and business-to-consumer trend

1.2.4.2 Rapid return on investment

There are many references to show you how putting a “e” on your business means rapid Return On Investment (ROI), according to the McKenna Group and IBM:

- Manufacturing
  - Increased order volume by 50% and improved dealer satisfaction
  - Projected 75% reduction in transaction costs and $60 million savings in better-negotiated procurement details
- Retail
  - Quadrupled previous year’s revenue in three months
  - Estimated savings of $28 million over four years
  - Improved franchise satisfaction
- Telecommunications
  - Increased customer satisfaction as response time rose by 20%
  - Deflected calls to the Web site and offered paperless billing, saving about $2.5 million at current levels of adoption

- Insurance
  - Doubled the number of policies sold and increased commissions by 150%, while reducing the turnaround time for policy approval from weeks to days
  - Saved $600,000 annually in call center expenses and acts as a platform for wide a range of agent communication needs
- Travel
  - Saved $4 million in revenue from an online reservation system within the first three months
  - Reduced average ticket prices by 15% and cut travel agency fees in half, resulting in $1.5 million to $4.25 million in annual ticket price savings

Coupled with the low cost of ownership, which was rated lowest in the industry (IDC study in November 1998) (hardware, software, staffing, maintenance, and repair), the AS/400e server is the right choice to handle your business needs, now and in the future.

1.2.4.3 Summary: Business benefits of e-business

Much has been written about the benefits of e-business. Depending on your organization, its value proposition, and organization, different benefits can be reaped. Some common benefits associated with e-business are:

- **Higher customer satisfaction**: The reasons are extensive, but some examples are customers having personalized 24x7 access to your business, information is better, faster, and easier to access.
- **Increased revenue**: The Internet allows companies to access new markets and customers without having to physically be there.
- **Decreased costs**: Online order status, shipping status, account inquiries, and other information lookups deflect calls from call centers, reducing support costs.
- **Lower prices for consumers**: Cutting out non-value-added distributors and shortening the supply chain pushes prices down.

If you are not convinced that your business has to be transformed to benefit from the Internet opportunity, somebody else will, such as one of your competitors or even a new and unexpected participant.

The question to ask is no longer “Should I go to the Internet?”, but rather “How?”

1.3 e-business development

Companies typically follow a similar process when building their Web presence. Figure 4 graphically presents three phases starting with a Web presence, then a dynamic site, and finally a transactional site. The graph is very steep to indicate the speed at which companies now move through these phases and the benefits and impact the transactional and dynamic sites can have.

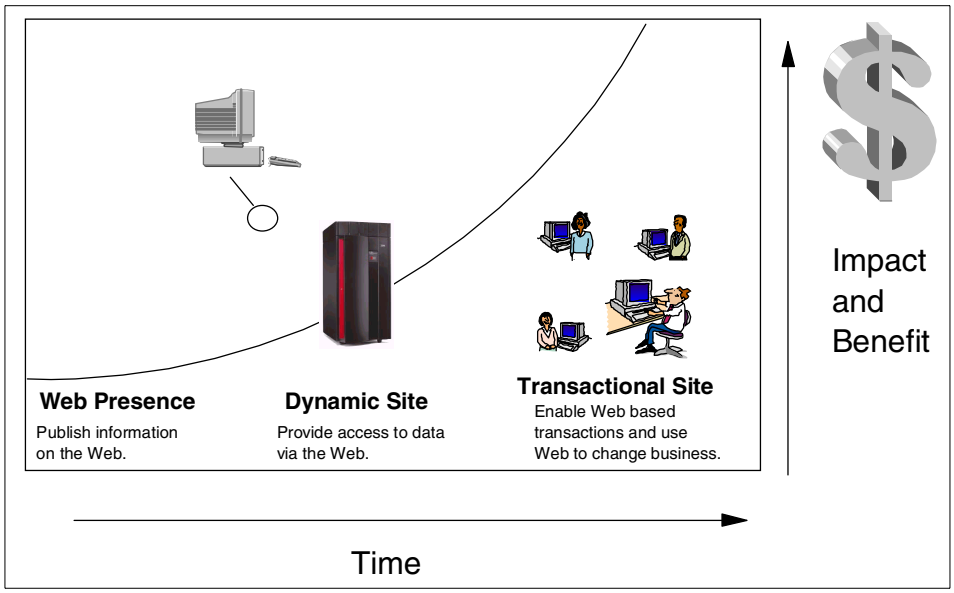

Figure 4. e-business development overview

The first phase in developing your business as an e-business is to establish a Web presence. A Web presence involves presenting marketing and company information on a relatively static HTML home page or site. As business forces change information access requirements, the Web presence typically moves toward providing dynamic data.

Dynamic data sites usually contain user-defined information that is extracted from business systems per the user's request. The user, however, does not add, delete, or edit data or complete a transaction. Customers are satisfied with this improved way to access data that traditionally was provided by call centers or 1-800 telephony applications.

The final phase in this process is to have a transactional site. A transactional site allows users to add, delete, or edit data on business systems and complete transactions (e-commerce).

This redbook is organized around these phases so you can understand where your business is in this process, read what tools and technologies are available and how they are used, and review the transition to the next phase. The phases are discussed in Chapter 2, “Building e-business sites: Phased approach” on page 49.

Note

The Rochester Opportunity Center serves as an e-business resource and solution provider. Experts can be reached at (888) 426-9857 in the United States or (507) 253-7056 worldwide. Contact them to explore the offerings and services available or to initiate an e-business analysis.

1.4 IBM Application Framework for e-business

The IBM Application Framework for e-business is an architecture and methodology for building e-business applications that uses industry standards and leading products. The framework for e-business is also the IBM view on how to create a successful foundation and architecture for applications being built. The AS/400e system fully supports and participates in this framework.

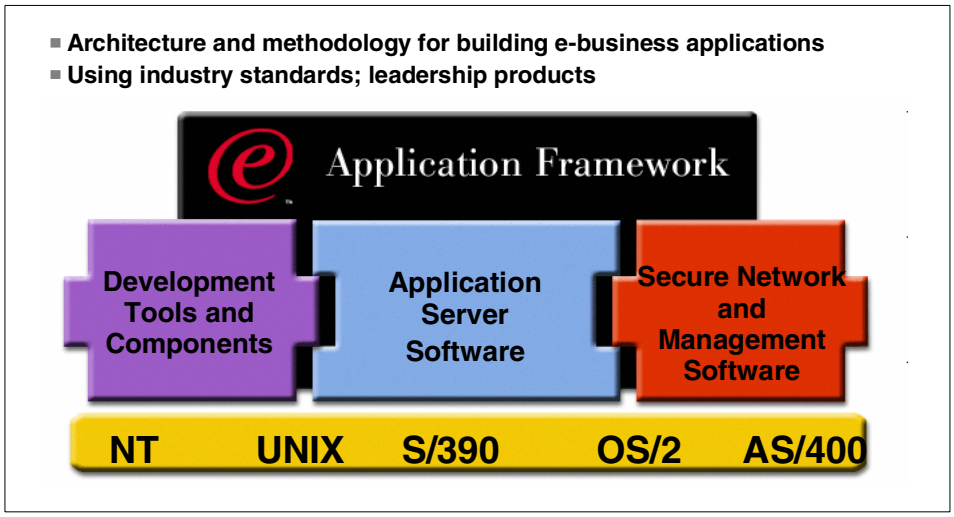

Figure 5. IBM Application Framework for e-business

The application framework provides the right supporting foundation for your new or existing AS/400e applications (Web-enabled) working with the Web. That means that this foundation is standards-based (in particular Java), easy-to-understand, and is a prescriptive approach to developing applications that are specially tuned to run on the Internet. This is an entire solution approach, rather than a single product or point solution. This means consistency in application development, faster speed for development, faster speed to deploy. Plus, it gives companies who “build fast and grow fast” the ability to quickly take advantage of the extensive opportunity that the Internet represents.

The IBM Application Framework for e-business helps to build applications for the heterogeneous multi-vendor world and shortens development cycle times by providing cross-platform tools and standards-based software that leverage the existing infrastructure and applications. It provides the fastest, safest way to capitalize on e-business. The AS/400e server is strongly committed to participate in this “vision”.

1.4.1 Framework overview

The IBM Application Framework provides a methodology, including the recommended architecture, programming model, ideal standards and techniques, as well as the supporting software portfolio (application server software, development tools and components, secure network, and

management software). These elements are shown in Figure 6 and are explained in the following list:

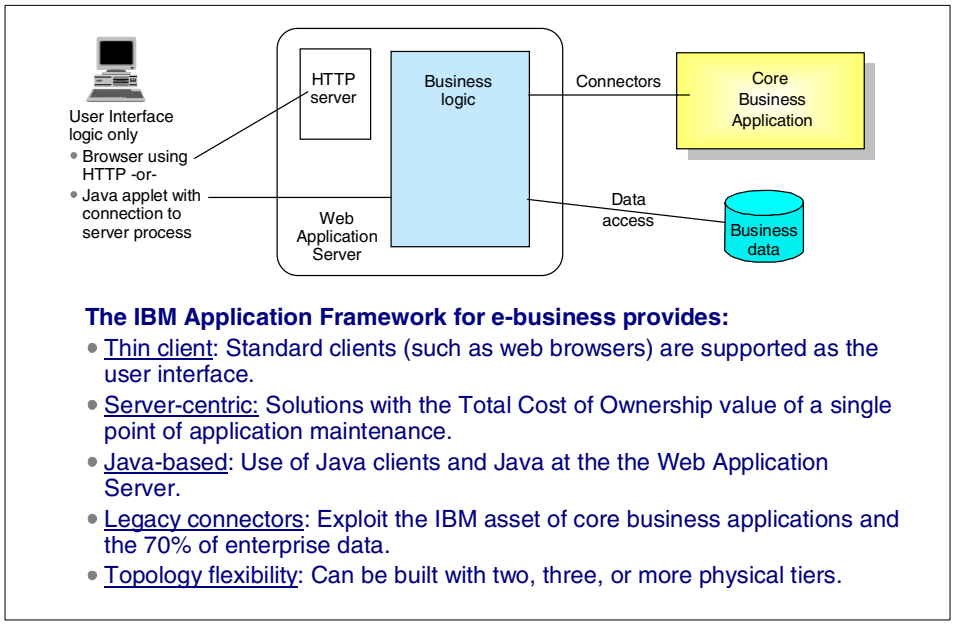

Figure 6. The e-business application model

- **Programming Model:** A single unifying Java-based programming model for building Web applications that can be written once and run anywhere.
- **Architecture:** Based on a “Web-able” style of network computing (object oriented design) and providing universal connectivity, rapid development and deployment, software reuse, and connections to “external services” where existing applications and data reside.
- **Ideal standards:** TCP/IP, HTML, XML, Java, servlets, JavaBeans, etc.

  Note: These standards are defined later in this handbook.

Note

The Enterprise acceptance of Java is strong. There are 70 million Java-enabled seats, with more than 1,000 shipping applications. Today, there are 700,000 serious Java developers, 40,000 universities providing Java courses, more than 1000 books available on Java, and more than 2 million downloads of Java Development Kit 1.1.

1.4.2 Development tools and components

IBM offers a rich set of development tools and reusable application components. These are complemented by leading application server software:

- VisualAge Family (Java)
- Domino Designer and Lotus Tools
- WebSphere Studio
- IBM San Francisco Application Framework

The software portfolio contains state-of-the-art products and a set of business-tested software to help customers develop, serve, integrate, secure, and manage their e-business applications.

1.4.3 Application server software

The heart of the IBM Application Framework is a set of application servers for building, running, and managing advanced e-business applications:

- IBM HTTP Server for AS/400
- Lotus Domino
- IBM WebSphere
- Net.Commerce
- DB2 Universal Database
- MQSeries
- CICS Transaction Server for AS/400

Each of these servers is mature and secure, feature-rich, and field-tested, the product of years of experience.

1.4.4 Secure network and management software

Security and manageability are keys within an e-business environment. The SecureWay Family of products simplifies the challenge of locating, connecting, and securing all the parties and resources involved in an e-business transaction or interaction. In this family of products, we cover:

- Host On-Demand Version 4
- Host Publisher V2.1 for AS/400
- Tivoli (for more information, see `http:\\www.tivoli.com`)

Those products could be seen as “Web-enabler” tools for existing applications. Host Publisher can also be classified as an application development tool.

1.5 The e-business cycle

Experience shows that companies typically go through well-defined steps when going through business transformations. IBM has developed a four-phase model to summarize these steps. This model is shown in Figure 7 entitled the IBM e-business cycle. The IBM e-business cycle provides basis for the IBM Application Framework for e-business. Companies use the e-business cycle repeatedly for each business transformation project they undertake.

The e-business cycle provides companies a blueprint of how to move through each phase when creating and deploying applications and providing support for e-business initiatives. In practice, it can be a powerful tool that allows business to act more quickly and decisively when faced with business threats or opportunities.

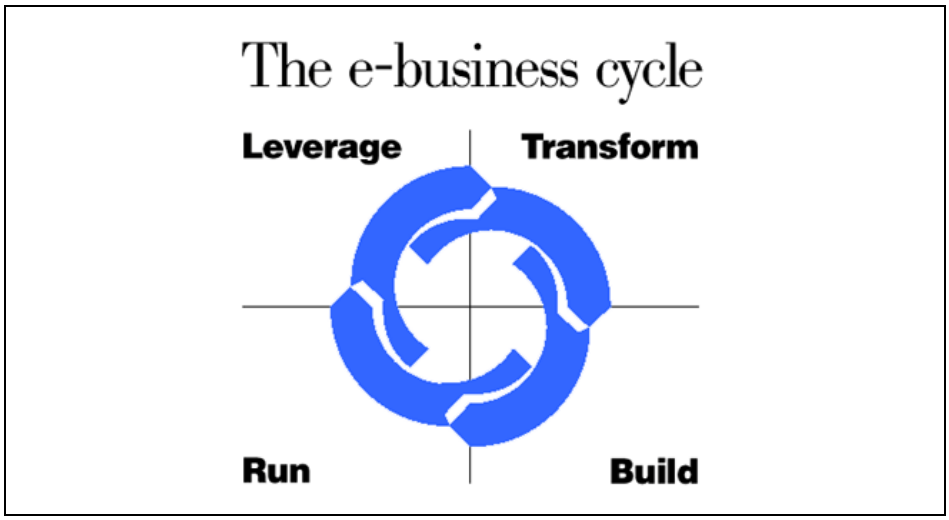

Figure 7. The e-business cycle

The four phases of the e-business cycle are further explained here:

- **Transform core business processes:** This step is about doing business in new ways by applying Internet technologies to create maximum value for your business. It's about “business, not just technology”. e-business changes the way you actually do Customer Relationship Management (CRM), Supply Chain Management (SCM), and electronic commerce. This means developing an electronic means to do business that provides benefits to the business and the customer.

- **Build new applications:** Transforming core business processes requires a new generation of applications. They run on servers, leverage existing applications and data, and scale to meet user demands. The IBM Application Framework for e-business is designed to help you build and deploy a new generation of applications that are open, flexible, and easy to change. This allows business to “start simple and grow fast”.
- **Run a scalable, available, safe environment:** The infrastructure that provides these new applications is under considerable pressure. Businesses are looking for a better return on investment. Users want systems that are easy to use, yet always responsive. The solution is to provide an environment with scalable servers, flexible clients, and advanced storage devices, which are all handled in a secure, manageable way. The AS/400e system provides the availability, security, and scalability benefits required.
- **Leverage knowledge and information:** e-business is about creating a responsive organization that makes intelligent use of all types of data and organizational knowledge. e-business allows you to use data as a competitive advantage (for example, profiling, personalization, and product offering customizing), and businesses can quickly customize product and service offerings to the customers requirements.

In its entirety, the e-business cycle builds the basis for the IBM Application Framework for e-business to provide a supporting structure for businesses and provide organizations with a common, unified programming environment.

1.6 e-business value chain: End-to-end solution model

The end-to-end solution model (Figure 8 on page 20) shows the variety business applications that e-business can have if applied from suppliers to customers. This model also focuses on the back-office applications in a company that are typically Enterprise Resource Planning (ERP) style business applications that house much of a companies valuable data. This data is not only valuable for the actual business, but also suppliers (for example, production or inventory information) and customers (for example, order status or support).

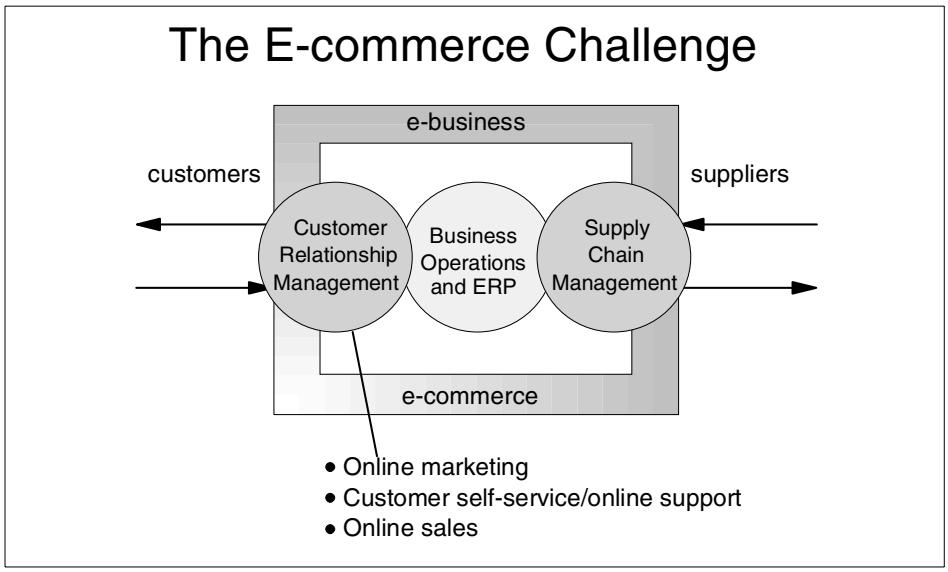

Figure 8. End-to-end solution model

For AS/400e customers, this data is typically almost entirely housed on an AS/400e system, and, by its nature, is a very central part of most e-business applications. The e-data is not only valuable for the company, but also its suppliers and customers. End-to-end e-business solutions leverage core business data and are the basis for most e-business applications today. This is where to start when looking for potential e-business opportunities.

1.6.1 ERP: Core business applications

ERP packaged software covers the primary back-office functions of a business such as financial systems (General Ledger, Accounts Payable, Accounts Receivable, etc.), inventory management, human resources, planning, procurement management, supply chain management, customer relationship management, and sales force automation. The business data that ERP applications contain is the raw material for many kinds of e-business applications that leverage into customer relationship management, supply chain management solutions, e-commerce, and other related solutions.

1.6.2 Customer Relationship Management

Customer Relationship Management (CRM) involves supporting, developing, and retaining profitable customers. CRM is central to e-business. Analyzing customer behavior enables businesses to personalize their offerings and to

anticipate their customers' wants and needs. Doing this successfully means organizations can maintain good customer relationships. This is key to retaining customers, which is something every organization is working hard to do. Gaining a new customer is six times more costly than retaining an existing one. The cost of customer defections is also well documented. A company with a 90% customer retention rate, which most businesses would consider exemplary, in fact loses almost half of its customer base every five years.

Creating an e-business application involves exploring the central theme of CRM: developing solutions that serve customers better. The development of an e-business application for CRM begins by answering some key questions:

- Which backend support processes (for example, inventory management, transportation management, product design) are integral to serving customers better? This involves inventorying available data and going through a process to assess the value of that data to customers and then determine which information to supply in which manner.
- How can a customer relationship management initiative to involve or integrate these processes in a manner that results in true performance improvements for customers be deployed? Some examples are to provide better information (for example, more accurate, faster, and easier to access) or better service (for example, 24x7 support, product access, and lower prices).
- Which business processes can be significantly improved by effectively implementing them as e-business solutions? Typically these involve customer interaction points (for example, price lookups, account status, and reports), large distributions of paper (for example, promotions, announcements, and newsletters), or data inputs (for example, account information, such as an address change).
- What is the relative business value of each independent process and which application will customers value most? There can be many.
- How capable is the IT infrastructure of supporting customer relationship management initiatives to integrate customer-facing or backend operational processes? Back office systems are opened to customers without a customer service representative as a middle-person. This creates its own unique availability, performance, and usability issues.

An effective customer relationship management system helps businesses be more successful because they can identify and sustain profitable and enduring relationships with their customers. This happens when customers get the right information, at the right time, in the right format. It provides value!

1.6.3 Supply Chain Management

A supply chain is the way an enterprise ties together the people, process, and related information, both internal and external, associated with its flow of products. Supply Chain Management (SCM) is a strategy for linking enterprises with their suppliers, distributors, and customers to facilitate information exchange and to unite all steps in the product cycle. This includes initial product design and procurement of raw materials, production, shipping, distribution, and warehousing, until a finished product is delivered to a customer. Companies deploy SCM technology to help improve communications, planning, and collaboration with trading partners to gain efficiencies and cost savings that lead to a competitive advantage.

SCM applications are developed to leverage better communication, access to information, funds transfers, and others provided by e-business and to reap benefits like lower costs, faster cash cycles, lower inventories, more satisfied customers, and so on. These applications have been successfully deployed across many industries and are major areas for the deployment of e-business applications.

Some examples of supply chain solutions include:

- Forecasting and demand planning, for example, supplying production schedules to suppliers to minimize inventory, and build it before peak periods
- Strategic sourcing and procurement, for example, selecting qualified suppliers and sourcing from the appropriate one when necessary
- Production logistics, for example, JIT (Just-in-time) systems
- Transportation and shipment management, for example, timely distribution and delivery of products and services
- Distribution and warehouse operations, for example, stock replenishment

As with CRM, SCM leverages existing business data and applications by using the Internet and e-business applications as an access and distribution point for suppliers, distributors, and partners.

1.6.4 E-commerce and e-business

As defined earlier, e-commerce is about actually exchanging products or services for money with the end-consumer via the Internet. When you make it possible for customers, distributors, and suppliers to conduct actual business with you over the Internet, you open an entirely new sales channel. This channel is unique because it can sell products and services in nearly every country in the world, 24 hours a day, for a fraction of the cost of traditional

channels. It is similar to hiring a global sales force for the cost of a single representative.

In addition to the sales and financial potential, there is also a large amount of strategic information about your Web customers that is hard to get through other sales channels. This information can help sell additional products and services and keep customers loyal.

In relation to core business systems, e-commerce brings them closer to the actual point of sale. Customers actually interact with inventory and financial systems (in a controlled and secure manner, of course). Web orders flow directly into your information systems, thereby reducing intermediate steps and error rates, which speeds up product deliveries, and builds customer satisfaction levels. This makes the availability, security, and usability of these options very important.

In summary, the IBM Application Framework for e-business gives you the foundation on which you can build successful e-business applications.

1.7 Requirements for success: The realities of e-business

Business pressure is increasing. Executives, including the CEO and Board of Directors (BOD), demand responsiveness and flexibility in their IT systems. Users demand reliability and functionality. The CFO demands better cost control. Existing and new customers demand new ways to access information and world class customer service. All of these demands challenge and put tremendous pressure on systems to accommodate these varying requirements. Downtime is feared because it impacts more than employee productivity. It affects the bottom line in the e-business world. And on the top, there is more pressure than ever before on development cycles, and the speed to deploy them is critical.

Given these tremendous pressures, what are the characteristics of a successful e-business application?

1.7.1 Attributes of successful e-business applications

Here are strong indicators of successful e-business applications:

- **Standard-based**: Support all clients equally.
- **Server centric**: Data, application logic, and business rules are managed centrally and can all update in one place, which means quick and cost-effective deployment.

- **Leverage core systems**: Extend existing investments in legacy systems that still run your business.
- **Scalable**: Applications that grow with your business and meet unpredictable demands, day and night.
- Quick to deploy and easy to use.
- **Manageable**: Ensure system continuity and availability; downtime is costly.

The environment these applications run in also needs to have specific attributes such as scalability, availability, and security.

1.7.2 Additional attributes for success

Beyond scalability, availability, and security, successful e-businesses incorporate these additional attributes:

- **Scalability for capacity on demand**: Investment protection for applications, snap-in upgrades for hardware, ability to add capacity on the fly, etc.
- **Interoperability among systems**: Synchronization of updates, real-time currency, sharing of data, common business rules, etc.
- **Availability around the clock**: Continuous access to data, workload management, redundancy, back-up and restore, and clustering.
- **Security of data and transactions**: Built-in security, firewall, cryptography, access control, global sign-on, network security, and secure gateways and servers.
- **Manageability of multiple resources**: For example, networks components, operating systems, databases, applications, servers.
- **Integrated system services**: For example, database services, transaction services, basic HTTP services, Java services, messaging services, components services, and Enterprise JavaBeans.

1.7.3 How the AS/400 system fares in the e-business game

To put it simply... very well! Integration, server centric model integration, availability, reliability, security of data and transactions, serviceability, ease of use and manageability, and scalability all sound familiar. It is because they are the core value propositions that have made the AS/400e system what it is today. They continue to be the value propositions that make it such a good e-business server.

More businesses (with more than 100 employees) run their most important business applications on an AS/400 system than any other platform (from the IDC report). You can “Web-enable” those applications and provide access to that information through the Internet.

The IBM Applications Framework for e-business provides the AS/400e system with a strong architecture and set of tools to develop with, especially if you are Java-minded.

What about other benefits of running your e-business application on AS/400e system?

Let us explain the top advantages that the AS/400e platform delivers today:

- **Security and integrity:** Both are quite important on the Internet. Security provides access to core business applications, secures data internally, and secures transactions. There are several types of products customers use to solve network security issues, such as standalone firewalls, security appliances, and security options in both hardware (routers and hubs) and software.

  The AS/400e system offers a C2 security rating (delivered by the U.S. Government, which means ready to work securely for the Pentagon where security requirements are very high), supports Secure Sockets Layer (SSL) and Virtual Private Network (VPN) natively. SET Secure Electronic Transactions support is included since there is an integrated firewall. And last but not least, there has never been a known virus on the AS/400 system.

Note

On 15 February 2000, IBM announced that the IBM Firewall for OS/400 product (5769-FW1) and Integration Services for FSIOP (5769-SA2) will be withdrawn from marketing effective 31 December 2000. A native AS/400 function will be developed to replace IBM Firewall for OS/400. Customers running either of these products on the Integrated Netfinity Server will be supported with their current capabilities until 31 May 2001. However, these products will not be enhanced.

We recommend that customers running Integration Services for FSIOP or IBM Firewall for OS/400 plan to implement an alternative solution. For planning information, refer to the Web site:
`http://www.as400.ibm.com/firewall`

There are many alternatives available for customers concerned with network security. Customers are likely to find alternative products available from third-party vendors that have equivalent or more functions, and are more extendable compared to the AS/400 firewall product.

- **Reliability and availability:** These benefits are key because e-business solutions are 24x7 operations and downtime equals lost money and customers. An IDC report shows that a single AS/400 system offers less than six hours of unscheduled downtime per year (from *Platform Availability Data: Can you spare a minute?*, Gartner Group, October 1998).
- **Scaleability:** This means how easily a computer system can grow and how much total growth is possible. Typically e-business solutions start small and grow quickly. This type of growth requires a system that can easily and quickly grow as demand grows. This is an AS/400 strength because of its modern architecture. The AS/400e system delivers over 18.9 TB of disk capacity for data on a single machine, up to 96 GB of "memory" on a single machine, and over 330x growth for processor capacity with the same operating system.
- **Ease of management:** Central administration is another essential point when working with the Web. Through easy graphical configuration wizards, features like Management Central, part of Operations Navigator, you can easily manage multiple AS/400e servers centrally. The AS/400e system can also integrate Windows NT applications through the Integrated Netfinity Server, and Domino running natively. Having central management of system resources makes the operator function much simpler.
- **64-bit architecture:** 64-bits means speed, and speed is valuable for Internet users. Often seen as an old system, the AS/400e server is everything except an old system. The AS/400e server is completely 64-bit hardware, operating system, applications, and database. As new hardware technologies are introduced, there is no need to re-compile or re-write existing applications, applications that are going to benefit immediately from the technology. Thanks to this architecture, the AS/400e system is now ready for the next step—128-bits, without disruption.
- **Logical Partitioning (LPAR):** Recently released in OS/400 V4R4, LPAR allows one AS/400e system to have multiple server functions running at the same time (requiring at least two processors, one for each partition). For example, this allows you to have the Web server, multiple OS/400 versions, languages, e-commerce, database access, and e-mail systems on the same machine.

- **Java leadership:** The AS/400e server offers a broad range of capabilities, sometimes underestimated or, even worse, unknown. Through extensive development, the AS/400e system has optimized OS/400 for running complex, multi-threaded Java applications that are coming to market. The AS/400e system also supports the WebSphere application server that lets ordinary Web servers run Java servlets on the AS/400e system with links to DB2/400.
- **Cost of ownership**: With scalability, security, and reliability built in from the ground up, the AS/400e platform is designed to enable you to conduct business-to-business and business-to-consumer Internet transactions. The AS/400e delivers all those things for the lowest total cost of ownership (see *Server Selection: Reversing the trend of rising IT costs*, IDC (December 1998), or *AS/400 equals cost-effective ERP*, Meta Group (April 1999)).

Clearly, the AS/400e server provides a path to e-business. By supporting transformation of business applications to an e-business model while minimizing disruption, this platform has a unique position. It has business proven values (reliability, security, scalability, low cost of ownership, logical partitioning, service, and support). Plus, the AS/400e system supports the latest enabling technologies for e-business. In combination, these qualities make the AS/400e system a good choice for not only extending existing applications, but also for deploying new solutions that require attributes that are AS/400e standard features.

Java and the AS/400e server

The AS/400e server offers improved performance, scalability, and reliability through the optimized implementation of the Java Virtual Machine below its Technology Independent Machine Interface (TIMI) and because the AS/400e is a true 64-bit Java server. The AS/400e server provides an object-based architecture that closely matches Java's own object-oriented architecture. Finally, the AS/400e server offers an AS/400 Java Transformer, which improves performance by creating optimized 64-bit AS/400 execution objects for AS/400e server.

1.8 The key products: An overview

As we have discussed in this chapter, e-business is and will continue to be an important part of almost any businesses strategy. Not every business is suited to have an online store. However, e-business technologies can be

used in business-to-business and supply chain applications, meaning creativity is the only limitation.

The AS/400e system plays an important role because of its inherent operational strengths and also because of the data typically stored on it. The operational strengths allow it to be a powerful Web and application server. The data stored on the AS/400e system is the raw material and back office operational system for many e-business applications.

The AS/400e system also provides many tools, features, and benefits for customers as they move through e-business phases. The following section highlights products featured in this redbook with a reference to read more.

To complement IBM e-business products, many third-party solutions are available. Some are outlined in Appendix C, “Third-party products” on page 233.

1.8.1 OS/400 (5769-SS1)

The AS/400 operating system, OS/400, is conceived as a *single entity*. This means that facilities, such as relational database, communications and networking capabilities, online help, and much more, are fully integrated into the operating system and the machine. The user communicates with all components of OS/400 using a single command language Control Language (CL).

OS/400 provides tools to handle two different computing environments for the AS/400: servers and systems. The AS/400 client/server dimension combines an open system environment with AS/400 system price/performance and the integration of system solutions to extend a complete product package for the server environment. For legacy systems, the AS/400e system provides integrated functions based on the traditional commercial computing environment.

As the computing industry moves rapidly towards a network-centric world made up of global networks, AS/400e software grows with significant enhancements to make the AS/400e system a key player in this vibrant and vital area.

OS/400 is designed to be comprehensive and scalable. Some of its features are described in the following list. They help to make OS/400 the most complete operating system on the market today.

- Ease of installation and ease of use: Includes system-supplied menus and fast path commands, automatic configuration of local devices, online help

text with index search and context sensitivity, copy screen images, operational assistance, a built-in communications line to contact service, enable remote service personnel to diagnose the system online, analyzing symptoms, and downloading program temporary fixes (PTFs) to resolve errors.

- Security is selected to meet business needs, ranging from minimal security (where no passwords are used and any user can perform any function), to resource security (where passwords are required and users and the use of objects can be restricted to specific functions), on to operating system integrity (which prevents unsupported interfaces to interfere with the system). Security violations are logged in a security journal.

  The highest level of security (known as Level 50) enables the AS/400e system to operate at the C2 level of trust as defined by the U.S. government.

  Within communications, further security is possible by implementing LU6.2 Session Level Encryption (SLE) for AS/400 applications, which use LU6.2 communications.

1.8.1.1 Connectivity

The AS/400e system offers a wide range of communication capabilities and functions to enable the AS/400e system to communicate with most IBM and non-IBM systems.

The AS/400e system supports many protocols and networks, including:

- ISDN Data Link Control (IDLC)
- IBM Token-Ring Network (IEEE 802.5 and 802.2)
- T1/E1/J1 and Fractional T1 Networks (high bandwidth)
- Synchronous Data Link Control (SDLC)
- Ethernet Version 2 or IEEE 802.3
- ATM LANs

OS/400 has the following communication facilities (and more), with each facility as part of OS/400: TCP/IP Support, Remote Work Station Support, Advanced Peer-to-Peer Networking (APPN), Dependent Logical Unit Requester (DLUR), SNA Distribution Services (SNADS), Distributed Data Management (DDM), ISDN Support, File Transfer Support, IPX/SPX Communications, and ATM LAN Emulation.

1.8.1.2 Euro currency

AS/400e support includes updates to input, display, print, and process the euro currency sign for both the host and PC client computing environments.

This includes an addition of euro keyboard types, including device configuration and device controller changes, the euro font and glyph support, and printer support.

1.8.1.3 Integrated file system

The integrated file system (IFS) is a part of OS/400 that supports stream data, including images, audio, and video; storage management similar to a personal computer and UNIX operating systems. The IFS also provides structure for all information stored in the AS/400e system with consistent use of object names and associated object information across national languages.

Key features include:

- Support for storing information in stream files that can contain long continuous strings of data
- A hierarchical directory structure
- A common interface that allows users and applications to access not only the stream files, but also database files, documents, and other objects that are stored in the AS/400e system
- A common view of stream files that are stored locally on the AS/400e system, an Integrated NetFinity Server for AS/400e, or a remote Windows NT server

1.8.1.4 Built-in system management facilities

A variety of tools and functions are available to provide system availability and management. These include:

- System Managed Access Path Protection (SMAPP) to automate the process of selecting which access paths should be protected.
- Expert Cache as a disk cache tuner. It dynamically responds to system jobs to cache pages of data in main storage to reduce the time to process disk I/O.
- Integrated Hardware Disk Compression supported by OS/400. Data is dynamically compressed and uncompressed by the DASD controller as data is written to and read from disk. Disk compression does not effect the main CPU utilization since this function is performed by the DASD controller IOP. Compression is a method to increase disk storage beyond capacity limits, while maintaining access and reasonable performance levels.

- Hierarchical Storage Management (HSM) APIs used by Backup and Recovery Media Services (BRMS) (5769-BR1) to provide HSM functions. These APIs can also be used to develop custom HSM applications.
- Internet PTFs: AS/400 customers can download PTFs over the Internet. The client hardware needed is a PC with Windows 95 or Windows NT, a TCP connection to the AS/400 system over a LAN, and access to the Internet. The functionality is the same as the Electronic Customer Support (ECS) method of transport. The user selects the PTFs and options using a Web browser and submits the order. The user can search on PTF cover letters and read them before the order is even placed.

1.8.1.5 Server availability: Over 99% and climbing

The AS/400e server boasts a 99.94% availability rating, second best in the industry behind the IBM S/390, 43 times more available than Windows NT, and 4.5 times more available than UNIX (from the Gartner Group, September 1998).

Various functions are available to help maintain this high-level availability of an AS/400 system. These include:

- All AS/400 systems support an optional Uninterruptable Power Supply (UPS) to maintain power to the AS/400 system during a site power loss.
- Disk mirroring for the entire system or one individual auxiliary storage pool.
- Journaling provides the capability to record all changes to records in a file as they occur. These journaled changes are applied to the file if the system is lost.
- Commitment Control ensures that if a transaction requires multiple database changes, all of them (or none of them) are made.
- Auxiliary storage pools (ASPs) isolates objects to assist in their recovery.
- Save While Active function allows continued use of applications while objects are backed up. This reduces the time the objects are unavailable and the time to save.
- Concurrent maintenance of I/O cards, power, and other components reduces down time due to the failure of components in the system.
- RAID-5 disk protection with the use of a disk controller and at least four disks to make up an array.

1.8.1.6 Database support

The integrated database, DB2 for OS/400, provides stability and compatibility of previous releases of the AS/400 database with a standards-based technology required for a heterogeneous computing environment. DB2 for OS/400 provides compliance in the area of standards compliance coupled with advanced function, distributed capabilities, and performance.

These and more functions are further described in the *AS/400e System Handbook,* GA19-5486.

Other functions available for the operating system include:

- **Client Access Express for Windows (5769-XEI)**: Includes the client software needed to connect Windows 95 and 98 and Windows NT workstations to an AS/400e system.
- **AS/400 Operations Navigator** (part of OS/400): Provides a graphical interface to systems administration functions. It is designed to be highly integrated with Windows. Windows NT Server (Version 4.0) is packaged, priced, and supported by Microsoft and must be purchased through a Microsoft dealer.

Refer to the online version of *AS/400e System Handbook*, GA19-5486, for further descriptions of OS/400, its features, and functions. A softcopy update of the Handbook is kept online at: `http://www.redbooks.ibm.com`

1.8.2 IBM HTTP Server for AS/400 (5769-DG1))

IBM HTTP Server is the follow on to the IBM Internet Connection Server (ICS). It is a scalable, high-performance, Web server that is available since OS/400 V4R3 and other IBM and non-IBM platforms.

IBM HTTP Server is a complete Web server product with advanced security and application development features. With IBM HTTP Server for AS/400, you have everything you need to quickly and easily establish a Web presence and start on your road to working the Web for business.

You can find more information on the IBM HTTP server in Chapter 5, “HTTP Server for AS/400” on page 89, or see the Web site at:
`http://www.as400.ibm.com/products/`

1.8.3 IBM AS/400 Developer Kit for Java (5769-SS1, 5769-JV1)

The AS/400 Developer Kit for Java is optimized for use in an AS/400e server environment. It uses the compatibility of Java programming and user interfaces, so you can develop your own applications for the AS/400e system.

The AS/400 Developer Kit for Java allows you to create and run Java programs on the AS/400e system. The AS/400 Developer Kit for Java is a compatible implementation of the Sun Microsystems, Inc. Java Technology. Unique aspects of the AS/400 Developer Kit for Java design include:

- The integration of critical Java Virtual Machine components below the Technology Independent Machine Interface (TIMI)
- A Java transformer for the conversion of Java bytecodes to RISC machine instructions
- Advanced, scalable implementations of garbage collection, object allocation, and synchronization
- The Remote Abstract Window Toolkit implementation that supports the java.awt APIs

The AS/400 Developer Kit for Java is not an Integrated Language Environment (ILE) language. It introduces a new language environment on the AS/400e system that is built on Java, American National Standard Code for Information Interchange (ASCII), integrated file system, and other industry standards.

The AS/400 Developer Kit for Java supports the common JDK tools, such as `javac`, `javadoc`, and `jar`. There are also CL commands and Operations Navigator interfaces to the AS/400 Developer Kit for Java.

1.8.3.1 Supported Java Versions on AS/400

For V4R4 (and V4R5 equally), the following Java versions are supported:

- Java 1.1.6
- Java 1.1.7
- Java 1.1.8
- Java 1.2

We recommend that you use either Version 1.1.8 or 1.2. However, if you are encountering problems with either Version 1.1.6 or 1.1.7, consider upgrading to Version 1.1.8.

Java 1.3 will be available for V4R5 in July of 2000. It is expected to be available for V4R4 around the same time.

1.8.4 AS/400 Toolbox for Java, 5769-SS1, 5769-JC1

The AS/400 Toolbox for Java is a set of Java classes delivered as a Java package. The classes can be used by Java applets and applications to easily access AS/400e data and resources and require no additional support over

the inherent OS/400 support of Java Virtual Machine and the AS/400 Developer Kit for Java.

The Toolbox for Java provides support for similar functions to those provided by Client Access APIs. It uses the OS/400 host servers (part of OS/400) to access the AS/400e data and resources. Each of these servers run in a separate job on the AS/400e system, communicating with a Java client program using architected data streams on a socket connection. The socket interfaces are hidden from the Java programmer by the Toolbox classes. JavaBeans are provided for most public interfaces. They provide access to these AS/400e resources:

- Database using a JDBC driver.
- Database using record-level file access with the interface of the classes.
- Integrated File System.
- Programs: Any AS/400e program can be called, parameters can be passed to the AS/400e program, and data can be returned to the Java program.
- Commands: Any AS/400e batch command that is not interactive can be run.
- Data queues: Access to both keyed and sequential data queues.
- Print: Using the print classes lists of spooled files, output queues printers, and other print resources can be retrieved.
- User spaces: Create, read from, write to, and delete AS/400e user spaces.
- Digital certificates: Manage digital certificates stored on the AS/400e system.
- Jobs: List active jobs on the AS/400e system and retrieve information about those jobs, including the messages in the job log of a job.
- Message queues: List, delete, and answer messages in a message queue. The ability to send messages is also provided.
- Users: List users on the AS/400e system and retrieve information about those users.

Additional classes provide the infrastructure needed to manage signon information, create and maintain sockets connections to the AS/400e services, and send and receive data. Data description classes for numeric and character data are provided to allow the Java program to describe the record format of a buffer of data with an object.

The Toolbox provides a set of Graphical Access classes. These classes use the access classes described above to retrieve data and then present the data to the user. The classes use Java's Swing 1.1 framework. Graphical APIs are available to access various AS/400e resources, such as the database, integrated file system, command call, and data queues. The AS/400e data is then displayed in various pane formats.

Enhancements at V4R4

The enhancements available to AS/400 Toolbox for Java at OS/400 V4R4 include:

- Access to additional AS/400 resources, such as information about users and jobs running on the AS/400e system, message files, data areas, system values, authority (both low-level and GUI classes), information about jobs and users on the AS/400e system, and system status.
- Improved security to support Secure Sockets Layer (SSL) specification. Data flowing between the workstation and an AS/400e system running V4R4 can run across an SSL connection providing data encryption and server authentication.
- Performance improvements for downloads, as the result of a smaller Java Toolbox file.
- Improved application development to include a user interface framework to provide a productive development environment to build graphical panels. The developer creates one or more data beans and binds them to the panel components. A user interface framework creates a platform and technology-independent representation of graphical panels.
- A GUI builder tool, a WYSIWYG GUI editor to develop Java GUIs
- When a Java program using the toolbox runs on a workstation, the toolbox can connect to V4R2, V4R3, and V4R4 versions of OS/400e.

1.8.5 WebSphere Application Server for AS/400

WebSphere Application Server is IBM’s premier Web application server product that runs on various IBM server platforms including the AS/400e system. WebSphere Application Server builds dynamic Web applications when using WebSphere Studio Pack, which is a set of the most popular state-of-the-art development tools. It includes these functions:

- Middleware for Web enablement
- Java servlet run-time environment
- Connectors for common backend databases
- Industry-standard object-request brokers
- Compatible with HTTP Server for AS/400

There are three versions of WebSphere Application Server: the Standard Edition, Advanced Edition, and Enterprise Edition. The Standard Edition of WebSphere is shipped with OS/400 and is a no-cost, separately installable program that supports the creation of servlets and JavaServer Pages (JSP). The Advanced Edition of WebSphere was announced for the AS/400e system on 08 February 2000 and for general availability on 25 February 2000. This product supports all the capabilities of the Standard Edition, plus additional capability including support for Enterprise JavaBeans (EJB). This product is priced per AS/400e CPU.

Finally, the Enterprise Edition of WebSphere is *not* supported on the AS/400 system because the AS/400e system customers don't require support for Component Broker or TX Series, which are based on S/390 technology. The AS/400e system customers running WebSphere (Standard or Advanced Edition) can interoperate with the Enterprise Edition of WebSphere.

The AS/400e system supports Version 2.02 of the Standard Edition of WebSphere and Version 3.02 of the Advanced Edition. As of April 2000, the AS/400e system also supports Standard Edition 3.02.

Additional WebSphere information is found on the Web at:
`http://www.as400.ibm.com/tstudio/websphere/docs/doc.htm`

1.8.6 Lotus Domino for AS/400e

Lotus Domino is the world's leading workflow, messaging, groupware, and Web software. Lotus Domino enables you to communicate with colleagues, collaborate in teams, and coordinate strategic business processes on and off the Web.

Powerful, flexible communications
Lotus Domino gives you the power you need to communicate within and beyond your organization. If you need to communicate with suppliers, customers, and partners at other companies that use different e-mail systems, or reach them using the Internet, Lotus Domino makes it easy. Mobile Notes users can take their desktop along with them, transforming airports, hotels, and cars into work spaces complete with up-to-the-minute information. The Lotus Domino family also includes sophisticated client server e-mail, based on the market leading cc:Mail user interface. Lotus Domino applications can be accessed from any Web browser that extends the openness and flexibility of your network.

World-class collaboration and coordination
Lotus Domino goes beyond traditional e-mail and groupware. With Lotus Domino, you can collaborate with team members using a local area network, wide area network, or the Internet. With the unique ability of Lotus Domino to integrate structured and unstructured information into coherent databases, you can organize and coordinate the most complex business processes.

Rapid application development
Lotus Domino allows you to create custom business applications that coordinate everyday business processes from start to finish to achieve results such as improved customer service, improved sales force productivity, and faster time-to-market for products. Lotus Domino customers consistently find significant payback on their Lotus Notes investment, regardless of whether they enable their Lotus Domino applications for the Web. According to the IDC study entitled *Lotus Notes Agent of Change: The Financial Impact of Lotus Notes on Business* (`http://www.idc.com`), Lotus Notes users achieve an average of 179% annual return on their investment.

Portability and interoperability
Lotus Domino is a server product that runs on a variety of platforms and provides easy-to-manage interoperability in a heterogeneous network. With the sophisticated replication capability of Domino, applications are easily distributed to multiple Domino servers in your enterprise, and just as easily deployed to end users. Replication also simplifies the job of deploying application changes. Lotus Domino applications are also available to any Notes client (such as Windows 95, Windows 3.1, OS/2, Windows NT, and Macintosh). Lotus Domino Version 4.5 and later releases are fully Internet-ready. You can access Lotus Domino server functions from either a Lotus Notes client on your workstation or a browser (including a browser on a Network Station).

1.8.6.1 Domino for AS/400
Domino for AS/400 is the Lotus Domino server product running on a 64-bit AS/400e RISC processor. It requires OS/400 V4R2 or later. Domino for AS/400 provides all the functionality of the Lotus Domino server that runs on other platforms and more.

Domino for AS/400 is an application that is packaged, distributed, and supported by Lotus Development Corporation. You may purchase Domino for AS/400 from a Lotus distributor, just like you buy the Domino server product for any other platform. Beginning 20 August 1999, you may also purchase the Lotus Domino Enterprise Server for AS/400 (5769-LNT) as a licensed program from IBM. At the same time, the Lotus Enterprise Integrator

(5769-LNP), which was formerly called NotesPump, was also made available as a licensed program for purchase from IBM. The AS/400e system continues to be purchased through IBM AS/400 channels.

With V4R4, the OV/400 Migration to Domino for AS/400 licensed program allows the migration of users, groups, mail, calendars, and folders to Domino from OV/400. The Lotus Calendar Connector for OfficeVision (LCCOV) allows free-time search and the distribution of meeting notices between Domino and OfficeVision/400.

Unmatched scalability

Within a single architecture, the AS/400e system spans a vast performance spectrum. The smallest Domino for AS/400e server may have less than a dozen users. The largest AS/400e system is capable of accommodating more than 10,000 mail users on a single footprint.

World-class reliability and availability

With more than 700,000 systems shipped to over 150 countries worldwide, the AS/400 system has earned a reputation as a reliable, undemanding workhorse. AS/400 users expect their system to be consistently available, night and day, and the AS/400 system does not disappoint. Domino for AS/400 takes advantage of the reliability and availability features of the AS/400 system, such as RAID-5, mirrored disk units, and integrated backup capability. Each Lotus Domino server runs as an OS/400 application in its own subsystem. The unique architecture of OS/400 makes it safe to run your Lotus Domino server and your mission-critical business applications on the same AS/400 system.

Powerful integration

Domino for AS/400 includes integration between Lotus Domino databases and DB2/400 databases. Both real-time and scheduled integration of databases are available to meet a variety of application needs.

Automatic synchronization between the Domino Public Address Book and the AS/400 System Distribution Directory provides a powerful, integrated mail server for organizations with multiple e-mail products, including OfficeVision/400, POP3, JustMail, and Internet mail.

The Lotus Enterprise Integrator option to synchronize authorizations between DB2/400 databases and Domino databases is platform exclusive.

Proven security
Integrated, flexible security is a long-standing strength of both Domino and the AS/400e system. The AS/400e system maintains a high reputation for security.

1.8.7 Other IBM products

In addition to the operating system, licensed program solutions are available to take the AS/400e system beyond base requirements. The products discussed in this chapter represent those that are most beneficial to an e-business environment. Further products are offered, but not covered within this e-business handbook. Contact your IBM marketing representative for further information, or refer to the *AS/400e System Handbook*, GA19-5486.

1.8.7.1 IBM Payment Server for AS/400 V1.2, 5733-PY1

The IBM Payment end-to-end suite of products helps enable more-secure commerce over the Internet. Payment products are designed to implement the SET Secure Electronic Transaction Version 1.0 protocol.

The IBM Payment Server for AS/400, Version 1.2 program, is the product within the suite providing the merchant's electronic cash register for Internet purchases. It provides functions similar to the physical cash register in traditional stores. It calculates and stores payment information, including split payments, and interfaces with financial institutions to get payment authorizations, refunds, deposits, and other credit card payment functions.

Payment Server communicates with consumers who may have a SET approved wallet. Transactions from an Internet consumer using a SET electronic wallet flow directly to the merchant's electronic cash register. Transactions without a SET wallet are managed by the merchant or merchant software. IBM Payment Server passes the information along to financial institutions for approval, and maintains records of all transactions. It also provides batch processing that can be customized, which completes the transaction life cycle for the payment transactions. Payment Server supports merchant initiated authorization (MIA) and merchant originated payment (MOP) to enable purchases without a SET-compliant wallet.

The strength and flexibility of the Payment Server program is complemented with the level of security with which the transactions are conducted. The product architecture, which is designed to accept emerging payment modules representing additional payment systems, also offers strength and flexibility in the Payment Server program. The Payment Server program implementation includes the SET protocol that can provide enhanced security for these systems.

The SET protocol created and maintained by MasterCard and Visa, with help from IBM and others, defines the actions and security of the card holder, the merchant, and the acquirer when functioning across the Internet.

For additional information about IBM Payment Server for AS/400, refer to the Web site: `http://www-4.ibm.com/software/webservers/commerce/payment/`

1.8.7.2 NetQuestion

NetQuestion is a powerful, full-text search engine that builds a global Internet or centralized intranet search service. It can handle large amounts of information that are typically stored on Web sites. Documents to be indexed by NetQuestion need to be provided in either plain text or text with HTML markup. CGI scripts and HTML forms are provided for search and administration. Administration can also be done by using command-line functions.

For all single-byte character languages, NetQuestion features:

- Boolean queries for phrase and proximity searches as well as for front-, middle-, and end-masking using wildcards
- Precise term searches optimized for Web applications in both Internet and intranet environments
- High-speed performance for indexing and retrieval where one precise index is built
- An optimized and reduced index to about 35% to 40% of the document size
- Sophisticated lexical affinity-based ranking for free-text and hybrid queries
- Advanced relevance ranking
- Detection of misspellings in documents and expansion of the search request accordingly

1.8.8 Third-party products

IBM recognizes the benefits and need of supplementing AS/400e e-business solutions with non-IBM software. As the AS/400e system remains the leading application development system in the world (with over 700,000 installations worldwide), many of these systems are installed in our business partner locations. Truly, the AS/400e system is what it is today because of the relationship with our third-party solution providers.

The AS/400e server is flourishing with a multitude of software offerings. As the interest, growth, and value of e-business have increased, the offerings from our business partners have also increased.

It is beyond the scope of this handbook to describe all of the options available, and is too exhaustive to “simply” list all of the offerings. We therefore, chose to highlight some of the offerings available, with a strong reminder to you that the solutions represented, are just a few of the total available.

Refer to Appendix C, “Third-party products” on page 233, for a description of a sampling of non-IBM solutions.

1.9 Testimonials and quotes

Testimonials and quotes give a practical view of how technologies can be implemented. The objective of those described in this section is to profile some typical implementations by AS/400 customers who have benefitted from the tools and technologies in this redbook. Several chapters in this redbook also have their own product specific references.

1.9.1 Case study 1: J. Leleux & Cie S.A. (Belgium)

“The Internet has enabled us to survive and prosper in a highly competitive market. We could not have taken advantage of these new technologies without IBM.” *Olivier Leleux, Director, J. Leleux & Cie S.A.*

In Belgium, the privilege of buying and selling stock on the Brussels Stock Exchange has always been reserved for licensed stockbrokers.

However, in the last five years, legislation has changed to allow banks and other financial institutions to trade on the market. Consequently, independent stockbrokers have lost their biggest customers. What’s more, they have watched their biggest customers become their fiercest competitors by offering investors lower brokerage fees with the convenience of banking and investing through the same institution.

To stay competitive, J. Leleux & Cie S.A., one of the last surviving independent investment firms in Belgium, has refocused its business from buying and selling stocks to portfolio management and financial consulting. The 70-year-old, $5 million company already had a loyal customer base of 5,000 customers. Even so, J. Leleux knew that it needed to reach a wider audience and offer more convenient services at a competitive cost. It viewed the Internet as a powerful means of achieving this goal.

Although J. Leleux already had a Web site, it offered only static pages of financial analyses and other reference information. With the help of IBM, J. Leleux developed and launched the first online brokerage service in Belgium, JLC OnLine (`http://www.leleux.be`). This service allows investors to view real-time stock performance information and submit orders to buy or sell stock on the Brussels Stock Exchange.

“With JLC OnLine, we're adding about 20 new clients every day,” says Olivier Leleux, director of the company and grandson of the founder. “Considering that it's taken us nearly 12 years to build up a base of 5,000 clients, attracting 500 new clients a month, an increase of 10 percent, is very significant growth.”

1.9.1.1 Leveraging investment in hardware and software

Leleux says that even though his competition would also like to offer online brokerage, many have neither the hardware that can scale up to meet the demands of such an application, nor the finances to abandon their existing systems and start from scratch. J. Leleux overcame these obstacles by leveraging its existing IBM hardware and software.

Leleux explains, “Because our brokers were already doing real-time transactions with the Brussels Exchange on our IBM AS/400e server, we simply needed to provide an Internet window to our existing platform. In addition, by using Lotus Domino for AS/400, we were able to build JLC OnLine as a Web shell right on top of our existing site. This allowed us to develop the online service in just three months and saved us about $10,000, which is the cost of building a whole new site.”

Financial developments, corporate background, and stock analyses are stored in an IBM DB2 database on an IBM AS/400e Model 620 system, which is linked to the Brussels Stock Exchange. Lotus Domino was used to establish direct e-mail links to the company's stockbrokers. Domino also runs on an IBM AS/400e Model 170 server and makes it easy for the company to update its Web site. IBM MQSeries is used to enable the AS/400 database to communicate with the Domino Web server. A third AS/400e server, a model 600, runs IBM eNetwork Firewall to protect the company's data assets from unauthorized users.

1.9.1.2 Internet transactions 100 percent accurate, efficient, secure

According to Leleux, JLC OnLine virtually eliminates the transaction errors that can occur when orders are communicated verbally. In fact, of the 3,000 orders that have been processed through the Internet so far, the company has not made a single error.

“Greater accuracy gives our brokers more time to provide financial counseling. This personal service is a definite competitive advantage over the large banks,” says Leleux.

Despite these advantages, secure transmission of data was a concern. Many of the transactions investors perform on JLC OnLine involve information that, for obvious reasons, must remain private. As 128-bit encryption technology cannot legally be exported from the U.S. for security reasons, IBM Denmark has developed software that provides equivalent protection. As an extra level of security, clients are issued a password so that e-mail messages can be authenticated.

Having successfully addressed all these issues, J. Leleux & Cie S.A. feels it is ready to take on the global market and is looking forward to adding to JLC OnLine real-time quote information from the Paris Stock Exchange and other major stock exchanges. “The Internet has enabled us to survive and prosper in a highly competitive market,” Leleux concludes. “We could not have taken advantage of these new technologies without IBM.”

This testimonial delivers the following key messages:

- e-business is real, secure, effective and could be seen as a necessity to survive in extremely competitive and changing markets.
- e-business is not an opportunity only for large companies.
- e-business benefits from the AS/400 system’s strengths.
- e-business gives value.
- IBM delivers on e-business with leading servers and software.
- The integrated architecture of the AS/400e server is key for security, scalability, and investment protection.

1.9.2 Case study 2: Massachusetts Institute of Technology (USA)

The Massachusetts Institute of Technology (MIT) is one of the world's outstanding universities. Education and research, with relevance to the practical world as a guiding principle, continue to be its primary purpose. MIT is independent, coeducational, and privately endowed. It is organized into five schools that contain twenty-one academic departments, as well as many interdepartmental programs, laboratories, and centers whose work extends beyond traditional departmental boundaries.

MIT is one of the leading research universities in the United States. Between 1997 and 1998, approximately 2,700 researchers worked with faculty and students on projects funded by government, foundations, and industry. MIT

employs 2,415 research assistants and 698 teaching assistants. A recent study concluded that university inventions add more than $20 billion and 150,000 jobs to the US economy every year. MIT routinely leads all U.S. universities in patents granted, and last year, it signed 99 license agreements with private companies.

MIT wanted to develop an e-commerce portal site to give students and customers Internet access to MIT's public materials. The University also wanted to include a feature that would allow specified audiences to view non-public materials.

Using the IBM Application Framework for e-business methodology, MIT created an e-commerce portal. The site provides students and customers with a simple, quick way to access public MIT materials. The core application includes a repository of searchable research documents. A messaging system alerts registered users when a document in their interest area has been posted to the site. The site also includes a private section that can only be accessed by select users via a registration page. Data on the select users is stored and analyzed in a database. For the solution pilot, MIT gave students Web access to their registration and billing records so they could review their bills and schedules for accuracy.

The site is housed on an AS/400 Model 170 server running the OS/400 operating system. WebSphere Studio, IBM's team-enabled Web project workbench environment, was used to develop the Web pages. WebSphere Application Server is used for the site's transactional functions and connects to the database that houses the documents. Lotus Domino is used to run the site's messaging and registration systems and was customized using Lotus Domino Designer. The Domino server runs on a Windows NT platform and enables students and alumni to send e-mail from their Web browser.

IBM partnered with MIT to implement the solution, and as part of the package, included instructional classes to help the customer use the products and create the solution.

The solution benefits have not been quantified, but MIT can now offer expanded information access to its customers and students. The customer anticipates significant service and maintenance cost savings from the solution, while providing services to a wider audience.

This example delivers the following messages:

- The IBM e-business vision of the e-business Applications Framework and that it works on the AS/400 system.

- The cross-platform solution works with an “open” architecture
- The AS/400 system is a platform choice for developing a Web site

The IDC white paper *Total Cost of Ownership (TCO)* analyzes the IBM AS/400 Dedicated Server for Domino versus PC Servers and shows that the AS/400e for Domino TCO was 51% lower than PC servers. This white paper is available on the Web at: `http://www.idc.com`

The following example shows us the synergy between Net.Commerce and the AS/400e system.

1.9.3 Case study 3: ICON Health and Fitness

ICON Health and Fitness wanted to enhance its business by creating a fully functional e-commerce site to make its operations more efficient. More specifically, ICON wanted to develop and implement a site where customers could order products, accessories and parts; check and track the status of present orders; and contact customer service with questions or comments. Security was a major concern for ICON since the primary method of payment would be through their credit card. In addition, ICON desired a solution that was not only competitively priced, but also one that would complement its existing technology.

ICON chose to work with the IBM business partner, Assist Cornerstone International, because it was able to provide the most efficient and cost-effective solution that would run on ICON's already established AS/400e environment. The ICON solution was made possible by enabling software such as IBM Internet Secure Server, IBM Firewall, and Net.Commerce.

The first phase of the solution was comprised of implementing the Internet Secure Server (HTTP Server for AS/400) and the Firewall. It is underway. At this stage in the solution, ICON has been taking orders (since 09 May 1998) for fitness equipment through a static Web site. However, this site only allows customers to place orders through an online customer service form. Once the second stage of development is complete (for example, implementing Net.Commerce), customers will be able to access all of the fitness Web sites that ICON represents, peruse the online catalogs, and order and purchase hundreds of fitness and outdoor products and parts. In addition, users of the site can track the status and location of present orders and review the history of orders made over the past several months. Once Net.Commerce is up and running, the customer service area of the sites will remain to provide users with an alternative avenue through which they can voice their questions and comments.

ICON plans to continually develop the site, making it more dynamic, to give customers incentive to return. Plans for future additions include up-to-date price changes, fitness/health tips and advice, and a Q&A section.

AS/400 details

ICON is currently running Net.Commerce on the AS400e server, model 9406-S20. The customer also has AS400e system models 9406-640 and 9406-620 installed.

Applications that run on the AS/400e system include: Acacia for Manufacturing software, Assist for Financial software, and various other third-party packages. There are 500 users.

ICON has a topology that uses both Token-Ring and Ethernet.

Teaming up with IBM, ICON has been thoroughly pleased with the results from the initial static ordering site. In fact, since the site's inception in May of 1998, ICON has seen an increase in sales with one order being made per 250 hits. This is particularly impressive since ICON has not yet launched an official advertising campaign. Once the application is up and running and a proper advertising campaign is in effect, all of the previously mentioned sites promise to boost revenue and sales at ICON and the other companies that ICON represents. As the site improves over the next few months, ICON is excited at the prospect of adding more buyers to its already large customer base.

This customer testimonial reminds us of these key elements:

- AS/400 Business Partners play an important role and deliver valuable solutions.
- Net.Commerce on the AS/400e server can be quickly deployed.
- The line-of-business applications running on the existing AS/400e server can be “Web-enabled”.
- e-business is a moving environment that needs a flexible platform for deployment and development.

Part 2. A practical guide for building e-business sites

Part 2, which is written primarily for technical people, covers the major technology components and standards of the e-business world, detailed products descriptions, and implementation road maps. It consists of the following chapters:

Chapter 2. Building e-business sites: Phased approach

There is no written rule that you have to follow certain steps to develop an e-business site and add functionality to it. However, there is a common or typical pattern in growing an e-business Web site. The pattern is a change, not just in terms of size, but in terms of functionality. In other words, an e-business site evolves through phases:

- Phase 1: Web presence
- Phase 2: Dynamic site
- Phase 3: Transactional site

This development model is not fixed. Usually customers move through the Web presence phase quickly. Earlier in the e-business wave, having a Web presence meant being “online” on the Internet. Today this is not nearly enough. Most companies skip right past Web presence. For example, you can start into e-business by building a transaction site, such as an online shopping store, and then moving on to a dynamic site.

At any rate, the phased approach is a methodology we adopted in writing this book. It is the same phase used in many other documents, whether hardcopy or online. It is our belief that you will see this pattern in most companies.

Figure 9 provides a high-level overview of the three phases, including the typical functionality for each phase.

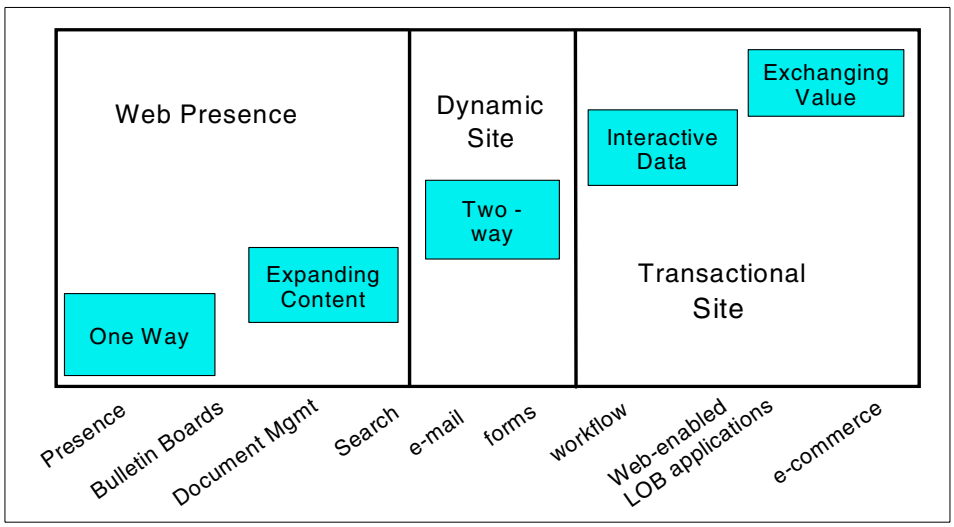

Figure 9. Overview of the e-business evolution phases

2.1 The e-business evolution phases: Description

This section describes each phase of the e-business evolution in more detail. To understand the difference between the different phases in more practical terms, we use the imaginary company of *ITSO-Rochester Investment Firm* for an example. We also include some tips on why the AS/400e system should be considered as the first choice in each stage, and overall.

2.1.1 Phase 1: Web presence

As the Web continually grows and quickly becomes a place where companies must have presence to survive in today's competitive world, your Web site gains importance as a company information resource.

The first step, or phase, is Web presence. This involves presenting marketing, product, and company information on a relatively static HTML home page or Web site.

A Web presence is an easy and low-cost way to distribute information about your business. Establish a Web presence and millions of people around the world are your potential audience. In addition, the Internet offers:

- **Speed**: Instantly deliver information anywhere in the world.
- **Availability**: The Web is open for business 24 hours a day, 7 days a week.
- **Scope**: Send and receive information to and from anyone, anywhere, and anytime so long as a connection exists.

The AS/400e system is necessary for establishing a Web presence because of its history of minimal downtime and powerful Web serving capacity. Also, all of the software necessary to publish a Web presence is packaged with the AS/400e operating system (OS/400) at the time of purchase.

As the Internet has evolved and forces shape individual businesses, information access requirements also evolve. When this happens, Web presence typically moves toward providing dynamic data.

An example: ITSO Rochester Investment Firm
An investment firm publishes brochures, contact information, services offered, and other marketing related information. Without the Internet, the customer interacts with the company using the telephone or meetings. Account information is mailed or accessed by a telephony application and trades are done by telephone.

2.1.2 Phase 2: Dynamic site

Dynamic data sites contain user-defined information that is extracted from business systems, as per the users request. The user, however, does not add, delete, or edit the business data. Nor does the user complete a transaction. Customers are satisfied with this improved method to access data that traditionally was provided by call centers or 1-800 telephony applications. These solutions are often seen in business-to-business applications and consumer self-service Web sites.

An example: ITSO Rochester Investment Firm
The firm can start to offer account information on a Web site where customers can login and view the current balance based on that particular day's trading. Customers still place orders by phone.

2.1.3 Phase 3: Transactional site

The final phase in this e-business process is to have a transactional site. A transactional site allows users to add, delete, or edit data on business systems and to complete transactions. This is known as *e-commerce*. This type of site is growing very quickly for business-to-business and business-to-consumer solutions as the demand for online commerce by businesses and consumers increases.

An example: ITSO Rochester Investment Firm
The firm sets up an application to allow customers to trade various financial instruments through their firm. This can replace placing orders by telephone.

2.2 The e-business evolution phases: Technology view

Figure 10 on page 52 illustrates a high-level view of the technology presented at each of the three phases of e-business.

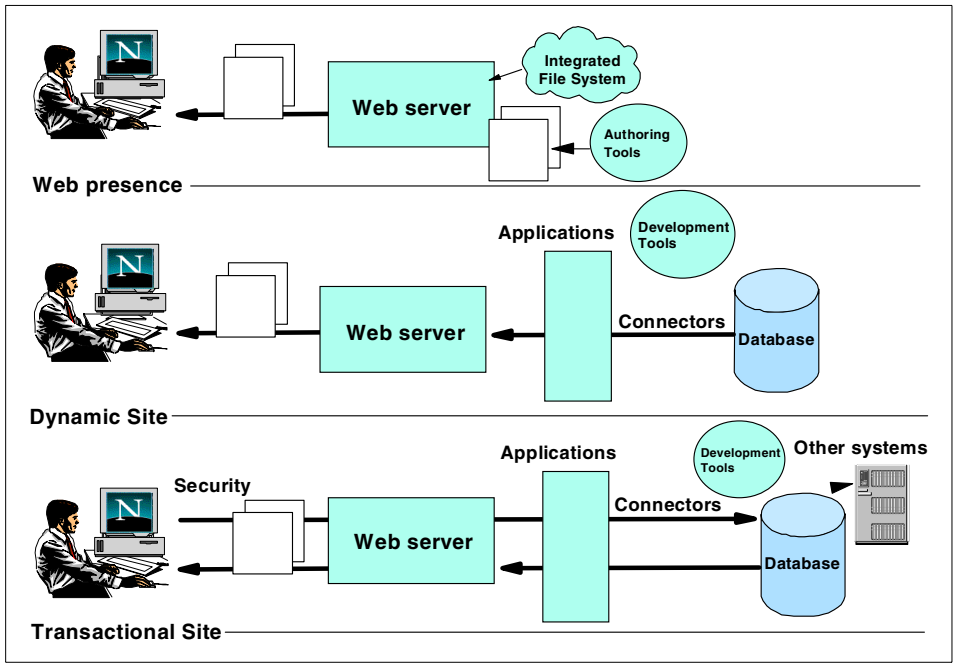

Figure 10. Technology overview of the phases of e-business adoption

Figure 10 is further explained here:

- **Web presence**: Users interact only with Web server and information presented is static. Technically this requires the lowest level of security and no integration with host systems. Any information published is developed and deployed manually.
- **Dynamic site:** Users interact with databases, and the Web server and are able to select and determine the information presented to them. This solution requires greater security, especially in communications, usually encryption or digital certificates. The business must now manage access to host data and the application through which the customer accesses it.
- **Transactional site:** Users interact with host business applications and processes to add, delete, or update information and to complete transactions (buying and selling). Security requirements are highest with communication and transaction security required (SET and so on). Transactions now occur, and the business needs to manage a variety of systems management and integration issues.

2.3 The e-business evolution phases: Business view

This section portrays the business view of the e-business phase for each technology component described in this redbook.

2.3.1 Web presence

The first phase, Web presence, involves your company publishing static Web pages onto the World Wide Web. As a result, your company has a Web site and a presence. Figure 11 shows how a business can use the Web presence technology.

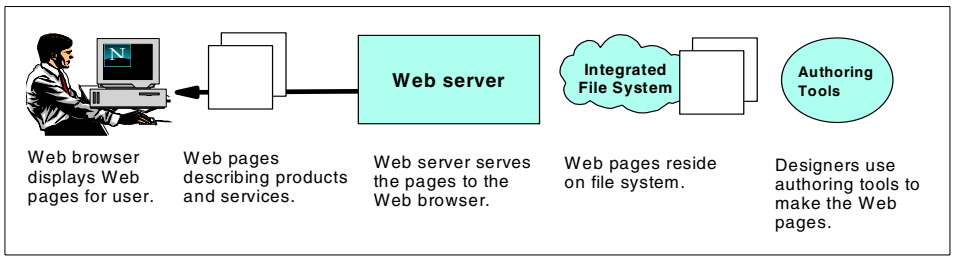

Figure 11. Business view of the Web presence phase of e-business adoption

2.3.2 Dynamic site

The second phase, dynamic site, turns the static information on your site into dynamic information. The Web server retrieves information from databases to display on a client machine. Figure 12 shows how a business can use the dynamic site technology.

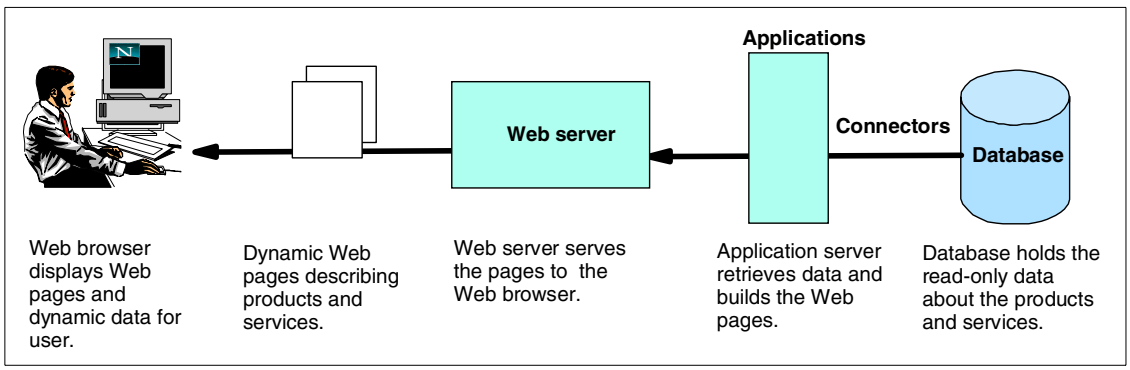

Figure 12. Business view of the dynamic site phase of e-business adoption

2.3.3 Transactional site

The third phase, transactional site, allows people to interact with the information presented on the Web pages. Therefore, data on your inhouse system is changed to reflect their interaction. Figure 13 shows how a business can use the transactional site technology.

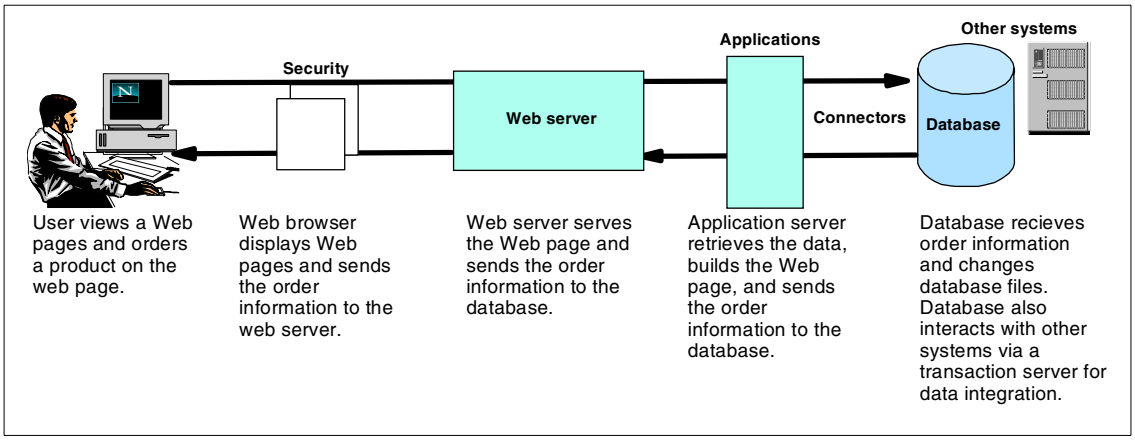

Figure 13. Business overview of the transactional site phase of e-business adoption

2.4 The e-business evolution phases: Products view

The three views shown in this section combine the technology with the IBM products that support it. The remainder of this redbook reviews the various technologies highlighted here.

2.4.1 Web presence

The Web presence stage is perhaps the simplest in regard to products. To establish a presence on the Web, your company needs a Web server that can retrieve files from an integrated file system. Your users have the client software, a Web browser, to view the pages you place on the Web server. Figure 14 shows which products support the Web presence technology.

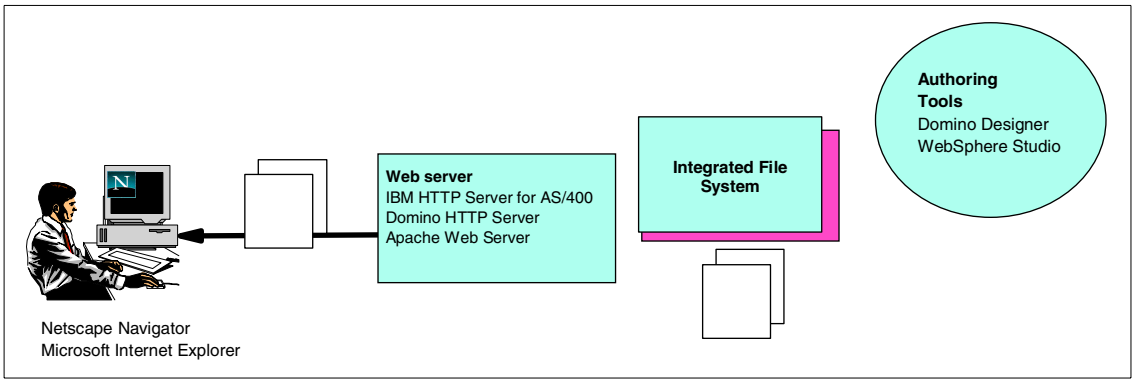

Figure 14. Product view of the Web presence phase of e-business adoption

At its simplest, a Web site serves static Web pages. “Static” does not imply that the information on the Web site is unchanging. You must constantly refresh your Web content to keep your visitors coming back. Rather, “static” means that the content of what the visitor sees is not changed by user interaction. It's like reading a newspaper. The page that you see is the same as the page that you see a few minutes later. But tomorrow, brand new newspaper pages are available.

In simple terms, the role of the HTTP server is to receive requests from browsers for Web pages, locate the pages, and send them to the requesters. The browser communicates with the HTTP server using URLs that contain the location of the pages that the user wants. To process that URL, the HTTP server uses a set of directives that the site administrator has created. The directives may have some mapping to tie a URL to the real directory where the page is located (to isolate your Web site design and the user from your underlying storage structure). The directives may also have protection information that requires user ID and password for certain information sensitive Web pages.

2.4.2 Dynamic site

The nature of a dynamic site is that it changes. Over time, organizations have seen the benefit of interacting with browser users by sending and receiving data. These interactions range from the simplest transaction, such as collecting the name and address of a browser user who wants to receive a catalog, to displaying order status and actually processing orders. In general, these interactions start with a form: a Web page that contains input-capable fields and push buttons (like function keys). The information that a user views through their Web server changes based on the information that lies in the

database. Figure 15 shows which products support a dynamic site technology.

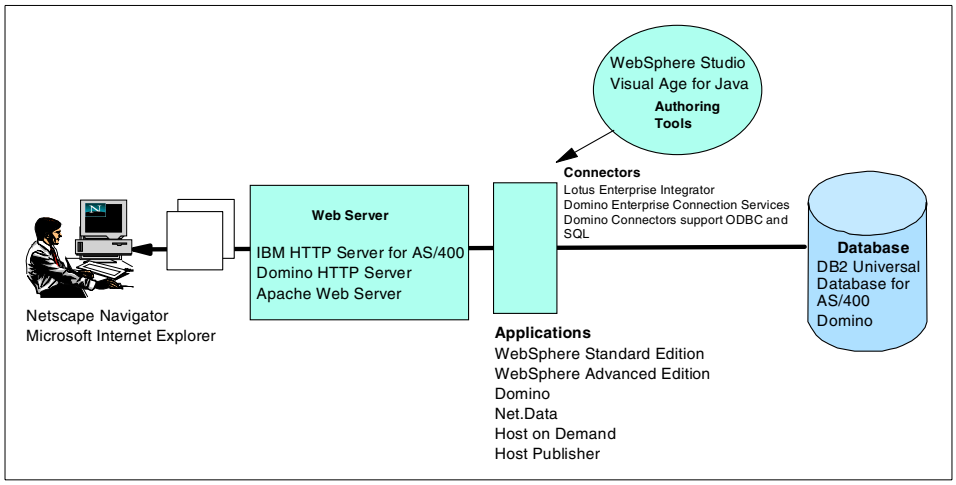

Figure 15. Product view of the dynamic site phase of e-business adoption

2.4.3 Transactional site

With a transactional site, the user can interact with information, for example, ordering a product or filling out a form. Applications and connectors ensure that database information reflect these changes and the user sees the correct information over the Web browser. Figure 16 shows the products that support a transactional site technology.

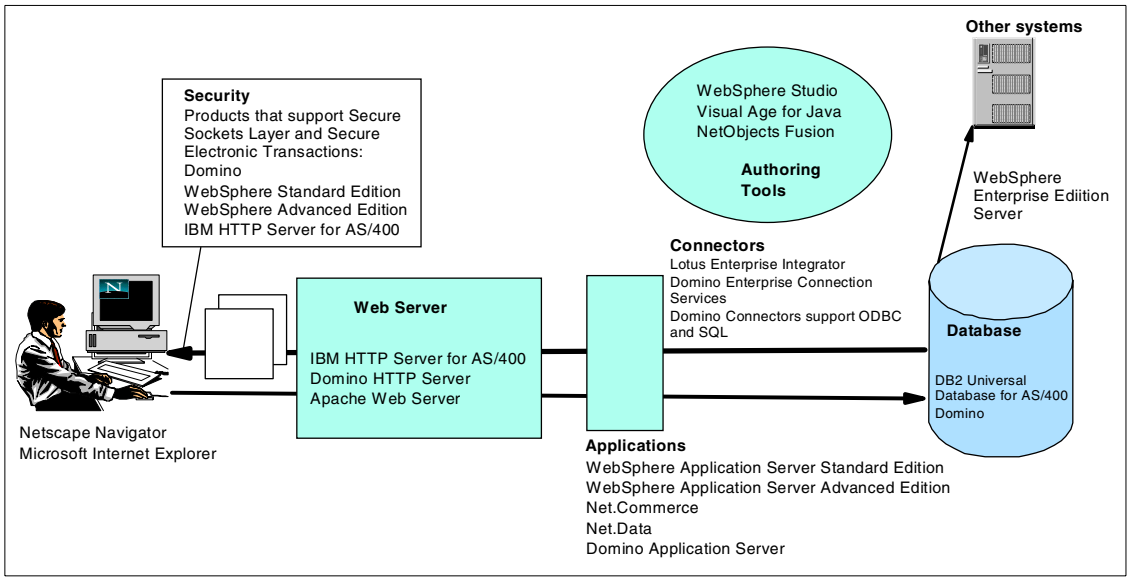

Figure 16. Product overview of the transactional site phase of e-business adoption

IBM provides numerous e-business products for AS/400 customers to build, run, leverage, and transform their businesses. Depending on which phase in the e-business development model you are in, different tools and technologies are appropriate. The remainder of this redbook discusses these technologies and products in detail and gives in-depth positioning, best-use scenarios, case studies, and product information so you can understand the IBM suite of offerings and apply the appropriate technology to your situation.

Chapter 3. Standards and technologies for e-business products

This chapter discusses the major standards and technologies of e-business that the industry has or is adopting. We focus on those standards related to applications and database serving that are the essential components in linking Web browsers and the server system. By definition, they are platform independent, but we include AS/400-specific information wherever appropriate.

3.1 Applications and database serving standards: Non-Java based

This section discusses two non-Java based standards for applications and database serving in the e-business environment: CGI and Net.Data.

3.1.1 Common Gateway Interface (CGI)

On most non-AS/400 Web serving platforms, CGI programming implies working with scripts written in the PERL language. Although there is an unsupported version of PERL available for the AS/400e system, most AS/400e CGI programs are created using ILE RPG, ILE COBOL, or ILE C.

3.1.1.1 Understanding CGI processing

Figure 17 shows CGI program processing and how CGI programs run on the AS/400 server.

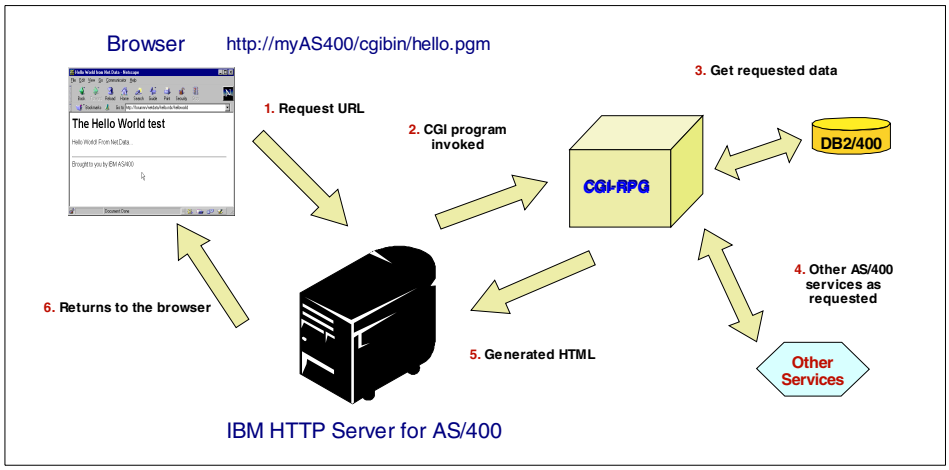

Figure 17. How CGI processing works

The process shown in Figure 17 on page 59 is explained here:

1. A CGI program is requested on an incoming URL. When a browser user enters a URL containing a request in a Web page, the request is sent to the HTTP Server for AS/400 with data that was entered on the Web page.
2. The CGI program is invoked. The HTTP Server for AS/400 finds the CGI program. The program name is specified in a MAP, PASS, or EXEC directive of HTTP configuration file.
3. The CGI program gets the data that was entered by the browser user. Since the CGI program is now invoked, it runs as the traditional AS/400 program to open files, read and write records with the DB2 UDB for AS/400 databases, run SQL statements, or call other user programs, commands, or APIs.

   At this point, the CGI program is conceptually similar to one of AS/400 traditional programs. It receives input from the browser form, works with DB2 UDB for AS/400 database files, and prepares a response to the browser.
4. The resulting HTML is returned to the HTTP Server for AS/400 program. When the response HTML to be returned to the browser is completed, the CGI program uses API calls to send the resulting HTML to the HTTP Server for AS/400 program.
5. The resulting HTML is sent back to the browser. HTTP Server for AS/400 sends the completed HTM page to the browser. The process is complete.

3.1.1.2 Benefits and considerations of using CGI

This section discusses the benefits and considerations of using CGI programs.

Benefits of using CGI

The primary reason to use CGI programing on the AS/400e system is that you or your staff may already be familiar with one of the AS/400e system programming languages such as ILE RPG, ILE COBOL, and ILE C. For example, if you already know RPG, it is relatively simple to learn how to incorporate CGI processing techniques into an RPG program, compared with learning Net.Data or Java.

When you write a CGI program, you have access to all of the AS/400e system programming tools. For example, you can use native database operations in your CGI programs. You can also use string handling operations in the language to create the exact HTML statements that you need. Finally, you can use the same debugging tools to put your CGI program into production.

Considerations of using CGI
A major concern of using CGI compared to other options (predominantly compared to Java-based technologies) is that it is somewhat labeled as legacy technology with reasons.

Generally there is considerably more code required for an RPG CGI program as compared to Net.Data. Once you create a working RPG CGI program, you can easily copy code for further programming.

The most difficult part of the RPG CGI program is the code that parses the buffer returned from the QzhbCgiParse API. Again, once you develop several programs using this API, you can extract the routines easily.

Positioning of CGI
CGI programming can be your optimal choice to Web-enable your AS/400 system applications if your primary goal is using existing programming skills.

3.1.1.3 Location of the CGI product on the AS/400 system
CGI is supported on the AS/400e system using IBM HTTP Server for AS/400 (5769-DG1). It is shipped with OS/400 at no additional charge.

3.1.1.4 References
There are many users who have already started their dynamic sites using CGI and Net.Data.

Turn to the following sources for more information:

- *Unleashing AS/400 Applications on the Internet*, SG24-4935, gives instructions enabling an AS/400 application to the Internet including CGI and Net.Data.
- *Cool Title About the AS/400 and Internet,* SG24-4815 (Chapter 9), discusses the application development interfaces including CGI and Net.Data programming.

3.1.2 Net.Data

Net.Data is a server-side scripting language that is packaged as part of the IBM HTTP Server. Net.Data extends Web servers by enabling the dynamic generation of Web pages using data from a variety of data sources. The data sources can include relational and non-relational database management systems such as DB2, DRDA-enabled databases, and flat file data. Net.Data applications can be rapidly built using a macro language that is simple, yet powerful. Net.Data allows the reuse of existing business logic by supporting calls to applications written in a variety of programming languages, including

Java, C/C++, RPG, COBOL, CL, REXX and others. Net.Data provides several features for high performance, including persistent connections to databases.

Using macros that you develop as input to the CGI program, Net.Data allows the users to achieve the same tasks as CGI programs do without writing their own CGI programs. The system provided Net.Data CGI program, Net.Data, uses the macro to:

- Send HTML to your browser
- Run SQL commands
- Call system services such as programs compiled in other languages

3.1.2.1 Understanding Net.Data processing

Figure 18 shows how Net.Data processing works.

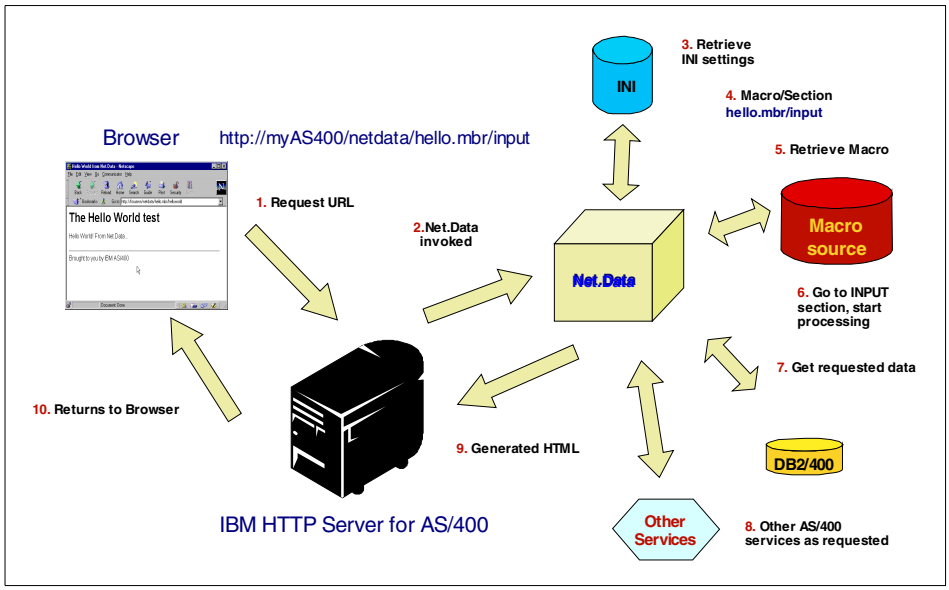

Figure 18. How Net.Data processes a macro and generates a response

This process is explained here:

1. A Net.Data macro is requested on an incoming URL.

   The request is sent through the URL to the IBM HTTP Server for AS/400 program.

2. Net.Data is invoked.

The IBM HTTP Server for AS/400 program recognizes that the request is for Net.Data. Then, IBM HTTP Server for AS/400 invokes Net.Data.

3. Net.Data configuration options are retrieved from the INI file.

   Upon starting, the Net.Data program retrieves initialization options from the optional INI file. Although it is optional, if you do not have an INI file, the URLs are considerably more complicated.

4. The macro and start-at section within the macro are identified.

   Net.Data determines where on the system the macro source file is located.

5. The macro is retrieved.

   Net.Data now retrieves the macro. All Net.Data macros are stored in text format.

6. Net.Data starts the execution of the macro at the start-at section.

   Net.Data parses the macro, and any global function calls are processed. The start-at section is typically an HTML block that contains statements describing the initial page to be sent to the browser.

7. DB2 UDB for AS/400 data is processed with SQL statements.

   If there are any SQL statements or Net.Data function calls to other AS/400 system services, those statements or function calls are now processed.

8. Other system services are invoked.

   In a typical Net.Data macro, you embed SQL statements or function calls within HTML statements. Net.Data runs the SQL statement or function call at the point where it is encountered. The resulting HTML sent to the browser can include your headings and footings with the merged output of an SQL statement or function call.

9. The resulting HTML is returned to the IBM HTTP Server for AS/400 program.

   The resulting HTML is returned from Net.Data to IBM HTTP Server for AS/400.

10. The resulting HTML is sent back to the browser.

    IBM HTTP Server for AS/400 sends the complete HTML page back to the browser. The process is completed at this point.

3.1.2.2 Benefits and considerations of using Net.Data

This section discusses the benefits and considerations of using Net.Data.

Benefits of using Net.Data

Net.Data is a superb tool for creating simple HTML forms that act as front ends to database queries. In addition to the default behavior of Net.Data (display SQL results in an HTML table), you can customize the resulting table or use Net.Data functions to add other HTML options to the table, such as listbox fields and checkbox fields.

If you do not have AS/400 programming skills (usually RPG, COBOL, or C) or if you are uncomfortable with using CGI APIs required to get, parse, and return data to the browser, you may find it easier to work with Net.Data. You can concentrate on the application, rather than the mechanics of communicating with the browser.

Net.Data also provides built-in support for working with the results of SQL queries. It takes care of getting and parsing requests from the browser and preparing output to return to the browser.

Net.Data is available on a variety of platforms, including AIX, OS/2, OS/390, and Windows NT.

Considerations of using Net.Data

A major concern of using Net.Data, especially when you expect a heavy transaction at any given time, can be a performance issue. Net.Data is interpreted, not compiled. This can be a benefit on one hand. For example, you can develop or make changes more quickly than the equivalent compiled program. On the other hand, it can cause some performance concerns.

Positioning of Net.Data

Net.Data can be your optimal choice to Web-enable your AS/400e system applications if your primary goal is completing the project without serious investment on internal or external programming skills acquisition.

3.1.2.3 Location of Net.Data product on the AS/400e system

Net.Data is supported on the AS/400e system using IBM HTTP Server for AS/400 (5769-DG1). It is shipped with OS/400 at no additional charge.

3.1.2.4 References

There are many users who have already started dynamic sites using CGI and Net.Data.

Refer to the following publications for more information:

- *Unleashing AS/400 Applications on the Internet*, SG24-4935, gives instructions for enabling an AS/400 application to the Internet including CGI and Net.Data.

- *Cool Title About the AS/400 and Internet,* SG24-4815 (Chapter 9), discusses the application development interfaces including CGI and Net.Data programming.

3.2 Applications and database serving standards: Java based

This section provides a brief review of the Java environment. Then, it discusses Java-based applications and database serving standards including:

- Java applets
- Java servlets
- JavaServer Pages (JSP)
- Enterprise JavaBeans (EJB)

3.2.1 Java technology review

Java is both a programming language and a platform. As a high-level programming language, Java is unique in its architecture-neutral, object-oriented configuration.

The Java language is unusual in that each Java program is both compiled and interpreted. With a compiler, you can translate the Java program into an intermediate language known as *Java bytecodes*. These are platform-independent codes interpreted by the Java interpreter. With this interpreter, each Java bytecode instruction is parsed and run on the computer. Compilation happens just once. Interpretation occurs each time the program is executed.

Think of Java bytecodes as the machine code instructions for the Java Virtual Machine (JVM, the base for the Java platform). Every Java interpreter (for example, a Web browser for running applets or a Java development tool) is an implementation of the JVM. The JVM can also be implemented in hardware. The basic structure of the Java environment is shown in Figure 19.

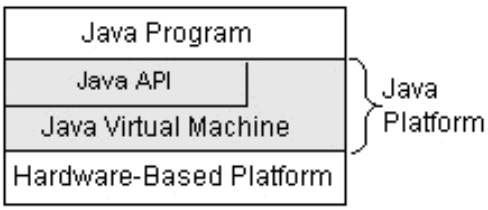

Figure 19. Basic structure of the Java environment

Note how the JVM allows for platform independence from the processor.

The Java bytecodes help make Java's famous "write once, run anywhere" capability possible. Once the Java program is compiled into bytecodes on any platform having a Java compiler, these bytecodes can run on any implementation of the Java Virtual Machine. The same program, for example, can run on the AS/400e system, Windows NT, or Sun Solaris.

The Java *platform* refers to the environment in which a program runs. While most platforms consist of both hardware or software (for example, Intel-based Windows NT), the Java platform differs in that it is a software-only platform that runs on top of other hardware-based platforms.

The Java platform has two components:

- The Java Virtual Machine (JVM)
- The Java Application Programming Interface (Java API)

The JVM has already been mentioned. The Java API is a large collection of ready-made software components that provide many capabilities, such as GUI widgets. The Java API is grouped into libraries, or packages, of related components.

Java manifests itself in the e-business arena in several forms, including applets, servlets, JavaServer Pages, and Enterprise JavaBeans.

3.2.1.1 Java applets, servlets, JavaServer Pages, and Enterprise JavaBeans

Java applets are dynamic and interactive programs that can run inside a Web page displayed by a browser enabled for Java, such as Microsoft Internet Explorer or Netscape Navigator. Applets were the first application of Java to gain widespread notice. They first gained popularity in the mid-1990s as a tool to add animation and other effects to Web pages.

Browsers that provide support for applets include:

- Netscape Navigator Version 4.04 or later
- Microsoft Internet Explorer Version 4.01
- Sun Microsystems HotJava

Java applets are delivered to the browser in HTML files that contain a reference to the applet. Upon arriving in the browser, the applet begins execution. The applet usually displays what appears to the user as a Web page. However, all of the user interface elements are contained within the applet itself and are not rendered by HTML.

Most importantly, the applet can communicate directly back to the server. When the server responds, it is up to the applet to display the response. Because the applet is in control of its user interface elements, it can update them to display the server response, again without requiring HTML.

Java applet processing on the AS/400 system

One of the most important features of applets for AS/400 developers is the capability of the applet to interact with the AS/400 system. When you create an applet, you can include Java classes from the AS/400 Toolbox for Java that let you access objects on the AS/400 system.

For example, you can:

- Get records from the AS/400 database using SQL statements or record-level access techniques
- Call programs or invoke commands on the AS/400 system
- Send and receive entries from data queues on the AS/400 system

Figure 20 shows an overview of applet processing.

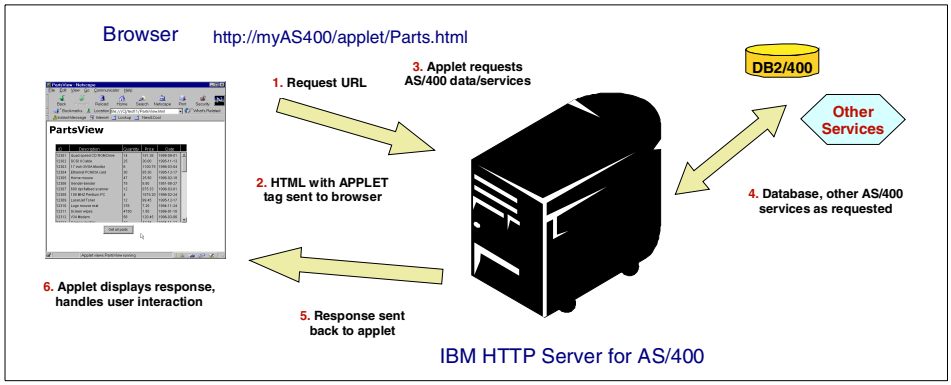

Figure 20. Applet processing

Each step of applet process is explained here:

1. An HTML page that contains an `APPLET` tag is requested on an incoming URL.

   You start an applet by requesting an HTML file that contains an `APPLET` tag.

2. An HTML page requested is returned to the browser.

   As the page is sent to your browser, the Java classes used in the applet are also sent to the browser. After receiving the applet, the browser starts it and passes control to the applet.

3. A request is sent from the applet to the AS/400e server.

   Once the applet has started, you interact with it as you would with other forms displayed in the browser. The applet may require that you enter data or make selections. You usually have one or more buttons in the applet that you can click. The buttons are not associated with a `FORM` statement in an HTML form, but rather are used to invoke methods in the applet's Java code. It is up to the Java code in the applet to use methods to send requests to the AS/400e system.

4. The AS/400e server services the request from the applet.

   The request from the applet is serviced the same as other types of program requests running on the AS/400e system. For example, if the request was to create an SQL result set, the SQL processor is invoked to query the AS/400e database.

5. The response is sent back to the applet.

   After the AS/400e processes the request, the results of servicing the request are sent back to the applet. The results are in the format that pertains to the request. For example, an SQL request generates a result set. A data queue read operation generates a packet of bytes that contains the data queue entry. The applet receives the results using the Java class and methods appropriate to the request.

6. The applet displays the response data.

   Once the results are available to the applet, it displays those results using any of the user interface components included in the applet when it was designed. The display is not limited to HTML only. After formatting and displaying the results, the applet is available for additional user interaction, which can include additional requests to the applet for more data from the AS/400e system.

Benefits and considerations of using applets

This section discusses benefits and considerations of using applets.

Benefits of using applets

Applets are useful when you need to work with AS/400e resources and you do not want to create Net.Data or CGI programs on the AS/400e system. You can also choose to work with applets to have greater control to design the user interface and interact with the user at runtime.

Another reason to use applets is to use the industry standard Java language, rather than the proprietary AS/400 Net.Data or CGI programming languages. Although the Java classes to access the AS/400 system are proprietary, the

classes are readily usable by any Java programmer with basic knowledge of the AS/400 system.

Considerations of using applets

Applets depend on the capabilities of the browser under which they run. Browsers are available from numerous vendors. Each of these browsers use a different security model. You may have to program an applet differently based on the browser under which you are running. In other words, there is a chance that your application may not run as it was designed depending on your clients' browser environment.

Another point of consideration is the size of the applets and communications link speed. Applets and their associated classes should be stored at a central location and downloaded as needed. This results in downloading the classes as needed by the browser. Depending on the size and number of classes, and the speed of the communications line, the download time can be an expensive use of resource and time.

Location the Java applet product on the AS/400e system

Java applet is supported on AS/400 using 5769-DG1 IBM HTTP Server for AS/400. It is shipped with OS/400 at no additional charge.

3.2.1.2 Java servlets

Java servlets have many advantages over its alternatives, such as Net.Data or CGI programming, or Java applets for a number of reasons. Two of the main advantages are in regard to:

- Performance
- Ready access to AS/400 database

Here, the advantages are because Java servlets run entirely on the AS/400e server as part of the IBM HTTP Server for AS/400. Therefore, the servlets can access the AS/400 database and other system resources with much less interactions over the network link.

Java servlet processing on the AS/400 system

If you are already familiar to CGI programming, covered earlier in 3.1.1, "Common Gateway Interface (CGI)" on page 59, servlet processing is similar. The primary difference is that the servlet can be prestarted in the multi-threaded job pool so that there is no start-up overhead when it is invoked.

If a servlet is not currently active when it is invoked, you incur the start-up overhead on its first usage. After that point, the servlet is available for subsequent invocations.

Figure 21 shows an overview of servlet processing.

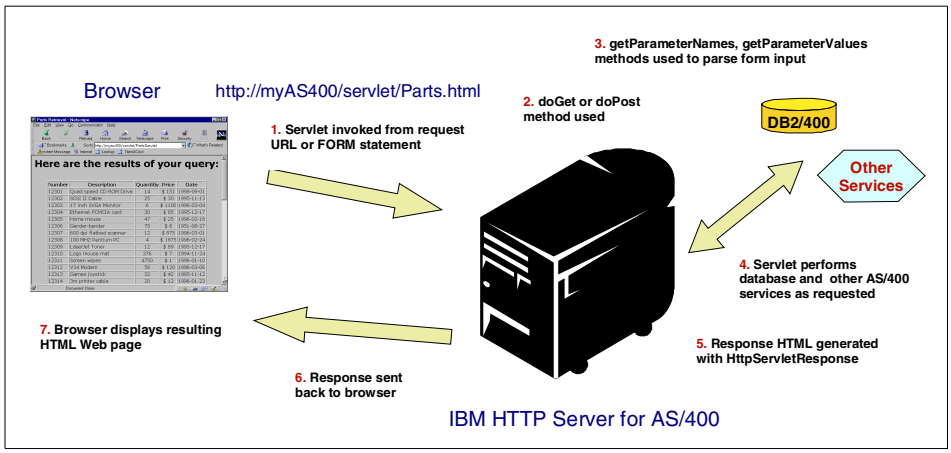

Figure 21. Servlet processing

Each step in the servlet process is explained here:

1. The servlet is invoked from a URL or `FORM` statement.

   The servlet is identified either in a URL that you type into the browser or click as a link. Or, it can be specified on an HTML `FORM` statement that is used when a **Submit** button is clicked. The request is sent using the HTTP protocol to the HTTP Server for AS/400 program, which identifies the servlet to invoke.

2. The servlet uses the `doGet` or `doPost` method to read form data.

   The Java servlet API includes the `doGet` and `doPost` methods that correspond to the HTML `METHOD="GET"` and `METHOD="POST"` techniques of sending data from the browser to HTTP Server for AS/400.

   The input data is available to the servlet in the HttpServletRequest input stream.

3. The `getParameter` methods are used to parse field name/value pairs.

   Now that the form data is available in the HttpServletRequest stream, it can be parsed into field name and value pairs that correspond to the data fields used on the HTML form. The Java servlets API includes the `getParameterNames` and `getParameterValues` methods to retrieve the list of field names and values from the input stream. After retrieving the name and value pairs, the values are available in enumerations within the servlet.

4. The servlet processes database and other requests.

   At this point, all of the data from the form is available to the servlet. The servlet can now run the functions that are required to service the request. For example, the servlet can run an SQL query against the AS/400e database or use other Java classes in the AS/400 Toolkit for Java to work with other AS/400e resources.

5. The response HTML is generated.

   The servlet can start generating response HTML to send to the browser at any point. Typically, the servlet generates HTML headers, followed by the actual form heading, then one or more lines of data, and finally a page footer.

   The Java servlets API provides the HttpServletResponse output stream to transport generated HTML statements from the servlet back to the browser. You create well-formed HTML statements as simple strings, using concatenation as necessary to build a string of HTML tags and the response data. To actually send the HTML, you simply use the `print` or `println` methods on the HttpServletResponse stream object.

6. The HTTP Server for AS/400 program sends the response HTML to the browser.

   As the HTML is written in the servlet, it is sent from HTTP Server for AS/400 to the browser. The STDOUT file is used, which is common for all server to browser communication.

7. The resulting Web page is displayed in the browser.

   Because the page is composed of standard HTML elements, there are no special requirements or security considerations for the browser.

Benefits and considerations of using servlets

This section discusses the benefits and considerations of using servlets.

Benefits of using servlets

If you have not yet started creating AS/400e Web serving applications, seriously consider adopting Java servlets as the technique to use, even if you do not yet use Java. In fact, learning Java by working with servlets is ideal, since servlets are basically batch processes that do not deal with user interface issues found in client-side programs.

A Java servlet is based on industry standard Java. Although using Net.Data and CGI programming techniques for Web serving is fine for AS/400e server users who have those skills, there was little to attract Java programmers to

the AS/400e server as a Web serving platform. With Java servlet support, the AS/400e server now runs as a powerful Web serving platform.

Java servlets provide an alternative to Net.Data, CGI programming, and applets. With servlets, you can parse requests from HTML forms and use simple `print` and `println` methods to send response HTML back to the browser. There are few browser dependencies when you use the servlet, while there are some differences between browsers when you run applets.

Java servlets are often faster than equivalent CGI programs. CGI programs have a reputation of being slow and unable to scale. The primary reason for this is the way they are loaded. CGI programs get loaded at each invocation in a process separate from the Web server. This requires a relatively large amount of resource, both from the Web server and the operating system. Also, many CGI programs are written in the interpreted PERL scripting language. This interpretation adds significant overhead.

Java servlets were designed with performance and scaling in mind. They are loaded only once, either when the Web server is initialized or at first invocation. They are not unloaded unless this is explicitly done by the Web server or system administrator. Also, servlets run in the same process as the Web server by taking advantage of Java's built-in multi-threading model. This results in faster communication between tasks and threads.

Figure 22 shows this relationship.

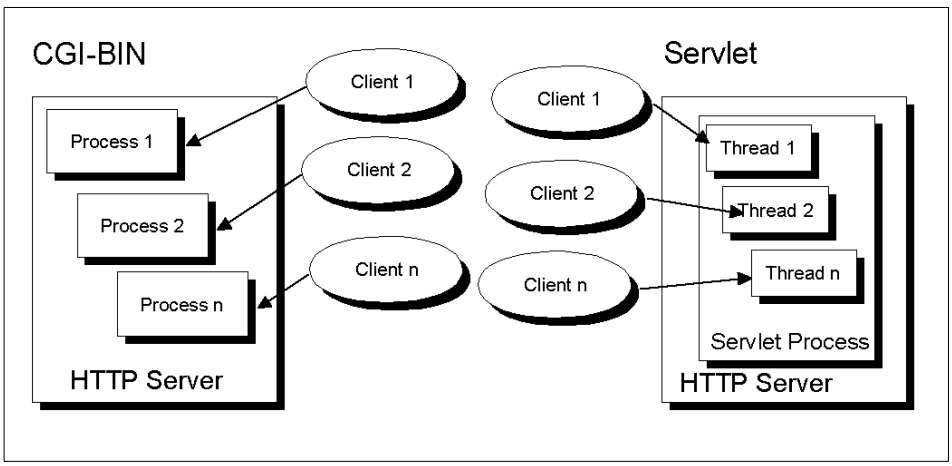

Figure 22. Servlets versus CGI.BIN

Your servlets can optionally be started when the IBM HTTP Server for AS/400 program is started, so that they are available and waiting for incoming requests. On the other hand, Net.Data and CGI programs are typically short-lived, there is little space to optimize their performance. Servlets also do not necessarily end when they are done serving a request. They can remain active for further requests. If you create an equivalent Net.Data or CGI application and a Java servlet, you typically see much better response time with the Java servlet.

Java servlets provide two simple input and output stream objects to get the data and to write the response, and two simple methods to parse field name and value pairs. Most of the work in CGI programming is concerned with getting the input data from the Web form, parsing the data into discrete field and value pairs, and writing response HTML back to the STDOUT file.

Considerations of using servlets

There are practically no considerations or potential disadvantages for using the servlets. In the e-business arena, the Java servlet is a far more useful business tool than the applet. A servlet is essentially the opposite of an applet. Think of it as a server-side applet in that servlets run inside the Web server the way applets run inside the Web browser.

3.2.1.3 Location of the Java servlet product on the AS/400e system

A Java servlet is supported on the AS/400e system using IBM WebSphere Application Server Standard Edition (5769-AS1). It is shipped with OS/400 at no additional charge.

3.2.1.4 JavaServer Pages (JSP)

JavaServer Pages (JSPs) allow you to embed Java code into HTML pages to execute directly by the server when the page is served. JSP technology is similar to Microsoft's Active Server Pages (ASP) technology, but JSP is standardized and portable. By using JSPs with servlets, you can separate business logic from its presentation and reuse the business logic (using JavaBeans) more practically.

In today's environment, most Web sites display dynamic content based on a user and session. And most content, such as images, text, and banner ads, is easiest to build with HTML editors. You need to mix the "static" content of HTML files with "directives" for accessing or generating dynamic content.

Such technologies as Java servlets, for example, make it easier to write server-based code using the Java programming language for interactive applications. Developers can write servlets that take an HTTP request from the Web browser, generate the response dynamically (possibly querying

databases to fulfill the request), and then send a response containing an HTML or XML document to the browser.

The problem with using this approach is that the entire page must be composed in the Java servlet. If a developer or Web master wants to tune the appearance of the page, they *edit and recompile* the Java servlet, even if the logic is already working. With this approach, generating pages with dynamic content still requires application development expertise.

An answer is an industry-wide solution for creating pages with dynamically-generated content. This solution addresses the limitations of current alternatives by *separating* the application logic from the appearance of the page (in other words, separating the business logic from the presentation logic). In addition, the solution should result in faster and more simple development and testing of interactive Web-based applications than in previous methods.

JSPs address this need. They provide server-side scripting support for generating Web pages with *combined* static and dynamic content, allowing easy access to server-side components from Web pages. A JavaServer Page is an extended HTML page with Java code inserted directly into the HTML source. At runtime, the JSP is compiled into a servlet class and activated for use servicing client requests. If the JSP changes between client requests, it is automatically recompiled before the servlet is executed again.

JSPs provide a way to combine the worlds of HTML and Java servlet programming. JSPs are text files (identified by the .jsp extension) that look much like HTML pages. In fact, they are a new type of file that combines standard HTML and new *tags* for scripting in the Java language.

These tags specify the programming of a servlet to control the generation of dynamic content. One of the new tags gives JSPs the ability to call *reusable* components called JavaBeans.

JSPs look like HTML, but they are code that gets compiled into Java servlets. The responsibility of the resulting servlet is to generate a user page. That page is a combination of the HTML from the JSP file with embedded dynamic content specified by the new tags. In this way, a JSP describes a representative HTML response. The dynamic content is specific to a given HTTP request.

In Model 1 shown in Figure 23, a user working in a browser makes a request that is sent to a JSP file.

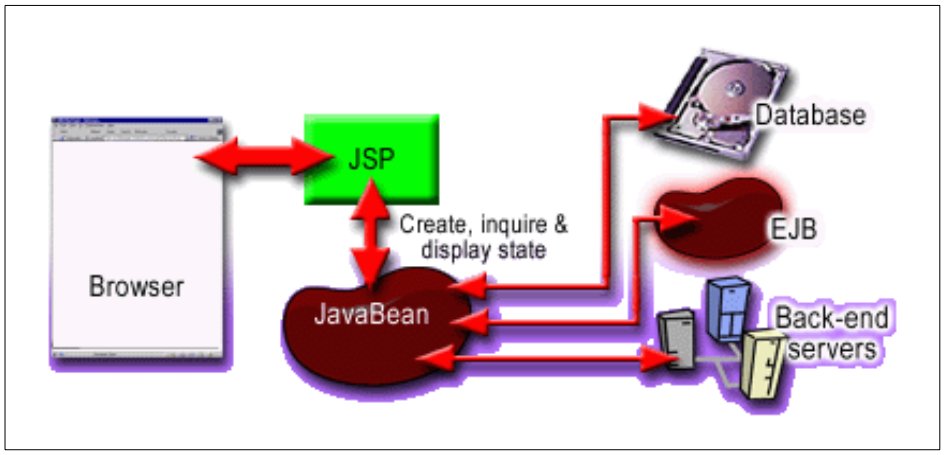

Figure 23. JSP model 1

After receiving the client request, the servlet that is compiled from the JSP file requests information from a JavaBean. The JavaBean can, in turn, request information from an Enterprise JavaBean, database, or other backend service. Once the JavaBean accesses the requested content, the JSP servlet can query and display the information as HTML in the user response.

Model 2, shown in Figure 24, shows another way to use JSPs, by sending a request to a Java servlet.

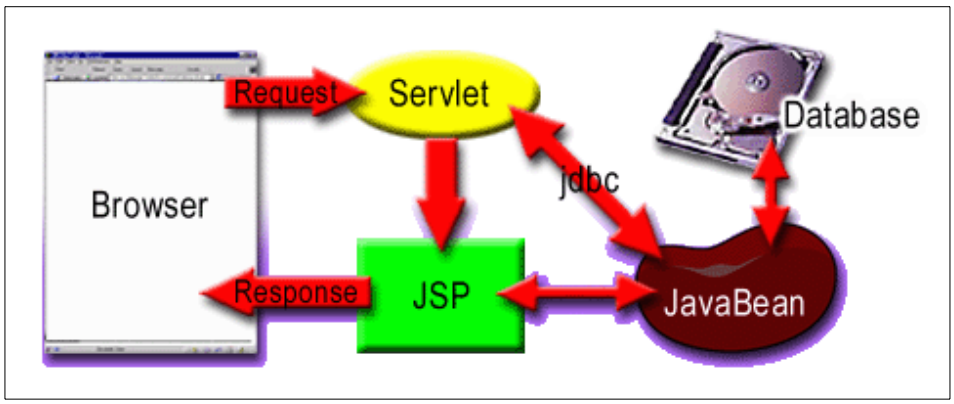

Figure 24. JSP model 2

In this example, the client makes a request that is handled by a Java servlet. The servlet, like the JSP in the model 1 case, requests dynamic content from a JavaBean or Enterprise JavaBean. The resulting dynamic content is then

wrapped in a JavaBean. The servlet invokes the JSPs servlet, which accesses the dynamic content from the bean and delivers the content to the client Web browser.

3.2.1.5 Enterprise JavaBeans (EJB)

Enterprise JavaBeans (EJB) is the key technology to deal with distributed transaction and complex persistence issues in a Web application. In the past few years, it is self-evident that the WWW has transformed the way in which a business interacts with its customers. Progressing from maintaining a simple Web presence using a home page, then onto a dynamic presence with an active Web site allowing ordering of products and services, contemporary businesses now face the next evolution of Web enablement. This is the need to *integrate* their Web-based systems with their other business systems. This linkage is the basis of the *transactional* stage of a company's Web enablement.

EJBs enable users of such application servers as WebSphere to achieve this integration. EJBs are critical to the operation of a transactional server.

EJB extends Java's "Write once, run anywhere" model of hardware and operating system independence to middleware and application server independence. It achieves this by separating the business application from the system services. Therefore, developers are not locked into using a particular vendor's middleware servers.

EJB technology complements and extends the existing Java architecture by providing an application server environment to handle system services that would otherwise be handled by the application code.

Enterprise JavaBeans, based on the Sun Microsystems Enterprise JavaBeans (EJB) specification, are *reusable* software components to build distributed, *transactional* business applications using Java. EJBs contain business logic functions, which simplify the development of database applications.

Some notable features of EJBs include:

- They make it possible to build distributed applications by combining components developed by you or by different software vendors. Defining business objects as components promotes reusability and development efficiency. An application developer can create new components, reuse existing components, or purchase components. By using existing components or purchasing components, the developer assembles the

application rather than taking further time developing and testing new code.

- EJBs make it easy to write applications. Application developers do *not* have to deal with low-level details of transaction and state management, security, persistence, multithreading, resource pooling, and other complex low-level application programming interfaces (APIs). A programmer gains direct access to the low-level APIs. The majority of these details are managed by the EJB server. Therefore, developers can concentrate on producing business logic (the coding of their business rules, logic, and knowledge) rather than spending time on “plumbing”.
- EJBs are developed once and then deployed on multiple platforms without recompiling or modifying source code.
- They allow interoperability with other Java and non-Java applications.

Enterprise JavaBeans and the AS/400e system are a perfect match. The Enterprise JavaBeans component model logically extends the JavaBeans concept. It is targeted at the server tier business logic development. It provides interfaces that insulate the programmer from the complexities and dependencies unique to a platform.

EJB technology provides a component model for server applications. It allows you to easily *separate* user interfaces from business logic.

The server-side business logic is packaged as Enterprise JavaBean components. Once they are written and deployed on a server such as the AS/400e system, client programmers can use them with very little knowledge of how the beans actually work. The client programmer only has to know what methods the Enterprise JavaBeans support and how to call them.

Another key advantage is that regardless of whether you are writing a Java application, that is a Java servlet, it always works the same. You only need to call the methods provided by the Enterprise JavaBeans to handle the application processing.

EJB technology also leverages *existing* applications currently running business environments. EJB technology allows the extension of existing applications to provide new and additional functions of the business.

Even without CORBA, EJB objects are used to wrap existing application logic. For example, you can wrap Microsoft’s Component Object Model (COM) objects as EJB components and use them as part of a Java application.

Figure 25 illustrates the architecture of the Enterprise JavaBean environment.

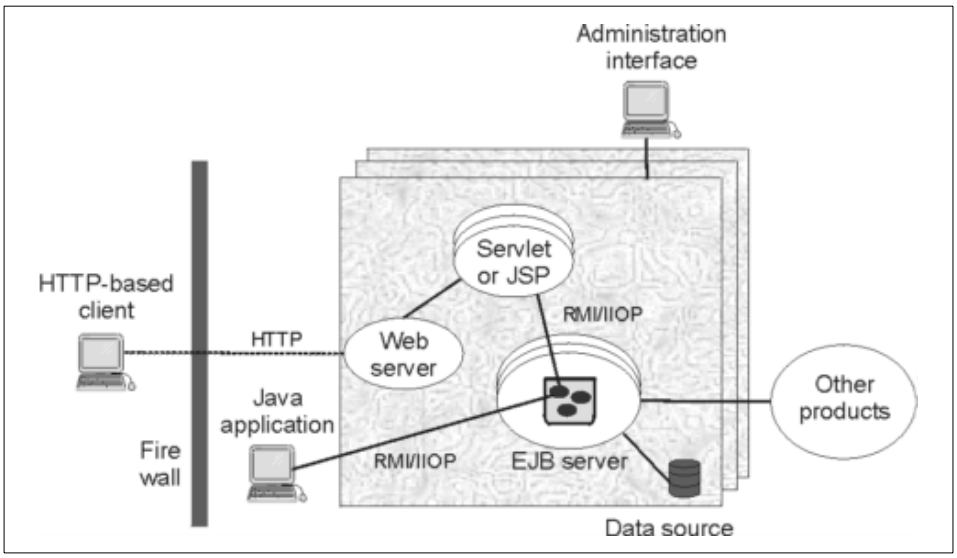

Figure 25. Enterprise JavaBeans (EJB) architecture

The EJB specification consists of two major units, reflecting the critical separation between the business application and system services:

- Components: Entity beans and session beans
- Services: EJB server and EJB container

EJB server

At the center of the environment is the *EJB server*. The EJB server is the application server tier of the WebSphere Application Server's three-tier architecture. It connects the client tier (Java servlets, applets, applications, and JSP) with the resource management tier (the data source).

This server contains and runs one or more *enterprise beans*, which *encapsulate* the business logic and data used and shared by EJB clients. The enterprise beans installed in an EJB server do *not* communicate directly with the server, which allows developers to focus on the business problem and lets the EJB server handle system services. Instead, an *EJB container* provides an interface between the enterprise beans and the EJB server to provide many low-level services such as threading, support for transactions, and the management of data storage and retrieval.

The EJB server allows the application developer to obtain the system services required by the application without directly dealing with lower level

APIs. The EJB server carries the majority of the burden of dealing with the system environment by managing and coordinating the allocation of resources to the application.

Key system services (APIs) that the EJB server includes are:

- A **security service**: The security server handles authentication and authorization for principals that need to access resources in an EJB server environment. In the EJB component model, security is both granular an flexible. It is granular because it is configured at the component level or at the method level. It is flexible because it is configured outside the application by using utilities provided by the application service provider.
- **Transaction service**: In the EJB component model, transactions take two basic forms: database and business.

  Note: The EJB specification does not specifically distinguish between these two forms. This breakdown is to simplify the explanation.
- **A workload management service**: The workload management service ensures that resources are used efficiently by distributing the workload to other servers.
- **A persistence service**: The persistence service handles interaction between an entity bean and its data source to ensure that persistent data is properly managed. The EJB architecture eliminates the need for the components to deal with the persistence mechanism. Using JDBC as the database management technology, the application server interacts with a wide variety of data stores on the market today.

EJB server support is currently available on the AS/400e system with WebSphere Application Server Advanced Edition 3.02.

EJB containers

The container is defined as a separate mechanism from the EJB server. The clarity of this separation is at the discretion of the tool vendor.

EJB containers serve as the means to insulate the enterprise bean developer from the specifics of the EJB server services, such as transaction management, security, and object distribution. Containers provide a simple interface for the enterprise bean and access the system services for it. This interface is referred to as the component *contract* for the Enterprise JavaBean.

The container manages Enterprise JavaBean objects. It manages the life cycle of the object (creation, maintenance, and deletion), implements the security for the object, and coordinates distributed transactions involving the

object. By performing these activities, the container eliminates the need for bean developers to concern themselves with these issues.

There are two types of enterprise beans or components. The first are session beans, which encapsulate short-lived, client-specific tasks and objects (transient persistence). The second are entity beans, which encapsulate permanent or persistent data (persistent persistence). The EJB server stores and retrieves this persistent data in a data source (for example, database, other application, or file). A description of the two types is given in the following sections.

Entity beans

These components represent business objects and contain business data. Because an entity bean contains business data, its contents are persisted for later use. Entity beans often reflect a row within an application database. An entity bean has methods to manage its data (get and set methods) and can support business logic pertaining to its business data. Entity beans are either:

- **Container managed**: Here the reading and writing of the bean attributes to the persistent datastore are delegated to the container that holds them. This allows mapping from the bean attributes to the database columns outside of the entity bean itself. It also allows the entity bean developer to keep the persistence details separate from the business object (the entity bean).
- **Bean managed**: Bean managed entity beans allow the bean provider to control the reading and writing of the bean attributes to the database. This gives the provider greater flexibility in providing their own persistence strategy.

Session beans

Session beans perform business processes or tasks within a business process. A client uses a session bean to complete a particular task. Session beans are transient (their data is not persisted) and only exist for the life of the transaction. Session beans usually perform activities like obtaining or storing business data by using the entity beans or performing business logic that is maintained separately from the business data. Session beans are either:

- **Stateless**: Perform activities for the client, but do not maintain any data.
- **Stateful**: Have data and maintain that data for the life of a transaction. If this data must be persisted, it must be forwarded to entity beans. Stateful session beans minimize the amount of interaction between the client and the server, making the application more efficient.

Part 3. Practical guide for building e-business: AS/400 products

Part 3 discusses AS/400 products available to build an e-business site. This part is for both business decision makers and technical people.

Part 3 consists of the following chapters:

Refer to Appendix C, “Third-party products” on page 233, for a description of some of the complementary tools and middleware products available from non-IBM companies.

Chapter 4. AS/400 e-business products overview

Version 4 Release 4 of OS/400 provides a variety of tools that help you to start and grow with e-business implementation. Figure 26 provides an overview of OS/400 V4R4 packaging for e-business. Those components new with OS/400 V4R4 are marked as such.

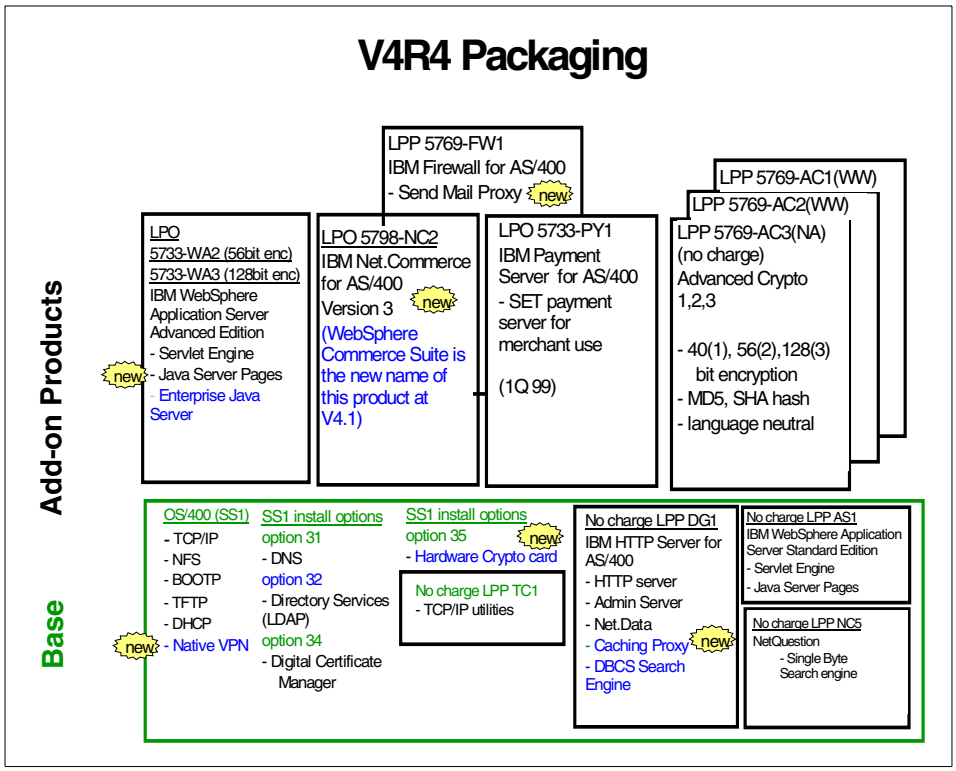

Figure 26. OS/400 V4R4 overview

This chapter provides an overview of the products offered to AS/400e users from the perspective of e-business. The products are discussed in more detail in later chapters.

4.1 Integrated functionalities of OS/400 for e-business

The greatest strength of the AS/400e system as an optimal choice of the e-business server, along with its superb availability and reliability features, is that almost all the products features and functionalities are integrated or

bundled as one packaged offering of OS/400. This is true for the AS/400e system from almost every business perspective. An e-business perspective is no exception.

4.1.1 Integrated quality of OS/400: Networking flexibility

The AS/400e server provides flexibility necessary for the network. The following functionalities are all integrated into OS/400 or offered using AS/400 TCP/IP Utilities (5769-TC1). All are supplied as no charge components.

- Numerous TCP/IP services and supported protocols such as TCP/IP servers and services; physical interfaces; protocols like VPN, CORBA, SNA, PING; and so on.
- Domain Name Services (DNS).
- Dynamic Host Configuration Protocol (DHCP).
- AS/400 acts as a Lightweight Directory Access Protocol (LDAP) server for X.500 standard.

For more details on the OS/400 integrated functions of TCP/IP, refer to:
`http://www.as400.ibm.com/tcpip`

4.1.2 Integrated quality of OS/400: Web enabling functions

The AS/400e server contains numerous tools to enable your applications to the Web including:

- IBM HTTP Server for AS/400
- WebSphere Application Server Standard Edition
- CGI support
- Net.Data support
- 5250 Gateway and emulator
- Webserver Search (formerly known as NetQuestion)

Another point to consider is that of the AS/400e system as a Java server platform. The potential of Java makes developers reconsider their non-AS/400e development environment. The AS/400e system perfectly fits the Java platform, not only for development itself, but also for run time (the Java Virtual Machine is under the TIMI). Built-in OS/400 V4R4, the AS/400 Java Toolbox and the Java Development Kit give you the tools to start. The support for Enterprise JavaBeans permits you to grow fast.

4.1.3 Built-in security features of OS/400 for e-business

The AS/400e server provides the tools necessary to secure the solution environment with encryption software, the security delivered by the IBM

HTTP server, IP packet filtering, SSL support, and so on. Virtual Private Networking (VPN) support (L2TP, IKE, IPSec) is the key technology to protect data in business-to-business relations. In fact, the OS/400 has built-in nearly all features to be a firewall in itself with the help of a router or firewall.

Note

The IBM Firewall for AS/400 V4R4 (5769-FW1) will be withdrawn from marketing 31 December 2000. Refer to the Web site at `http://www.as400.ibm.com/firewall` for sample configurations using alternate solutions and references to other solutions, such as Check Point Software Technologies, Cisco Systems, or Axent, Inc.

4.1.4 DB2 UDB for AS/400 and the integrated file system

DB2 Universal Database for AS/400 (DB2 UDB for AS/400) Version 4 Release 4 of OS/400 delivers the advanced database functions necessary to provide this technology to our customers to help ensure their success by delivering universal database support for the AS/400e system. As a result of these improvements, DB2 for AS/400 is renamed to DB2 Universal Database for AS/400.

The requirements of a high-function, robust database with the capabilities to deliver universal data support include:

- Universal access
- Universal application support
- Universal extensibility
- Universal scalability
- Universal reliability
- Universal management

While DB2 for AS/400 has long provided facilities to address most user requirements, many forms of information could be stored on the AS/400e system, but not managed by DB2 for AS/400. With Version 4 Release 4, DB2 UDB for AS/400 supports storing and managing all forms of information, including complex objects (such as spreadsheets, word processing documents, and multimedia objects) within the database. This release includes such features as large object (LOB) support (BLOBs for binary, CLOBs for character or DBCLOBs for double-byte character), user-defined functions (UDFs), user-defined data types (UDTs), and DataLinks. All of these features, combined with the functions of constraint checking, trigger, and

stored procedure support, allow customers to use one database management system to store, retrieve, and manage all of their corporate information.

These functions can be incrementally implemented as business requirements dictate. DB2 UDB for AS/400 provides robust database functionality in the same simple, easy-to-use environment. This allows small businesses to maintain their current application base, while adding new database functionality to their applications in an incremental fashion. No changes are necessary to legacy applications that do not require these new functions.

4.1.5 Universal Database access

DB2 UDB for AS/400 provides a wide variety of universal data access features. It allows customers to access information on the AS/400e system using Structured Query Language (SQL) or through AS/400-unique commands and application programming interfaces (APIs). Virtually any program or product that provides data access through one of the standard interfaces for relational data can access data stored and managed by DB2 UDB for AS/400. These industry standards and product-specific interfaces include:

- ODBC Windows Database Access Standard
- OLE DB Windows Information Access Standard
- ADO Windows Information Access Classes
- JDBC Java-based Database Connectivity
- SQLJ Java-based Embedded SQL
- SQL ISO and ANSI Standard SQL
- DRDA X/Open Distributed Database Standard
- CLI X/Open Database Access Standard
- EDA/SQL IBI EDA SQL Standard
- DAL Apple Relational Database Standard APIs
- Net.Data Internet Data Access

In addition to these interfaces, DB2 UDB for AS/400 continues to support integrated database access. All of these interfaces provide direct access to a single common data store with excellent performance. These interfaces allow thousands of products to access the AS/400e system without special modifications.

With Lotus Domino being integrated on the AS/400e system, virtually all Lotus Domino applications are supported, as well as the existing OLTP, Business Intelligence (BI), e-business, and client/server applications previously available.

DB2 UDB for AS/400 is completely Web enabled. Not only is the data managed by DB2 UDB for AS/400 accessible through your favorite Web browser, but all host applications are Web enabled. The AS/400e system allows customers to make their host-based applications and data available over the Web with no application conversion needed.

DB2 UDB for AS/400 also leverages a common set of IBM products like Visual Warehouse, Intelligent Miner, and DataPropagator. This integration has been enhanced even further with new features like the integrated DB2 OLAP (on-line analytical processing) Server for AS/400, AS/400 Agent support for Visual Warehouse, and DB2 DataJoiner support on the AS/400 Integrated PC Server (IPCS).

Although DB2/400 Universal Database is not covered in this redbook, you can find more information on the Web at:
`http://www-4.ibm.com/software/data/db2/`

The key to complete an e-business solution is to use tools and middleware that build onto the operating system. Refer to the remaining chapters of Part 3 of this redbook and Appendix C, “Third-party products” on page 233, for non-IBM tools.

Chapter 5. HTTP Server for AS/400

IBM HTTP Server is the follow-on to IBM's Internet Connection Server (ICS). It is a scalable, high-performance Web server that is available from OS/400 V4R3 onward, as well as other IBM and non-IBM platforms.

IBM HTTP Server is a complete Web server product with advanced security and application development features. With IBM HTTP Server for AS/400, you have everything you need to quickly and easily establish a Web presence, and get started on your road to working the Web for business.

HTTP is the protocol used to communicate between a browser and a Web server. To implement a static Web site, all that is required is a Web server and an HyperText Markup Language (HTML) authoring tool such as NetObject Fusion.

5.1 HTTP Server for AS/400: Product description

The primary software backbone of a Web presence is the HTTP server, known commonly as a Web server. It is a TCP/IP application similar in concept to a network file server.

The key uses of the HTTP server are described in this chapter. These uses include:

- File server
  - Serves any kind of file to a browser (for example html, gif, or avi)
  - Caches files for performance
- Application server

  Numerous application models
- Security server
  - Trusted component of the system
  - SSL support
  - Client authentication and access control
- Management server
  - Access logs
  - SNMP MIBs (V4R4)
- Proxy server

  Caching proxy

The purpose of the HTTP server is to respond to browser requests for files, graphics, and other media, such as sound, and to reply in the form of sending HTML pages back to the browser. On the AS/400e system, Web pages are stored either in directories in the Integrated File System (IFS) or as members in database files in libraries.

HTML is the standard language for Web pages. WWW documents are written in HTML script. The HTML coding describes, to the browser, the appearance of the displayed document. Therefore, an HTML page is a mixture of text and special HTML tags that describe the page. There are tags that describe the structure and presentation of the page, such as heading tags, ordered list tags, and table tags. There are also tags for including an image on the page and tags for creating a link to another page.

The general sequence of operation for a Web server is:

1. A Web browser requests a document.
2. The HTTP server sends the requested document.
3. The Web browser interprets the document and displays it.

HTTP servers can also load and run Java applets from browsers and forward browser-generated requests to Java servlets on the main server.

Application servers (such as the IBM WebSphere Application Server) and transaction servers run on top of HTTP servers to provide the Dynamic Data and Transaction capabilities of the customer e-business Web site respectively.

For the AS/400e platform, from an IBM product viewpoint, there are two HTTP servers available:

- The HTTP Server for AS/400
- The Domino HTTP Server

Note: In addition, the Apache Web Server will be offered on the AS/400 system during 2000.

The IBM HTTP Server for AS/400 (5769-DG1) is the current Web server packaged with the AS/400e system. It is the Web server component of the WebSphere Application Server for AS/400. It can also act as a gateway between the client and the AS/400e database, using the CGI interface and Net.Data. Refer to Figure 27 for a diagram.

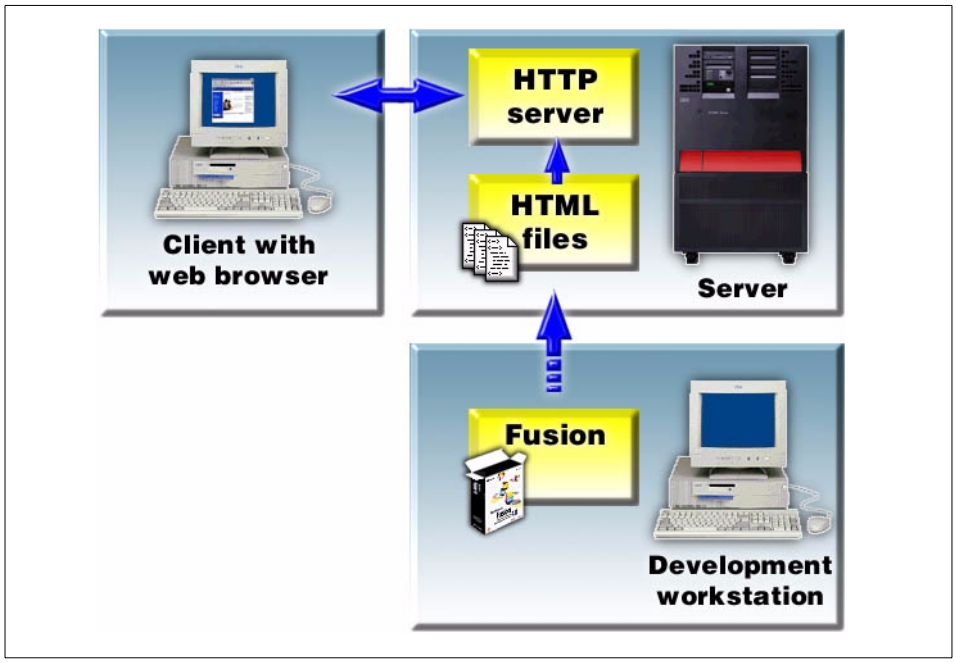

Figure 27. IBM HTTP Server for AS/400

IBM HTTP Server for AS/400 was known as the HTTP Server in OS/400 V3R7 and the Internet Connection Server (ICS) in OS/400 V4R1 through V4R2. At the time, ICS was part of TCP/IP Connectivity Utilities (5769-TC1). With V4R3, substantial enhancements were incorporated into the product and it reverted back to its former name (along with a newly assigned product number 5769-DG1). It also introduced new SSL support. An Internet Connection Secure Server (ICSS, 5769-NC1/128-bit or 5769-NCE) was introduced at this time to provide SSL support of the V4R1 and V4R2 Internet Connection Servers.

The V4R3 HTTP Server introduced the integration of WebSphere Application Server for AS/400, providing support for Java servlets on the AS/400e system. Given the importance of this product in OS/400 V4R4, the WebSphere Application Server Standard Edition packaged with OS/400 was newly numbered as 5769-AS1.

5.1.1 V4R3 features of HTTP Server for AS/400

V4R3 introduced substantial improvements over the V4R2 ICS product. The major features of the V4R3 product are described in the following sections.

Current HTTP
The IBM HTTP Server for AS/400 implements the HTTP version 1.1 protocol. This is the current version of the HTTP protocol.

Dedicated subsystem
The previous ICS ran its HTTP server tasks in subsystem QSYSWRK. The V4R3 HTTP Server tasks run in their own subsystem, QHTTPSVR, for greater efficiency of processing.

Persistent connections
When you enter a URL into your browser's address line or click on a link on a Web page, you open a connection between your browser and the HTTP server.

Prior to the availability of persistent connections, each file referenced on the Web page was retrieved using a separate connection. This type of retrieval is tremendously costly for the HTTP server and the network since there is overhead required to establish and terminate each connection.

Persistent connections are the default behavior for an HTTP server that implements the HTTP 1.1 protocol. Persistent connections provide the following advantages:

- Because there is less opening and closing activity, CPU and memory utilization on the HTTP Server is reduced.
- Network congestion is minimized because of the fewer number of TCP/IP packets that are required to request the files.
- HTTP requests and responses can be pipe lined on the connection. Using pipe lining, a client can make several requests to the server without waiting for the responses to the requests.

Virtual hosts
In previous versions of the AS/400 system HTTP server, the only way to host multiple Web sites on the AS/400 system and use the default HTTP port (80) is to use different communications adapters in the AS/400 system. If you want to host multiple Web sites through the same communications adapter, only one of the sites can use the default HTTP port. All other Web sites need a separate port assignment. To request those Web sites, the unique port assignment is included as part of the requesting URL.

Starting with the OS/400 V4R3, IBM HTTP Server for AS/400, you can enable virtual hosting. This allows you to host any number of Web sites through one communications adapter. With virtual hosting, you do not need to assign a unique port to each Web site.

Virtual hosting is useful if you need to provide multiple “top-level” URLs for your Web sites or if you provide Internet Service Provider (ISP) services to clients.

Proxy, cache, and local memory cache

The IBM HTTP Server for AS/400 can be configured as a non-caching or caching proxy server. When used as a non-caching proxy, the primary benefit of enabling proxy services is that the IP addresses used on your internal network are not sent out of your network. The proxy service forwards the request from your internal network using the IP address of the proxy server, not the address of the original requester. When the proxy server receives the response, it forwards the response to the original requester.

Proxy caching

With caching enabled, the proxy server can act as a high-speed local store of previously accessed Web pages. When you configure your server as a proxy caching server, you can improve performance. You can also allow users of your internal network to access documents on the Internet. For example, if you frequently access the same set of Web pages from one or more sites, it may be advantageous to activate the caching feature. The retrieved Web page is stored locally on your AS/400e system. Any subsequent accesses to the page occur at LAN speed, rather than at Internet speed.

Web pages can be encoded with a “no-cache” attribute or a specific expiration date. You can also configure the IBM HTTP Server for AS/400 proxy service so that it periodically performs “garbage collection” to remove expired files from the cache. The cache is located in the QOpenSys file system, which provides support for case sensitivity in file names. You configure the maximum size of the cache (which uses AS/400e system disk storage), protocols, and URLs to cache or not cache.

Proxy logging

Another use of the proxy service (with or without caching) is to log client requests. Some of the data available includes:

- Client IP address
- Date and time
- URL requested
- Byte count
- Success code

With this information, you can construct reports to account for the use of your Web site. The information can be used in a charge-back system, to understand and track marketing trends, for example.

Local memory cache
A proxy cache is traditionally most beneficial to clients on your network since it lets you store files that were retrieved from other Web sites. You can provide a caching service for files on your site using the local memory cache configuration options.

To use a local memory cache, you identify an amount of memory to allocate and a set of files to be cached. When the IBM HTTP Server for AS/400 is started, the files are read into the local memory cache up to the limit of the amount of memory allocated or the limit of the number of files that you allow to be cached.

When a request is received at your IBM HTTP Server for AS/400, the local memory cache is checked first to determine if it has a copy of the requested file. If so, the file is served from the cache, which is significantly faster than if the file is retrieved from disk storage.

Server-side includes
Server-side includes enable the server to process some of the Web pages before the server sends the page to the client. The current date, size of the file, and the last change date of a file are examples of the kind of information that you can include in Web pages you send to the client.

Automatic browser detection
Use this feature to provide different documents for different clients, allowing the customer Web site to seamlessly exploit the unique capabilities of whatever browser your customers are using.

Server API support
A follow-on to ICAPI, server API support enables users to write applications to extend or customize how the HTTP server handles client requests.

CGI programming
Corporations and other customers benefit from interacting with browser users by sending and receiving data. In the Web presence arena, this type of transaction is simple, such as collecting the name and address of a browser user who wants to receive a catalog. In general, these interactions start with a form: a Web page that contains input-capable fields and push buttons (like function keys). On the server system, for example, the HTTP server needs to hand the input from the form off to a program for processing. Typically, on AS/400e systems (and most of the platforms), that program is a CGI program or has Net.Data macros, which put a user-friendly interface around CGI programs. The CGI program receives the form data from the browser, accesses business data and business logic on the AS/400e system, updates

or stores information (if required by the transaction), and then builds the Web page that the HTTP server returns to the browser user in response.

There are several techniques available to you to create Common Gateway Interface (CGI) programs for use with the IBM HTTP Server for AS/400. The V4R3 IBM HTTP Server for AS/400 provides the following enhancements for GCI programming:

- Java and REXX CGI
- Non-parsed headers CGI
- QzhbCgiParse API

Java and REXX CGI

In addition to traditional AS/400 system languages used for CGI programming (ILE RPG, ILE COBOL and ILE C), you can use Java and REXX to create CGI programs. Java, in this case, means Java applications that use AS/400 system support for working with the STDIN and STDOUT files or the CGI APIs, not Java servlets. Support for Java servlets is provided with the WebSphere server, which is an add-on to the IBM HTTP Server for AS/400.

Non-parsed headers CGI

Most CGI programs generate response headers and HTML and return the data to the requesting client through the IBM HTTP Server for AS/400. However, there may be occasions when you want to generate a response in your CGI program and return it directly to the requesting client.

If the name of your CGI program begins with `nph_` or `nph-`, its output is not converted by the IBM HTTP Server for AS/400. You are responsible in your non-parsed header CGI program for creating a complete HTTP response message, including the HTTP return code and status information.

QzhbCgiParse API

Prior to the V4R3 IBM HTTP Server for AS/400, CGI programs written in ILE RPG or ILE COBOL needed to use several APIs to work with HTML form data:

- QtmhGetEnv to get the value of the QUERY_STRING environment variable and other environment variables
- QtmhRdStin to read data from the STDIN file for a POST request
- QtmhCvtDb to parse data from the QUERY_STRING environment variable or the data retrieved from STDIN

Although the QtmhGetEnv and QtmhRdStin APIs are easy to work with and relatively straightforward, the QtmhCvtDb API is somewhat cumbersome to use.

The IBM HTTP Server for AS/400 provides the QzhbCgiParse API, which combines the functionality of the three Qtmh APIs into one. Some of the features of this API include:

- Support for both GET and POST data
- Parses form data into field name and field value pairs
- Uses a list technique similar to other AS/400e system APIs. Rather than determine the format of the data to be retrieved in advance (that is, while coding the CGI program), simply call the API and walk through the list of retrieved values. If your HTML form changes, you do not necessarily need to recode and recompile your CGI program to accommodate the changes.

Persistent CGI

One of the most significant enhancements in the V4R3 IBM HTTP Server for AS/400 for CGI programs is the introduction of the persistent CGI, or persistency. To understand the benefit of persistency, you can compare it with what happens in a non-persistent CGI application:

1. The requester makes entries on an HTML form and clicks a submit button on the form. The submit button has an associated URL that invokes a CGI program on the HTTP server. A connection is created between the HTML form and the CGI program.
2. The CGI program is invoked and retrieves the form data (using either the GET or POST method). The CGI program processes the data, prepares a response, and returns the response to the requester using the STDOUT file.
3. After completing the output to STDOUT, the connection between the requester and the CGI program is terminated when the end-of-file indication is sent through STDOUT. At this point, the CGI program ends, since there is no way for any subsequent requests to reconnect to that instance of the CGI program.
4. Subsequent requests start at step 1 again. A new connection must be established between the HTML form and the HTTP server.

Although this scheme is fine for HTML forms that can be processed in a single invocation of a CGI program, most Web transactions involve more than one HTML form or multiple interactions with the same form.

For example, a “shopping cart” application is a form that is continuously added to as the requester selects items from other Web pages. As items are added to the cart, the list of items must be maintained somewhere because in a non-persistent application, there is no program running on the HTTP server to retain the list. Some solutions for maintaining this state information include

temporary files on the HTTP server or “cookies” that are written to the requester’s local storage.

How persistent CGI works

In contrast, a Web application that uses persistent CGI does not need to rely on temporary storage schemes to maintain state information. A persistent CGI application can work as described in the following series of events:

1. The requester fills in an HTML form and clicks the submit button. The requesting URL invokes a CGI program. The connection between the requester and the HTTP server is now active.
2. The CGI program prepares output to send back to the requester. However, a special header record (Accept-HTSession) is returned to the requester along with a “handle” to identify the persistent CGI program that services the requester.
3. Output from the CGI program is sent to the requester in file STDOUT. As with non-persistent CGI, the connection between the requester and the CGI program is terminated after an end-of-file. However, the CGI program itself remains active, since the HTTP server can identify and use it for additional requests from the same requester.
4. Subsequent requests send the handle along with data from the form. The HTTP server recognizes the incoming request as belonging to the particular instance of the CGI program. The new connection between the requester and the HTTP server is linked to the already executing CGI program. Because the program never ended, any internal data structures that it had created on previous requests are still available.

Controlling a persistent CGI

Since there is no way to guarantee that a requester completes a transaction, the IBM HTTP Server for AS/400 includes directives that let you specify the amount of time a persistent CGI application can be inactive before being terminated. The time-out value can be specified at both the server level and the application level so that you can allow some applications more time to complete.

No indication is sent to the requester when the time out is reached. Also, any database and file processing is your responsibility. For database applications where changes occurred, you typically want to perform a rollback operation when a persistent CGI time out occurs.

NetQuestion

NetQuestion is a powerful, full-text search engine that builds a global Internet or centralized intranet search service. The Information Technology (I/T)

department can handle large amounts of information that are typically stored on Web sites. Documents to be indexed by NetQuestion are provided in either plain text or text with HTML markup. CGI scripts and HTML forms are provided for search and administration. Administration can also be done, using command line functions.

Net.Data

The follow on to DB2 WWW, Net.Data is a no-charge AS/400 tool for helping application developers to add live data to their Web pages.

With static HTML pages, data is present that never changes. Therefore, you need to write CGI programs to dynamically build Web pages. You can do this using the AS/400 HTTP Server, which provides a CGI interface. But, it is not easy to write these programs.

IBM Net.Data is a CGI program that allows application developers to easily transform static HTML Web pages into dynamic Web applications using Web macros. Web macros created for Net.Data have the simplicity of HTML with the functionality of CGI-BIN applications, making it easy to add live data to static Web pages. Live data includes information stored in DB2 UDB for AS/400 (locally or remotely), databases on other systems, REXX programs, C and C++ programs, RPG programs, COBOL programs, and other sources.

5.1.2 Security features (cryptographic, certificates, and digital ID)

SSL is a security protocol that was developed by Netscape along with RSA Data Security. This protocol ensures that data transferred between a client and a server remains private. It allows the client to authenticate the identity of the server and the server to authenticate the identity of the client.

IBM HTTP Server provides HTTP secure (HTTPS) transactions with the Secure Sockets Layer (SSL) V3 protocol. Starting with V4R3, IBM includes the Cryptographic Access Provider as a no-charge LPP with OS/400 to use with SSL.

Once your server has a digital certificate, SSL-enabled browsers, such as the Netscape Navigator, can communicate securely with your server using SSL. With SSL, you easily establish a security-enabled Web site on the Internet or on your corporate intranet. You can also install digital certificates on the clients in your network so the server can authenticate connections without prompting for a user ID or password.

SSL uses a security handshake to secure the TCP/IP connection between the client and the server. During the exchange signals, the client and server agree on the security keys that they will use for the session, and the client

authenticates the server. After that, SSL encrypts and decrypts all of the information in both the HTTPs request and the server response, including:

- The client's URL request
- The contents of any form submitted
- Access authorization information like user names and passwords
- All data sent between the client and the server

The IBM HTTP Server for AS/400 uses the public key cryptography from RSA Data Security, for encryption, digital signatures, and authentication. This support is built into OS/400 for optimal performance and is readily available to all TCP/IP servers wanting to use SSL.

There are three versions of the Cryptographic Access Provider:

- 5769-AC1 provides 40-bit encryption
- 5769-AC2 provides 56-bit encryption
- 5769-AC3 provides 128-bit encryption

Only one version is shipped with your OS/400 installation media. The version shipped is based on the country where the AS/400e system is installed. This version complies with United States export laws for computer encryption products and local laws of the country.

Note: By providing the Cryptographic Access Provider along with OS/400, it is possible to use the support provided by this Licensed Program Product (LPP) even if the IBM HTTP Server for AS/400 is not installed.

5.1.2.1 Digital Certificate Manager (DCM)

Another change introduced with OS/400 V4R3 is the Digital Certificate Manager (DCM) option. You can install this as option 34 of the OS/400 base installation.

Digital Certificate Manager provides support for generating and maintaining digital certificates. Certificates are used for both server and client authentication.

Although you can generate certificates for your HTTP Server to attest to its authenticity, you most likely need to apply for and receive a certificate from a well-known certificating authority (for example, Verisign) if you intend to conduct e-commerce with your AS/400 system. Both the Netscape Navigator and Microsoft Internet Explorer browsers include a list of well-known certificating authorities that are accepted by the browsers to authenticate Web pages from your HTTP server.

Digital ID

Another feature introduced with the V4R3 IBM HTTP Server for AS/400 uses digital IDs to provide client certification. Although we traditionally think of digital IDs to provide verification of the server's authenticity, it is also useful for clients to provide the server with a guarantee of their authenticity.

Client authentication using digital IDs can be used as an alternative to prompt for a user ID and password. Digital ID authentication requires SSL client authentication for HTTP Server client certificates. This offers resource protection with:

- Valid client certificates
- Client certificates with certain distinguished names values
- Client certificates associated with AS/400 user profiles
- Client certificates associated with AS/400 validation lists

5.1.2.2 Socks support and SSL tunneling

If your environment has a Socks-based firewall for access to the Internet, you can use the IBM HTTP Server for AS/400 proxy server to access the destination outside the firewall. Client connections that use SSL are tunneled through the proxy server, eliminating the need to decrypt and encrypt the data at the proxy.

5.1.3 OS/400 V4R4 features of HTTP Server for AS/400

With the advent of V4R4, several improvements are added to the HTTP Server for AS/400. Such enhancements include:

- **Improved management**
  - SNMP subagent support is added. This allows HTTP server statistics to be forwarded to an SNMP network manager upon request. The subagent allows use of any SNMP-capable network management system, such as TME 10 NetView, TME 10 Distributed Monitoring, or HP OpenView to monitor the server.
  - Log reporting provides the ability to define access reports, generate reports, view reports, and maintain report files using a GUI based on report templates. The capability to remotely access HTTP server logs, statistics and status is also introduced with V4R4. Parameters such as the number of hits on an AS/400 Web page are readily accessible using this interface.
  - Log archiving allows the customer to manage and maintain their log files.

– The standard Extended Log File Format is supported. This allows a broader use of industry-wide log analysis tools and log file customizing. The extended format allows more data to be saved in the access log files and allows more control over which data is stored in these files. Numerous analysis tools are available that use this new log format.

– Web server error logs now contain messages presented in the customer's language of choice.

– Serviceability of the Web server is improved with additional trace points, additional information in service traces, and improved FFDC information.

– Error logs are NLS enabled.

- **Performance improvements**

  HTML files are dynamically cached in memory when a URL request for that file is processed. Subsequent requests for that file are handled without the need to do a file input or output. This results in better static page serving performance without manual configuration.

  Multi-threaded CGI programs are now supported. Multi-thread programs can often be more efficient than single threaded ones.

- **LDAP support**

  The HTTP server uses Lightweight Directory Access Protocol (LDAP) to store configuration information and user authentication information. LDAP integration allows you to use directory services for server configuration and authentication.

- **Tools enablement**

  New APIs to the HTTP server are provided to allow third-party management tools to query the value of certain configuration directives as well as use the Web server's mapping rules for a URL.

  The following additional HTTP methods are now supported:

  - **PUT**: Allows a resource identified in a URL to be stored on the AS/400e system
  - **DELETE**: Allows a resource identified by a URL to be deleted from the AS/400e system
  - **User Defined methods**: Additional methods with user-defined behavior may be implemented

- **Additional security function**

  Certificate administration is centralized in the Digital Certificate Manager (DCM) product. The HTTP Server for AS/400 is a certificate customer.

Platform for Internet Content Specifications (PICS) support is added.

- **Web server search engine**

  With V4R4, the HTTP server now has a no-charge built-in search engine to support both SBCS and DBCS search data. DBCS encompasses documents written in all languages including Chinese, Japanese, and Korean. The engine allows the customer to perform full text searches on HTML and text files sorted in an AS/400e file system from any Web browser. The AS/400 Web server search engine allows browser-based administration and provides Net.Data macros to customize the search and search results.

You can find more information on the IBM HTTP server at:
`http://www.as400.ibm.com/products/`

Chapter 6. WebSphere Application Server for AS/400

What is WebSphere Application Server? In a nutshell, it is a set of tools for developing, testing, running, and measuring Java-based Web applications. WebSphere Application Server is the IBM Java-based Web application deployment environment for server-side applications and JavaBeans. It helps customers deploy and manage Web-based applications ranging from simple Web sites to powerful e-business solutions. This chapter discusses WebSphere Application Server for AS/400 in more detail.

6.1 Introduction to IBM WebSphere Family

WebSphere Application Server for AS/400 is a product component in the IBM WebSphere family. This section provides a brief overview of the IBM WebSphere family and how AS/400 WebSphere Application Server products fit in the picture.

6.1.1 Server concept review

As the name of the product itself says it, WebSphere Application Server is a product to build and maintain an application server. In that case, what is an application server in an e-business context? To clearly understand this, we discuss the components pictured in Figure 28.

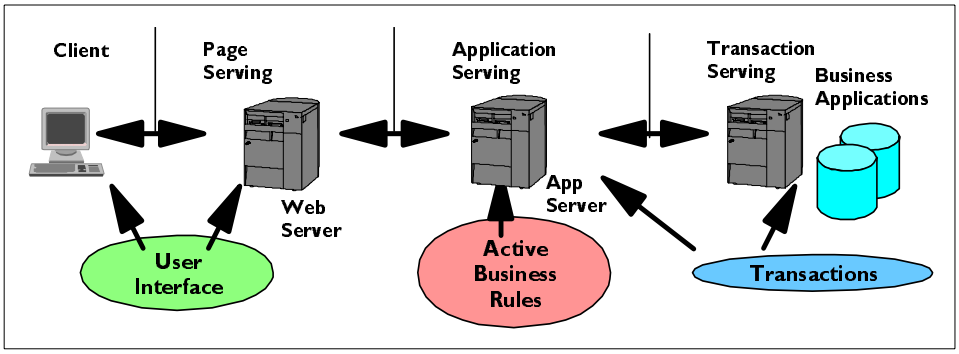

Figure 28. Web server, application server, and transactions server

6.1.1.1 Web (or HTTP) server

The Web server's primary purpose is to serve Web pages to a client browser. A business application for this technology is to develop a static Web catalog to list product descriptions (including graphics and pictures) and pricing, as well as instructions for ordering the product using a non-Web means.

6.1.1.2 Application server

An application server mediates between the Web and business applications. This type of server can be described as “Web middleware”, or a middle tier in a three-tier e-business environment, where the first tier is the HTTP server and the highest tier is the business database (that is, DB2) and the business logic (traditional business applications such as order processing). An e-business example of this kind in a dynamic Web site environment involves automatically linking the Web catalog to price changes in the customer’s price database.

An application server is a set of routines or software allowing the user to run server side applications, such as servlets, JavaServer Pages and Enterprise JavaBeans. These applications can serve as a link to the existing “legacy” applications or database information.

Application servers naturally support Web-based applications. They provide the services and tools to generate Web-user interfaces. They support all of the Web-related protocols and infrastructure. Application servers apply active business rules and run business logic (filters, rules, and so on). Several different Web programming models are typically employed, including HTML, CGI (implemented using the HTTP server in the WebSphere environment), and the above mentioned Java servlets, and JavaServer Pages (JSPs).

Typical features of application servers include:

- Managing browser and Java-based client sessions
- Support to run server-side e-business logic
- Enabling connections to backend computing resources for data and transaction processing
- Simplified development and deployment of Web-enabled e-business applications
- Support of connections to legacy data and applications
- Application deployment and management tools

Application servers work in concert with a development tool that supports servlets and JSPs. WebSphere Studio provides this support.

6.1.1.3 Transaction server

Transaction servers are often the same as, or a more capable version of, the application server. A transaction server is required when a customer wants to extend e-business across the entire spectrum of business processes to encompass transaction processing and run the actual state of the business.

A catalog company wanting to acquire a transaction server can introduce browser-initiated ordering of their products. This requires *integration* of Web customer ordering with the existing order processing system. The Web application performs some level of processing before accepting and confirming an order.

If a company using a transaction server wants to use the existing ordering program, then connectors can be employed. Connectors are Java classes that interact with another program or data source. Connectors work with a program on the same machine or serve as a proxy to a program running on another machine.

The transaction server customer can take this concept further and evolve the Web ordering process to automatically integrate with the inventory system. Potential applications include an automatic ordering of products when their inventory falls below a set threshold level. This involves transactions scoped across more than one data source (also known as *distributed transactions*).

As well, *persistence* requirements can also grow along with the acceptance of the Web application. *Persistenc*e refers to the process of moving data between the customer's relational database and Java objects.

Transaction servers often employ Enterprise JavaBeans (EJB), a key technology for dealing with distributed transaction and complex persistence issues in a Web application. In addition to a Web development tool supporting servlets and JSPs, a transaction server can also employ a Java Integrated Development Environment (IDE) such as VisualAge for Java Professional Edition (included with WebSphere Studio).

6.1.2 Overview of IBM WebSphere Family

WebSphere is a brand name for a set of IBM products designed to make it easier and more productive to build, deploy, and manage a dynamic Web site. WebSphere's architecture enables you to build business-critical applications for the Web.

The IBM WebSphere family consists of the following components:

- WebSphere Application Server
- WebSphere Studio
- WebSphere Performance Pack
- WebSphere Site Analysis

For the most current information on IBM WebSphere support, go to the site at: `http://www.software.ibm.com/webservers`

6.1.3 The IBM WebSphere Application Server

As the popularity of Java continues to increase, the emerging program model that people are expected to move to is the application server model. The IBM offering for the AS/400e system is the WebSphere Application Server. It is a Java-based servlet engine that is built on top of the native Java virtual machine on the AS/400e system. It provides Java servlet API support, which is defined by Sun Microsystems.

If you write to the Java servlet API standard, your application is portable across any operating system and any environment that supports servlets. This is a big reason why Java servlets are a popular interface to write to.

Figure 29 shows how servlet support is provided on the AS/400 system. The browser-based application is at the bottom of the figure. A database or file or some other resource that the browser application wants to access through a servlet are shown at the top of the figure.

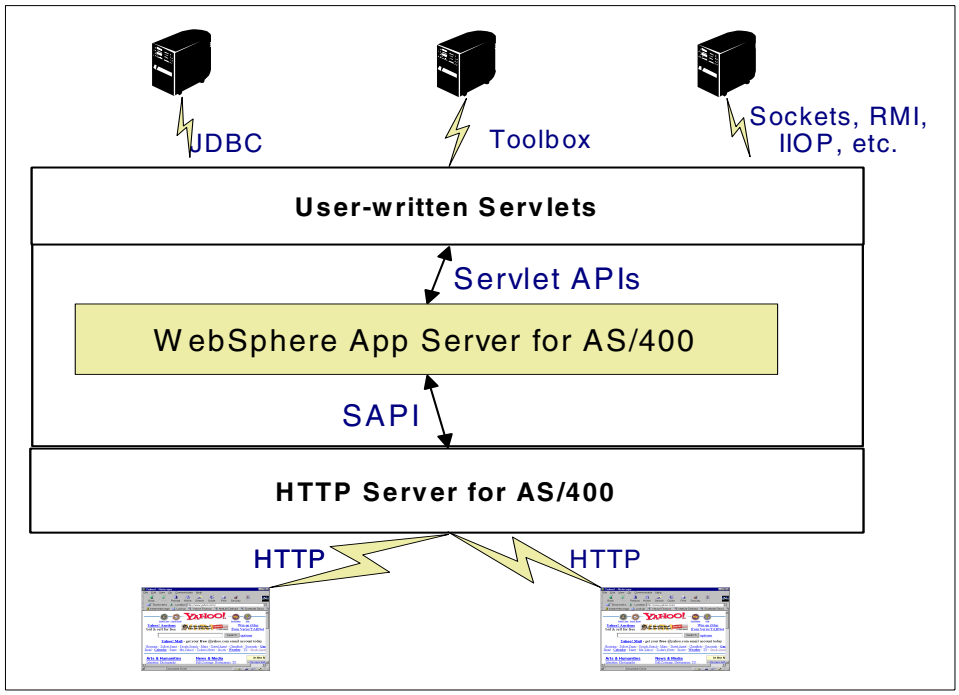

Figure 29. AS/400 servlet support

The browser always interfaces to the Web server, whether it is the Web server built into OS/400, Apache, or Netscape. In the case of the AS/400 system, it is the IBM HTTP Server (5769-DG1).

The WebSphere Application Server is an add-on product to the HTTP server. It provides the servlet API support. The user-written servlet interfaces with these APIs. The WebSphere Application Server interfaces to the Web server using the Web server's API. On the AS/400e system, it uses the Server API (SAPI) interface, which is also called IBM Connection API (ICAPI). This path is used on the AS/400e system because the AS/400 HTTP server provides this level of API support. The WebSphere Application Server interfaces to the IBM Web server, which, in turn, interfaces to the browser.

On other platforms, the WebSphere Application Server also supports the Apache API, ISAPI, which is the API that the Microsoft Web server supports, and NSAPI, which is the Netscape API. This means that the WebSphere Application Server provides servlet support for almost any Web server.

The WebSphere Application Server comes with a graphical user interface to manage servlets and control who has access to them. Since most applications access a database, there are many advanced database access capabilities available. This includes a connection manager to improve performance when accessing remote databases, and data access beans that make accessing the database even easier for Java programmers.

The WebSphere Application Server also comes with JavaServer Pages support. The JavaServer Pages technology is a simple but powerful way to dynamically generate HTML on the server side. With JavaServer Pages technology, you can quickly and easily create Web pages with dynamically generated content. When you write JavaServer Pages, you call reusable server components (such as JavaBeans or servlets) to automatically create data objects from an HTML file. This allows you to cleanly separate the generation of dynamic content from its presentation.

There are three versions of the WebSphere Application Server:

- **Standard Edition**: The Standard Edition is intended for use by Web application developers who focus on the issues of presentation logic, data access, and the business logic that resides in the middle tier. The focus is on servlet run-times, HTML, and support for JavaServer Pages (JSPs). This combination provides an easy-to-use set of capabilities for presentation and data access-oriented Web applications.
- **Advanced Edition**: The Advanced Edition adds support for Enterprise JavaBeans. The EJB support includes bean-managed and session-managed persistence using entity beans, full support for session beans, relational database connectivity using JDBC (allowing support of the Java Transaction Service, or JTS using EJBs), and support for EJBs to MQSeries and CICS for even more robust transactional support.

- **Enterprise Edition**: Integrating enterprise applications is the focus of the Enterprise Edition. This edition adds to the EJB and services support of the Advanced Edition the ability to integrate applications across the enterprise using the robust architecture and services provided as part of the CORBA standard. Enterprise Edition leverages the connectivity and application integration capabilities of IBM Component Broker technology, which has been incorporated into WebSphere. In addition, users can deploy EJBs either to the same EJB container that is part of the Advanced Edition or to the Component Broker container.

The AS/400e system provides WebSphere Application Server support starting with OS/400 V4R3. In V4R3, WebSphere Application Server 1.1 support is provided as part of the HTTP Server for AS/400 (5769-DG1). In OS/400 V4R4, it is split out into a separate product numbered 5769-AS1, which is still at Version 1.1. For V4R4, you can upgrade to the new Standard Edition, Version 2.031, by installing the group PTF SF99027.

Note: To determine the level of group PTF on your system, use the Display Data Area (`DSPDTAARA QAPPSVR/SF99027`) command. For Version 2.0.1, the data area must display a date of 12/01/1999 or later with a suffix of -04. That is, `SF99027-04 V4R4M0 12/01/1999` should display. Note also that this group PTF also contains the latest HTTP server, database, and Java PTFs.

Complete details on the PTF and service information for WebSphere are available at:
`http://www.as400.ibm.com/tstudio/websphere/services/service.htm`

Version 3 of the WebSphere Application Server Advanced Edition for AS/400 is now available. It provides support for Enterprise JavaBeans and Enterprise Java Services.

EJB components are reusable, portable, server-side business logic components. IBM has adopted the EJB model to deliver productivity and flexibility to customers who are building sophisticated Web applications. This unified component model, supported across the IBM product line, makes it easier for customers to build, run, and manage the new generation of e-business applications, using tools and platforms that best meet their business needs.

Enterprise Java Services are the IBM-provided functions to run and manage applications coded to the EJB specification. The container and server provide transaction, security, and persistence support, which makes the development of server-side business logic considerably easier.

6.1.4 WebSphere Studio

WebSphere Studio is a suite of tools for development of Web applications. It is optimized specifically for WebSphere Application Server applications, but you can also use many of the Studio tools for the development of applications for other Web servers or Web application servers. You run the WebSphere Studio development tools on a Windows workstation, but you can deploy the resulting application to an AS/400e system running either WebSphere Application Server Standard Edition or Advanced Edition. WebSphere Studio provides tools you can use for managing your Web application project and for the creation of HTML, Java, and JSPs including graphics and database access. This is not an AS/400 product, but is available from the IBM Software Group.

The following tools are included in WebSphere Studio Version 3.0:

- Studio WorkBench
- Studio Wizards
- Page Designer
- Applet Designer

The following components are optional with WebSphere Studio Version 3.0:

- NetObjects Script Builder 3.01
- VisualAge for Java 3.0 Professional Edition
- Remote Debugger

For more information on using the WebSphere Studio in an AS/400 environment, see *Web Enabling AS/400 Applications using WebSphere Studio*, SG24-5634.

6.1.5 WebSphere Performance Pack

WebSphere Performance Pack is a set of tools for caching, load balancing, and Web-site replication. This is not an IBM AS/400 licensed product, but is available from the IBM Software Group.

WebSphere Performance Pack comes in two versions. The first is *Cache Manager*. It provides a proxy caching capability. The HTTP Server for AS/400 Web server has caching proxy built into it. The Cache Manager is an enhancement over that. It uses more sophisticated algorithms and has some additional features. It is basically a Web server that acts as a caching proxy and does that very well. It also has a built-in Platform for Internet Content Specifications (PICS) filtering platform. This is a self-rating system. You can put information on your Web page that basically rates the contents of the Web page for violence, nudity, and so on. In the caching proxy, you can filter out

those types of sites. Anybody using the caching proxy to get to the Internet will never see the filtered content in their browser. This is especially useful in an educational environment where you're trying to filter that type of information away from the students.

Performance Pack Cache Manager is not currently available for the AS/400e system.

Availability Services provides the network dispatching capability or load balancing capability. This is needed for scalability or high availability services. For example, you may want multiple AS/400e systems to serve requests.

Perhaps you have one Web address, but you need more than one server to serve the requests to deliver adequate response time. You need multiple machines to look like one machine. It is usually a load balancer that does that. All the requests come into the load balancer and they get forwarded to the different Web server machines based on their capability of handling the requests. The load balancing software does not run on the AS/400e system. It runs on an external box including an IBM 2216 Router, AIX, SUN, or Windows NT box. It is a front end to multiple systems, including multiple AS/400e systems. This provides for scalability and high availability.

6.1.6 WebSphere Site Analyzer

The WebSphere Site Analyzer tools provide site administration and analysis tools to administer and manage the usage of a Web site. The collected statistics reside on the server, for example, an AS/400e system. This data is downloaded to a Windows 32-based workstation with the site analysis tools installed. The tools perform the analysis and have graphical display functions to display the results. This is not an AS/400 licensed product, but is available from IBM Software Group.

The Site Analyzer Tools includes functions such as:

- An administration site visualizer
- A report generator and builder
- A content Analyzer to scan the Web site and identify such items as duplicates, unavailable resources, and content with excessive size
- A usage Analyzer to scan the Web logs for hits, requests, paths, agents, and so on (analysis can be scheduled and results placed in a database)

6.1.7 Putting it all together

WebSphere products are available for many servers, including IBM servers. Figure 30 shows the family of WebSphere products and whether they are used for building, running, or managing e-business. Section 6.2, “WebSphere Application Server for AS/400: Product description” on page 112, discusses the WebSphere products that apply to the AS/400e server family.

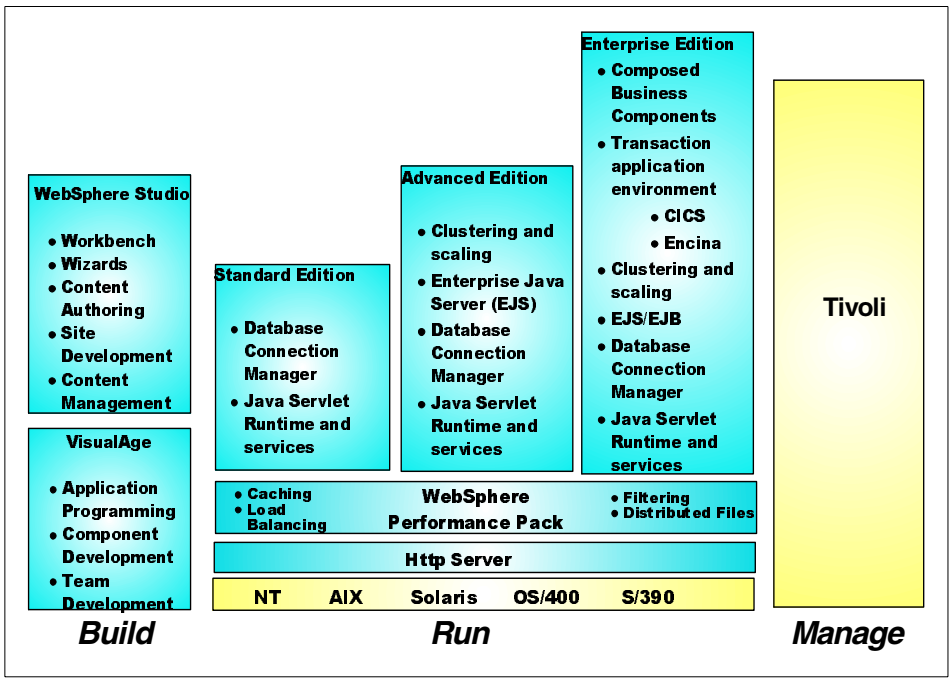

Figure 30. The WebSphere product family

Functional highlights include:

- WebSphere Studio and VisualAge for Java are used to build the applications
- WebSphere Application Server is used to run the applications. It works in conjunction with the HTTP server
- WebSphere Performance pack is used for caching, load balancing, and Web-site replication
- Tivoli is used for change management

For the latest information on WebSphere on the AS/400 system, go to the site at: `http://www.as400.ibm.com/products/websphere/index.htm`

6.2 WebSphere Application Server for AS/400: Product description

This section explains the products of IBM WebSphere Application Server for AS/400. Figure 31 provides an AS/400 specific view of the WebSphere product family. Each member is described in the following sections.

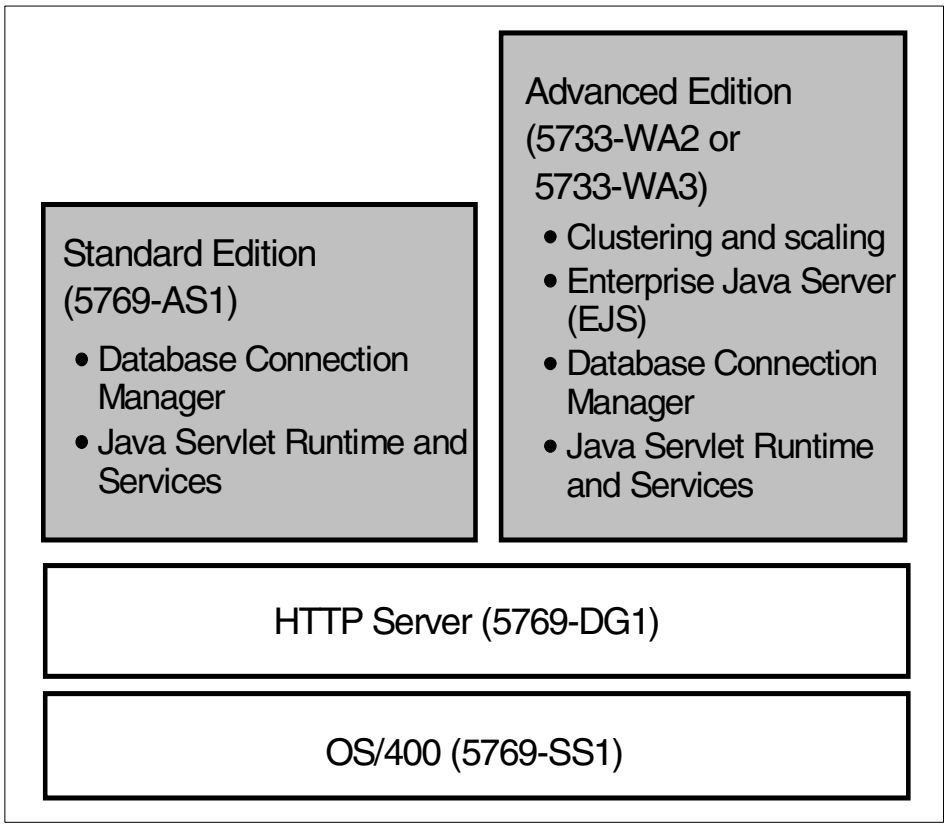

Figure 31. AS/400 WebSphere product family

The AS/400e system currently supports the Standard Edition, Version 2.02, of WebSphere and Version 3.02 of the Advanced Edition. As of April 2000, the AS/400e also supports Version 3.02 of the Standard Edition.

For the latest versions of the products supported for the AS/400e system, refer to: `http://www.as400.ibm.com/products/websphere/index.htm`

6.2.1 WebSphere Application Server for AS/400: Standard Edition

WebSphere Application Server for AS/400 Standard Edition is a no charge Licensed Program Product (LPP), 5769-AS1. It comes in OS/400 as part of the base package. It features the following components and services:

- Plug-in for IBM HTTP Server for AS/400
- Support for servlets, including:
  - Java-based servlet engine
  - Implementation of the JavaSoft Java servlet API
  - IBM extensions and additions to the servlet API
- JavaServer Pages (JSP) support
- XML Document Structure Services
- Connection management feature to cache and reuse JDBC connections
- WebSphere Application Server Manager, the graphical administration interface for WebSphere Application Server

6.2.1.1 Plug-in for IBM HTTP Server for AS/400

The IBM HTTP Server for AS/400 handles static content, Common Gateway Interface (CGI) program invocations, and proprietary plug-ins. The runtime environment (WebSphere Application Server) plugs into IBM HTTP Server for AS/400 using plug-in application programming interfaces (APIs), and then routes servlet requests to the servlet manager, which then takes care of handling the request and passing the data back to the client.

6.2.1.2 Servlets

Within the middle-tier and the Web Application Server environment, the focus is on the Servlet Engine which is Java-based. The servlet runtime provides the Sun/JavaSoft APIs for the Java servlet environment, including the servlet life cycle: init, service, and destroy. Servlets can be preloaded, so that when a client request comes in, a servlet is loaded and waiting to act on it.

Servlets send and receive most of their data through output and input streams. These streams are supplied each time a servlet is invoked using service callback. A popular specialization of servlets provides a function designed to make it easy-to-read parameters from a URL and send HTTP output in response to that URL request.

The servlet manager (part of WebSphere Application Server Manager) creates instances of the servlets, deploys them, manages their execution, and provides tracing and monitoring facilities for them. The servlets themselves handle HTTP requests, maintain an HTTP session with the client,

produce presentation logic using HTML, stream, and non-transactional business logic. Servlets can also call component functions or routines built as JavaBeans. These beans can be called to connect to or interface with remote systems of various types and formats using different native APIs.

6.2.1.3 JavaServer Pages (JSP)

The WebSphere Application Server servlet engine also handles requests for JavaServer Pages (JSP) or server-side HTML scripting. These dynamic requests are normally not as “short-lived” as static ones. Therefore, the limit of how many concurrent requests this engine can handle is smaller than for static serving, and the response time is longer. This is to be expected, since we are now running applications and dynamic content, and not just sending static bytes back to the client.

6.2.1.4 XML

WebSphere Application Server supports XML document structures and can generate, validate, parse, and serve XML content.

6.2.1.5 Connection Manager

The Connection Manager manages a pool of relational database connections. Coupled with some data access JavaBeans, the Connection Manager connects to a remote database, pulls in required data, saves it into a local cache, and disconnects. The JavaBeans then work with the data in the cache to dynamically generate Web content.

6.2.1.6 WebSphere Application Server Manager

WebSphere Application Server Manager is a browser-based graphical interface that allows you to change WebSphere Application Server settings and to configure and monitor Java resources, WebSphere Application Server security, JDBC connections, active sessions, and logs.

After installing WebSphere Application Server, you can locate the Manager by directing your browser to the URL: `http://your.server.name:9090`

Here, *your.server.name* is the host name of your Web server.

6.2.1.7 WebSphere Standard Edition V3.02

This latest version of the product features:

- Support for JavaServer Pages:
  - Support for specifications .91 and 1.0
  - Extended tagging support for queries and connection management
  - An XML-compliant DTD for JSPs

- Support for the Java Servlet API 2.1 specification including automatic user session and user state management
- High-speed pooled database access using JDBC
- XML server tools, including a parser and data transformation tools
- Additional integration with IBM VisualAge for Java to help reduce development time by allowing developers to remotely test and debug Web-based applications

6.2.1.8 WebSphere Standard Edition V2.031, V2.02, and V1.1

These older versions of the product feature:

- Support for JavaServer Pages:

  Support for specification .91
- Support for Java servlets:
  - Java Servlets API 2.0 specification support in version 2.02 and 2.031
  - Java Servlets API 1.1 specification support in version 1.1
- Connectors to common database formats
- Java-based Application Server Manager
- Session Tracking framework
- Personalization
- Database connection management
- XML document structure services

6.2.2 WebSphere Application Server for AS/400: Advanced Edition

There is a new version of the WebSphere Application Server, WebSphere Application Server Advanced Edition 3.02 for AS/400. It is available as program product 5733-WA2 (56-bit encryption support) or 5733-WA3 (128-bit encryption support). The Advanced Edition of WebSphere was announced for the AS/400 system on 08 February 2000 with an availability date of 25 February 2000. It is a chargeable licensed program option (LPO) and priced per AS/400 CPU.

The WebSphere Application Server Advanced Edition 3.02 for AS/400 is part of an extended brand of IBM products for e-business. It goes beyond the capabilities of the WebSphere Standard Edition product, servlets, and JavaServer Pages (JSP) support, to provide support for Enterprise JavaBeans (EJBs). EJBs allow you to develop sophisticated server-side components (or objects) for your business. This model may include:

- Business applications
- Internet- or intranet-based applications that require integration into existing AS/400 applications
- New business applications that require complex database integration with a heterogeneous, multi-database vendor environment.

When used with development products such as VisualAge for Java Enterprise Edition 3.0, WebSphere Application Server Advanced Edition 3.0 provides a modern development environment for building Java applications. This environment provides the facilities to provide similar levels of integration, security, and transactional support that was previously only available to the traditional AS/400 developers utilizing ILE languages. The component technology utilized, EJBs, is *the* standard within the Java community for building components.

WebSphere Application Server Advanced Edition 3.0 implements the EJB Version 1.0 specification, with some 1.1 specification enhancements, particularly in the area of the finder helper methods. For more information on EJBs, refer to the Sun Microsystems Enterprise JavaBeans Technology Web pages at: `http://java.sun.com/products/ejb/index.html`

6.2.2.1 Advanced Edition product features

WebSphere Application Server Advanced Edition 3.0 product features include:

- Support for JavaServer Pages:
  - Support for specifications .91 and 1.0
  - Extended tagging support for queries and connection management
  - An XML-compliant DTD for JSPs
- Support for the Java Servlet API 2.1 specification including automatic user session and user state management
- Full support for the Enterprise JavaBeans (EJB) 1.0 specification, including both SessionBeans and EntityBeans (container-managed and bean-managed persistence)
- Deployment support for EJBs, Java servlets, and JSPs with performance and scalability improvements, including:
  - Application-level partitioning
  - Load balancing
- High-speed pooled database access using JDBC
- XML server tools, including a parser and data transformation tools

- A Web site analysis tool for developing traffic measurements to help improve the performance and effectiveness of your Web sites
- Additional integration with IBM VisualAge for Java to help reduce development time by allowing developers to remotely test and debug Web-based applications
- Enhanced support for distributed transactions and transaction processing
- Improved management and security controls, including:
  - User and group level setup
  - Method level policy and control

Performance and scalability

The Advanced Edition includes application-level workload management and clustering, with enhanced container deployment environment services for EJBs, servlets, and JSPs. Improved transaction management intelligently deploys and executes across multiple applications and components, therefore optimizing object management and performance.

The Advanced Edition focuses on higher performance and scalability across the deployment environment. It addresses load balancing, application partitioning, and workload management for EJB components. This involves enhanced and added “container” deployment environment services for servlets, EJB, and JSP technology. The improved transaction management has intelligence on the type of applications being executed and can deploy and execute across multiple applications and components accordingly. Object management and performance are optimized.

Transaction management

The Advanced Edition includes deployment and management capabilities for Java applications and EJB components that allow powerful interactions with enterprise databases, transaction processing systems, and other applications.

The EJB server provides better monitoring and control of containers used within the server. It offers enhanced Java Transaction Service (JTS) support within the EJB server, better interoperability, and a major rewrite of the deployment environment.

A single, robust server offers better control, more flexibility, and better serviceability for the deployment and management of JavaBeans, Java servlets, JSPs, and applications built to the EJB specification for execution and transaction management.

Container management and persistent storage with DB2 Universal Database help provide a high-performance transactional environment using servlets and EJBs.

Site analysis

A completely new and exciting package of site usage and analysis tools are included with WebSphere Application Server, Advanced Edition. Site analysis focuses on developing basic traffic measurement functions while allowing the user to gauge traffic volume (hits, visits), identify traffic sources (domains, subdomains, referrers), and manage site integrity (link verification, site conformance). These are the key features enabling the user to enhance and improve the Web site content and performance, making Web sites more enticing, informative, and ultimately beneficial to the “bottom line” of your business.

The new “server” contains the analyzers whose responsibility is to transform the raw data into valuable information and store it into the provided UDB DB2 database. The client provides administrative, visualizing, and report-generating functions. From the client, the user may schedule analysis tasks to run at a specific time or time interval. Progress status is broadcast to interested clients and displayed as appropriate and necessary. Once the analysis is complete, users can generate reports or view the data. The system offers many predefined, ready-to-use reports.

6.2.3 Final look: Architectural view of all components

We covered all major technology components of WebSphere Application Server and their relationships with other components. We also covered how WebSphere Application Server product is implemented on the AS/400e system. Let’s take a final look at the architectural view of all related components as shown in Figure 32. See if you can explain each component and their relationship comfortably.

Note

Customers who need AS/400 Support Line for WebSphere heed to purchase the Internet Product group of support offerings.

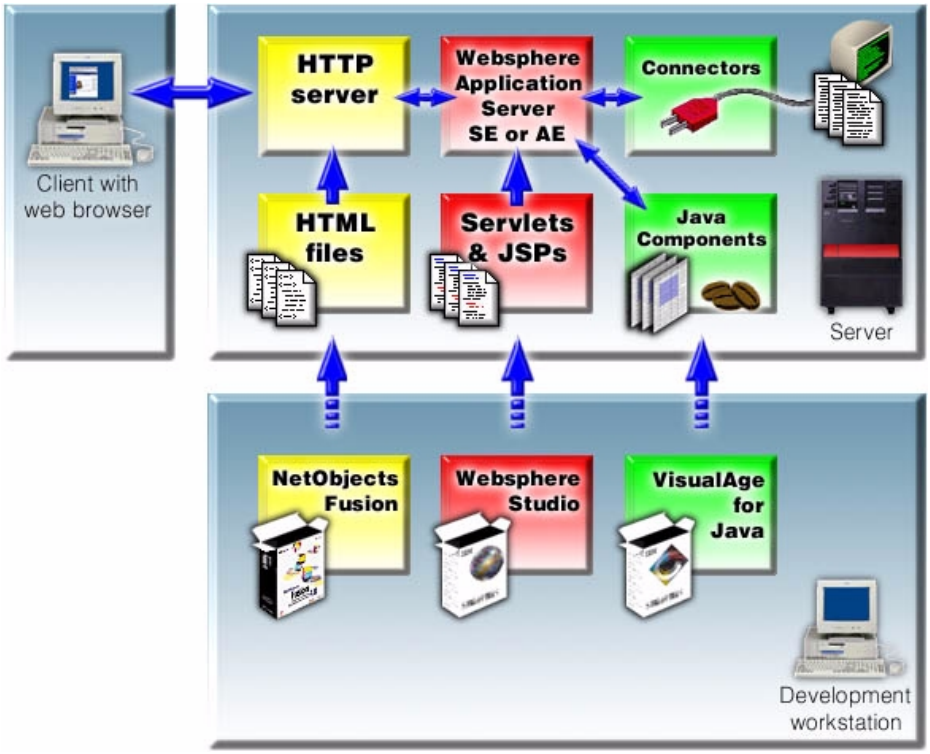

Figure 32. WebSphere Application Server with HTTP server and tools

6.3 Case study: Welch's Foods, Inc.

We conclude this chapter with a case study of a real-life customer testimonial from Welch's Foods, Inc. This case study shows how Welch's Foods used WebSphere Application Server for AS/400 to build their e-business and achieve success with it.

Vintage IT infrastructure with IBM e-business solution

"We wanted to run our new Web-based application on our AS/400 because that's where our company data resides, and we wanted a programming environment that gave us the flexibility to run portions of the application on any other platform as well. Java was the obvious answer. Our investment in Java is paying big dividends," says *Deepak Mohapatra, Manager of Operations and Networks, Welch's Foods, Inc.*

Founded in 1869, Massachusetts-based Welch's Foods, Inc. (`http://www.welchs.com`) is a well-established firm by any standards. Welch's

Foods, Inc. has 1,350 employees with headquarters in Concord, Mass. The company is owned by the 1,500 members of National Grape Cooperative.

Welch's has been an American household name for many years. It is well known for its juices, jams, and jelly products. Welch's also comes to our attention as a company embracing technology to make its business more effective proving that "old" doesn't mean old-fashioned.

Welch's first became an IBM AS/400 customer in 1993, when it moved its core business applications from the mainframe to the AS/400 system. With IBM Business Partners Marcam and J.D. Edwards providing ERP and financial packages, the AS/400 system became the center of the company's information technology (IT) strategy.

By 1995, with the bread and butter applications established on the AS/400 system, Welch's began to explore ways to use information technology (IT) to expand business opportunity. Welch's manager of operations and networks, Deepak Mohapatra explains, "We were looking at ways to deliver decision support systems and to better include our suppliers and brokers in our business process." Welch's built an AS/400 data warehouse that provided the sales force with timely information and aided in decision support. This effort eliminated about forty-thousand reports from their former mainframe days.

Beginning in 1996, the company began to look at ways to use the emerging Internet to improve its business. By 1999, Welch's had rolled out three major new AS/400 applications all Web-based, all using Java and the IBM WebSphere Application Server.

Welch's has kept loyal customers over the years by providing consistently high-quality products. Concord grapes taste just like they did in 1869 when the world was low-tech, but it's AS/400 high-tech solutions that help to bring these quality grape products to your table in 2000.

Solving a promotion challenge

We have all seen special promotions like free tasting samples when we do our grocery shopping. Welch's, like most other food product producers, conducts these promotions at the retail locations as a way to attract new buyers. In fact, the company budgets $100 million in its marketing development fund each year to support various types of in-store promotional events. Management had always seen this as a necessary investment, but a nightmare to manage and measure. Deepak Mohapatra explains, "We had a complex process based on spreadsheets that tried to keep track of what events had taken place and what moneys were owed. We were never really sure what had happened and our "unresolved" spending account was very

large." In addition, there was no quick and easy way to measure the results of a promotion event to see if it actually had a positive effect on sales.

As the Welch's IT staff first sought ways to get the Marketing Development Fund process under control, it looked at outside service offerings. Eventually Welch's rejected them because they required Welch's brokers and retailers to invest in equipment and IT skills. What was really needed was a system that was "universally" available to all participants, even those sales people who worked out of their homes. Welch's decided to develop a system in-house and use the Internet and browser-based PCs to connect.

This led to the development of an AS/400e-based Java solution where Welch's brokers, retailers, sales staff, and customer service representatives all see the same data regarding promotional events and the associated payments. This improved promotion management system is expected to yield between 10 and 20 percent savings, returning their investment in six months.

Java for programming

According to Deepak Mohapatra, "We knew that our application had to run in a browser to satisfy the no-client maintenance requirement. We looked at ActiveX controls, but rejected that approach because it would also involve installation of code on the PC. So Java was our answer." Once deciding on Java, Welch's approach was to make all Java code server-based.

Coding began in 1997. The programming model consists of servlets for AS/400 code and DHTML and Swing 1.2-based applets for the client side. By early 1999, all retailers and brokers were communicating with Welch's AS/400 system from browser-based PCs and thin clients using the Internet backbone. Java applications provide screens to enter promotional events and track them through the payment cycle. What was once a nightmare has become a well-managed process where all parties see the same data. Results are noted immediately, and decisions can be taken to repeat successful events or cancel unsuccessful ones.

Welch's went through extensive education of its programming staff to create the skill base for the new application set. Today, five programmers are fully skilled at object-oriented programming methodologies and Java coding. This resulted in a bonus of two other Java-based applications rolled out in 1999. Welch's employees can now access human resource files and receive self-service 24 hours a day, 7 days a week for most personnel and benefit-related matters. A new forecasting and reporting system allows sales people and brokers provide their forecasting data using the Internet and shows them the actual shipments in realtime.

WebSphere as the server

When Welch's first wrote its prototype for the Marketing Development Fund application, IBM WebSphere Application Server was not available. Then, the IT group wrote its own AS/400 server engine.

Welch's was one of the first beta customers of the IBM AS/400e model 720 in 1998. That system was dedicated to the new Web-based application. When WebSphere Application Server was released in 1998, Welch's restructured the application to take advantage of the servlet APIs and monitoring functions.

Working with IBM all along, the addition of WebSphere Application Server to the application went very well. Mohapatra summarizes his company's IBM experience in the project. He says, “We had direct access to the Java and WebSphere development teams. This was very helpful in giving us the skills we needed to write and deploy this very successful AS/400 Java application.”

With the final implementation of WebSphere, the Welch’s project achieved 100% ROI in less than six months, a 10% to 20% reduction in operational costs, and enhanced customer service.

For more case studies of AS/400 and WebSphere interaction, see the site at: `http://www2.software.ibm.com/casestudies/swcsweb.nsf/swgSearch?SearchView&Query=AS/400+AND+WebSphere`

6.4 References

This following sources provide references for WebSphere Application Server for AS/400 for both Standard Edition and Advanced Edition.

Web sites

- AS/400 WebSphere Application Server home page: `http://www.as400.ibm.com//tstudio/websphere/docs/doc.htm`
- For initial sizing of AS/400 for WebSphere Application Server: `http://as400service.ibm.com/estimator`

  This site provides the sizing service for multiple workload types. From the pull-down menu, under Workload Type, select **WebSphere**.
- IBM e-business home page: `http://www.software.ibm.com/e-business`
- AS/400 North America home page: `http://www.as400.ibm.com/na`

  Among other things, this site provides the quickest access to AS/400 Web Events including a “Lunch and Learn” series.

- Link to various AS/400 products and their PTFs at:
  `http://www.as400.ibm.com/misc/map.htm`

Publications

- *Building AS/400 Applications for IBM WebSphere Standard Edition 2.0,* SG24-5635

Chapter 7. Net.Commerce V3.2 for AS/400

What is Net.Commerce? And why should it be your choice among so many possible, nice alternatives to build your e-business sites? One quick answer is “because your primary interest is *e-commerce*”.

No other aspect of e-business has garnered more attention than e-commerce. After all, consumers spent $30 billion online in 1999, and that figure is expected to grow more than $300 billion in the next four years. But, that is just part of the story. E-commerce spending between businesses is expected to be at least ten times more than consumer e-commerce.

WebSphere Commerce Suite V4.1 for AS/400, formerly called Net.Commerce V3.2 for AS/400, is the optimal choice if you agree to the previous point and are willing to implement e-commerce sites quickly and yet in a highly reliable manner as possible.

Product name change

IBM changed the name of product from “IBM Net.Commerce” to “IBM WebSphere Commerce Suite”. Thus, new version of AS/400 product is to be called “WebSphere Commerce Suite V4.1 for AS/400”. This chapter is based on the existing implementation of “Net.Commerce”. Basically, underlying architecture is not greatly changed except the newer version adopts some Java technologies. Section 7.3, “WebSphere Commerce Suite V4.1 for AS/400” on page 143, covers what is expected to be different.

7.1 Net.Commerce and the WebSphere Commerce Suite

As mentioned earlier, e-commerce is the area where opportunity lies. Your business needs to take advantage of this trend. E-commerce is about much more than simply opening up a new, online sales channel. It’s about using technology to streamline your business model, creating savings, and increasing efficiency. It’s about lowering costs and establishing closer, more responsive relationships with your customers, suppliers, and partners.

You can link dealers and factories online, reducing both lag time and paperwork. You can move procurement online by setting up an extranet that links directly to vendors, cutting inventory carrying costs and becoming more responsive to your customers. You can streamline your financial relationships with customers and suppliers by Web enabling billing and payment systems.

The end result? While building customer loyalty, companies can reduce costs by improving order processing efficiency, maintaining fill rates while reducing inventory and warehousing expenses, and lowering the actual dollar costs of sales transactions.

7.1.1 IBM Net.Commerce

IBM Net.Commerce is the IBM answer to the needs of building and benefiting from a successful e-commerce site. It is designed and architected for dynamic, flexible Web sites integrated with enterprise information.

IBM Net.Commerce is an extensible framework with an emphasis on scalability, flexibility, security and performance. Shoppers can easily find your products with flexible shopping metaphors. It works in a wide variety of environments and handles a wide range of applications.

IBM Net.Commerce is a cross-platform architecture. IBM offers various versions of products for the AS/400e system, Windows NT, AIX, and Solaris. Net.Commerce is the IBM e-commerce product for the AS/400e system.

7.1.2 Net.Commerce: Advantages

The real question should be: Which particular product or mechanism should you use to achieve your goal? What benefits would you see from that choice compared to other alternatives? Here's why Net.Commerce can be your best friend in many cases.

7.1.2.1 Packaged offering with robust integrated functions

First of all, Net.Commerce is IBM's premier offering that allows many businesses to quickly conduct consumer-to-business transactions through the Internet. It is not an AS/400-specific benefit, but is still important to be reminded (especially when there are multiple choices of doing similar jobs on the AS/400e system with another product offering than Net.Commerce).

It is a merchant solution that provides a framework to conduct business over the Web in a secure and scalable manner. It supports both business-to-business as well as business-to-consumer environments.

7.1.2.2 Secured e-commerce solutions

IBM Net.Commerce works together with a relational database and Secure Web Server to give users and companies a simple and secure environment. It is also combined with IBM Payment Server and other secured payment methods such as SET Secure Electronic Transaction. Combined with the integrated security features of OS/400, this is an outstanding advantage.

7.1.2.3 Seamless AS/400 integration

Net.Commerce uses built-in Web serving, Java and, database capabilities. This way, the AS/400e system extends such benefits of Net.Commerce as:

- Built for business reliability
- Industry's best availability
- Industry leading security to protect information assets
- Extensive scalability to accommodate growth
- Legendary service and support

But most importantly, you can maximize the impact by Web enabling your already robust backend applications using Net.Commerce.

7.1.2.4 Industry standards architecture

And yet, Net.Commerce architecture itself is an industry standards implementation. It is a cross-industry and cross-platform architecture. This is not an exception for its AS/400e implementation Net.Commerce.

7.1.2.5 Scalability

Net.Commerce is designed to be scalable to meet the needs of the small to large business. Merchants can take advantage of their existing operating environment and expand to larger systems as their electronic traffic grows. The benefit of this scalability-minded characteristic of Net.Commerce architecture can be greatly multiplied when it is combined with, or physically realized on, the ever-increasing hardware scalability of the AS/400e system.

7.2 Net.Commerce V3.2 for AS/400: Product description

This section provides the product description of Net.Commerce V3.2 for AS/400. Topics include the mandatory and optional software product requirements to use Net.Commerce V3.2 for AS/400 and the product components. We then summarize the section with an entire architecture view.

Note: The current product name is WebSphere Commerce Suite. Net.Commerce Version 3.2 for AS/400 is the former name.

7.2.1 Net.Commerce V3.2 for AS/400: Software requirements

This section describes the software products required for Net.Commerce V3.2 for AS/400.

7.2.1.1 Software requirements on the AS/400e system

The software required on the AS/400e system to use Net.Commerce V3.2 for AS/400 include:

- **5798-NC3**: AS/400 Net.Commerce V3.2

  Note: At the time of this book's publication, the product number for the new version of V4.1 was not available. Check with your IBM Marketing Representative to obtain the appropriate product number for WebSphere Commerce Suite V4.1 for AS/400 5769-SS1. This product applies to OS/400 V4R3 or above.

- **5769-SS1 Option 34**: Digital Certification Manager
- **5769-SS1 Option 30**: Shell Interpreter
- **5769-TC1**: TCP/IP Connectivity Utilities for AS/400

  This is a free product which comes with OS/400.

- **5769-DG1**: HTTP Server for AS/400

  This is a no-charge product that comes with OS/400 and includes the following functions:

  - IBM HTTP Server for AS/400
  - IBM Net.Data for AS/400

- **5769-AS1**: WebSphere Application Server Standard Edition for AS/400 (a no-charge product that comes with OS/400)

  Note: In V4R3, WebSphere Application Server V1.1 support is provided as part of the HTTP Server for AS/400 (5769-DG1). In V4R4, it is split out into a separate product of 5769-AS1. It is still at V1.1. With V4R4, you can upgrade this to Standard Edition V2 using PTFs that the WebSphere Application Server Group PTF SF99027 contains.

- One of the following IBM Cryptographic Access Provider products to use Secure Sockets Layer (SSL):

  - ***5769-AC1***: 40-bit encryption implementation
  - ***5769-AC2***: 56-bit encryption implementation
  - ***5769-AC3***: 128-bit encryption implementation

- **5769-JV1**: IBM AS/400 Developer Kit for Java

  This is required for Java servlet support. It is a no-charge product that comes with OS/400. It is optimized for use in an AS/400 server environment.

7.2.1.2 Net.Commerce administrator PC requirements

You configure and administer the AS/400 Net.Commerce site through a Web browser on a PC. The administration PC requires the following environment:

- Configured and operational TCP/IP support
- A Web browser that supports HTML frames, Java Script, and Java 1.1.4, for example, Netscape Communicator 4.06 or higher, 32-bit version

7.2.1.3 Browser requirements for shoppers

To shop in a store that is created with Net.Commerce, shoppers can use any browser that supports the following features:

- SSL
- Java and Java Script
- Tables and frames
- Cookies

7.2.1.4 Optional software for the Net.Commerce environment

Depending on your intentions, you must install one or more of the following software products either on the AS/400e system or on your workstation. This is a list of some software products that can help you with your Net.Commerce implementation:

- **5769-XW1** and **5769-XD1**: IBM AS/400 Client Access

  These products include AS/400 Operations Navigator which provides GUI mode interface for AS/400 operations.
- **5769-FW1**: Firewall for AS/400
- **5733-PY1**: IBM Payment Server 1.2 for AS/400
- SSL payment program, for example, I/NET Merchant 400
- **5769-ST1**: DB2 Query Manager and SQL Development Kit for AS/400
- **5769-RG1**: ILE RPG for AS/400
- **5763-CL2**: VisualAge RPG for Windows
- **5716-CX5**: VisualAge C++ for AS/400 Windows95/NT
- **5799-GDW**: AS/400 Native C++ Compiler PRPQ
- Domino for AS/400, V4.6.2 or higher, if you want to use Domino e-mail and the discussion database from Net.Commerce WebSphere Commerce Suite V4.1 for AS/400

There may be other software products than those listed above that are useful for your Net.Commerce implementation.

Tools that can be useful when you build the Net.Commerce site include:

- Net Object Fusion
- Claris

- FrontPage
- Net.Commerce Template Designer
- Net.Data design tool (for Windows NT)
- XML
- Net.Commerce Mass Import Utility
- Net.Commerce Database Cleanup Utility

7.2.2 Net.Commerce V3.2 for AS/400: Product components

Figure 33 provides an overview of Net.Commerce V3.2 for AS/400 with its product components. Some of them are parts of Net.Commerce V3.2 for AS/400 itself and some are not. We explain them in more detail.

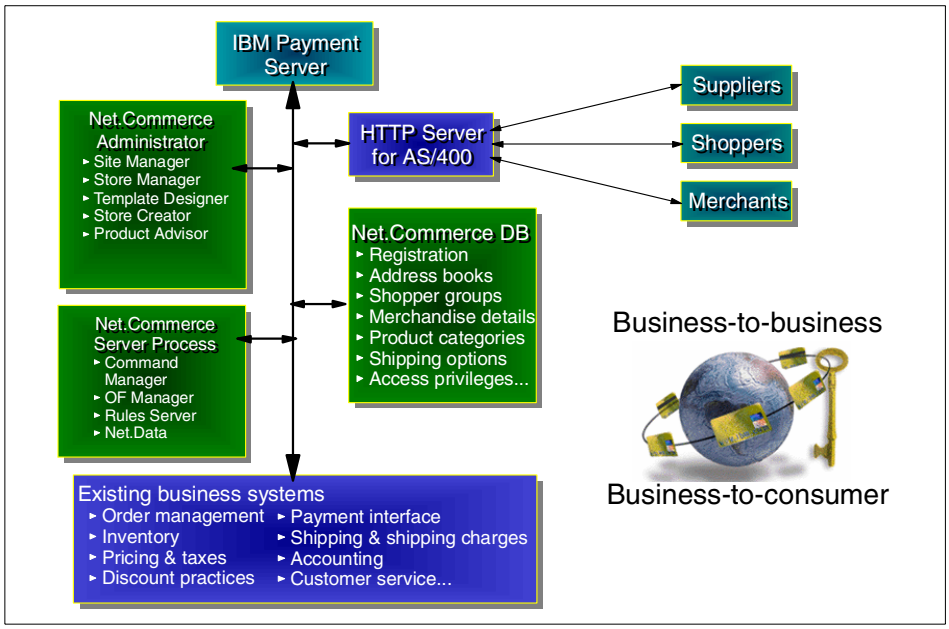

Figure 33. Net.Commerce V3.2 for AS/400 product components overview

As you can see in Figure 33, the product components of Net.Commerce V3.2 for AS/400 include:

- HTTP Server for AS/400
- Net.Commerce Administrator
  - Site Manager
  - Store Manager
  - Template Designer

  - Store Creator
  - Product Advisor
- Net.Commerce Server Process
  - Command Manager
  - OF Manager
  - Rules Server
  - Net.Data
- Net.Commerce DB
- IBM Payment Server

In addition to these, you need the following components:

- Web browsers
- DB2/400
- Existing backend applications or business systems

7.2.2.1 Web browsers and HTTP server components

Figure 34 on page 132 highlights the Web browsers and HTTP Server for AS/400. Web browser users can be suppliers, shoppers, or merchants depending on the nature of service you provide. Many of interfaces to the WebSphere Commerce Suite (WCS) product itself, if not all, are also provided using Web browsers, tasks such as configurations and initial store creations.

All these requests come into the AS/400e system through HTTP Server for AS/400. Likewise, all the responses to Web browsers are served by this component.

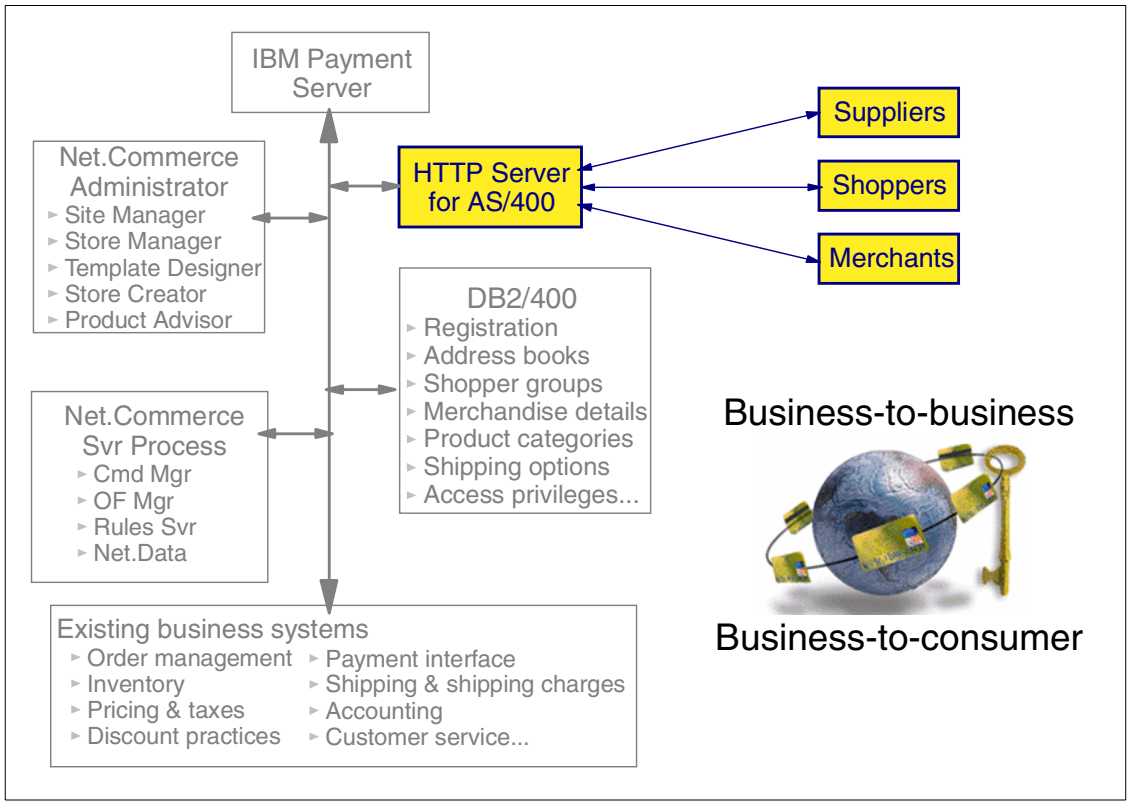

Figure 34. Net.Commerce V3.2 for AS/400: Web browsers and HTTP server

7.2.2.2 Net.Commerce V3.2 for AS/400 administrator

At the beginning of this chapter, we brought the point to your attention that you want to build the site as quickly as possible. You also want to dynamically change, update, enhance, or customize the sites. Net.Commerce Administrator is a core component that enables most of these functional requirements.

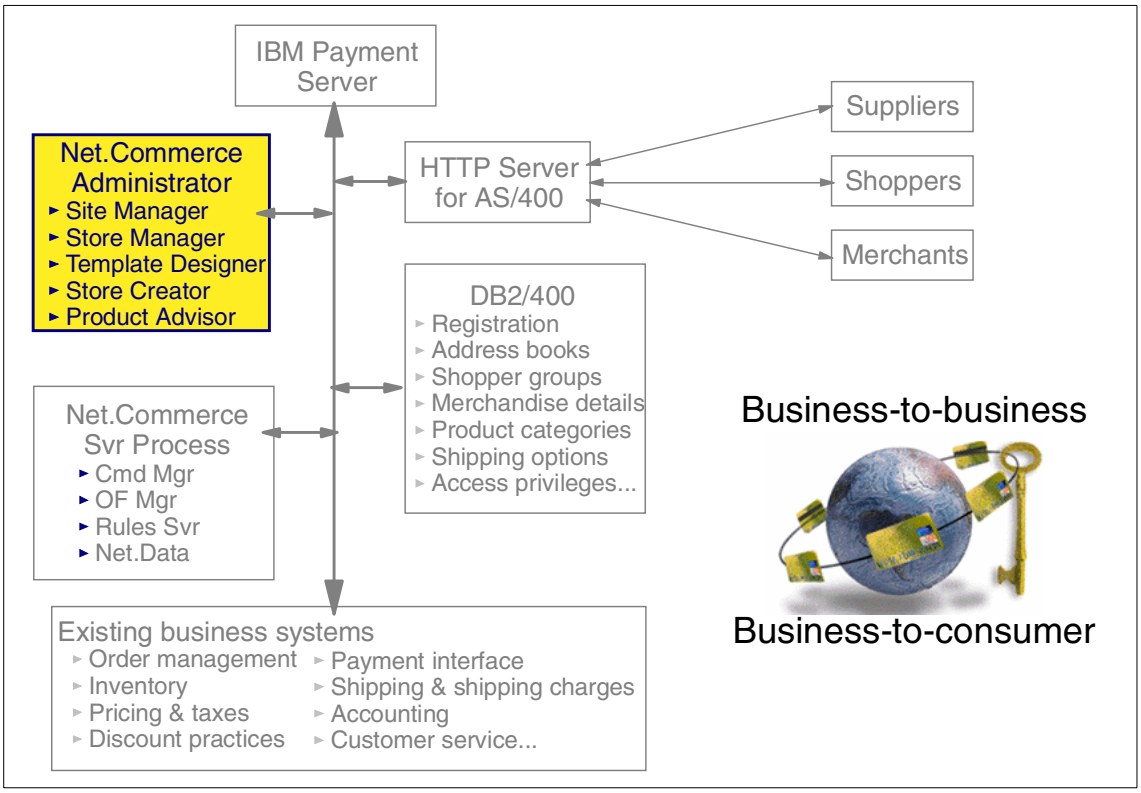

Figure 35. Net.Commerce V3.2 for AS/400: Net.Commerce Administrator

You can use the Net.Commerce Administrator to build and manage an electronic store or mall. You can easily enter store and product information and tailor product displays to suit your merchandising requirements. Changes appear automatically on your Web site.

The Net.Commerce Administrator contains two data management applications: Site Manager and Store Manager. It also contains a Web page design tool called Template Designer. Site Manager creates and manages commercial Web sites. You can use Store Manager to develop an online catalog and to manage such information as shipping options, shopper groups, and customer numbers. Use the simple online forms to enter and update information in the database.

The information you can keep in the database and display in your electronic store includes:

- Store or mall name
- Logo location
- Contact information
- Mission statement
- Policies
- Types of services and products
- Currency used
- Merchandise offered (including descriptions, product number or stock keeping unit, images, prices, availability dates, dimensions, weight, etc.)
- Product categories
- Shipping options and services
- Shopper groups
- Information about the people who have access to the store's database

You can use the Java-based Template Designer to design template pages. With Template Designer, you can create static or dynamic Web pages that display up-to-date data that is linked to a DB2/400 database. Template Designer's graphic look, drag-and-drop capabilities, and quick testing functionality help you create and test your pages. Your design is laid out on a reusable template. You can create different templates for different types of pages (for example, one template for regularly priced products and another for products on sale).

You can also use Template Designer to create a home page for a store or mall, category pages, product pages, and unique pages for members of shopper groups.

7.2.2.3 Net.Commerce V3.2 for AS/400 server process

This component, which is the actual server engine of Net.Commerce V3.2 for AS/400 on the AS/400 system, is explained in 7.2.3, “Architectural view of Net.Commerce V3.2 for AS/400” on page 139.

7.2.2.4 DB2/400 component

Almost everything you create with Net.Commerce V3.2 for AS/400 is stored in DB UDB for AS/400 of your AS/400e server. DB2/400 plays a role in the storage of the resources required to run a Net.Commerce V3.2 for AS/400

implementation. There is one distinction that you are required to make. There are two database: one is a WCS database and the other is the existing backend applications database. Technically, you can run transactional sites purely with WCS DB, without interfacing with an existing backend database, but it is not a very practical scenario. Figure 36 shows how the Net.Commerce database can be used in a Net.Commerce implementation.

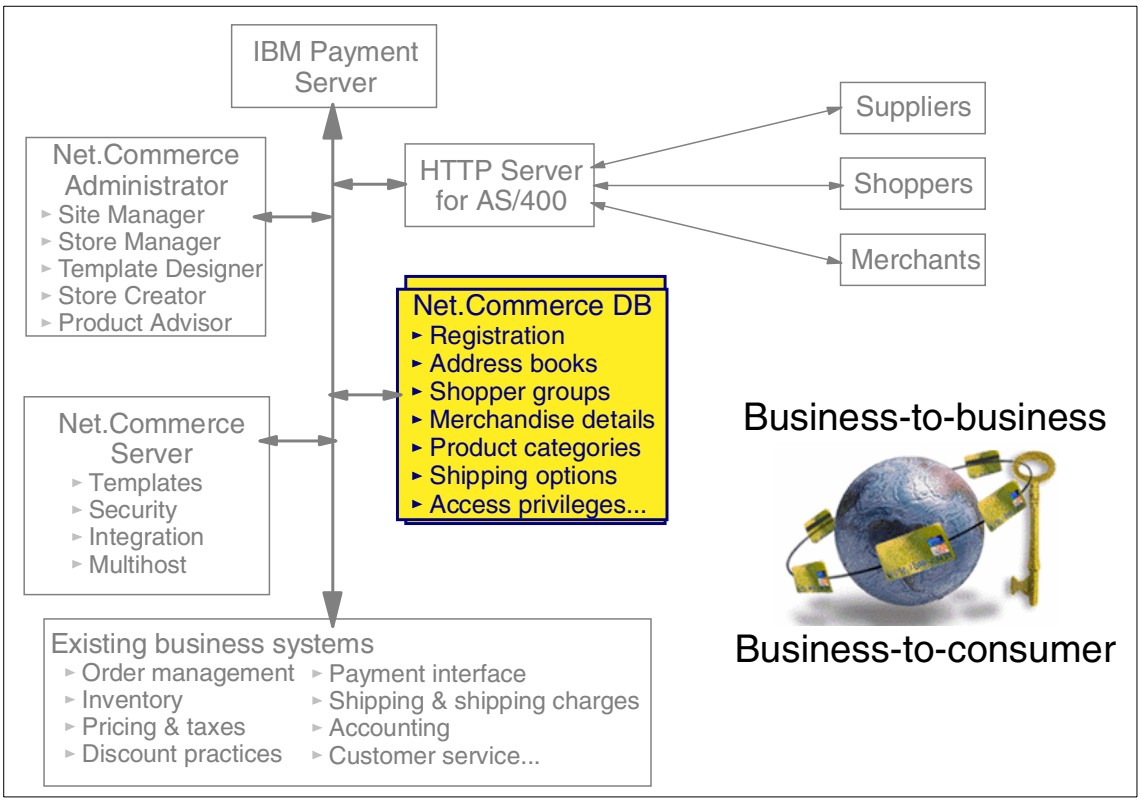

Figure 36. Net.Commerce V3.2 for AS/400: DB2/400

As shown on Figure 36, Net.Commerce V3.2 for AS/400 DB includes:

- Registration
- Address books
- Shopper groups
- Merchandise details
- Product categories
- Shipping options
- Access privileges

Importing business data into Net.Commerce

Many Net.Commerce customers already have their own backend applications for running their business. These backend applications access and use data in existing databases that contain information relating to customers, products, billing, and inventory control.

When a Net.Commerce instance is created, the database created has sufficient information in it to allow the mall to be administrated. However, it has no product, category, or price information unless the option was taken to install a demonstration store or mall.

The Net.Commerce database tables contain all the information Net.Commerce needs to store information about the mall or store and its operation, such as products, categories, and prices. Initially these product, price, and category tables are empty. This information must be fed into the Net.Commerce database.

This information can be added to the database from the administrator screens. However, if there is a large amount of data to be added to the database, manual addition can be impractical. In this case, customers may want to load data from their current backend system for the initial dataload phase and for ongoing changes.

Fortunately, there are a number of options available for loading data from the backend database into the Net.Commerce database. These options need to be considered and used not only for the initial loading, but also for keeping the Net.Commerce data and the backend system data fully synchronized.

7.2.2.5 Payment Server component

Payment transactions are an integral part of e-business success. As more and more merchants move online, there is a growing need to seamlessly integrate payment capabilities with existing software for an easy-to-use, end-to-end, more secure e-commerce solution. IBM WebSphere Payment Server enables service providers to quickly and easily link merchants to payment processors to handle today's complex e-commerce transactions. This latest e-commerce solution helps service providers grow revenue from existing merchants while attracting new ones.

With IBM WebSphere Payment Server, service providers can extend their businesses and ability to be profitable with new offerings that can provide a clear advantage over their competition. IBM WebSphere Payment Server offers payment hosting capabilities for Internet service providers (ISPs), commerce service providers (CSPs), application service providers (ASPs), banks, and financial institutions.

Figure 37 shows how the Payment Server fits in the e-commerce architecture on the AS/400 system.

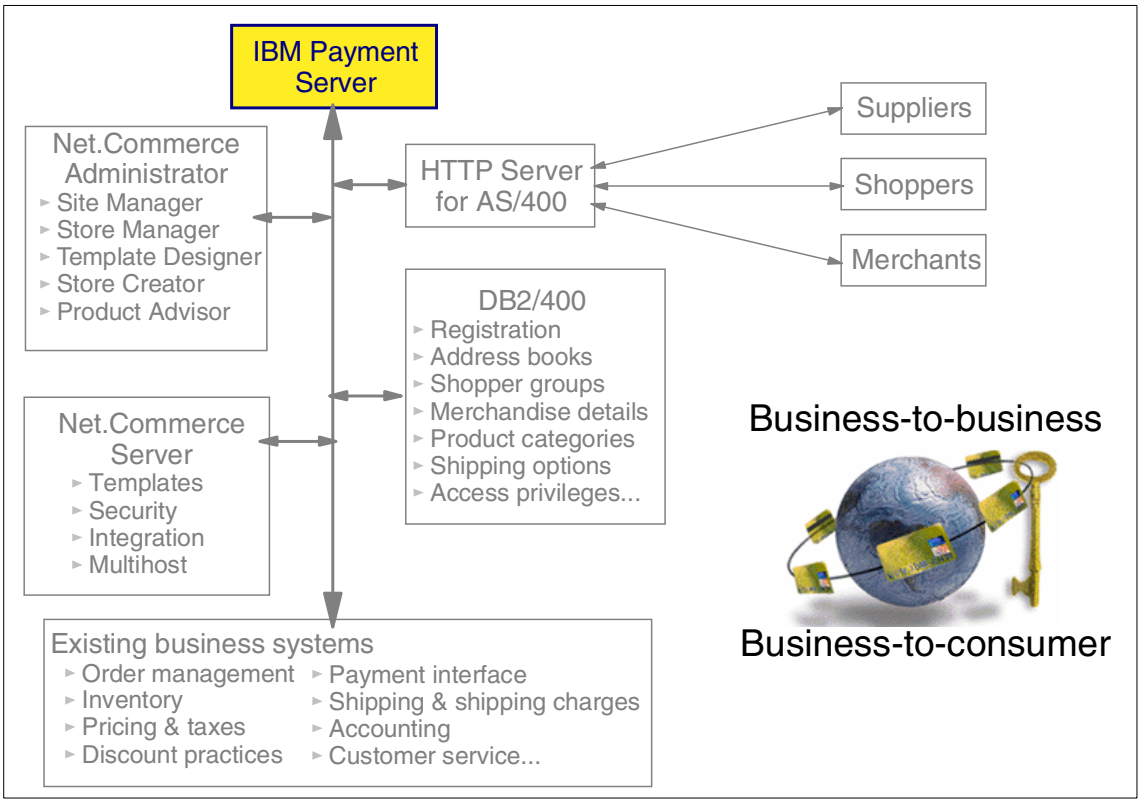

Figure 37. Net.Commerce V3.2 for AS/400: Payment Server

The Payment Server provides payment services on the Internet by taking credit card payments from consumers. The Payment Server runs at a merchant and is used in conjunction with online shopping software such as WCS. It supports the SET Secure Electronic Transaction protocol developed by Visa, MasterCard, IBM, and others. The data is kept private and not improperly modified.

The Payment Manager can obtain credit card approvals and capture funds by communicating with a payment gateway, which runs at a bank (typically called an *acquirer*). In addition, it can process deposits and credits or perform reversals.

SET Secure Electronic Transaction

SET is an open-network payment-card protocol that provides greater confidentiality, greater transaction integrity, and less opportunity for fraud on each transaction point than any other existing secure payment system. The process involves a series of security checks performed using digital certificates that are issued to participating purchasers, merchants, banks, and payment brands.

There are five main parties involved in a SET transaction:

- Cardholder
- Merchant
- Issuer: The customers financial institution, which provides the payment card to the customer and the payment to the merchant
- Acquirer: The merchants financial institution, which enables the merchant to accept a payment card brand and issues the captured payment to the merchant
- Certificate Authority (CA): A trusted third-party that can certify the identities of the customer, the merchant, and the acquiring institution to each other

Four of these parties require their own SET software. The issuer communicates with the acquirer over a secure network or other communications channel, and therefore, does not need a secure Internet implementation.

SET has four components:

- **Cardholder Wallet**: Component that is run by an online consumer enabling secure payment card transactions over a network. SET Cardholder Wallet components must generate SET protocol messages that can be accepted by SET Merchant, Payment Gateway, and Certificate Authority components.
- **Merchant Server (Payment Server)**: Component that is run by an online merchant to process payment card transactions and authorizations. It communicates with the Cardholder Wallet, Payment Gateway, and Certificate Authority components.
- **Payment Gateway**: Component that is run by an acquirer or a designated third party that processes merchant authorization and payment messages (including payment instructions from cardholders) and interfaces with private financial networks.

- **Certificate Authority**: Component that is run by a certificate authority that is authorized to issue and verify digital certificates as requested by Cardholder Wallet components, Merchant Server components, or Payment Gateway components over public and private networks.

Some benefits to merchants for implementing SET are:

- Increased sales from existing online shoppers who can now more confidently expand the number of merchant sites where they shop
- Additional sales from consumers who were traditionally constrained from electronic shopping due to their concerns about security on the Internet
- Increased savings through a reduction of exception handling
- Reduced costs associated with fraud

For more information about SET, refer to the site on the Web at:
`http://www.setco.org`

7.2.2.6 Backend business systems

The final compound in our diagram is backend business systems. This component is also referred to as backend applications, or legacy applications or systems. Whichever name you choose to call it, this is where the richest business functions exist and the source of endless potential of benefits when you successfully “Webulate” or Web enable it.

7.2.3 Architectural view of Net.Commerce V3.2 for AS/400

Figure 38 on page 140 provides the architectural view of Net.Commerce V3.2 for AS/400 implementation. In fact, this is a detailed view of the Net.Commerce Server Process component shown in Figure 33 on page 130.

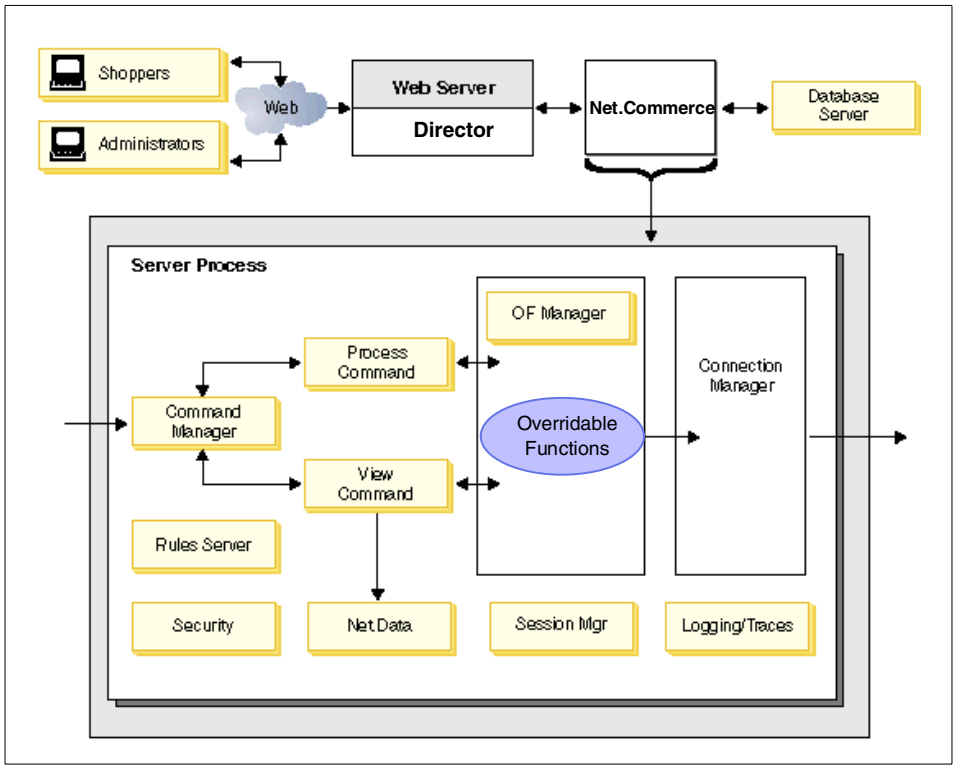

Figure 38. Architectural view of Net.Commerce V3.2 for AS/400

Director

The director provides the same function as WebSphere Commerce Plug-In of WebSphere Commerce Suite V4.1 for AS/400. It is a component of the Net.Commerce server that parses HTTP requests from shoppers, performs a cache lookup, and if the appropriate cached page is not found, routes the requests to the Net.Commerce server engine, based on a workload balancing scheme.

7.2.3.1 Net.Commerce server process components

People use Net.Commerce V3.2 for AS/400 from their Web browsers. This includes the actual clients, such as shoppers or business partners, who do business with you over the Web and with you as the administrator of your e-business site. Web browser users interface with Net.Commerce V3.2 for AS/400 via a graphical user interface. When they click the browser expecting the server to provide the function required, the actual request is delivered to the AS/400e system in the form of commands.

The Net.Commerce V3.2 for AS/400 server process, therefore, is a set of functions to process the commands. Net.Commerce server consists of several components that interact to process C++ and Net.Data commands. Again, the details of the implementation of this server engine is transparent to the users (that is not just your clients, but your administrators as well). The commands themselves are transparent to the users.

Command manager
The command manager locates the required command and executes it. Commands are separated into two distinct groups: view commands and process commands. View commands perform viewable tasks (for example, displaying an order using the OrderDisplay command). Process commands perform business functions (for example, process an order using the OrderProcess command).

Overridable functions (OF)
Overridable functions are used to extend the business logic in commands. Net.Commerce is a frontend application that provides the tools to quickly set up a mall from which shoppers can browse and order. Net.Commerce uses API functions to implement the shopping process. The ideal situation is to map the entire site flow directly to an existing Net.Commerce API. However, if Net.Commerce meets only part of your requirements, you must tailor and extend the system by using the Net.Commerce commands and overridable functions.

Another potential usage of OFs is when you link your Net.Commerce applications with your backend applications. You can do this in a number of other ways including using the MQSeries product, but OFs can be a favorable option if you have a skill set of C++ programming.

Connection manager
The connection manager manages a pool of database connections.

Security
An important aspect to a successful e-commerce site is security. Your customers are concerned with the security of their personal information as it is transmitted across the Internet and as it is used throughout your order processing environment. In addition, you should be concerned with securing your information assets and systems. The security component performs authentication and access control tasks.

Net.Commerce V3.2 for AS/400 provides features to help you implement your security strategy including:

- Authentication
  - Basic authentication
  - X.509 authentication: A feature now available from WebSphere Commerce Suite V4.1 for AS/400
- User Registry
  - Net.Commerce V3.2 for AS/400 database and commands for user registration
  - Lighweight Directory Access Protocol (LDAP): A new feature that is available from WebSphere Commerce Suite V4.1 for AS/400

Net.Data
Net.Data is an application that facilitates interaction between shoppers and the database. A Net.Data macro is a file that retrieves data from the database and displays it as a formatted Web page. It contains functions that usually execute SQL queries, HTML tags (which can also contain JavaScript code), and Net.Data statements.

Session manager
The session manager is responsible for tracking user sessions.

Logging and tracing
The logging and tracing component provides diagnostic functions and error handling.

Rules server
The Blaze Advisor Rule Server processes rules and provides personalized product recommendations based on a user-defined set of rules.

7.2.4 Net.Commerce components on the AS/400 system

Table 1 provides valuable information for those who know the AS/400e system well to have a better understanding how Net.Commerce V3.2 for AS/400 is implemented on the AS/400e system.

Table 1. INet.Commerce V3.2 for AS/400 components facts table

Components	Functions	What they are	AS/400 object types	How to find on the AS/400 system
Net.Commerce Processes	Serving requests from browsers via HTTP server	C++ programs and service programs	*PGM *SRVPGM	QNESERVER, QNEBACKSVR, ANESCHED, QNETCOMM, etc. jobs in QNETCOMM subsystem
Director	Connecting Net.Commerce server jobs and HTTP server	Connecting C++ service programs	*SRVPGM	QNEICAPI
Net.Commerce database collection	Net.Commerce applications tables, views, indexes	SQL tables, views, indexes, and objects for journaling	*File (*PF and *LF) *JRN *JRNRCV	Library with the same name as the instance name
Display pages	Formats and displays static and dynamic data on the browser from the Net.Commerce database collection	Net.Data macros, HTML, and JavaScripts	Stream files in IFS	/QIBM/UserData/Commerce /NetCommerce/instance/ <instance_name>
Net.Commerce commands and overridable functions (OFs)	Contains logic for business processing	Mainly C++ service programs although another language can also be used (such as ILE RPG)	*SRVPGM	In any library on the library list of the Net.Commerce server job, or you can specify the library in which the command or OF service program can be found when you register the command or OF in the Net.Commerce database

7.3 WebSphere Commerce Suite V4.1 for AS/400

As mentioned at the beginning of the chapter, IBM Net.Commerce is now named WebSphere Commerce Suite. Thus, Net.Commerce V3.2 for AS/400 is called WebSphere Commerce Suite V4.1 for AS/400.

This section explains what WebSphere Commerce Suite is and how WebSphere Commerce Suite V4.1 for AS/400 is different from Net.Commerce V3.2 for AS/400.

7.3.1 IBM WebSphere Commerce Suite

IBM WebSphere Commerce Suite, formerly known as Net.Commerce, is the latest version of IBM's leading e-commerce software. WebSphere Commerce Suite offers significant new functionality such as richer personalization, merchandising, and order management capabilities on a WebSphere platform supporting Java and XML. The new functionality enables you to build or enhance your commerce sites to appeal to your customers' buying behavior, and to drive incremental revenue through capabilities such as cross-selling and up-selling.

The new software is integrated with the Web development and design tools from IBM's WebSphere application server software as well as WebSphere's core technology. WebSphere Commerce Studio tools are easier to use, reducing development time and costs. The tools provide a flexible and powerful Web application development and management workbench for advanced, rapid and easy Web application development, integration, deployment, usage, and management.

WebSphere Commerce Suite V4.1 and WebSphere Commerce Studio software combined with WebSphere Application Server, Advanced Edition, provide a core set of technologies upon which future applications services are built. By leveraging these technologies in the WebSphere family, you can use a single Web application server technology foundation for a wide range of e-business applications.

WebSphere Commerce Studio, Developer Edition 4.1 for Windows NT, is available as of 01 February 2000. WebSphere Commerce Studio, Developer Edition, is a complete development environment that allows the quick creation of stores using a store creation wizard and maintain them using IBM WebSphere Studio. Using JavaServer Pages (JSP), you can quickly create dynamic Web pages to display your catalog data.

WebSphere Commerce Suite includes the industry-leading Web application server, a rich application development workbench, an award-winning database, a robust LDAP directory, and a secure online payment manager. It provides an open and component-based architecture based on Extensible Markup Language (XML) and Java technologies as well as standard Internet and database access protocols. It supports open standards for rapid application development, integration, deployment, and maintenance.

7.3.2 WebSphere Commerce Suite V4.1 for AS/400

This section summarizes the additional features or standards introduced in WebSphere Commerce Suite V4.1 for AS/400 compared to Net.Commerce V3.2 for AS/400.

7.3.2.1 Architectural changes

The basic C++ server engine remains the same and therefore the architecture is essentially the same. However, a new Java-based servlet engine has been added to the existing architecture. This new Java-based engine processes a couple of specific commands such as Product and Category Display commands and Product Advisor commands.

Figure 39 provides an architectural view of the new Java-based servlet engine.

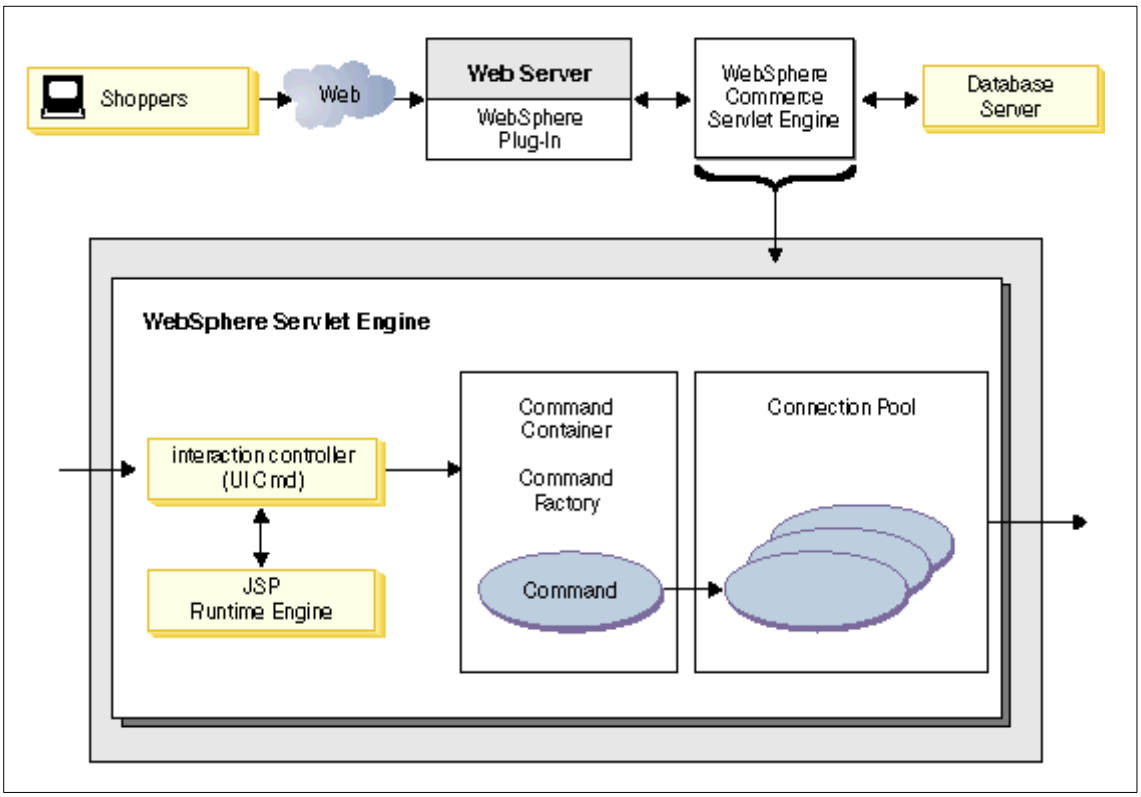

Figure 39. WebSphere Commerce Suite V4.1 for AS/400: Java-based server engine

WebSphere Plug-In

The WebSphere Plug-In is a component of the WebSphere Application Server that parses HTTP requests from the shoppers, routes the requests to the WebSphere servlet engine, and performs workload balancing functions.

7.3.2.2 Java-based servlet engine components

The servlet engine performs authentication functions, invokes the appropriate interaction controller, and handles exceptions. Refer to Figure 39 to follow the descriptions of the components of the WebSphere Commerce Suite V4.1 for AS/400 Java-based servlet engine:

- **Interaction controller**: The interaction controller parses the input parameters and forwards the request to the command manager. It also executes commands that are passed back by the command factory.
- **Command container**: The command container holds the command factory and commands. The command factory locates the required command and passes it back to the interaction controller for execution.
- **JSP Runtime engine**: The JSP runtime engine builds and returns the HTML page.
- **Connection pool**: The connection pool maintains database connections and interfaces to Java Database Connectivity (JDBC).
- **Database server**: The database holds store and catalog information.

7.3.2.3 Newly supported standards or technology

The newly added standards or technology as of WebSphere Commerce Suite V4.1 for AS/400 include:

- JDK
- JSP
- Servlet
- XML
- X.509
- LDAP
- SMTP

We do not describe what each of these standards or technology is because there are many sources for this information. What's more important to you is: Do you need to learn all this new information? Do you need to do something for migrating your existing Net.Commerce V3.2 for AS/400 based applications?

Standards to consider learning

First of all, all these new standards are implemented on the product level. The users do not need to understand any of these unless they need to for customizing or further personalization reasons. This is the same value proposition of the existing product implementation, Net.Commerce V3.2 for AS/400. You do not need to learn Net.Data, C++, or OFs unless you want to add or modify something.

Again, the same rules apply in the case of a Java-based engine. The following suggestions, recommendations, or considerations are purely the author's personal idea, not the official position of IBM or the AS/400 Division. Your discretion is required. Having said this, there are two Java standards that may help you in the long run. These are:

- **JSP**: JSPs can replace Net.Data macros. They are used for the Product and Category display when you issue the commands through the Java engine. You need to know about them if you are generating new stores that use the Java commands.
- **JavaBeans**: We are starting to "wrap" database access with JavaBeans. For example, if you write a JSP for Product Advisor, you may need to understand the JavaBeans, but only from the context of using it. This is documented.

7.4 References

This section provides various references for Net.Commerce V3.2 for AS/400 and WebSphere Commerce Suite V4.1 for AS/400.

Net.Commerce V3.2 for AS/400 online manuals

Most of the manuals of Net.Commerce V3.2 for AS/400 are delivered as online documentation installed on the AS/400 system. If Net.Commerce V3.2 for AS/400 is installed on your system, you can find its manuals under the AS/400 /QIBM/ProdData/NetCommerce/html/MRI2924/ncbooks integrated file system directory. All the online manuals are PDF files.

Web sites

- IBM Net.Commerce home page:
  `http://www-4.ibm.com/software/webservers/commerce/servers/`
- For initial sizing of AS/400 for Net.Commerce V3.2 for AS/400:
  `http://as400service.ibm.com/estimator`

  This site provides the sizing service for multiple workload types. From the pull-down menu under Workload Type, select **Net.Commerce**.

- IBM e-business home page at: `http://www.software.ibm.com/e-business`
- AS/400 North America home page: `http://www.as400.ibm.com/na`

  Among other things, this site provides the quickest access to AS/400 Web Events including a “Lunch and Learn” series.
- Linking to various AS/400 products and their PTFs: `http://www.as400.ibm.com/misc/map.htm`
- AS/400 manuals online server: `http://www.as400.ibm.com/infocenter`

Publications

- *AS/400 e-commerce: Net.Commerce,* SG24-2129
- *Net.Commerce V3.2 for As/400: A Case Study for Doing Business in the New Millennium,* SG24-5198
- *Building e-commerce Solutions with Net.Commerce: A Project Guidebook,* SG24-5417
- *Net.Commerce for AS/400 Installing and Getting Started Guide, V3.2,* GC09-2864
- *Demonstration CD-ROM,* GK3T-2318
- *IBM e-commerce Solutions,* G310-0712
- *Net.Commerce Technologies,* G310-0705
- *Net.Commerce AS/400 Spec Sheet,* G325-6345
- *e-business with Net.Commerce,* SR23-8849
- *Audio Tape - Global Commerce in Info Age,* SV31-3974

Chapter 8. Lotus Domino for AS/400

This chapter provides an overview of Lotus Domino and related e-business and e-commerce products. It will help you to understand the products required and to know why the AS/400e system is a great platform on which to deploy Domino applications. It offers concrete examples of how Domino can be deployed in the enterprise. After reading this chapter, you should have a clear understanding of what Domino can do in terms of e-business application development.

8.1 Lotus Domino overview

Domino for AS/400 was ported from the UNIX version of the Domino product. The native Domino version became available in February 1998, followed by Release 5.0 for AS/400e customers in 1999. The AS/400e system includes Dedicated Server for Domino (DSD) released in September 1999 and May of 2000. These are specially tuned Models 270, 820, and 170S to give optimal performance to the Domino workloads. They are easily identified by the yellow badging. The DSD is often called the “Bumble Bee”.

There has been a great deal of writing and many case studies on developing workflow, collaboration, e-mail, and database applications. This is where Domino’s strengths lie, as a collaboration and workflow solution. However, that is not all that Domino can build. This section reviews the Internet-related application that Domino can build.

As a server, the AS/400e system provides reliability and scalability to enhance existing business applications. It can also reach new levels of collaboration and coordination, previously not possible with other Domino servers.

Domino base functions

Domino is an entire infrastructure and framework with which you can build new applications or extend existing AS/400 applications to Notes on Web-based clients. It includes an application server, Web server, tools, processes, security, and other base functions on which, and with which, you can build applications.

Tools within the Domino environment to enable Web technology include:

- **Dynamic and transactional Web site**: Development tools, business data, applications, middleware, and architecture to design and build dynamic Web sites.

- **Workflow**: Managing the movement of documents and information through the organization.
- **Collaboration**: Helping people work together by managing information, data, schedules, documents, communication, and business processes.
- **Database**: Store and manage non-traditional, data-like graphics, pictures, scanned images, scanned signatures, documents, and relational data.
- **E-mail**: Mail serving and management.
- **Application development**: Tools, environment, security, features, and functions to develop a wide variety of applications.

These base functions can be built into a wide range of applications. The functions are provided and managed by the Domino server and services. Within the broader Domino environment, there are features (such as messaging and replications services) and tools (like Domino Designer and Java) on which, and with which, you can build applications.

Domino server and services

The core of Domino is a document database server used to run various applications. The Document database server is the base of Domino, complemented by the following services:

- The *database replication services* allow several replicas (full or partial related copies of a database) over different Domino servers or Notes clients. These services synchronize the replicas in a scheduled or an on-demand basis.
- The *messaging services* allow the sending and receiving of mail. Many protocols are supported, including:
  - Notes Mail
  - Post Office Protocol 3 (POP3)
  - Internet Message Access Protocol (IMAP)
  - Lightweight Directory Access Protocol (LDAP)
  - Simple Mail Transfer Protocol (SMTP)
  - Multipurpose Internet Mail Extensions (MIME)
- The *search services* provide the capabilities of a full text search engine to search documents in databases, attachments, and files across an entire domain.
- The *security services* include:
  - Multiple user and object access levels
  - User groups
  - Digital signatures

- Public key encryption
- Object integrity checking

- The *HTTP services* support Hyper Text Transfer Protocol (HTTP), Hyper Text Markup Language (HTML), and Network News Transfer Protocol (NNTP). Domino Internet security includes support for the Secure Sockets Layer (SSL) protocol and X.509 certificates. Use your existing Internet infrastructure with Domino and be assured that your system works with other systems based on open protocols.

Domino is available on many other platforms, including IBM OS/390, IBM OS/2 Warp Server, IBM AIX, Linux and other UNIX operating systems, as well as Microsoft Windows NT.

Lotus Domino for AS/400 is the native implementation of the Lotus Domino server on the AS/400e platform and is also one of the best performing servers. In November 1998, the AS/400 system achieved a “NotesBench Mail only” mark of 27,030 users with a 0.08 second response time using a 12-way AS/400e server. Improvements have continued to support even more throughput.

8.1.1 What a Domino application is

In generic terms, a Domino application is a set of actions within a piece of software that the designer considers a unit of work. The application is made of processes, data, business rules, and so on. Lotus developers and users refer to a set of related Domino databases (.nsf files) as an application. It can be one or more databases.

These databases contain forms, pages, views, framesets, agents, scripts, applets, HTML pages, and so on. Applications can import, update, or access data from host systems, including DB2/400, as well as native Domino databases.

Note

Additional information about Lotus Domino is available at:
`http://www.lotus.com/domino`

Information about Lotus Domino for AS/400 is available at
`http://www.as400.ibm.com/domino`

Developer information is at: `http://www.notes.net` under “All About Notes & Domino”.

8.1.2 Domino for AS/400 functions

Domino for AS/400 combines the AS/400e value proposition of integration, ease of use, reliability, and scalability with the world's leading groupware offering. Domino provides the application development infrastructure. Combined with AS/400 reliability, the AS/400e system is a great server on which to run Domino applications. Features include:

- **Integrated messaging**: The messaging infrastructure in Domino is robust and is the *foundation* for applications, not the end result.
- **Business architecture**: The design of Domino is specific to business process automation and supports many kinds of data and human interactions.
- **Clustering support**: Clustering offers high availability switchover on failure. Cluster servers redirect database open requests to other servers in the cluster to provide users with uninterrupted access to important databases. This means greater availability on the AS/400 system as the AS/400 manages automatic restarts. The Internet Cluster Manager (ICM), available from Release 5.0, lets you use Domino clusters to provide failover and workload balancing to HTTP clients (Internet browsers) when they access Domino Web servers.
- **Rapid application development environment**: The environment is visual (point and click), rapid (wizards and forms), client/server, Web-enabled, Java-enabled, and event driven.
- **Suite of Connectors to enterprise applications**: Lotus has developed many connectors to access data from many systems and databases. This makes Domino a good integration or consolidation point and environment to build new, high-impact, business process-oriented applications.
- **Versatile database**: Structured and unstructured data, such as plain text, rich text, scanned images, video, and audio, can be combined and are the foundation for building high-impact applications.
- The ability to operate in a distributed environment allowing documents and applications to be shared through an intuitive interface (Notes Client or Web browser) across LANs, WANs, and the Internet.
- **Security**: Domino supports leading security and has access controls (user authentication), digital signatures (documents and mail), encryption (communications such as SSL and mail). Execution Control Lists (ECLs) prevent unauthorized Domino applications from causing damage.

Lotus Domino provides rapid application development tools, including LotusScript, to help you design and develop collaborative applications for your users that can extend to the Internet. LotusScript allows you to easily

integrate your existing DB2/400 data into these applications. For example, a customer service application could access an existing DB2/400 customer master file for such information as name, address, and phone number. DB2/400 integration works both ways. Your AS/400 accounts receivable application might update your Domino customer service database to alert your customer service representatives to any outstanding accounts receivable issues.

With Domino for AS/400, you can tackle many business problems that require organizing unstructured data or managing the flow of information. At the same time, you can link this workflow and unstructured information to the wealth of business data in your DB2/400 databases.

The application integration options available to you depend on what you want to achieve. For example, a Notes client or a Domino server may need to access DB2/400 data, or an AS/400 application may need to access a Domino database.

Domino makes developing applications easy to automate business processes. Organizations with heterogeneous platforms and operating systems can benefit from the seamless cross-platform design of application databases created with the Lotus Notes Designer for Notes client. With the Notes Designer for Notes client, you create applications from a graphical user interface (GUI) with little knowledge of programming or scripting languages.

Pre-defined templates (for example, xxx.ntf files) make setting up and configuring applications fast and easy. Experienced application developers can create more complex workflow, GUI-based client/server, or network-centric applications.

8.1.3 Why Domino on the AS/400 system

As a server, the AS/400 system provides reliability and scalability, which are essential in the dynamic and often unpredictable world of e-commerce. Domino for AS/400 makes it easy to integrate the business data in DB2/400 databases with the Web-enabled applications you build with Lotus Notes. This is based on these factors:

- **Reliability:** The AS/400e system boasts the most robust reliability in the market, with an incredible record of 99.97% uptime. If a specific application should fail, the AS/400e system's unique architecture, which logically insulates applications from one another, assures uninterrupted performance for other applications.

Each Domino Partition runs in its own subsystem, which enables Domino to benifit from this feature.

- **Availability:** Self-diagnostics, remote administration, and the debugging capability of the AS/400e system ensure maximum availability. AS/400e Integrated File System architecture allows for centralized backup and recovery for AS/400e applications and data, including Domino. With the Domino Enterprise Server, availability is further enhanced by the ability to run multiple partitioned servers on one physical system, and clustering to provide server failover support and dynamic load balancing.

  An exclusive feature of Domino for AS/400 is the automatic restart of the Domino server. IBM has built a watchdog job that starts automatically when you start a Domino server and it monitors the Domino server. In the event of a failure, it automatically brings down the failing Domino server in a controlled manner and restarts it without affecting any other Domino partitions or other applications running on the system.

- **Scalability:** Unsurpassed single footprint scalability is available with Domino for AS/400. With one administrator and one backup to perform, administration costs are minimized as user capacity is maximized.

- **Server consolidation:** Scalable Domino platforms reduce the number of servers required to support an entire enterprise. The fewer the number of servers you have, the lower the complexity and cost of administration and management for a groupware solution are.

  With Domino on the AS/400 platform, you can consolidate multiple Domino servers into one box. Servers are all “under one roof”, so administration costs are a fraction of what is required for server farms.

  In addition, with all the Domino servers on the same AS/400e system, you don't need to replicate your relational databases and applications to other servers to make them accessible. All the Domino servers have access to the same relational data and traditional applications. In addition, when you run multiple partitions on one physical box, the partitioned servers communicate over an internal network, which does not add any network traffic to your LAN.

- **Integration with the IBM DB2/400 database:** Domino for AS/400 applications take advantage of direct real-time access to the DB2/400 database. Users embed the results of an AS/400 query into a Notes document without the need for programming. Domino for AS/400 allows access to DB2/400 from Domino application development tools and APIs. This access is direct (that is, it is in microcode). This enables the fast, reliable, secure and scalable access, without the need for an ODBC driver

or a middleware communications layer, when the application code runs on the server rather than the client.

The Lotus Enterprise Integrator product (a separately purchased product, formerly known as Lotus NotesPump) provides for data movement between DB2/400 and Domino, and direct real-time access to DB2/400 data from Domino applications with no programming required. The AS/400e implementation adds unique capabilities to Lotus Enterprise Integrator. Using a feature of LEI, AS/400 access rights can be mapped to Domino access rights for unprecedented security implementation. You can enable replication of access rights between a DB2 table and a Domino database.

An exclusive feature of the AS/400e implementation of Lotus Enterprise Integrator is the propagation of deleted records, so that any operations you perform (update, insert, or delete) can be synchronized between your Domino databases and DB2/400 tables.

For more details on positioning the various DB2/400 access alternatives, refer to the redbook *Lotus Domino for AS/400: Integration with Enterprise Applications*, SG24-5345.

- **Total cost of ownership:** The primary benefits of installing Domino for AS/400 include data integration and centralized management. AS/400e with Domino offers customers a single hardware platform to manage both line of business applications and groupware applications to coexist and extend to Notes and browser clients through Domino without adding multiple servers or middleware. Customers with an AS/400 Domino implementation do not need to invest in an additional hardware platform, operating system software, and the skills needed to maintain this environment.

The following section reviews solution types and implementations of Domino.

8.2 Technology and architecture: Domino for AS/400 solutions

Domino is heavily used in areas that directly impact such areas of the business as customer support, lead and customer management, workflow, publishing and distribution of information, competitive analysis and positioning, product improvement processes and development, communications, electronic commerce, and customer service.

The focus of this redbook is specific to e-business applications that can be built with and on top of Domino. As reviewed in Chapter 2, “Building e-business sites: Phased approach” on page 49, customers typically go

through three distinct phases when building e-business solutions. Domino can provide functionality to build and support all three types: Web presence, dynamic site, and transactional site.

The following sections define and show representations of the implementation of these phases with Domino.

8.2.1 Web presence definition

As outlined earlier, Web sites serve static Web pages. The content of what the visitor sees is not changed by user interaction. In simple terms, the role of the HTTP server is to receive requests from browsers for Web pages, locate the pages, and send them to the requesters. The browser communicates with the HTTP server using URLs that contain the location of the pages that the user wants. The Domino HTTP server provides the static content.

8.2.2 Dynamic site definition and architecture

A dynamic site, by definition, has read-only access to data on back-office business systems through a Web browser. The back office systems we refer to and access are AS/400e-based applications (ERP, home-grown, legacy, and others) and Domino applications (.nsf database). An example is a customer accessing the order status of an item purchased or a supplier checking the inventory level at a customer warehouse.

Figure 40 represents an overview of the components of a Domino dynamic site implementation. It shows the flow of information through the databases, server, and network to the user. As defined earlier, dynamic sites allow access to Domino applications through a Web browser through the Internet, intranet, or extranet. The client user has read-only access through the browser to back-office and Domino databases and the Domino application server. Typically these applications move documents, automate processes, provide information, and respond to queries.

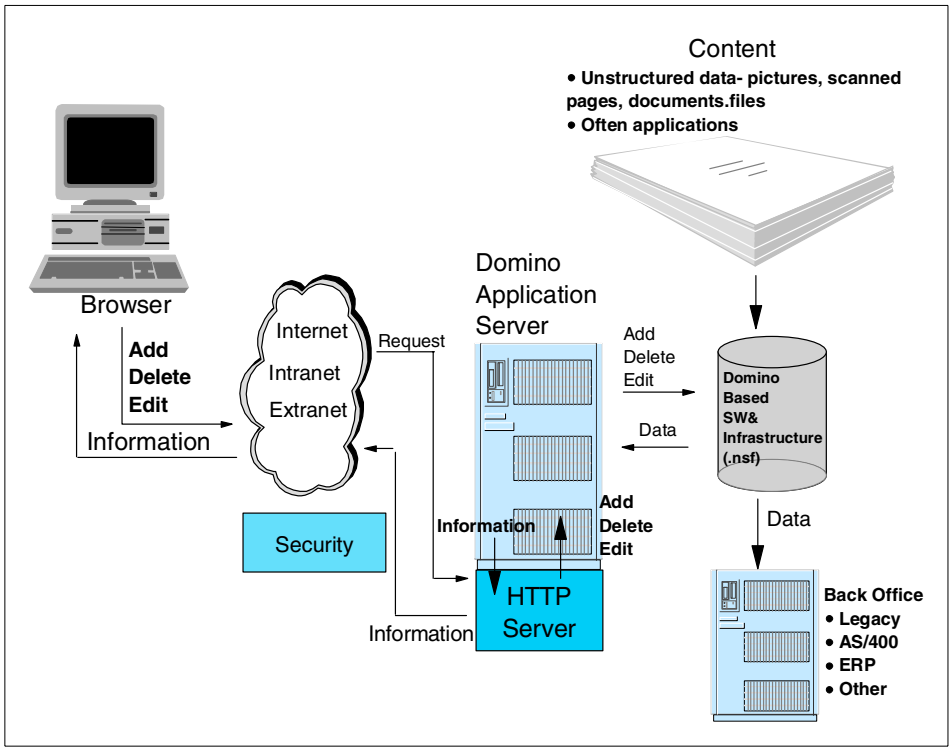

Figure 40. Domino dynamic site architecture

Domino can be used to build the following types of dynamic site solutions:

- Enhance and extend existing legacy applications and provide workflow and collaboration functions not easily added with legacy development methods and tools, without having to replace those core systems. At the same time, you can link this work flow and unstructured information to the wealth of business data in your DB2/400 databases to enhance the value of what you've already built.
- Consolidate existing system interfaces not currently connected. And if connected, provide significant benefits.
- Automate business processes (for example, communications and e-mail) and discuss databases, movement of documents (workflow, scheduling, publication of information), distribution of documents, and access to information more accurately and with better timing.
- Rapid application development tools, templates, wizards, and data access tools allow quick development.

- Integrate existing DB2 UDB for AS/400 data into new Notes applications. Your Notes application can access your existing DB2 UDB for AS/400 customer master file for such information as a customer's name, address, and phone number.
- Security for which Domino supports leading security and has access controls (user authentication), digital signatures (documents and mail), encryption (communications: SSL and mail), and protection from active content (ActiveX, JavaScript, executables, self-extracting .zip).

Domino provides this functionality with its base server functions, host integration, development tools, and messaging infrastructure. This list begins to outline the broad scope and impact these applications can have for your business.

8.2.3 Transactional site definition and architecture

A transactional site has add, delete, and edit access to data on back-office business systems through a Web browser. The back-office systems we refer to and access are AS/400-based applications (ERP, home-grown, legacy, and so on) and Domino applications (.nsf database). Some examples are a customer accessing and updating their personal information, a distributor placing an order for an out-of-stock item with their supplier, or a customer placing an online order. An overview of the transactional site architecture is shown in Figure 41.

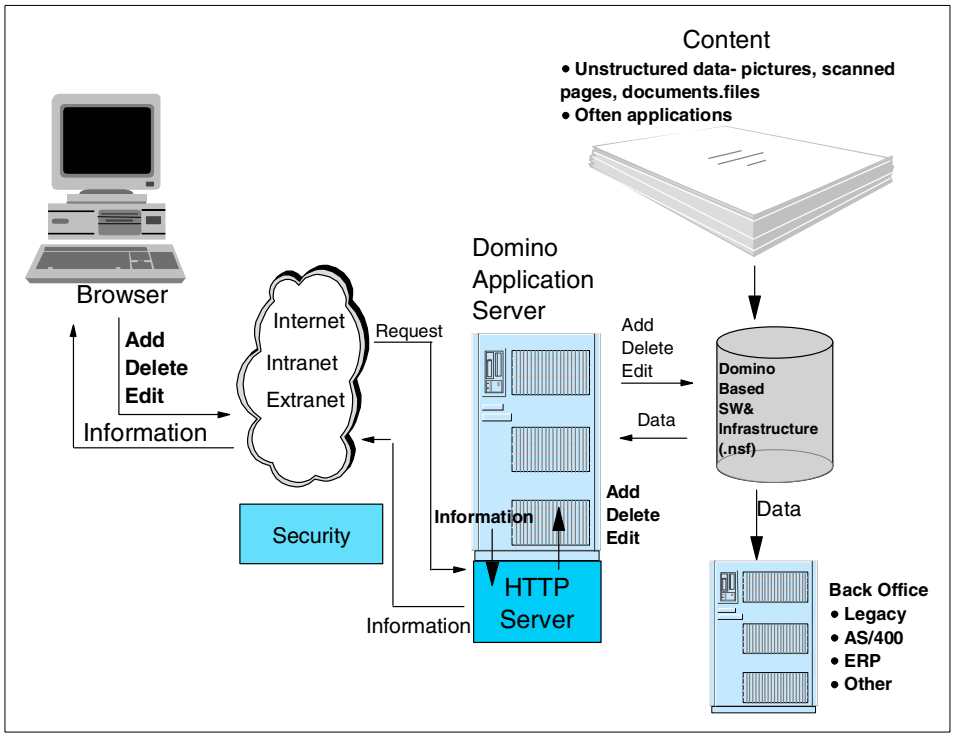

Figure 41. Domino transactional site architecture

Transactional sites can be divided into three main categories for analysis purposes:

- **Business-to-business**: This type of transactional site provides external supply chain (partners, vendors) add, delete, and edit access to company databases. Some examples include ordering products, filing sales forecasts, and accessing and updating account data. Applications on the host system process the transaction, update data, and trigger other events depending on the application design. This type of solution typically has some form of user authentication (login and ID), a forms-based information request or query function that is user defined, and a forms-based data entry function for the transaction detail.
- **Business-to-consumer**: This type of transactional site provides consumers with add, delete, and edit access to company databases. This is different than a dynamic site where users can view only. Transactional sites have add, delete, and edit functions. Customers can update their personal information, be added to databases, complete information forms, application forms, and so on. This information is then processed. The

corresponding applications on the host manage the transaction. As with business-to-business solutions, this typically has some form of user authentication (login and ID), a forms-based information request or query function which is user-defined, and a forms-based data entry function for transaction detail.

- **E-commerce (e-store):** The e-commerce implementation involves actually transacting commerce and purchasing products or services. Business-to-business (B2B) and business-to-customer (B2C) sites provide data and information and allow add, delete, and edit functions, but there is no shopping. E-stores, as they are commonly referred to, can have shopping carts, shipping functions, product catalogues, order tracking, some form of back office integration, order processing, and accept credit payments, among other possible functions.

  The store model, shown in Figure 42, graphically presents the steps that customers follow in the shopping process.

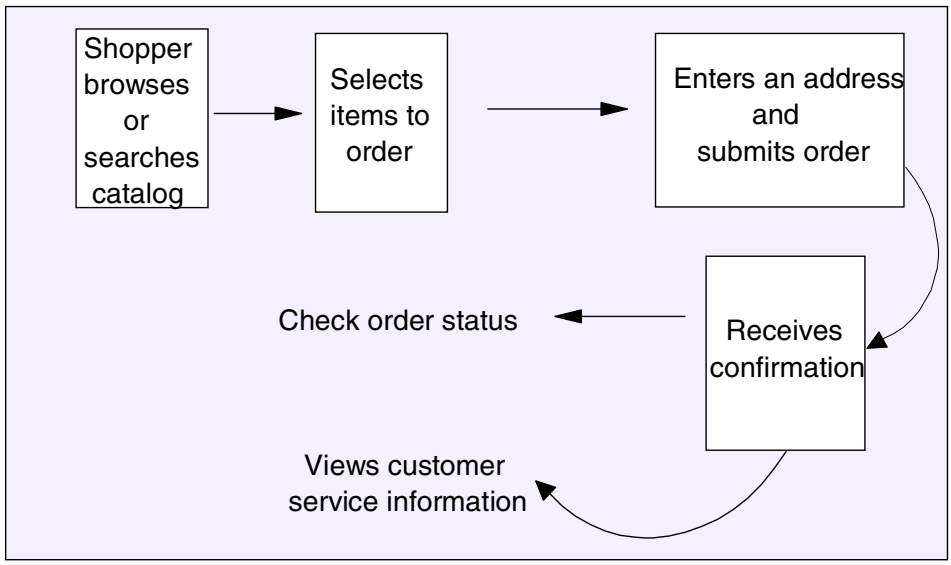

Figure 42. Electronic store shopping model

To enable this process, such functions as shopping cart, shipping, product catalog, order tracking, user registration, taxation, back office integration, order processing, credit cards, and payment must be integrated into the application. These are not standard features of Domino but can be built using the tools provided with Domino.

Refer to C.1, “Commerce-related products” on page 233, for a description of several e-store solutions offered by IBM Business Partners.

8.3 AS/400 Domino products: Web presence, dynamic, transactional

This section describes the AS/400 Domino products available to provide Web presence, dynamic data, and transactional solutions.

8.3.1 Domino HTTP Server

Domino for AS/400 is a combination of several server types. Among these are a Notes, POP3, and IMAP4 mail server, a database server, database replication server, and others, such as LDAP servers.

It also incorporates its own HTTP server, which may be used together or as an alternative for the HTTP Server for AS/400. The main strength of Domino HTTP Server is its unique ability to dynamically translate Notes documents into HTML, allowing Domino databases to be seen as HTML documents on the Web.

The Domino HTTP Server supports the following features:

- **Notes to HTML conversion**: HTML Web pages served by Domino automatically convert valid URLs into links. Views can be sorted from a Web browser by clicking the view’s column title. Static HTML files can be published by using a Domino server.

  In HTML code, hotspot links are translated into anchor (<A>) tags.
- **Passthru HTML**: Passthru HTML allows you to include HTML markups without Domino HTTP translating the codes. HTML code is included in a form, document, or About and Using documents that Domino interprets during the page translation. Passthru HTML lets you use Web-only text formatting, links, images, commands, and programs. Using passthru HTML, you can combine Domino features with HTML code.
- **Current Notes Client support**: Domino HTTP Server supports Domino 4.6 and R5 clients.
- **Security**: Database ACLs can control access by Web browsers, as well as traditional Notes clients. Domino supports name and password authentication, and Domino HTTP Server supports SSL V3.
- **HTTP**: Domino HTTP Server supports HTTP 1.1.
- **NNTP**: Domino HTTP Server supports Native Internet News Protocol (NNTP).

- **Java**: Domino HTTP Server provides support for Java servlets and applets.
- **Virtual servers**: Support in Domino HTTP Server is included for virtual servers, which allows more than one Web site with a separate DNS name to exist on a single server partition. With R5 you can run multiple virtual servers in a single partition.
- **WebSphere support**: The WebSphere Plugin for Domino is planned to be available for WebSphere Application Server Standard Edition V3 and WebSphere Application Server Advanced Edition V3. With the WebSphere Plugin for Domino, it will be possible to define the WebSphere Application Server as the servlet and JSP engine in the Domino HTTP server configuration. Additional integration functions are considered.

Note: A new Domino R5.0 release is planned to contain the Domino Plugin for HTTP server for AS/400, to allow Domino databases (*.NSF) to be served through the IBM HTTP Server for AS/400 instead of the Domino HTTP Server. That is, it allows you to select built-ins for HTTP or AS/400 HTTP so both won't need to be configured.

8.3.1.1 Domino HTTP Server and HTTP Server for AS/400 coexistence

The Domino HTTP Server and HTTP Server for AS/400 each use port 80 by default. Depending on whether each server is attempting to bind to the same TCP/IP Interface, there might be a port conflict. This can be resolved two ways:

- Only run one of the HTTP servers. This is typically done by disabling autostart on either the AS/400 HTTP server or configuring Domino *not* to run the HTTP server.
- Configure the HTTP servers to use different ports or different TCP/IP addresses.

Note: If multiple Domino partitions are installed, each partition running HTTP must use unique TCP/IP ports or addresses.

The IBM HTTP Server runs int he QHTTPSVR subsystem. The Domino Webservers run in their designated Dominoxx subsystem.

8.3.1.2 Using Domino HTTP Server versus HTTP Server for AS/400

Domino HTTP Server is *functionally equivalent to* V4R3 HTTP Server for AS/400. Both products are based on the same base code. Subsequent versions were developed independently.

Generally, HTTP Server for AS/400 is better tuned for syatic HTML and offers better functionality in its V4R4 release. It should be used as the preferred Web server.

However, if the customer's Web site is mostly based or coded using Domino, or if NNTP is used, choose the Domino HTTP Server.

8.3.2 Application server: Domino for AS/400

Lotus Domino for AS/400 requires an AS/400 system based on PowerPC (RISC) technology. Although it also runs on all RISC-based AS/400 models with available capacity to support it, there is a price and performance advantage in running Domino on the newest technology server models that are optimized for client/server applications.

In addition, keep in mind that the workload and function mix must be considered relative to the hardware specifications. For example, applications with highly CPU intensive functions (such as database lookups and full text indexing) should not be expected to perform well on systems with low processor speed, low CPW rating, and no cache. The same is true for an Intel-based system. That same system may fit very nicely for a simple mail workload, supporting up to the number of users rated for it in the sizing guidelines.

AS/400 server recommendations

The AS/400e server should meet the following minimum requirements:

- 256 MB base memory for application serving, 128 MB minimum for mail server
- 0.5 to 1.0 MB memory per active mail user
- 490 MB DASD for Domino executables and data (such as data directories and help files)
- 50 MB DASD per enrolled and active mail user. This estimate is a planning guideline. The amount of space needed varies, depending on how much information each user stores and Domino applications installed.
- At minimum, two DASD arms are recommended for best performance

Administration workstation

The workstation you use to administer a Domino server on the AS/400e system requires the following hardware:

- A PC with an Intel Pentium processor
- 48 MB of RAM minimum

- 70 MB minimum disk space; 112 MB recommended (above operating system requirements)
- A color display supported by the operating system
- A mouse
- A printer (optional)

Note

The AS/400 server memory and disk space requirements mentioned here are based on results from test environments. Use these values as general guidelines for minimum memory and disk space. The requirements for your environment will be different. For more information on sizing an AS/400e for Domino see the following Web sites:

- `http://www.as400.ibm.com/notes`
- `http://as400service.ibm.com/estimator`

Software requirements

The general AS/400 system software requirements are:

- Operating System/400 (OS/400) V4R2 or later, 5769-SS1 (V4R3 is the minimum requirement for supporting servlets)
- Pre-requisite PTFs listed on the Web at `http://www.as400.ibm.com/notes` under Support, QMUs, QMRs, and PTFs
- TCP/IP Connectivity Utilities for AS/400, 5769-TC1 (no additional charge; comes with OS/400, but needs to be explicitly installed)
- If you plan to use Java with Domino, you need to install these options:
  - OS/400 Qshell Interpreter option, 5769-SS1 (option 30)
  - AS/400 Developer Kit for Java, 5769-JV1

If you plan to use Operations Navigator for Domino, you need:

- OS/400 Host servers option, 5769-SS1 (option 12)
- Client Access for Windows 95/NT, 5763-XD1 (no additional charge; comes with OS/400, but needs to be explicitly installed)

  Client Access for Windows 95/NT must be installed on the AS/400e system to receive fixes. The Windows 95/NT client may be installed directly on the PC from the PC CD-ROM. Using Operations Navigator does not require a Client Access license, and you do not need to install 5769-XW1 on your AS/400 system.

If you plan to develop applications with Notes C or HiTest APIs (C, C++, or HiTest), either of the following options is required:

- To compile on the AS/400 system, use the AS/400 ILE C Compiler (5769-CX2).
- To compile on a client workstation, use VisualAge C++ for OS/400, 5716-CX4, with built-in OS/2 client support, or 5716-CX5 and VisualAge C++ for Windows Version 3.5 for Windows 95 or NT support (for GUI development tool).

  The latter is a PC product 5622-880, Part# 33H4980. The pre-requisites are the same as for Operations Navigator, delineated above.

  In the case of Notes C++ APIs, only the client compiler option is available.

The following software is required for a workstation on which you use Notes administrator functions to manage Domino for AS/400:

- An operating system supported by the Lotus Notes Release 5.0 client (5.0 runs under Windows 95, Windows 98, Windows NT 4.0, Mac PowerPC 7.6 and 8.5) or by the Lotus Notes Release 4.6 client (4.6 runs under AIX 4.1.5 or 4.2.1 HP-UX 10.20, Sun Solaris Intel Edition 2.5.1, Sun SPARC Solaris 2.5.1, Windows 95, Windows NT 4.0; 4.1 and 4.5 also run under Windows 3.1, OS/2, Macintosh)
- TCP/IP installed and configured
- Lotus Notes R5 client

The following software is required for a workstation on which you use the AS/400 Operations Navigator to manage the Domino for AS/400:

- A Windows 32-bit operating system (such as Windows 95 or NT)
- IBM Client Access support for Windows 95 or NT
- TCP/IP configured and used to connect to the AS/400 system
- Lotus Notes R5 client
- For Notes 4.6, include Notes Designer

Refer to Appendix A, “Sizing and performance” on page 211, for further Domino sizing information.

Networking requirements

Domino for AS/400 runs with the TCP/IP network protocol. TCP/IP is delivered with OS/400 but must be configured. TCP/IP knowledge on the AS/400 platform is a necessary pre-requisite to a successful implementation of Domino for AS/400.

Other miscellaneous considerations

An add-in called DB2 Client Import Library, which enables AS/400 query embed using the Notes client, is available at no charge for optional use with

Domino for AS/400 from Notes client machines running Windows 3.1, Windows 95, Windows NT, or OS/2. It requires a client ODBC connection to the AS/400 system using TCP/IP, such as the ODBC driver which ships with Client Access/400. Keep in mind the following points:

- For Windows 95 clients, the pre-requisites are the same as for Operations Navigator, mentioned above, and no fee-based Client Access license is required.
- For Windows 3.1 clients, a 5769-XW1 license is required for each concurrently active user of this type.
- For OS/2 clients, a 5769-XY1 license is required for each concurrently active user of this type.

More information about the DB2 Client Import Library and a link to download it is available at `http://www.as400.ibm.com/domino` under Related Products. For more information about Client Access/400, go to the site at: `http://www.as400.ibm.com/clientaccess`

If the optional product Lotus Enterprise Integrator is used, it needs to be installed on the same AS/400 system as Domino for AS/400. The journaling setting in LEI (or DECS) must match whether the file is journaled.

Directory synchronization requires the installation of Domino software AS/400 Integration (option 1) and HiTest C API (option 6).

The ability to edit the NOTES.INI file from a 5250 screen requires PTF SF45296 of OS/400 V4R2 or PTF SF49052 for OS/400 V4R3. V4R4 and V4R5 include the EDTF function.

8.3.2.1 Domino for AS/400 licensing

Domino can be ordered in two ways, including through Lotus as written, and through IBM as a Licensed Program Product (LPP).

As a Lotus product, it is ordered through Lotus authorized software resellers. Domino for AS/400 is packaged on a yellow Lotus CD-ROM. A Domino for AS/400 license includes the core Domino server, the SMTP MTA, and many facilities to support integration with AS/400 services and data.

Domino Advanced Services, which provides clustering, partitioning, and charge-back billing capabilities, is provided with the base code and appears on the installation menu. It is licensed and paid for separately (see pricing information later in this section). Optional companion products, such as Lotus Enterprise Integrator, are ordered and packaged separately.

Lotus software maintenance provides upgrades for the purchased licenses at no additional cost within a one- or two-year period. Otherwise, upgrades are purchased as though they are new product acquisitions.

It is a great savings to purchase maintenance at the same time as initial licenses. The maintenance (upgrade strategy) for Lotus software is handled differently from the IBM strategy for most AS/400 products. Understand this to avoid confusion and maintain customer satisfaction. We recommend that customers obtain detailed information from a Lotus authorized software reseller.

For volume licensing (as compared to an individual retail sale), Lotus uses a contract called a *Passport agreement*. The Passport agreement authorizes customers to use Lotus software products purchased from resellers, typically at a volume discount. It also enables customers to purchase maintenance so they can have no-charge software upgrades for one or two years upon installation. This includes maintenance releases of code, which occur approximately once per quarter, to provide fixes to reported defects and provide functional enhancements.

A typical example of a Passport contract for a small- or medium-sized business is a *Volume Purchase Agreement (VPA)*. Additional contract types are available for larger volume software acquisitions. A Volume Purchase Agreement uses a point structure, in which each product is assigned certain point values. Additional points are accrued for purchase of maintenance and support.

Note

Additional information on Domino for AS/400 software licensing, hardware, and software requirements is found at: `http://www.as400.ibm.com/domino/`

8.3.3 Legacy system integration

Domino, on all platforms, offers a set of application programming interfaces (APIs) to allow access to Domino databases from external applications. The AS/400e system supports C and C++. Domino for AS/400 also supports Java application development. AS/400 applications interface with Domino applications by calling programs written using these APIs.

Note

RPG is a strong requirement for most customers that have the AS/400 system installed. RPG APIs are available at `http://www.as400.ibm.com/snippets` by using the search function. Specify Domino as the first keyword.

Data Integration for Domino applications is achieved through connectors and Domino, specifically ODBC, Lotus Enterprise Integration (Lotus Enterprise Integrator, formerly known as Lotus NotesPump), and Domino Enterprise Connection Services (DECS). Each of these services uses Lotus Domino Connectors to access a variety of data sources. Depending on the functionality, performance, application and so forth, the data integration option selected varies.

8.3.3.1 Lotus Domino Connectors

Lotus Domino Connectors allow Domino server applications to connect, authenticate, and translate data between Domino and external RDMS, ERP, transaction systems, and text/file source data. This allows applications to integrate and have interactive access to enterprise source data. The Lotus Domino Connectors work in tandem with Lotus Enterprise Integrator (formerly NotesPump) and Domino Enterprise Connection Services. The architecture is represented in Figure 43.

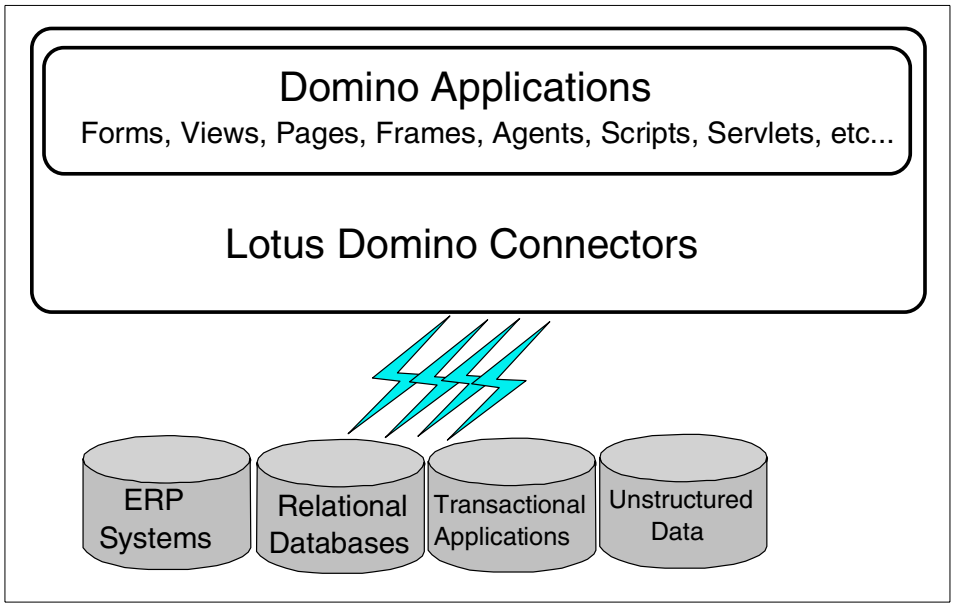

Figure 43. Lotus Domino Connector architecture

Connectors manage connection, login authentication, and data translation across enterprises data sources. They are developed using vendor supplied APIs (DB2, Oracle, Sybase, MS SQL Server, ODBC, EDA/SQL, MQSeries, ERP applications, and others) and are integrated with the Lotus Connector API.

8.3.3.2 Domino Enterprise Connection Services (DECS)

DECS is the name for a Lotus developed technology. It is a feature of Domino, beginning with Release 4.6.3, to supply an easy-to-use forms-based interface to achieve live, integrated connectivity to external data from Domino applications in *RealTime*. With DECS, you can view, create, update, or delete external, backend data, directly and transparently through a Notes client or Web client. Using DECS, developers work with a template-based application that enables them to integrate external source data with any Domino application. This represents a significant advance in Domino application development capabilities.

DECS provides seamless realtime integration between Domino applications and data in enterprise systems. This allows developers to store application data in either the Domino object store or another system such as a relational database. Enterprise Integrator provides activity-based connectivity between

systems, allowing large volumes of data to be transferred or synchronized between systems.

Domino application developers enhance existing Domino applications by identifying named forms and individual fields to interact with data supplied from external source servers. Developers simply identify a Domino form field as the key field within a DECS realtime connection definition form, and identify other form fields to hold query result information, supplied through realtime access to an external server source, such as a DB2/400 table. Finally, the Web developer schedules the realtime connection form to the Domino server add-in task.

Users with either a Notes client or browser gain immediate benefits by accessing the Domino form and entering specific key values for query to the external data source. This action causes the Domino Extension Manager to recognize this user initiated event, and transfer the key values to the external source server to perform a query, (or update) on behalf of the end user, using the key value supplied. The query result is sent back to the user in the Domino application, in realtime.

8.3.3.3 Lotus Enterprise Integrator (LEI)

LEI provides a server based, multi-tasking environment to define and administer high-volume data exchange, synchronization, event-driven and real-time transfer of data across Domino Connector sources. This service provides a declarative interface to control data exchange between Domino and the various data sources in an organization, for example scheduling, remote management e-mail notification, and so on.

Note: For those that are familiar with earlier version of LEI, the LEI Connector is the enhanced equivalent to the NotesPump Link.

Lotus Enterprise Integrator features

On the AS/400 system, the LEI server is a 64-bit application, which executes as an ADDIN server task to a native 64-bit Domino server on the AS/400 system. Access to DB2 databases, Domino databases, and file system objects is allowed using the LEI server running on the AS/400 system. Direct (native API) connections to databases such as Oracle and Sybase are not supported on the AS/400 system, nor is the ODBC Connection allowed. Access to non-DB2 data sources is achieved by using the IBM DataJoiner product on a Windows NT IPCS server, outboard Windows NT, AIX, or HP_UX platform to reroute DRDA requests from AS/400 system to the target data source. Databases which support DRDA or an AS/400 Requester/Driver can be accessed without using DateJoiner.

Note

Additional information about Lotus Enterprise Integrator for AS/400 is found in the *Lotus Integrator 3.0 User Guide.* You can find this document on the Web at: `http://www.lotus.com/home.nsf/welcome.ei` (keyword search: LEI).

Domino applications written with LotusScript have the ability to call external applications using SQL statements. SQL can call a stored procedure that is an AS/400 RPG program, for example. Another technique is for the programs to communicate using a data queue. For example, you can write information to a DB2/400 table and have a never-ending RPG program read or update it (as a way of communicating) to process requests.

8.3.3.4 LEI/DECS purpose

LEI/DECS is a tool typically used to synchronize between Domino databases and relational datasources, such as DB2, Oracle, and so on. LEI/DECS can be used with or without clustering Domino servers. However, since the AS/400e system only supports LEI/DECS connections to DB2 (locally or via DRDA), an alternate platform can be used to synchronize between Domino for AS/400e databases and, for example, Oracle. In that scenario, we might have a Domino for Windows NT server synchronizing between Oracle and a Domino database using LEI, and then replicating those synchronizations onto a Domino for AS/400 server through Domino clustering replication.

Clustering and LEI/DECS are administered using separate tools (clustering via Domino Administrator and LEI/DECS via their respective admin databases. Both of these are “centrally managed” in that one set of configuration data can be used to control many servers or server instances. The configuration can be accessed and modified from any appropriately connected Notes client.

8.3.3.5 ODBC and AS/400 data access

You can write Java agents and servlets that use JDBC to get to DB2/400 (and non-IBM databases, such as Oracle). Data access is described in this section.

Lotus Notes/Domino application development tools, regardless of platform, allow for access to relational data by using ODBC. Many existing applications use LotusScript:Data Object (LS:DO) or include @db statements with an ODBC parameter specified. With Domino for AS/400, the application code looks exactly the same from the programmer's perspective.

The AS/400e differentiation is what OS/400 does with the database request after it leaves Domino. When the code runs on the Domino for AS/400 server, as in the case of Web agents or scheduled agents, OS/400 intercepts the ODBC request and processes it by making direct calls to DB2/400. No ODBC driver or middleware communications layer is necessary. This provides a shorter path length for optimum performance, as well as eliminating the cost and work associated with installing, configuring, and managing an ODBC driver. This benefit assumes you do not have client-based Domino functions or others that use ODBC directly.

Database terminology comparison

There are some differences in terminology between the AS/400 system, SQL, and Notes. Table 2 shows the terms that have similar meaning between the three environments.

Table 2. Database terminology

AS/400 DB2/400 relational database	SQL database	Domino database
Library	Collection	Database (.nsf file)
File	Table	Form/View
Record	Row	Document/Row
Field	Column	Field/Column
Query	Query	Selection Formula

On the AS/400 system, there are libraries that contain groups of data. This is similar to the concept of a collection in SQL and a Notes NSF database. Within a library on the AS/400 system, files are synonymous with a table in an SQL collection and a view in Notes.

One example of a data item is known as a record in an AS/400 file. This record is the same as a row in an SQL table and a document in a Domino database view. Within the record, we have individual data elements called fields on an AS/400 system. A column is a data element within an SQL row. A data item in a document is called a field.

Lastly, on the AS/400 system and in SQL, you create queries to obtain data from the data repositories. In Notes, you use selection formula to perform this function.

Note

The redbook *Lotus Domino for AS/400: Integration with Enterprise Applications*, SG24-5345, provides a broad understanding of the different ways to integrate Notes and Domino applications with DB2/400 data and AS/400 applications in a Domino for AS/400 environment. In selecting the most appropriate tool, it is important to understand the trade-offs of each, such as where it can be used, the prerequisites, the required skills, scope of data or application access, and performance considerations.

8.3.4 Security

Domino supports leading security and has access controls (user authentication), digital signatures (documents and mail), encryption (communications, SSL, and mail), and protection from active content (ActiveX, JavaScript, executables, self-extracting .zip). The AS/400e system is known for its security. The combination of the application security of Domino and AS/400 security makes for very secure systems.

8.3.5 Development tools

Several development tools are described here, including Domino Designer, VisualAge for Java, and WebSphere Studio.

8.3.5.1 Domino Designer

Lotus Domino Designer R5 is an integrated Web application development environment used to rapidly build and deploy secure e-business applications to connect enterprise data with strategic processes.

The key features of Domino Designer R5 include:

- **Comprehensive IDE:** A task-oriented, integrated environment to create secure, end-to-end Web solutions.
- **Rapid development:** Create applications based on Web-ready templates, add workflow, security, and other services using Domino Objects.
- **Native access to enterprise data:** Quickly and seamlessly connect Web applications to live data in relational databases, ERP applications, and transaction systems.

- **Open standards support:** Use any HTML authoring tools, Java IDEs, and scripting tools. Supports such Web standards as Java, JavaScript, HTML 4, CORBA/IIOP, and OLE.
- **Build locally, deploy globally:** Supports Web users worldwide in their native languages, with Domino Global WorkBench.

Domino Designer comes with the following tools:

- **Page Designer:** WYSIWYG HTML authoring with complete control over page design and layout. Add styled text, image maps, tables, Java, and ActiveX components to applications.
- **Frameset Designer:** Used to create multi-paned interfaces for Web applications, without HTML coding. Automatically maintains target links.
- **Outline Designer:** Design an entire site, link content to the site design, manage the links, and automatically generate a personalized site map.
- **Domino Objects:** Rapidly build applications that access system services like security, messaging and workflow in your applications, using your choice of Java, JavaScript, CORBA/C++, or LotusScript.
- **Domino UI Java Applets:** Enhance the functionality of browser-based applications with Notes design elements like a view with resizable columns, multiple document selection, and rich text with no programming.
- **Forms Designer:** Create professional-looking forms (surveys, visitor registration, and so forth) quickly.
- **Programmer's Pane:** Provides universal, consistent access to all programming languages and scripts.
- **Instant Feedback:** Preview as you go in your choice of client, including Lotus Notes, Microsoft Internet Explorer, and Netscape Navigator.

Domino Designer gives you live access to enterprise data and applications, via support for Domino Enterprise Connection Services (DECS). This feature offers:

- **Comprehensive connectivity:** DECS supports a wide range of enterprise systems, including DB2, Oracle, Sybase, ODBC, EDA/SQL, SAP, PeopleSoft, JD Edwards, Oracle Applications, MQSeries, CICS, and more.
- **High performance, real-time connectivity:** DECS manages persistent, parallel, pooled connections from Domino to external data sources, enabling efficient, simultaneous data access.

- **Your choice of development options:** Connect to enterprise data non-programmatically via the DECS interface, or programmatically from LotusScript.

Domino Designer allows your choice of popular Web development tools, including:

- **Extensive Java support:** Develop Domino Web applications in your favorite Java IDE, such as Symantec Cafe, Borland JBuilder, or IBM VisualAge for Java. Embed and manipulate Java applets, integrate Java servlets, and even create Domino server agents in Java.
- **Integration with NetObjects Fusion and Microsoft FrontPage:** Create HTML pages and links in your favorite site authoring tool and save them directly to the Domino object store.
- **Use with Lotus eSuite DevPack:** Domino Designer templates enable easy integration with a powerful set of pre-built, pre-tested, Java applets including spreadsheet, word processor, calendar, address book, and CGI gateway.

Domino Designer lets you create and maintain multilingual Web applications, with Domino Global WorkBench, so you can:

- **Make your applications multilingual:** Work the Web in your site visitors' native languages. Maintain multilingual Web sites with minimal additional overhead, while slashing translation costs.
- **Synchronize translated content:** Manage the release of documents across different language versions of your site.

To find out more about Domino Designer and other Domino development tools and services, visit the Lotus Web site at `http://www.lotus.com`

You can also refer to the Developer Central site at:
`http://www.lotus.com/developers`

8.3.5.2 WebSphere Studio

Domino is optimized for application and collaborative services (messaging, content management security, etc.) and convergent applications (automating unstructured business processes, information flow). WebSphere is optimized for such infrastructure services as basic HTTP, server-side Java Web services, distributed transaction management, Java standards, Java programming model, EJB, and performance management.

Domino is becoming more of a development environment (with WebSphere for JavaServer Page (JSP) and Enterprise JavaBean (EJB) support).

WebSphere and application development sites are incorporating workflow and messaging more into the solutions.

The overall integration strategy by Lotus and IBM is building towards an integrated and consistent Web application platform. Figure 44 illustrates this organization.

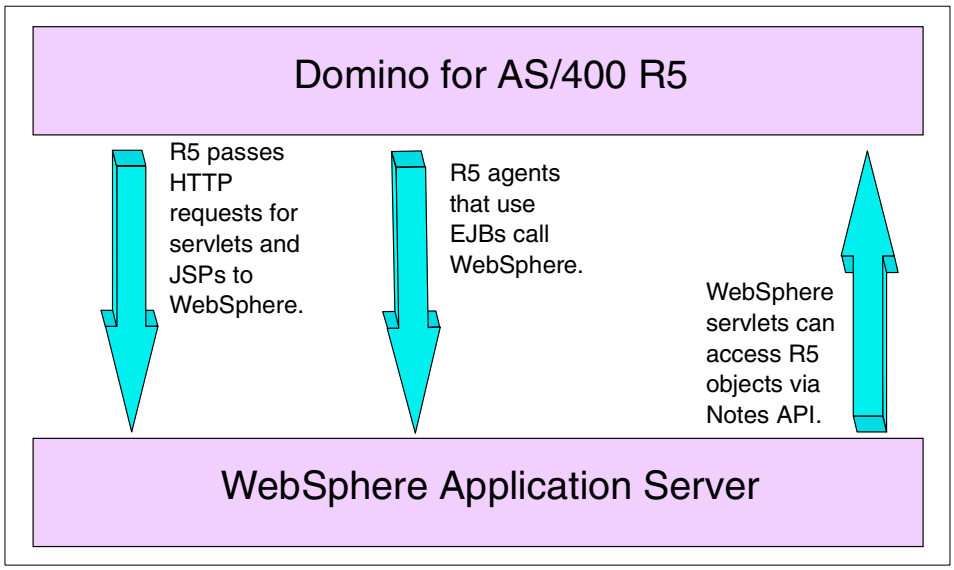

Figure 44. Applications span Domino and WebSphere

This includes common application services (directory security), common programming models (JavaBeans, servlets, JSPs, EJBs, Domino objects), a common set of developer tools (Java, eBasic as common scripting language for JSPs), common enterprise data connectivity structure, and combined solution packages.

Refer to Chapter 6, “WebSphere Application Server for AS/400” on page 103, for additional information.

8.3.5.3 Net.Commerce integration with Domino

Net.Commerce programs are based on DB2, which Domino applications can connect to using DECS and LEI. Typically these two products do not integrate automatically by themselves, but work in a complementary way. One scenario is a Net.Commerce transactional site with Domino workflow, messaging handling communications, and business process management in the organization.

Refer to Chapter 7, “Net.Commerce V3.2 for AS/400” on page 125, for further information.

8.3.5.4 Domino Toolkit for Java

The Toolkit for Java product enables developers to write, test, and debug Domino agents using their favorite Java Integrated Development Environment. Visit `http://www.as400.ibm.com/domino/DomDevTools.htm` for further information.

8.3.5.5 VisualAge for Java

VisualAge for Java is for programmers. It is a full-blown Java IDE that has all the tools you need for writing, debugging, and testing Java applets, servlets, and applications. It integrates with Domino through the free Domino Toolkit for Java. Please visit `http://www.as400.ibm.com/developer/` for additional information.

8.3.5.6 Lotus eSuite 2.0

Effective 09 September 1999, Lotus no longer markets the eSuite product line. eSuite DevPack 2.0, the latest version continues to be available through Passport Advantage.

A core team of eSuite developers will continue to provide support for both eSuite WorkPlace and eSuite DevPack through January 2001. The company also offers guidance to customers and Business Partners to replace eSuite with other technologies.

eSuite customers will be contacted directly by the Lotus and IBM sales organizations. Lotus encourages customers and Business Partners who have concerns or further questions to contact Lotus directly through the eSuite Web site at: `http://www.lotus.com/esuite`

Note

The Domino Application Studio is a comprehensive set of leading Web development tools and servers for designing and developing Web applications. Products not covered include NetObjects Fusion, NetObjects Bean, and Script Builder. Additional information is available at: `http://www.lotus.com/home.nsf/welcome/appstudio`

8.3.5.7 Payment systems

Domino allows connection to industry standard authentication authorities (Visa, MasterCard, CyberCash, Amex, and so on) and supports SET Secure

Electronic Transactions and Electronic Commerce Mark-up Language (ECML).

When processing a transaction, the Domino application uses standard APIs to communicate with payment authorities. Domino developers code with these APIs and instruct the application to verify payment at the point in which payment verification is needed in the purchase process. Once confirmation is received or rejected, the transaction continues or an error message is shown.

When do you need payment transactions? The answer depends on the type of payment, such as:

- Real-time: When user submits a form
- Real-time: When order is being fulfilled
- Asynchronous: As a step in a workflow process
- Asynchronous: On a mixed schedule: Authorize now, capture later

Where do you need payment transactions? The options include:

- Web agents (QueryOpen, QuerySave, OpenAgent)
- Scheduled agents
- Notes client events

8.3.5.8 Electronic Store: ezMerchant

Developing and deploying an electronic store requires specialized skills to develop the various underlying technologies (cookies, encryption, data translation, API integration, and so on). It is not a task customers typically undertake. The e-store market is dominated by packaged products that (after being installed and setup) create a functional online store. Currently, ezMerchant by BinaryTree.com is the only offering available that is totally developed using, and is on, the Domino Application Server environment.

ezMerchant is the only electronic store currently offered for sale as a package. It offers a full and complete shopping basket, catalogue, order tracking and other functions, all implemented on Lotus Domino. This solution is developed by BinaryTree.com, an IBM and Lotus Business Partner. It is a feature-rich commerce solution to create fully functional corporate Web sites, electronic store fronts, and business-to-business solutions.

Some major features include site creation, a product catalog, commerce options, order processing, customer registration, and so on. Additional information is available at: `http://www.binarytree.com`

Refer to Appendix C, “Third-party products” on page 233, for further information on BinaryTree.com.

8.4 Scenarios: Positioning, sizing, performance, and implementation

This section provides customer testimonials, quotes, sizing information, and references for AS/400 customers who use Domino products for building their e-business, transactional site solution.

8.4.1 Domino positioning and best use scenarios

Domino offers a rich set of capabilities, enriched by the numerous solutions available from Lotus, independent software vendors, and business partners. Everyone has a different view of what the product does, and every view is usually correct, since Domino means many different things to many people. This makes positioning and defining best-use scenarios difficult. You can perform many different tasks with the product so the best-use scenario is usually “it depends”.

Traditionally Domino (or Notes as it was called) was thought of only as e-mail, calendaring, and basic workflow. This is still valid, and many companies use the product simply for regular groupware and communication functions.

Domino can be used for building and running more robust and complex applications, as has been described throughout the Domino sections in this handbook, particularly when it comes to e-business.

If you now think of Domino as just a groupware product or just collaboration, think of it as an integrated messaging and Internet application software platform on which you can build and deploy various e-business applications. These applications are enterprise strength and can be deployed to the Internet, intranet, and extranet. They provide a variety of high-impact business process-oriented solutions.

In general, the applications built with Domino are not as transaction oriented or scaled as large as a WebSphere or Net.Commerce solutions. However, that is not the value proposition of Lotus Domino. This product focuses on business process automation, building new information based applications, managing unstructured data and information, flexibility, integration with back-office computers and databases, and business-oriented solutions. These are all elements of e-business. Consider Domino as a platform to deploy your business on the Internet.

8.4.2 Sizing information

Probably the number one question about Domino for AS/400 is “How big an AS/400e server do you need to run Domino for x number of Notes users?” You can find the answer on the IBM Domino sizing home page at:

- http://www.as400.ibm.com/domino/

  At the site, go to “Domino Sizing Information”.

- http:www.as400service.ibm.com/estimator

As with every performance estimate (whether a rule of thumb or a sophisticated model), treat it is as an estimate only. Particularly with a robust product like Domino that offers so many different capabilities with a chameleon-like ability to conform to the habits of the users, each installation has unique performance characteristics and demands. The typical disclaimers that go with any performance estimate (“your experience might vary...”) are especially true with Domino. These sizing estimates are general guidelines, but their accuracy in all circumstances cannot be guaranteed.

For more detailed sizing information, particularly if you plan to add Domino for AS/400 to your existing AS/400 workload, refer to your IBM consultant and look to the BEST/1 modeling tool. The BEST/1 capacity planning tool has been updated (with PTF SF47087 of 5769-PT1 on V4R2) to include three Domino workloads. This helps size the system for adding Domino to an existing V4R2 workload. Descriptions of those workloads are available through the Support Center and are also posted at the ILIC Web site: http://www.software.ibm.com/is/ibm-lotus

8.4.3 Domino for AS/400 performance

When the AS/400 division introduced its fourth generation of 64-bit technology, it achieved a NotesBench “Mail only” mark of 27,030 users with a 0.08 second response time. This benchmark used 12-way AS/400e servers and is the second highest NotesBench number ever. The RS/6000 has achieved about 1000 more users, as has the AS/400e (with lower CPU utilization and faster response times than the RS/6000 model). This means the AS/400 system has the raw processing power to manage the batch server type workloads demanded of a server running Domino.

The AS/400e system’s well documented reliability is increased further with the implementation of Logical Partitioning (LPAR) and Domino clustering technology. The AS/400e system on its own has only hours of downtime per year. LPAR allows multiple Domino instances to run concurrently (up to 30 on large machines) and be managed by the AS/400e system. If one of those instances fails, the AS/400e system manages the failure, re-distributes the processing across the cluster, and re-starts the failed server.

Note

A NotesBench audit is an independently verified measurement of the capacity and price-performance of a platform (hardware and operating system combination) running a standard Domino mail workload. See `http://www.notesbench.org`

Other additional links related to performance include:

- Domino for AS/400 Performance home page:
  `http://www.as400.ibm.com/developer/domino/perform/index.html`
- Maximizing application and server performance in Domino:
  `http://www.as400.ibm.com/developer/domino/perform/maxperform.pdf`

Document references to server performance and Domino include:

- *Lotus Domino for AS/400: Performance, Tuning, and Capacity Planning,* SG24-5162. This redbook shows a detailed approach for:
  - Measuring Domino application performance
  - Analyzing throughput and response times
  - Extrapolating measured data and doing capacity planning for growth
  - Tuning Domino servers and OS/400 resources for optimal use
  - Considering partitioning, clustering, and sizes of databases
  - Using text search, indexing, and views
  - Measuring, tuning, and extrapolating Domino HTTP server workloads
- *Performance Considerations for Domino Application*s, SG24-5602. This redbook investigates how to consider performance and capacity when designing and developing a Domino application. It also discusses how to analyze a Domino application that does not meet its performance and capacity goals.

Other IBM Redbooks are available at `http://www.redbooks.ibm.com/`

Use the search function to find the publication for which you are looking.

Note

The IDC white paper *Analysis of AS/400 Dedicated Server for Domino versus PC Server* is available on the Web at:
`http://www.as400.ibm.com/conslt/dsd_tco.htm`

This white paper discusses the cost differences between two popular Lotus Domino servers: the AS/400 and the PC. To quantify these differences, an analysis of 500- and 1,000-user configurations for each platform was done, and a calculation of three-year total cost of ownerships (TCOs) for both models. Refer to the Web site above for more information.

8.4.4 Scenarios: Implementation examples using Domino

This section includes write-ups of selected case studies, that is, actual customers using Domino for various functions of e-business. Included are dynamic site and transactional site case studies. The problem to solve and the solution chosen is described for each case study selected.

8.4.4.1 Dynamic site scenario case study: Saab Cars USA

To empower dealers with up-to-date product and service information, Saab Cars USA, Inc. built a corporate intranet. It was intended to:

- Improve communications between Saab and its network of more than 225 independent retailers nationwide
- Integrate multiple backend business systems with the Web
- Minimize the software and hardware required at retail sites

Technology solution

Saab developed an Intranet Retail Information System (IRIS), incorporating the IBM AS/400e system and Lotus Domino running natively on AS/400e server.

The new solution offers the following benefits to Saab:

- Improved information flow to retailers, with two-second response time for any transaction
- Seamless integration with an existing IBM S/390 server and AS/400e systems, both housed in different physical locations
- A “serverless” environment at dealership locations, with Web browsers as the only software required on the client

- Simplified systems management through the use of the AS/400e system and server in multiple roles

A solid anchor for a complex e-business initiative

In the past, information about service, ownership, warranties, and parts was scattered among three systems:

- An AS/400e server at Saab's U.S. headquarters in Norcross, Georgia, which houses the company's core business applications
- An IBM S/390 server at Saab's parts distributor
- A variety of management systems at Saab retail locations

IRIS seamlessly pulls information together from all these sources into DB2/400, the built-in relational database on the company's AS/400e server. An AS/400e server running Lotus Domino for AS/400 was added as the main Web and messaging server. When a dealer requests data, IRIS pumps it from DB2/400 into Domino databases residing natively on the AS/400e server.

“The AS/400e system and AS/400e server give us the solid reliability and performance we need to make our intranet fly,” says Jerry Rode, director of information technology.

Integrated AS/400 functionality simplifies the intranet

The next piece to the IRIS puzzle moves the data from the AS/400e server to the retailer clients using a satellite network. Saab chose IBM Business Partner Jacada in Atlanta, Georgia, to develop Java-based graphical clients, using Jacada's Web-to-host product, Jacada for Java.

Jacada for Java generates interfaces for the AS/400e system and mainframe applications using Java technology. The advantage of Jacada for Java is its transparency. It supports online transaction processing with Saab's intranet without requiring changes to existing backend applications. “Now we can tap the rich functionality we've built up in our business systems, and move forward from there,” says Rode.

From the retailers' point of view, all they see is a Java applet. And, all they need to view the data is a Web browser. “With this approach, our retailers do not require a server on site,” says Rode. “... this is a great benefit since it greatly simplifies systems management for them.”

At the time of the initial roll out of IRIS, the Jacada for Java Web-to-host solution could reside only on a Windows NT server. Now that Jacada has announced a new version of Jacada for Java on the AS/400 platform, the AS/400e server fills this role.

“We'll be moving to the AS/400e server as soon as the Jacada for Java code becomes available,” says Rode. “It's one less system we'll have to manage, and we know the AS/400e server will accommodate more concurrent users than our NT server.”

He adds, “With the built-in capabilities of the AS/400e server, we can standardize our headquarters hardware platform. Everything runs native on the AS/400e server. We don't need an NT server for one application, UNIX for another, and Novell for yet another. That means we don't need a lot of disparate skills to support our systems.”

A solid foundation for growth

Saab is working to develop a system for forwarding warranty, sales, and repair information directly from retailer locations to Saab's AS/400e server. This will eliminate costly paperwork and rekeying.

“IRIS will retrieve data automatically from our retailer systems,” says Rode. “We won’t have to wait for batch transfers.”

For example, Saab will be able to track service reports daily and determine whether a particular part is causing recurring warranty claims. The problem can then be corrected at its source, in the manufacturing process.

For the future, Saab plans to roll out IRIS worldwide to all its retailers. The company will tap into the power of AS/400 systems located at 14 data centers around the world.

“The AS/400 strategy is right for our business,” says Rode. “Intranet and extranet applications are where the field is headed. The recent changes in the AS/400 architecture positions us very well to move in that direction. And, its capabilities keep growing as our environment is growing. It gives us a solid foundation for the future.”

For further information on this case study, refer to this Web site:
`http://www.as400.ibm.com/CASEST/SAAB.HTM`

8.4.4.2 Dynamic site scenario case study: U.S. Olympic Committee

Established in 1978, the United States Olympic Committee (USOC) is the coordinating body for all U.S. Olympic-related athletic activity. Almost 500 employees work from its headquarters and training center in Colorado Springs, Colorado; Lake Placid, New York; and Chula Vista, California.

Like the aspiring athletes it supports, the USOC is committed to excellence in serving American sports. The USOC is continually ranked among the top 100 nonprofit organizations in the United States. Its primary goal is to assist in

finding opportunities for every American to participate in sports, regardless of gender, race, age, geography or physical ability. It does that by:

- Supporting sports that are, or want to be, included in the Olympic or Pan-American Games
- Supporting the bids of U.S. cities to host the Olympic Games
- Hosting more than 25,000 athletes each year at three Olympic Training Centers

In fact, the USOC allocates grants that are worth more than $30 million to athletic programs and $115 million to member organizations every year.

In coordinating all U.S. Olympic-related athletic activity, the USOC must provide timely, accessible information. It lead the way in the early 1990s by creating a centralized data repository on the AS/400 platform with information on athletes, training centers and ongoing competitions. Data is accessed via PCs in a high-speed wide area network, through Client Access for AS/400.

Technology challenge

The United States Olympic Committee (USLC) wanted to provide information to a wider community of users, including athletes and the media. Initial applications included:

- Drug education
- Insurance policy benefits and administration
- Press Box (including results, event schedules, athletes' biographies)

Technology solution

The USOC implemented the new applications using the Domino server. The benefits included:

- Easy access through an intuitive graphical user interface
- Simplified systems administration
- High level of security
- Stable environment
- Excellence in delivering timely, accurate information

Integrated AS/400 functionality simplifies the intranet

In early 1997, the USOC raised the bar, setting new goals for information delivery. It saw a need to make information more timely and easy to access for the USOC community of users, including developing athletes and the media. The challenge was to make it easy and intuitive for these people to access information from any PC anywhere in the network. The USOC cleared this hurdle by implementing Lotus Notes/Domino on AS/400 on the Integrated PC Server.

“This enables us to provide graphical applications while taking advantage of all the strengths of our AS/400 server,” says Becky Autry, MIS director, USOC.

“Our goal is to achieve an absolutely intuitive graphical user interface integrated with our DB2 database on AS/400. The AS/400 offers numerous advantages,” adds Cal Hedgeman, senior manager for application development at the USOC. “The ease of administration and high level of security and reliability are very important. We had done a lot of PC-based application development in the past, but felt the AS/400 offered a stronger platform to enable us to integrate complex applications. It's a very stable environment.”

Setting new standards for information delivery

The USOC decided to start with three small applications:

- Drug education
- Insurance policies and administration
- Press Box

The first two applications provide information directly to athletes on drug use policies for the Games and insurance. For example, an athlete can check information on various drug categories, for example anabolic steroids. In the past, the USOC delivered this information (primarily) on paper or by telephone. Now, it can offer it electronically to everyone at the training centers.

According to Mark Vogtner, associate director, MIS, “With these Notes applications, we'll be able to provide information faster and keep it current. Plus with Notes easy-to-use, intuitive tools, we can dig in and pull out exactly the information that our clients need.”

The third application, called Press Box, is an Internet-based Notes application. Its users are media people writing stories about the U.S. athletes. Press Box debuted at the 1998 Winter Games, providing up-to-date information about participating U.S. athletes to the media at Nagano. It replaced a PC-based bulletin board system that was set up each time at past Games. Amid a complex tangle of telephone lines, modems, and interfaces, Vogtner recalls, “It was always a challenge to get the system up and running, especially overseas. Press Box, on the other hand, can be accessed from any PC with a Web browser. It requires no special set up at the Games.”

With Press Box, users can send text files instantly, using a Web browser. This process greatly simplifies the flow of media information from the Games, making it more immediate.

For the future, the USOC has plans for a number of additional Notes initiatives. For example, building an Executive Information System (EIS), using the Domino server running natively on the AS/400 system.

“Our goal is to exploit the rich graphical functionality of Notes and the equally rich database capabilities of our AS/400 with its DB2 database,” says Vogtner.

“Notes is the foundation of our information delivery system, replacing some printed reports and faxed documents. It's a leap forward for us in terms of the quality of service we provide to our clients.”

For further information on this case study, refer to the Web site:
`http://www.as400.ibm.com/CASEST/OLYMPIC.HTM`

8.4.4.3 Transactional site scenario case study: Longmont Police Department

The Longmont Police Department in Longmont, Colorado, needed to replace its out-dated, unreliable police report-writing system running on a Novell platform. It needed a more efficient accurate system that would integrate with its records management process.

Technology

Through the force of Lotus Domino for AS/400, the department was able to establish a stable, reliable platform on which it deployed a highly functional crime report writing application that has drastically cut the time it takes to write and file reports, allowing officers to spend more time on the streets protecting their community.

Terry Lahoun, Police Commander, explains, “After evaluating a number of systems, we decided to go with Lotus Domino for AS/400 because of platform stability with DB2/400 integration that didn't force us to create a lot of infrastructure. At that time, I didn't realize how much we were trying to do depended on a solid e-mail system. With reliability, integration, and e-mail, Lotus Domino for AS/400 tied it all together for us.”

Report writing has long been the bane of every police officer. Dramas on television characterize police singing the blues of this time-consuming process. Report writing keeps them tied up for hours behind their desks, instead of out on the street performing their more important duties for the public.

In reality, writing crime scene and arrest reports that are both accurate and complete is crucial to the legal process and pivotal to the criminal justice system.

To reduce the time and hassle associated with the report writing process, the Longmont Police Department turned to Lotus Domino for AS/400. With the goal of allowing officers to spend more crucial time on the street, the department deployed a new application to make report writing faster and easier, while increasing accuracy.

This was not the department's first attempt to enhance its reporting system. In the late 1980s, the department deployed an initial application for an automatic police reporting system written in d-base residing on a Novell server. At that time, only about 12 officers used the program. Then the department decided to increase the number of officers on the system and, at the same time, put laptops in many of the patrol cars.

"We actually had two versions of the program: the network version and the standalone version for the laptops in the field," says Lahoun. "But we had a lot of ergonomic problems using the laptops within the cars, so the officers just quit using them and preferred the network version within the department. The entire force of nearly 60 officers eventually moved over to the network version that resided on a Novell server."

As more users moved onto the networked d-base program, the department began to experience system crashes and conflicts due to downtime. When the system needed to upload the crime reports to its record management program that resided on its AS/400 Model 500, every officer needed to get out of the system. "Due to the fact d-base rebuilds indexes, every officer needed to be out of the system when we uploaded the reports; we were forced to run the transfer only twice a day," says Jan Kilgore, Director of MIS for the department. "There was a 12-hour delay in getting the crime reports into our records management system."

The department realized it needed to install a more stable, reliable platform than was offered by its present Novell server and deploy a more functional report writing application. "Our driving force was to move to another platform that could handle more users and offer more functionality," says Commander Lahoun. "We wanted to stay in an automated format and not step backwards to paper reporting. I didn't want to use a dictation system. Many forces use dictation systems, but you can show a higher degree of accuracy and efficiency with an automated police reporting system than with a dictation system."

After evaluating a number of systems, the department implemented Lotus Domino for AS/400 “... because of platform stability and its DB2/400 integration that didn't force us to create a lot of infrastructure,” Lahoun says.

With the installation of the AS/400 Model 170, combined with the power of Lotus Domino, the department now deploys a crime reporting application that offers connectivity and functionality, while working seamlessly with its records management system. “We have been very pleased with the reliability and performance of our AS/400,” says Elizabeth Copley, Program Analyst for the department. “Another important reason we went with Lotus Domino was the flexibility and functionality of working within a Domino environment. Our present and future applications call for the Workflow capabilities of Domino. The system is always reliable; these trusty AS/400s are fabulous.”

Working with its IBM and Lotus Business Partner, Midrange Performance Group (MPG), Boulder, Colorado, the department confidently deployed its newly developed application, Lotus Report Writing System (LRWS). “Now the officers click on the LRWS icon that opens a front-end screen. Everyone is greeted by one main screen as opposed to the previous d-base system that offered officers certain menus and supervisors different menus,” says Randy Watson, President of MPG. “It's very intuitive in nature. The dialogue boxes, the drop-down boxes, the radio button are all things that enforce consistency. Even those officers that know very little about the application can easily get into the system and quickly write a report.”

The new reporting system takes advantage of Notes' ability to organize and associate information from different sources. When an officer gathers notes from a crime scene and begins writing a report, the new system provides the option to automatically attach the original dispatch request. The report writing system is linked to the Computer Aided Dispatch (CAD) system to eliminate duplicate entry of information and increase accuracy.

“When the officers are adding persons to their reports, such as suspects, victims, complaints, or witnesses, there is a function within the report called a Person Lookup that uses Open Data Base Connectivity (ODBC)”, says Elizabeth Copley. “The officer can put in part of a name or a full name and all of a sudden we bring up a subfile of all the possible name matches based upon what is keyed into his selection criterion box.”

This function has saved on keying time by bringing in all standard information on the person, such as date of birth and address. There is no need to constantly rekey the same information, increasing both productive and accuracy. “The CAD look up is a real timesaving activity bringing in the information that resides within the AS/400 Model 500,” Copley says.

To make things simpler and quicker for the officer, the report writing system offers a variety of forms appropriate for different incidents. “You can write an offense form, a vehicle form, a property form, a hate crime form, a press release, and then you can write an officer narrative. When the officer finishes, the report is escalated to the next level for a supervisor's approval,” says Commander Lahoun. “The nice feature is that if the supervisor disapproves, a reason for disapproval is put into that document, and an e-mail notification is sent back to the officer stating why the report was disapproved. The cycle now repeats itself.”

Domino's embedded Workflow capabilities keep the report moving until it is approved and finally becomes an official police report. It is then uploaded to the AS/400 system, flowing over into another view for records management department to do a final quality check.

“Now it takes only a matter of a few minutes to transfer data to the records management system,” says Jan Kilgore. “We run it several times a day to keep the records current, saving us nearly 75% of the time it used to take. But more importantly, nobody knows what is happening behind the scenes because we never need to be down.”

Response to the new system has been very positive. The previous process in the records department required nearly ten steps to file and transfer, now accomplished in just a couple of seamless steps.

Lotus Domino for AS/400 also helps the department in its national crime reporting to the Federal Bureau of Investigation (FBI). “We have a program called National Incident Bureau Reporting System (NIBRS) which provides data to the FBI. There is certain data they need, not the narrative, but the statistics, such as victims, arrestees, suspects, and the crime itself,” says Commander Lahoun. “It's very complex to pull out that information; there are about 52 data elements that actually get submitted. They are embedded in our report writing. We used to ask the officers to fill out a NIBRS report, but this was time consuming for them. With Lotus Domino, we have been able to eliminate the NIBRS form we had within the old report writing application, because now that data is pulled out automatically, without the officers worrying about it.”

Lotus Domino for AS/400 positions the department to begin plans to continue to build upon the connectivity of its present system. “The whole force has seen advantages to the system with regard to our case management,” says Lahoun. “For me, the bigger possibility is to network the actual report writing system to all the components of the criminal justice system. Networking to others with the whole criminal justice system such as the District Attorney's

office, probation officers or judges would be a great benefit. If we had the application on their PCs, they could pull the report themselves. With Lotus Domino, it's just so much simpler."

Other future plans may even include the creation of a subset of the report writing program that the department can put out on the Web. For minor crimes, citizens could fill out a smaller version of the application instead of coming into the department. "These reports would be filtered to our administrative report takers who would then follow up with the citizen," says Jan Kilgore. "This also allows the police to spend their time dealing with issues that best use their resources."

Lotus Domino for AS/400 gives the Longmont Police Department the ability to allocate its resources to better serve the community. Instead of sitting behind a desk, Longmont's officers make the best use of their training and skills by being able to spend more time protecting the community.

For further information on this case study, refer to this Web site:
`http://www.as400.ibm.com/CASEST/LONGMONT.HTM`

8.4.4.4 Business-to-consumer case study: Copart, Inc.

Copart Incorporated (`http://www.copart.com/`) is an automobile salvage dealer and reseller service provider. They offer salvage services primarily to insurance companies that buy and sell salvaged vehicles through auctions. Founded in 1982, the company began with a single location using telephone and fax to contact customers. Today, using technology as a key enabler, it operates more than 60 facilities in 30 states, with 1,100 employees and annual revenues exceeding $100 million (U.S.).

Copart's technology base is an e-business solution running on IBM AS/400e server. Copart uses the AS/400e server in a number of different roles:

- Web server
- Production
- Solution development
- Offsite backup

And, the company plans to launch Lotus Domino to deliver Web-based electronic mail and workflow capabilities.

Technology challenge

To grow its business, Copart Inc. looked to information technology (IT) as a key enabler. It wanted to implement a new Web-based system to:

- Help it reach more customers in a shorter time frame
- Enable customers to conduct transactions electronically with Copart
- Help Copart realize increased operating efficiencies
- Provide a scalable foundation on which to grow its business

Technology solution

Copart Inc. chose the AS/400e server to deliver online bidding on the Web. The benefits include:

- More timely customer response to bids
- Increased business
- Time and cost savings
- Greater reliability, scalability, and flexibility

Double-edged challenge: Build a business and contain costs

The business challenge Copart faced was how to increase efficiencies within its business processes to enhance customer service, without increasing costs.

"We decided an electronic interface would help reduce costs and improve the delivery of information to buyers," says David Bauer, senior vice president and chief information officer at Copart Inc. "Prior to our new e-business solution, we used a paper-based system creating a heavy administrative workload. Today, with our AS/400e Web-based solution, we have two-way communications that enable customers to bid electronically on cars and receive critical information on their transaction."

"In addition, Web-based bidding has greatly reduced the time spent by Copart employees on the telephone and enabled them to accept more business," adds Bauer. "They save an average of seven hours per day on the telephone doing administrative chores and are able to divert this time to enhance revenue-producing activities with customers. We estimate that this will translate into substantial cost savings annually."

A proactive strategy for increased business

Using the AS/400 e-business solution, customers can:

- Place bids electronically
- Receive confirmation that bids were received
- Receive bid status and notification if they are among the "Top Five" bidders
- Rebid if they are displaced from the "Top Five"
- Receive confirmation that they have won (or lost) as well as essential information such as closing price, location of the automobile, and claiming procedures

“Our business has virtually exploded since we went online using AS/400e,” says Bauer. “In addition to opening new facilities this year, we've experienced extraordinary growth.”

Also, by being able to notify bidders if they drop out of the Top Five (and their chances of obtaining their automobile are slim), Copart believes that it has generated additional and generally higher bids.

According to Bauer, Copart is now planning a Domino application to send e-mail automatically via the Web to customers.

“When we initially introduced online bidding, our customers took to it like fish to water,” he says. “Today, they can see their bidding results online by accessing our Web site. With Domino, we can now take it a step further and actively send them e-mail. We'll move from a passive approach to an active system that electronically prompts customers to actions such as increasing the amount of their bid or even bidding on another automobile.”

With the help of Tailored Systems, an IBM Business Partner providing leading-edge e-business solutions, Copart is also deploying a high-availability Real Vision imaging system on the Web using the AS/400e server. This system will enable Copart to take digital pictures of automobiles up for auction and post them on the AS/400e server for Web access by customers.

“Our online bidding system is an excellent example of the Web-serving capabilities of the AS/400e,” says Bauer. “Also, the scalability and flexibility of the AS/400e platform means we are strategically positioned to incorporate new initiatives such as Domino that will help us grow our business even more.”

For further information on this case study, refer to this Web site:
`http://www.as400.ibm.com/CASEST/COPART.HTM`

8.4.4.5 Domino-based electronic store ezMerchant case study: Blake Equipment

Blake Equipment (`http://www.H2Oproducts.com/H20products/home.nsf`) traditionally had strong sales and a sterling reputation for quality and customer service, but they realized that they were missing an opportunity with the growth of the Internet. Looking to capitalize on the new Digital Economy, Blake Equipment wanted to create a new e-commerce enabled Web site for their successful Connecticut-based water products business. The challenge was that what Blake wanted to build was an entirely new brand identity, H20products.com, on the Web.

Needs assessment

With the water product industry being a niche market, a highly focused approach was necessary to capture their target audience's attention on the Web. What Blake Equipment needed was an e-commerce enabled Web site to provide a secure environment for transactions as well as the ability to communicate with their backend systems. Blake also wanted a phased, integrated approach, so that different components could be added as time and budget allowed.

Binary Tree's solution

Binary Tree's ezMerchant solution (Version 2.0) allowed Blake Equipment to expand quickly into this new medium using only a fraction of the costs and resources normally required for an e-commerce Web site. In looking for a site builder to not only develop an appealing Web site, but also meet their criteria for secure e-commerce transactions and seamless backend connectivity, Blake Enterprises settled on Binary Tree's ezMerchant.

Some competitive differentiation of ezMerchant includes shopping cart capabilities, secure credit card transactions, and above all, Web site ease of use. Internet surveys confirm that if a customer finds the information they are looking for within three mouse clicks, the chances of them returning to that site are reduced considerably. Thanks to ezMerchant's intuitive site builder, H20products.com customers can easily access the information they need.

“ezMerchant makes interacting with our customers easier and more efficient.With Binary Tree’s tools and services we are able to serve our customers better,” according to Fred Cuda, President of H20products.com.

Binary Tree recommended that Blake Equipment use Domino for their messaging needs as well. On the basis of this recommendation, Blake Equipment upgraded their AS/400 server from an AS/400 600 series to the Model 720. In doing so, they also implemented a Lawson system to handle their backend needs. The decision to go with Lawson was made after Blake Equipment initially settled on an alternate backend system, but found that Binary Tree's expertise with Lawson, coupled with ezMerchant's high degree of compatibility, made Lawson the most attractive choice.

Realtime information exchanged between the backoffice and the H2Oproducts.com Web site provided improves customer service and facilitates faster customer access to their accounts. H20products.com was up and running in two months, with a site that met all of their objectives.

By using H20products.com as a primary business tool, customer service can be far more effective, with updated orders and information available

immediately on the Web. With realtime data available, customers know the inventory status of products they are interested in, without waiting for a sales person to get back to them. Their new ezMerchant site, H20products.com, Blake Equipment signs up new distributors over the Web, which reduces their overhead costs. This site also gives Blake the opportunity to expand nationally, as opposed to region by region.

The software they use includes:

- BinaryTree.com's ezMerchant 2.0
- Domino Server R5
- Domino R5 Clients (Administrator, Client, and developer)

The hardware they use includes the IBM AS/400 720e server.

Additional product information is available at: `http://www.binarytree.com`

8.4.5 Additional reference material

Additional Domino for AS/400 case studies available on the Web at: `http://www.as400.ibm.com/casestudies/GRPW`

The *Lotus Domino for AS/400: Developing an e-business Application*, SG24-6052, redbook shows you how to create an e-business application with Domino for AS/400. It describes the tools and techniques used to develop a sample e-business application with Internet, intranet, and extranet functions, as well as the infrastructure and security implemented for the application.

Up and Running with Domino for AS/400, SC41-5334, was recently published to help new Domino users install and configure Domino for AS/400 Release 5.0.1 or later on a Dedicated Server for Domino.

Lotus Domino for AS/400 R5: Implementation, SG24-5592, Domino R5 is Lotus' new generation of Internet products. This redbook helps you implement and administer this exciting new release on the AS/400 system with Lotus Domino for AS/400. This redbook is written for technical specialists and programmers, who are IBM customers and Business Partners.

Chapter 9. Other IBM e-business products for the AS/400 system

This chapter discusses some of the many non-IBM products that run on AS/400 systems to enable an e-business environment. It is important to understand that this chapter only offers a few examples of the many applications available. By no means does our discussion indicate an endorsement of the products represented.

This chapter also discusses some of the many IBM products that run on AS/400 systems to enable an e-business environment, including Host-On-Demand, Host Publisher, and MQSeries. Many other solutions are available, some of which serve the same functions as these featured products, and others to further complement them.

IBM PartnerWorld for Developers sponsors an AS/400 Application Development Tools Network. This AS/400 program is a resource used for IBM and non-IBM tools and currently sponsors over 100 business partners. The Tools Network program is described at:
`http://www:as400.ibm.com/developer/tools/index.html`

This site also offers a reference for non-IBM e-business products. You can also find this information in Appendix C, “Third-party products” on page 233.

9.1 Host On-Demand

IBM SecureWay Host On-Demand Version 4 gives users a simple way to reach critical host data, without requiring any software (except a browser) to be installed on the client. Host On-Demand (HOD) has browser-based access and uses the power of Java applet technology.

With V4R4 of the OS/400, HOD benefits the latest improvements. Figure 45 on page 198 shows how the components of Host-On-Demand interface with each other and the AS/400 system. The browser used by the client is Java enabled.

9.1.1 Host On-Demand technology and architecture

HOD gives you secure, scalable, and reliable access to your host data, with AS/400 (TN5250), S/390 (TN3270), and DEC/UNIX (VT52/100/220) emulation in a single package. CICS Gateway for Java access is also provided.

IBM SecureWay Host On-Demand Version 4 includes the following main products:

- Host On-Demand Server
- Database On-Demand
- Host On-Demand Screen Customizer/LE (Light Edition)

Figure 45 shows how the components of Host-On-Demand interface with each other and the AS/400 system.

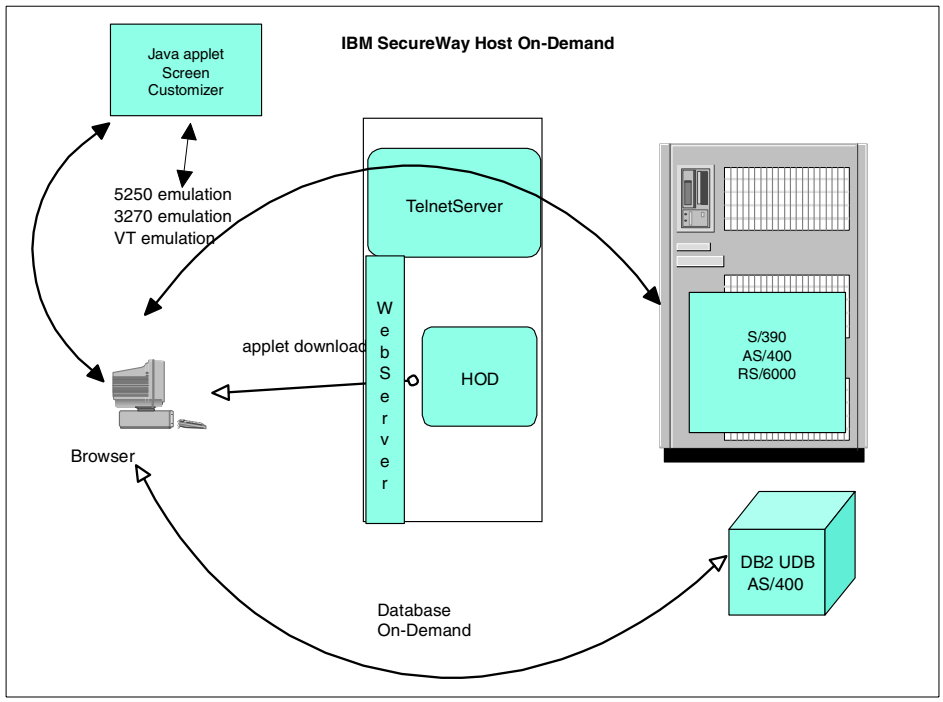

Figure 45. HOD: How it works

The browser used by the client is Java enabled.

9.1.1.1 Host On-Demand Server

Host-on-Demand Server provides management of the Host On-Demand environment and supplies the client applets for download. Install it in the same machine as a Web server, for example, IBM HTTP Server.

9.1.1.2 Database On-Demand

The Database On-Demand feature allows access of AS/400 databases by running SQL statements online. It uses the OS/400 JDBC client.

9.1.1.3 Screen Customizer/LE

A basic Screen Customizer/LE is provided as a subset of IBM SecureWay Screen Customizer. IBM SecureWay Screen Customizer automatically converts host screens into a graphical presentation that is easily customized without any programming. The subset or the full product is installed on the client side.

9.2 IBM SecureWay Host On-Demand Version 4 on the AS/400e server

SecureWay Host On-Demand is part of the Software Group offerings and provides the following features:

- **Host Access**: 5250 emulation, 5250 device ID, direct connection to any 5250 Telnet server
- **File transfer and Print function**: Integrated file system file transfer, screen print, 5250 host printing (HPT)
- **Security**: SSL 3.0 support
- **Ease of use**: Full color remapping, full keyboard remapping (including mapping host keys to PC keyboards), CCP (copy, cut and paste), and more
- **Ease of management**: Web-based remote administration, LDAP support, user and group management, RSTLICPGM installation, Service Location Protocol (SLP), load-balancing support
- **Application development**: Host Access Class Library (HACL) API for Java and Host Access Beans for Java

The only requirement to run HOD on the AS/400 system is for OS/400 V4R2 to be at a minimum. HOD uses TCP/IP Connectivity Utilities for AS/400, Java for AS/400, Qshell Interpreter, and the IBM HTTP Server for AS/400.

Note: If you are running OS/400 V4R2, IBM Internet Connection Secure Server is used instead of the IBM HTTP Server for AS/400.

This solution is a cost-effective approach because it uses the existing applications. You save time and money in product deployment and maintenance. HOD is particularly efficient for intranet or extranet environments.

HOD can be viewed as a step to Host Publisher, which integrates the WebSphere product capabilities, notably Java.

9.2.1 Host Access Beans for Java and Host Access Class Library

The Host Access Beans for Java are beans written using the HACL libraries, providing a programming interface for host access. They can be used with visual development tools, such as VisualAge for Java, to rapidly develop new applications from existing products and applications.

At the core of the technology is a session bean that secures a connection to a host, and a macro bean that uses a “Record and Play” technology to MIME application data on the host.

The Host Access Class Libraries (HACL) for Java are at a lower programming level than the Host Access Beans for Java. HACL is the basis for the Host Access Beans and provides a core set of classes and methods to allow the development of platform-independent applications to access host information without the need for a graphical display.

The library represents an object-oriented abstraction of a host connection that includes:

- Reading and writing the host presentation space
- Enumerating the fields in the presentation space
- Reading the operator information area for status information
- Transferring files
- Performing asynchronous notification of significant events

9.2.2 SecureWay Host On-Demand product positioning

The Internet reaches more and more users every day. SecureWay Host On-Demand 4.0 is targeted to customers who want to provide easy, secure, and cost-effective host access to users in Internet-based environments. It enables businesses to reach new users who may be unfamiliar with or have no access to traditional terminal emulators.

Host On-Demand is an Internet-to-host connectivity solution that provides secure browser access to host applications and Java-based emulation. With support for TN5250, TN3270, VT52/100/220, and CICS Java Gateway access, users have a single interface to most of their key host data.

In addition, customers can save significant expense in product deployment and maintenance with Host On-Demand using Web server installation. In Host On-Demand 4.0, a default graphical user interface (GUI) is provided to simplify the user experience for users unfamiliar with host green screens. Customers who want to provide customized GUI screens can purchase Screen Customizer for Host On-Demand.

Host On-Demand 4.0 also provides a rich Java toolkit to enable customers to rapidly create custom e-business applications. Because of this support, Host On-Demand is also targeted to independent software vendors.

Host On-Demand is recommended for users requiring Java-based emulation. IBM SecureWay Personal Communications is recommended for full function emulation, more extensive APIs, and a wider range of protocols or connectives. Both products are components of the IBM SecureWay Host Integration solution.

9.2.3 Implementation examples using HOD

This section provides references for AS/400 customers who want to use Host On-Demand for e-business and dynamic data solutions.

Refer to *IBM SecureWay Host On-Demand: Enterprise Communications in the Era of Network Computing*, SG24-2149, and *Web-to-Host Integration Solutions*, SG24-5237, for step-by-step implementation scenarios of Host-On-Demand.

9.2.4 Performance considerations

Host On-Demand is a Java applet. Therefore, performance is a function of the speed of the network, processing power of the workstation, as well as the characteristics of the browser being used.

9.3 Host Publisher

This section describes the technology required (or available) for dynamic data in e-business, based on Host Publisher and other IBM products.

9.3.1 SecureWay Host Publisher technology and architecture

IBM SecureWay Host Publisher V2.1 for AS/400 (5648-D31) provides a quick and easy way to implement e-business applications. With this software, you can extend the reach of mission-critical applications to users across the intranet and Internet without changing existing applications.

SecureWay Host Publisher for AS/400 allows you to integrate multiple sources of host data into a single Web page, giving end users the appearance of a single new application. Host Publisher uses Java technology like JavaBeans, JavaServer Pages (JSP), and Java servlet. Consequently, the existing applications are built in an ILE language.

Note

The IBM Integrated Languages Environment RPG for AS/400 V4R4, 5769-RG1, provides different compilers to help you to move with minimal disruption to the ILE environment.

SecureWay Host Publisher supports applications written for 5250, 3270, VT, Java, and databases that provide a JDBC interface, such as IBM DB2 Universal Database, Oracle, and Sybase. It supports any HTML-based browser and does not require any specific Java-enabled browser.

Host Publisher consists of two major components:

- **Host Publisher Studio**: A collection of easy-to-use, task-oriented, point-and-click tools that provide the development environment for creating Host Publisher applications. It runs on a PC.
- **Host Publisher Server**: Works with the IBM WebSphere Application Server to provide the runtime environment for executing applications created with the Host Publisher Studio.

These components are shown in Figure 46.

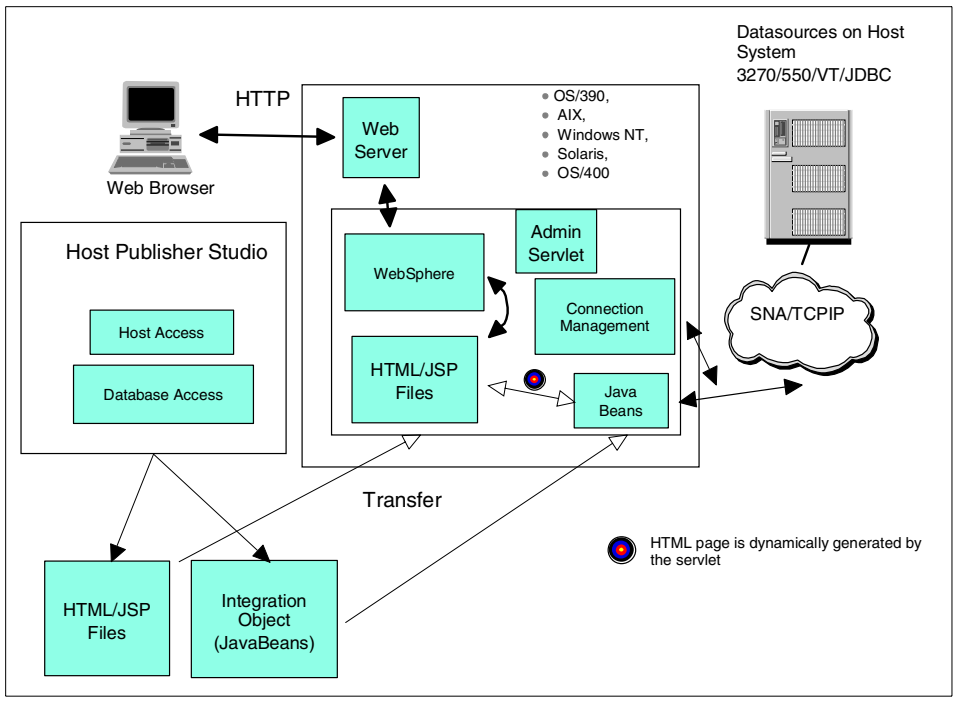

Figure 46. Host Publisher components

You create Web-to-host applications using the Host Publisher Studio, publish them to the Host Publisher Server, and provide access to the final end user. The Web-to-host applications you build are based on integration objects, which are reusable beans for Java that can:

- Automatically establish a connection with a host
- Accept user input (if required)
- Navigate to and extract data from an application
- Disconnect from the host and end the connection

Host Publisher Server provides enterprise-class security, performance, scalability, and availability through several key features, such as object chaining, connection pooling, load balancing, fail over, and cross-platform portability. Applications created with the common Host Publisher Studio run unchanged in all other supported operating environments, AIX, Windows NT, Solaris, and Host Publisher for OS/390. These are available as separate products.

9.3.1.1 Load balancing

The load balancing capabilities of Host Publisher allow you to balance the load of host integration object requests over a group of Host Publisher Servers to provide more predictable performance, easy scalability, and failover protection. The ability to move from one operating system platform to another allows you to move your workload to a higher capacity platform as demands increase.

9.3.1.2 Connection pools

To enhance performance, SecureWay Host Publisher provides connection pools, which are defined in the Host Publisher Studio. Connection pools are used during runtime to cache connected, logged on, and ready connections to improve response time to end users.

A user-defined number of connections are started at the first request and remain active in the pool for subsequent requests from any user. This eliminates the overhead of establishing a connection, and connecting and disconnecting each host request.

9.3.1.3 Object chaining

SecureWay Host Publisher supports object chaining. Object chaining allows you to break a complex task into logical subtasks to improve performance and flexibility, and reduce the administration of creating complex Web pages. For example, you may use chaining in a typical 3270 application that uses multi-level menus. A corporate phone directory may have several menus to step you down to the point to list everyone in a particular department. You want to display the office location of someone in the list, return to the department list and select a new name, and display the second person's office location.

Object chaining enables you to break the task into several reusable integration objects so that the end-user does not have to navigate down through the several menus to reach the department list again.

9.3.1.4 Secure connections and encryption

Host Publisher provides SSL Version 3 for securing the connections for TN5250 and TN3270E communications with AS/400 and S/390 systems. SSL support provides data encryption and server authentication using signed certificates.

The encryption level, included in the SecureWay Host Publisher Version 2.1 consists of:

- 128-bit for the U.S. and Canada
- 40-bit for export outside of the U.S. and Canada

The 128-bit DES version can be exported outside of the U.S. and Canada, subject to limitations, to particular industries (for example, banks and insurance companies).

SecureWay Host Publisher works with WebSphere Standard Edition, which is part of the V4R4 package. The ability to reuse Host Publisher integration objects within the new Web-based applications built with the WebSphere Application Server tools delivers a non-disruptive evolutionary path. This allows customers to enable an investment leverage as Web applications extend into Web application development projects of the future.

Table 3 compares the key differences between Host On-Demand and Host Publisher.

Table 3. Host On-Demand and Host Publisher comparison

	Host On-Demand	**Host Publisher**
Technology	Java applets	Java servlets
Host interfaces	• 3270 • 5250 • VT (VT52, VT100, V220) • JDBC to AS/400 • CICS Gateway applet	• 3270 • 5250 • VT (VT52, VT100, VT220) • DB2 • JDBC interface • Oracle, Sybase, other • Java applications
Programming effort	No programming necessary; may add customization with Screen Customizer	• Build Integration Objects and JSPs with the Host Publisher Studio • Use Java to add new business logic
Presentation	TN3270 / TN5250 green screen or GUI, VT	HTML (use HTML editors to enhance output pages)
Browser requirements	Java Virtual Machine1.1 support	No requirements

9.3.2 IBM SecureWay Host Publisher Version 2.1 for AS/400

This section describes AS/400 Host Publisher and other IBM products available to provide a dynamic data solution. This includes positioning of products, and advantages and disadvantages.

IBM SecureWay Host Publisher V2.1 for AS/400 (5648-D31) provides a quick and easy way for you to implement e-business applications. With this software, you can extend the reach of mission-critical applications to users across the intranet and Internet without changing the existing applications. The SecureWay Host Publisher for AS/400 allows you to integrate multiple sources of host data into a single Web page, giving end users the appearance of a single new application. Host Publisher uses Java technology like JavaBeans, Java Server Pages (JSP), and Java servlet. Consequently, the existing applications would have been built in an ILE language.

Note

The IBM Integrated Languages Environment RPG for AS/400 V4R4, 5769-RG1, provides different compilers to help you to move with minimal disruption to the ILE environment.

The software requirements are:

- OS/400 V4R4 (5769-SS1) with the latest cumulative PTF package applied. The following included features must be installed:
  - IBM HTP Server
  - IBM WebSphere Application Server Standard Edition
  - Java Developer Kit with JDK 1.1.7
  - AS/400 Java Toolbox
  - Qshell Interpreter (option 30)
- DB2/400 Toolkit (5769-ST1) is required only for development activities associated with DB/2 UDB

The hardware requirements are:

- AS/400e server
  - Models 170 7xx Model
  - Minimum of 512 MB RAM
  - 200 MB DASD to support Host Publisher Server base code and all languages
  - A Java-capable CPU feature code

For additional information, refer to *AS/400 Performance Capabilities Reference* at
`http://publib.boulder.ibm.com?go=IBM+Online+Publications/pubs/html/as400/onlinelib.htm`

- Studio Installation (Windows 95, 98, NT)
  - 70 MB disk space
  - 128 MB RAM

Because Host Publisher Server runs within a client/server environment addressing an interactive dataflow, install it on the new generation of the AS/400e Models 170 or 7xx.

9.3.3 SecureWay Host Publisher positioning

SecureWay Host Publisher focuses on consolidating multiple existing applications, without modification, to present a single integrated view in a Web browser, leveraging security, scalability and availability features that are essential for the deployment of e-business applications. It delivers a quick and easy way for companies to implement e-business applications by extending existing applications to the Internet. It is primarily intended for the legacy extension space with little or no new business logic.

WebSphere Application Server focuses on providing an infrastructure for developing and deploying server-side Java applications, as well as tools to develop, deploy, and manage Web sites efficiently. It provides a robust Java infrastructure for the development and execution of Java applications and servlets. It is primarily intended for adding new business logic to existing applications or deploying totally new Web applications.

SecureWay Host Publisher is the IBM answer for HTML delivery of host information. It is designed specifically for the Internet environment, for example:

- It does not require the browser to be Java enabled.
- It is ideal for a large number of users connected for short periods of time.
- A Web page is the required end-user interface.
- Users are typically not familiar with green screens and the location of input fields.
- Access capabilities are extended beyond 5250 and 3270 to include Java, JDBC, and VT.

9.3.3.1 Implementation examples using other IBM products

This section provides references for AS/400 customers who use Host On-Demand, Host Access, and other IBM products for e-business and dynamic data solutions.

SecureWay Host Publisher is a recent addition to the AS/400 solution family. We do not have a relevant customer implementation example at this time. Refer to the Web site `http://www.as400.ibm.com` under the case studies thumbnail for more up-to-date case histories.

9.3.3.2 Performance considerations

Host Publisher Version 2.1 is a Java product. Performance is a function of the speed of the network and the processing power of the server. Possibly accessing 5250 applications running on the same AS/400e server, be sure to balance Interactive CPW and Batch CPW for the most effective performance. Take into account the new requirements of Java in addition to your interactive requirements for your existing applications.

9.4 MQSeries

MQSeries provides the capability for AS/400 applications to communicate using message queues with other AS/400 applications and with MQ-enabled applications on other platforms. The asynchronous design of MQ isolates applications from each other while allowing robust communications between them.

With MQSeries, one application does not depend on the availability and uptime of other applications because communications are asynchronous. In addition, the message content is independent from the underlying application and database design, thus isolating applications from changes in other communicating applications.

MQSeries provides the infrastructure necessary for mission-critical communication between applications, either within an organization or business-to-business: guaranteed delivery (integrity) and proof of delivery (non-repudiation).

The AS/400 implementation of MQSeries provides the benefits of both cross-platform interoperability and renowned AS/400 integration. MQSeries on the AS/400 system takes advantage of the integrated security that's part of OS/400. For integrity, it builds on the journaling and commitment control within OS/400. And to capitalize on the existing skills of AS/400 customers

and AS/400 ease of use, MQSeries on AS/400 offers an option of AS/400-specific interfaces to use and manage the queues.

The AS/400 system is one of the 35 or more (and growing) platforms to support MQSeries.

For more information, see: `http://www-4.ibm.com/software/ts/mqseries/`

9.5 IBM CICS Transaction Server for AS/400

IBM CICS Transaction Server for AS/400 V4R4, 5769-DFH, also known as CICS for AS/400, supports CICS COBOL command level or C applications on the AS/400 system. It is based on a major subset of the CICS/ESA Application Programming Interface (API) and supports minimal function Basic Mapping Support (BMS).

The CICS platform is widely-used as a basis for implementing business solutions. CICS for AS/400 enables many of these existing applications available on the AS/400 without excessive costs of code conversion. AS/400 applications can coexist with CICS applications.

Improved data integrity is ensured with CICS for AS/400 exploiting the OS/400 two-phase commit capability. When a CICS for AS/400 application updates multiple systems, it ensures successful updates of all files and backs out partial updates if the full transaction is not completed. CICS for AS/400 two-phase commit support provides a backward recovery facility.

The Inter-Systems Communications (ISC) facilities of CICS for AS/400 allow connectivity to other CICS platforms, giving access to both applications and data on those systems. CICS for AS/400 supports ISC functions on the following products:

- CICS for AS/400 (other AS/400s running CICS for AS/400)
- CICS/ESA V3R2 and V3R3
- CICS/MVS V2R1
- CICS/VSE V2R1
- CICS OS/2 V1R2 and V2R0
- CICS/6000 V1R1

Formerly called CICS/400, this product not only has a new name, CICS Transaction Server for AS/400, it also comes packaged with two other products. CICS Universal Clients and CICS Transaction Gateway are delivered with the CICS Transaction Server allowing you to enable your e-business right away.

For more information, see: `http://www-4.ibm.com/software/ts/cics/`

9.6 Future support: Apache Web Server

In the next release of OS/400, support for the Apache Web Server will be announced. The product will go on to achieve functional parity with HTTP Server for AS/400 in 2001.

The HTTP Server for AS/400 will *not* be discontinued as the result of this introduction. CGI and WebSphere applications currently running on customer installations with HTTP Server for AS/400 will not be affected should the customer switch to Apache. Therefore, they remain viable products in the IBM product solution catalog.

Appendix A. Sizing and performance

This appendix discusses the sizing- and performance-related issues of e-business on the AS/400 system, including:

- A focus on the AS/400 server component
- An explanation of what hits/second/CPW means
- Information on the number of hits/second/CPW for each category
- Configuration considerations on the AS/400 system from the performance point of view

Note

At the time this redbook was published, V4R5 performance information was not available. Refer to the *Performance Capabilities* manual online at:
`http:www.as400.ibm/infocenter`

At the site, select **What's New** to see V4R5 information, including the *Performance Capabilities* manual.

A.1 Understanding the performance components of your system

When evaluating performance in a Web environment, response time is the most visible measurement, particularly when the end user is the primary objective and recipient of the resulting information. As such, response time is a key factor to consider when sizing a system for performance.

There are three major components affecting performance in Web environments. The components include the:

- **Client**: The client component typically contributes up to 25% of the response time if using Web browser pages through a modem connection. The memory size of a client is an important factor since many Web-related tasks use large amounts of memory.
- **Network**: Usually the network component has a significant impact on overall performance. It typically contributes up to 60% of the response time.
- **Server**: Server components are described in the following section.

Work with each component when sizing and managing performance in the Web environment. Each component is discussed in the following section.

A.1.1 AS/400 server component

There are also three major components within the AS/400 server component itself. To understand how your AS/400 system acts as a Web server, we discuss the major components of the server. Each component has some sub-components.

The server components and subcomponents are:

- Hardware resources:
  - Processor
  - Memory
  - I/Os
- Application code affecting:
  - Static pages
  - Dynamic pages
  - Servlet, CGI, Net.Data
- Database functions:
  - Get key
  - Get method
  - R/O and R/W

Figure 47 illustrates the components and their subcomponents from a performance perspective. The pie chart at the center represents the server side subcomponents.

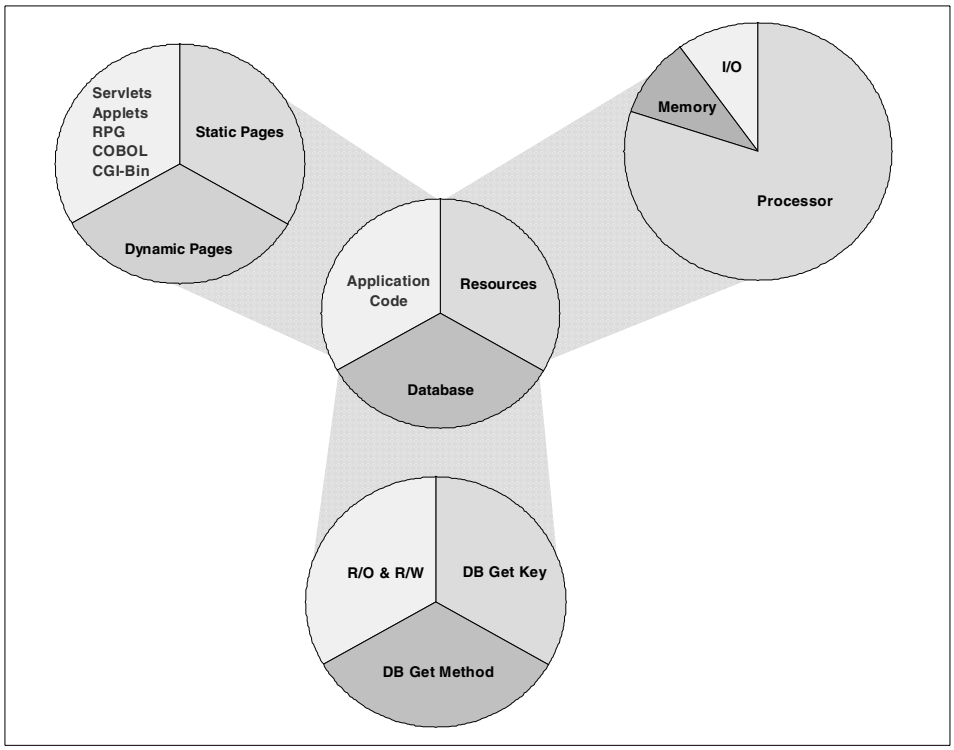

Figure 47. Subcomponents

The subcomponents shown in Figure 47 are further divided into the resource subcomponents (upper right corner), the application code subcomponents (upper left corner), and the database subcomponents (lower center).

Note

The areas of each subcomponent pie chart do not necessarily represent the portions or contribution of the subcomponents for performance.

A.2 Hits per second per CPW

AS/400e Web serving capacity is represented by hits/second/CPW. This measurement is used to estimate and size an AS/400e model.

A *hit* refers to every single object that is displayed inside the Web browser user. A hit does not mean a single request to send a Web page from the

server. The elements such as graphics, HTML code, or applets are hits on the server. As shown in Figure 48, if you serve a Web page that has five .gif images, 1,000 characters, and a Java applet, expect that every time this page is requested, the server receives seven hits per page.

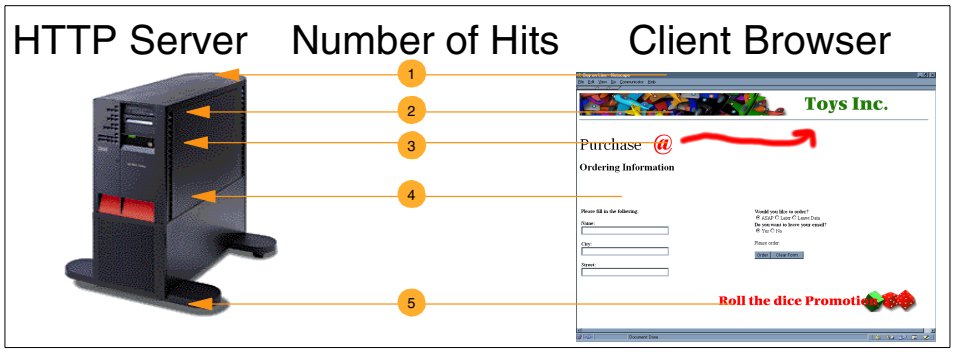

Figure 48. Each single object that is requested is considered a 'hit'

This is determined as:

```
5 hits (one per image) + 1 hit (HTML source code + 1000 characters) + 1 hit
(initial request) = 7 hits per page
```

A.3 Workload description and data interpretation

The workload is generated by a program that runs on a client workstation. The program simulates multiple Web browser clients and repetitively issues URL requests to the AS/400e server. The number of simulated clients can be adjusted to vary the offered load. Each of the transaction types listed in Table 4 serve about 1,000 bytes:

- **Static page**: Serves a static page via the HTTP server. This information can be accessed from the Web server's cache of specified integrated file system files.
- **CGI (HTML)**: Invokes a CGI program that accesses data from the integrated file system and serves a simple HTML page using the HTTP server. This runs in a named activation group.
- **CGI (SQL)**: Invokes a CGI program to perform a simple SQL request and serve the result using the HTTP server. This runs in a named activation group.
- **Persistent CGI**: Invokes a CGI program to receive a handle supplied by the browser, accesses data from the integrated file system, and serves a simple HTML page using the HTTP server.

- **Net.Data (HTML)**: Invokes the Net.Data program that serves a simple HTML page using the HTTP server.
- **Net.Data (SQL)**: Invokes the Net.Data program to perform a simple SQL request and serves the result using the HTTP server.
- **Servlet**: Invokes a Java servlet to access data from the integrated file system and serves a simple HTML page using the HTTP server.

Each of these types can be served in secure or non-secure mode. The secured environment needs extra CPU processing. It is much faster to run a CGI program using a named activation group than a new activation group.

A.4 Web serving performance measurements

Table 4 provides a summary of the measured performance data. Use it in conjunction with the rest of the information in this section for correct interpretation.

Note: The results that are listed do not represent any particular customer environment. Actual performance may vary significantly from what is provided here.

Table 4. Hits per second per CPW

Transaction type	Non - secure		Secure (encrypted)	
	V4R3 Token Ring	V4R4 Ethernet	V4R3 Token-Ring	V4R4 Ethernet
Static Page: Not cached	1.110	1.180	0.450	0.480
Static Page: Cached	1.560	1.860	0.520	0.560
CGI (HTML): New activation	0.070	0.070	0.060	0.060
CGI (HTML): Named activation	0.250	0.440	0.190	0.280
CGI (HTML): Persistent	0.260	0.440	0.180	0.250
CGI (SQL): New activation	0.060	0.060	0.060	0.060
CGI (SQL): Named activation	0.250	0.430	0.190	0.280
Net.Data (HTML)	0.140	0.240	0.120	0.190
Net.Data (SQL)	0.120	0.150	0.100	0.130

Transaction type	Non - secure		Secure (encrypted)	
	V4R3 Token Ring	V4R4 Ethernet	V4R3 Token-Ring	V4R4 Ethernet
Net.Commerce: Cached	0.250	0.250	NA	NA
Net.Commerce: Not cached	0.006	NA	NA	NA
Java servlet	NA	0.400	NA	0.280
NA = not available				

Measurement examples for a Static page are:

- **V4R3 720-2062 (CPW=420)**:

  `420 x 1.56 = 655hits/second, 2,358,000hits/hour`

- **V4R4 720-2062 (CPW=420)**:

  `420 x 1.86 = 781hits/second, 2,811,600hits/hour`

The values used for these calculations are based on the following conditions:

- IBM HTTP Server for AS/400, OS/400 V4R4, and 100Mbps Ethernet with TCPONLY(*YES)
- Based on measurements from an AS/400 Model 720-2062
- Static page caching is done with the HTTP server (using the Work With HTTP Configuration (WRKHTTPCFG) command).
- All requests are cached for Net.Comerce.
- 1 KB of data is served for each of the transaction types.
- The data assumes no access logging.
- Static page serving is served from the root directory of integrated file system.
- Secure measurements are done using Secure Sockets Layer (SSL) with 40-bit RC4 encryption.

Note: Web server capabilities may not scale exactly by CPW. Therefore, results may differ significantly from those listed here.

A.5 Sizing basics

To size Web-based applications, there are two general approaches:

- Determine the client, network, and server resources necessary to meet a level of expected Web application load (which can be comprised of static pages and application generated pages).
- Treat the resources available as a set of “fixed” resources, and the application load as the dependent variables.

When you think about the number of Web browser users that visit your home page, you find that there is no clear estimation. But you have a budget to provide an AS/400e server. Treating the resources available as a set of fixed resources works, since an AS/400e configuration is determined with the fixed budget and the capacity that this configuration provides represents your maximum load.

A.6 Web serving performance tips and techniques

When you meet performance concerns, check the following items to determine which values are specified:

1. OS/400 V4R4 provides a performance improvement of up to 70% over that of V4R3 (with similar hardware)

   This is mostly due to improvements in the IBM HTTP Server and TCP/IP performance. For static pages that are not cached, V4R4 provides up to 7% more capacity. For static pages that are cached, V4R4 provides up to 20% more capacity. For CGI and Net.Data transactions, V4R4 provides up to 70% capacity.

2. Web serving capacity (using the example calculations)

   Throughput for Web serving is typically discussed in terms of the number of hits/second. Typically, the CPU is the resource that determines overall system capacity. If the IOPs become the resource that limit system throughput, then the number of IOPs supporting the load could be increased, or faster IOPs could be installed.

   Two examples to estimate capacity or CPW values follows, with considerations in the Net.Data and CGI environment, are presented here:

   - **Example 1**: Estimating the capacity for a given model and transaction type

     Estimate the system capacity by multiplying the CPW for the AS/400 model with the appropriate transaction type.

```
Capacity = CPW x hits/second/CPW
```

For example, a Model 170-2386, rated at 460 CPW doing Web serving with CGI programs, has a capacity of 202 hits/second (460 x 0.44 = 202).

This assumes that the entire capacity of the system is allocated to Web serving. If other work is on the system, pro-rate the CPU allocation. For example, if only 25% of the CPU is allocated for Web serving, it has a Web serving throughput of 50 hits/second (460 x 0.44 x 25% = 50).

- **Example 2**: Estimating how many CPWs are required for a given Web transaction load

  To estimate how many CPWs are required for a given Web transaction road, characterize the transaction makeup of the estimated workload and the required transaction rate (in hits/second).

  Estimate the CPWs required to support a given load by dividing the required transaction rate by the appropriate hits/second/CPW value. The formula for this estimate is:

  ```
  Required CPWs = transaction rate / hits/second/CPW
  ```

  For example, to support 175 CGI transactions/second, 398 CPWs are required (175 / 0.44 = 398 CPWs).

3. Net.Data

   Net.Data is more disk I/O intensive than typical HTTP transactions. Therefore, more HTTP server jobs may be needed to provide the optimal level of system throughput.

   A Net.Data SQL macro is slower than an SQL CGI. This is because the Net.Data SQL macro is interpreted while the SQL CGI.bin is compiled code. There are functional advantages in using an SQL macro:

   - Direct reuse of existing SQL statements (no programming required)
   - Provides the built-in ability to format SQL results
   - Provides the ability to store SQL results in a table and pass the results to a different language environment

4. CGI and Persistent CGI

   Significant (perhaps as much as six times) performance benefits can be realized by compiling into a “named” versus a “new” activation group. It is essential for good performance that CGI-based applications use a named activation group.

   Persistent CGI is specific to applications needing to keep state information across Web transactions. Do not confuse persistent CGI with a way to

improve the performance of your CGI program. Notice in Table 4 on page 215 that the performance of CGI is nearly identical to that of persistent CGI due to the advantages gained by running in a “named” activation group.

5. Web server cache for integrated file system files

   Serving static pages that are cached can increase Web server capacity by about 50%. Ensure that highly used files are selected to be in the cache. The Work With HTTP configuration (WRKHTTPCFG) CL command runs a query for this purpose.

6. Page size

   The data in the tables assumes about 1 KB being served. If the pages are larger, more bytes are processed, CPU processing per transaction significantly increases, and the transaction capacity metrics are reduced.

7. Response time (general)

   User response time is made up of Web browser (client workstation) time, network time, and server time. A problem in any one of these areas can cause a significant performance problem and be attributed to the server, even though the problem may lie elsewhere.

   It is common for pages that are served to have embedded images (for example, .gifs). Each of the separate Internet transactions adds to the response time since they are treated as independent HTTP requests and can be retrieved from various servers (some browsers retrieve multiple URLs concurrently).

8. HTTP and TCP/IP configuration tips

   The configuration of the network, including HTTP and TCP/IP, can affect performance in a Web environment. Consider these factors when planning for capacity and performance:

   - The number of HTTP server jobs

     The Change HTTP Attribute (CHGHTTPA) command has parameters to specify the minimum and maximum number of server jobs. This is a system-wide value (system value). The Work HTTP Configuration (WRKHTTPCFG) command specifies similar values (such as MaxActiveThreads and MinActiveThreads). These values override the values that are set using CHGHTTPA and are for a given configuration.

     The reason for having multiple server jobs is that when one server is waiting for a disk or communications I/O to complete, a different server job can process another user’s request. Also, for N-way systems (systems with multiple processors), each CPU can simultaneously

process server jobs. The system adjusts the number of servers that are needed automatically (within the bounds of the minimum and maximum parameters).

The values specified are the number of “child” or “worker” threads. Typically, five server threads are adequate for smaller systems (100 CPWs or less). For larger systems dedicated to HTTP serving, increasing the number of servers to ten or more can provide better performance. A starting point for the maximum number of threads is the CPW value divided by 20. Try not to have more than what is needed, because this may cause unnecessary system activity.

- The maximum frame size parameter

  The maximum frame size is specified in the maximum frame size on the line description (that is, MAXFRAME on LIND). The value can be increased from 1,994 bytes for Token-Ring LAN connections (TRLAN), and other values for other protocols, to a maximum parameter value of 16393. A larger maximum frame size allows for larger transmissions. Typically documents are larger than 1994 bytes.

- The maximum transmission unit (MTU) size

  The maximum transmission unit size parameter is changed by the Configuration TCP (CFGTCP) command. The MTU value of both the route and interface affect the actual size of the line flows. Increasing these values from 576 bytes to a larger size (up to 16388) will likely reduce the overall number of transmissions, and therefore, increase the potential capacity of the CPU and the IOP.

  Similar parameters exist on the Web browser. The negotiated value is the minimum value used for the server and browser (and perhaps any bridges or routers). Therefore, increase them all.

- TCP/IP buffer size

  The TCP/IP buffer size is changed by the TCP Receive Buffer (TCPRCVBUF) and TCP Send Buffer (TCPSNDBUF) parameters on the Change TCP Attribute (CHGTCPA) command, or using the Configure TCP (CFGTCP) command. Increasing the TCP/IP buffer size from 8 KB to 64 KB may increase the performance when sending larger amounts of data. If data coming into the server is simply requests, increasing the TCPRCVBUF value may not provide any benefit.

- Secure Web serving

  Secure Web serving involves additional overhead to the server. Additional line flows occur (as a fixed overhead), and the data is

encrypted (as a variable overhead, proportional to the number of bytes).

Note the capacity factors in Table 4 on page 215 compare non-secure and secure serving. For simple transactions (for example, static page serving), the impact of secure serving is two times or more based on the number of bytes served. For complex transactions (that is, CGI or Net.Data), the overhead is in the range of 15 to 40%.

- Complex transactions

  e-business applications typically yield a variety of complex transactions. These transactions have sub-transactions made up of static pages, CGI, Net.Data, and so forth. Capacity planning for these is more complex and warrants a careful analysis of the makeup of the transactions. The data from the tables can assist with this analysis.

- Error and Access logging

  With error and access logging turned on, a small amount of system overhead in CPU time and extra I/O occurs. Turn logging off for best capacity. Use the Work with HTTP Configuration (`WRKHTTPCFG`) command to make these changes.

- Name server accesses

  For each Internet transaction, the server accesses the name server for information (IP address and name translations). These accesses cause significant overhead (CPU time, communication I/O) and greatly reduce system capacity. Add the line `DNSLookUp Off` in the WRKHTTPCFG command to eliminate these accesses.

9. HTTP server memory requirement

   Follow the faulting threshold guidelines suggested in the *Work Management Guide*, SC21-8078, by observing and adjusting the memory in both the machine pool and the pool in which the HTTP servers run. Use the Work with System Status (WRKSYSSTS) command to observe and perform this adjustment.

   Factors that may significantly affect the memory requirements include using larger document sizes, CGI.bin programs, and Net.Data.

10. AS/400 model selection

    Use the information provided in this section along with the characterization of your HTTP workload environment in a capacity planning exercise with experts in the area. The BEST/1 modeling program (part of the AS/400 Performance Tools product) is an option that allows you to choose the appropriate AS/400 model. All the tasks, jobs, and threads associated with

HTTP serving are “non-interactive”, so AS/400e servers provide the best price/performance unless other interactive work is present on the system.

11. File system considerations

    Web serving performance varies significantly based on which file system is used. Each file system has a different overhead and performance characteristics. Note that serving from the ROOT or QOPENSYS directories provides the best system capacity.

    If Web page development is done from another directory, consider copying the data to a higher-performing file system for production use.

    The Web serving performance of the non-thread-safe file system is significantly less than the root directory. Using QDLS or QSYS can decrease capacity by two to five times. For a more detailed information of Integrated File System performance, refer to the “Integrated file system” section in the *Performance Capability Reference* document, found online at: `http://www.as400.ibm.com/infocenter`

    Select **What’s New**. "Performance Capability Reference should appear on the first page.

12. File size considerations

    The connect and disconnect costs are similar regardless of size, but cost for the transmission of the data with TCP/IP and the Integrated File System access vary with size. As file size increases, the IOP is more efficient by achieving a higher aggregate data rate. However, being larger, the files require more data frames, which, therefore, causes the hits/second capacity for the IOP to go down accordingly.

13. Communications/LAN IOPs

    Since there are a dozen or more line flows per transaction, the Web serving environment uses the IOP more than other communications environments. Use the Performance Monitor (Start Performance Monitor (`STRPFRMON`) command) and the component report (obtained by using the Print Component Report (`PRTCPTRPT`) command) to measure IOP utilization. Attempt to keep the average IOP utilization at 60% or less for best performance.

    IOP capacity depends on file size and MTU size. Increase the maximum MTU size parameter).

    Feature code #2619 or the #2617 LAN IOPs have a capacity of roughly 70 hits/second when serving small (for example, 1 KB) non-secure pages. Keep in mind that each hit contains a dozen or so line flows.

Using Ethernet or TRLAN IOPs from OS/400 V4R1 or later, capacities range between 100 and 130 hits/second. If 100Mb Ethernet is used and the TCP only (TCPONLY) parameter in the Create Ethernet Line (CRTLINETH) has a value of *YES, capacities of up to 250 hits/second can be seen.

On larger AS/400 models, the communication or LAN IOP can become the bottleneck of performance before the CPU does. If additional HTTP capacity is needed, multiple IOPs (with unique IP addresses) could be configured. The overall workload would then have to be “manually” balanced by Web browsers requesting documents from a set of interfaces. The load can also be balanced across multiple IP addresses by using a domain name server (DNS).

A.7 AS/400 Workload Estimator

To obtain an estimate of the size AS/400e system recommended to run one or more workloads associated with e-business and or collaboration, such as Domino, Java, or WebSphere, use the IBM Workload Estimator for AS/400. Use the Estimator to size a brand new AS/400e with all new workloads, size new workloads, or to size the upgrade of an existing AS/400 with the original workload set. IBMers, Business Partners and customers can use the Estimator to size a single new Workload (such as just Domino or just WebSphere) or to size several Workloads running on the same AS/400. The Estimator recommends the model, processor, interactive feature, memory, and DASD necessary for the mixed set of workloads.The recommended processor model is based on the processor utilization, amount of disk, memory, and interactive feature are based on the defined workload. The predicted CPU utilization of the recommended system is presented in graphical format.

The results can be customized. For example, if you want to project for growth, adjust the target processor utilization accordingly. After customization, the Estimator recalculates to determine the best AS/400e server options to fit your needs.

A.7.1 Using the Workload Estimator

The recommended access method for obtaining the IBM Workload Estimator for AS/400 is logon to the Web site at:
`http://www.as400service.ibm.com/estimator`

Note: There is also a download form available to IBM Sales and IBM Business Partners.

It is also highly recommended that there should be involvement by IBM Sales or IBM Business Partners before making any purchasing decisions based on the results obtained from the Estimator. All Estimator results need to be refined by Marketing and/or a Business Partner.

A.7.2 Obtaining the Workload Estimator

The approximate size requirements are about 1.5 MB of hard disk space for the Workload Estimator and 25 MB for the Server setup.

A.7.2.1 Client requirements

To run the Estimator in a Web browser, the client interface portion of the Estimator prerequisites are:

- Windows 95/98/NT 4.0 (Service Pack 3 or higher)
- TCP/IP installed and configured
- Netscape 4.05 or higher (the Estimator can also be used with Internet Explorer)
- Browser should have Java, JavaScript, and cookies enabled

A.7.2.2 Server requirements

To run the Estimator independently of the Web, the server portion of the Estimator prerequisites are:

- Java Development Kit 1.1.6 (or higher)
- JSDK 2.0
- Apache Server (1.3 and up)
- Apache JServ (1.0 and up)

Two items recommended but not required to run the Workload Estimator are:

- Pentium(R) processor or higher
- SVGA (800x600) display or higher

For updated levels of these requirements, and for the latest version of the Workload Estimator, see the current version of installing.htm included with the download.

If you encounter problems, or have comments regarding the IBM Workload Estimator for AS/400, send a message to: `Workload_Estimator@us.ibm.com`

Answers to some of the more common questions can be found in the Frequently Asked Questions (FAQ) section.

A.8 Firewall performance

Using the Integrated Netfinity Server as a firewall provides additional value-add for the AS/400 system as a Web server. The firewall can be on the same system as the Web server or on a different system within the network. With the Integrated Netfinity Server handling the firewall activity, the AS/400 CPU is not significantly impacted.

Web server behind the Firewall

In this scenario, the Integrated Netfinity Server performs packet filtering and allows HTTP traffic only through to the Web server (also on the same AS/400). On an optimally configured system, having the firewall function active under a load only slightly degrades the overall AS/400 Web server capacity (compared with a similar, non-firewall configuration).

If a system is not optimally configured, the decrease can be more significant. For example, if the MTU size is reduced to 500 bytes, the impact of the firewall can be a 50% capacity reduction.

Appendix B. NLS considerations

This section includes considerations for using e-business in those businesses and countries requiring national language support.

B.1 General considerations

The most remarkable effect using the Internet for business is its broader coverage of geographies. You can extend the reach to every corner of the globe thanks to Internet technology. Otherwise, it is impossible. Wherever the server is located, the information is just a click away from a browser. This draws an interesting consideration of what languages have to be delivered and whether you need multiple systems to serve more than one language. The AS/400e system is an ideal system to choose, because it has well-architected multilingual support functions for the system administration and user application programming.

To serve users better, who are the customers and potential customers, be careful to examine which language is acceptable in the Web pages. If you have to serve in more than one language, think about how you set up and manage the server to achieve the multilingual services.

The AS/400 system uses EBCDIC encoding (CCSID) to store data in its DB2/400 databases and ASCII encoding for the integrated file system. On the other hand, all browsers use ASCII encoding (CCSID). When data is transferred to the browsers, data needs to be converted between the two encoding (CCSID). Figure 49 on page 228 shows the overview of how the code conversion takes place in the HTTP server.

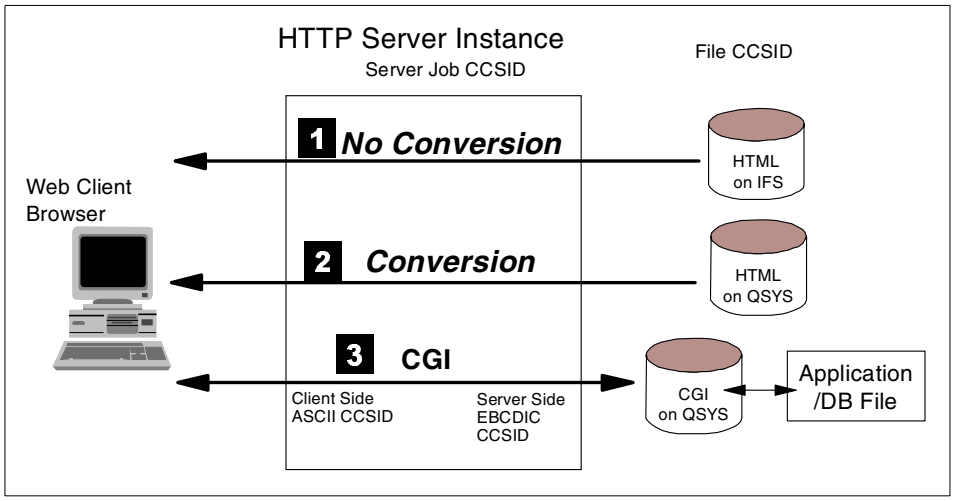

Figure 49. Overview of Code Conversion Mechanism on AS/400 HTTP Server

Consider the following points:

- If the page (HTML in the figure) is from IFS file system, it is not converted.
- If the page is from qsys.lib, it is converted to the CCSID associated with HTTP server job.
- If the CGI is used to serve the page, the data is converted to the CCSID configured for the HTTP server instance.

If the CCSID, which is set up in the HTTP server does not match an expected CCSID, which is used in the browser, the characters that are displayed may be meaningless.

There are two types of information regarding Web publishing:

- **Static page**: The contents of pages do not change.
- **Dynamic data**: Some contents of pages change, depending on time, user requested data, and so on. The contents may come from database files.

B.2 Static page

As discussed in Chapter 2, “Building e-business sites: Phased approach” on page 49, the static page is the first phase for doing e-business. This is also the easiest scenario in terms of multi-lingual services. Focus on the Web pages to be published and translate them or create new pages for other languages. The following list shows the technique and functions to leverage:

- Different directory for each language:

  Divide the Web pages depending on the language that is displayed on a browser. The users, through a browser, click the button designated to the language. This is the simplest solution. You do not have to set up the server separately for the language, but you have to choose one language for the very first page that may not be understandable for some users (such as Hindu displayed in the US). Perhaps English is the least common denominator for the first page with the buttons captioned by their languages. In this scenario, it is assumed that all pages are stored in the integrated file system in ASCII encoding, so that no text conversion takes place.

- Multiple HTTP server instances to server multilingual sites in one system:

  Set up one HTTP server instance for each language. Then let users know the appropriate URL for the language. The URL may be a different host name or a different port number. To have the multiple server instances, you need IBM HTTP Server for AS/400. Domino HTTP Server does not support multiple instances. In this scenario, the pages can be stored in both the qsys.lib file system and integrated file system. You can configure each server instance to convert data residing in qsys.lib to an appropriate ASCII encoding.

- How to synchronize data between multiple home pages or instances:

  There is no tool to synchronize the multiple pages and instances. You have to maintain each one manually every time you change the contents.

B.3 Dynamic data

When data is retrieved from other resources and stored in the Web pages, the application programs need to account for the multilingual environment. For example, when a customer name is retrieved from a database file, the application needs to know from where the data is retrieved. It may be in a different record in the same file, in a different field in the same record, or in a different file. It depends on how you develop the multilingual programs.

Refer to *AS/400 International Application Development V4R2*, SC41-5603, for more information on how to develop the multilingual applications. The following list outlines the considerations for a multilingual environment:

- **Different directory for each language**: If data is retrieved from a database and needs to be converted to different languages (that is, to different ASCII CCSIDs), your application program needs to convert the data based on the language that the other end (browser) uses.

- **Multiple HTTP server instances with CGI**: This is similar to the discussion in B.2, “Static page” on page 228, but there are programming considerations, such as the places where the data is stored. As mentioned before, the CGI program may have to retrieve the data in a different database file or in a different record depending on the database design, for the matching language the browser user is using. After retrieving the data, the HTTP server converts the data to ASCII CCSID as mentioned in Figure 49 on page 228.
- **Domino server**: Domino server is the NLS capable product. It uses UNICODE for internal character representation, which is capable to represent all possible languages. Domino documents are tagged with the language that is used by the Notes user and stored as it is. It is up to the Notes users to display and type in the correct language. That is, when a French Notes user enters French text, other French users can see the text in the correct character images, but German users may not. If data comes from database files, the story is different. It has to be converted from one CCSID to another, that is EBCDIC CCSID to ASCII CCSID even within the same language. Since Domino does not tolerate the locale values associated with the QNOTES user profile for this conversion process, it is not possible to convert to multiple CCSIDs. If you want to serve more than one language to end users, you need more than one system that runs Domino server.
- **WebSphere**: Since WebSphere runs on top of the HTTP server, the same can be applied as in the HTTP server considerations. Java has a different programming structure from the AS/400 traditional programming languages, such as RPG and COBOL. It may be easier to code the multilingual application.

B.4 Browser (client) considerations

When you browse the Web pages, use the appropriate language version of the browser or operating system. Otherwise, you may not be able to see the text as it is supposed to be displayed. For example, when you read the Japanese text on your browser, use the Japanese version of Windows operating systems. Japanese text displayed on the English-language version of Windows 98, for example, does not make sense at all.

Note

Microsoft Internet Explorer gives the capability to display many languages, including DBCS languages, on the English-language version of Windows operating systems. Simply download the fonts that you want to see from the Microsoft IE sites.

Appendix C. Third-party products

As the strength of the IBM AS/400 system, Business Partners provide e-business solutions to complement and enhance those offered by IBM. The list of products reviewed in this appendix represents a few of the major applications available at this time. Some, but not all, products and solutions are represented due to the breadth of technologies in this market space. The products discussed are beyond those described in Chapter 9, “Other IBM e-business products for the AS/400 system” on page 197.

A short description of the company offering the product and how the product positions for e-business functionality is provided for each of these significant product offerings.

Additional tools and vendors for e-business solutions can be found on the Web at: `http://www.as400.ibm.com/solution/`

Note: IBM PartnerWorld for Developers has an AS/400 Application Development Tools Network for AS/400 program. It is a resource used for IBM and non-IBM tools and currently sponsors over 100 Business Partners.

The Tools Network program is described at:
`http://www:as400.ibm.com/developer/tools/index.html`

The site also offers a more complete listing of IBM e-business products for the AS/400 system.

C.1 Commerce-related products

The products discussed in this section are directly related to e-commerce. E-commerce-related products typically have some or all of the following characteristics:

- **Transaction engine**: E-commerce products have some method of exchanging goods for money and managing the transaction. Either through the product having its own engine to process the orders, a third-party engine, or through existing legacy system business processes.
- **Host integration**: E-commerce solutions are not standalone and often are tightly connected to finance, inventory management, distribution, and marketing systems. The commerce applications view, add, edit, or delete information to and from host systems and either use standard middleware or have their own middleware to do so. A vendor may also feel it is

appropriate to have direct access to these host systems. Many commerce applications make this possible.

- **Security features**: Products that enable commerce on the Internet need security to protect transaction information, private information of the customer, and the assets of the business. As a result, e-commerce products use encryption technology, credit card verification technology, and system access security to protect the transaction, customer, and business.
- **Scalability**: E-commerce solutions need to scale and be able to grow as your business grows. Some products can grow much larger than others but they can all start at low transaction levels and scale up.
- **Customizing and templates**: All e-commerce solutions have the ability to customize interfaces, functions, and processes. All e-commerce solutions come with wizards and templates that provide “canned” processes to get started. When comparing solutions, the degree to which you create yourself or have templates and wizards to assist varies depending on the intended audience of the vendor selling the solution.
- **Payment function**: Solutions intended for commerce on the Internet require facilities to collect payment. To collect payment, the vendor connects to some third-party payment authority. There are many with different rates and services, but they generally do the same tasks: verify the customer has money and then transfer the correct amount to the vendor in a secure fashion. E-commerce solutions provide APIs and connectors to connect to a variety of payment authorities.

The following section reviews significant e-commerce offerings for the AS/400e system using the features listed above as a basis for analysis. Such products covered include:

- Ironside Technologies Ironwork’s
- IP/400 Web.Merchant
- Binary Tree ezMerchant
- LANSA for the Web Commerce Edition
- Magic Software eMerchant

C.1.1 Ironside Technologies: Ironworks

Ironside Technologies is a highly focused electronic commerce solution provider that designs, develops, and markets business-to-business e-commerce software products.

Ironworks is a frontend Internet transaction server for the AS/400e system that provides thin client access to host systems over the Internet. A vendor

would use Ironworks to develop a browser interface to allow partners and customers to access and interact with their host systems. To enable commerce functions Net.Commerce is used as the transaction engine and processes while Ironworks manages secure access to the host system.

C.1.1.1 Company overview: Ironside Technologies

Ironside is a privately held company with headquarters in Pleasanton, California. It has sales offices in Atlanta, Boston, Chicago, Columbus, Dallas, Los Angeles, Minneapolis, New York, Philadelphia, and San Diego in the U.S; Toronto, Canada; the United Kingdom; and the Netherlands.

The company's target market includes manufacturers and wholesale distributors. Ironside's unique go-to-market strategy extends beyond their direct sales force, including strategic partnerships with technology partners, solution partners, and sales alliance partners.

C.1.1.2 Product overview: Ironworks

Ironworks is a business-to-business Internet electronic commerce solution. Ironworks resides on an Internet server and provides a direct, interactive and real-time session between a customer and the host order management system (Figure 50).

Ironworks interfaces with any host order management system to provide such services as order entry, product configuration, order status, request for quotation, inventory availability, promotions, and e-mail communications. Through a gateway, Ironworks integrates directly with your order management system without interrupting your business, and with no duplication of host data and business logic.

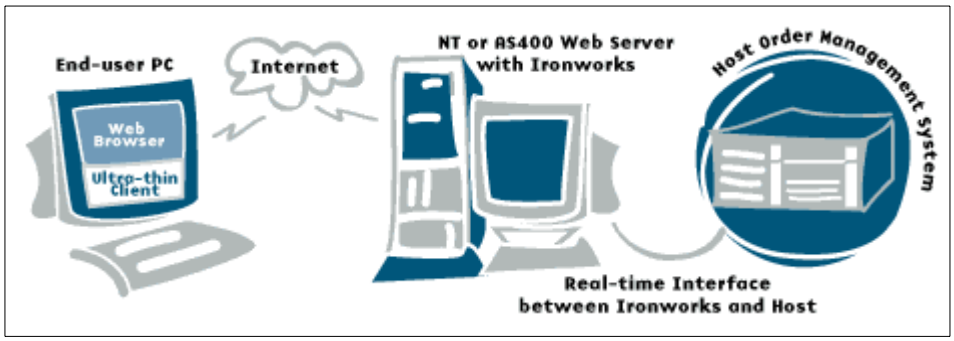

Figure 50. Ironworks solution schematic

Ironworks is implemented with a set of core applications suitable for online electronic business applications and provides direct order queries, order entry, product configuration, and so on.

Ironworks provides enhanced functionality, including:

- Configuration abilities
- Customizing abilities
- Support for multiple companies or product lines
- Integration with IBM Net.Commerce
- Comprehensive security
- Multilanguage support

C.1.1.3 Positioning of Ironworks

The target market for Ironworks is manufacturing and distribution companies, which maintain high customer satisfaction ratings. Ironworks has even been accepted by analysts in this market. The Ironworks product provides a host-access service that is more effective than a phone call to a call center or customer support personnel, which is a typical dynamic site implementation as defined in this redbook. A thin Java client that downloads in 5 to 10 seconds, vector graphics, field-level screen updates, and small transaction sizes keep performance levels high (sub-second response over the Internet).

C.1.1.4 More information

Visit `http://www.ironside.com/` for demonstrations, product information, partner information, and Ironworks and Ironside Technologies support.

C.1.2 BinaryTree.com: ezMerchant

BinaryTree.com develops and markets ezMerchant, which is a Lotus Domino based e-commerce storefront for business-to-consumer and business-to-business applications.

C.1.2.1 BinaryTree.com: Company overview

BinaryTree.com is headquartered in New York, NY, with offices in Red Wing, Minn. and Boston, Mass. It is the developer of proprietary software products within the Internet marketplace. These products include mail migration products and services, various e-business products, and consulting services. BinaryTree.com is a Business Partner of Lotus and IBM.

C.1.2.2 ezMerchant product overview

ezMerchant is BinaryTree.com's Lotus Domino based e-commerce package. It allows customers to quickly build a complete online store that includes such features as site creation, product catalogue, commerce options, order

processing, and customer registration. Included is a seven-step site creation wizard that quickly builds a product catalogue, shopping basket, and commerce functions (under one hour).

Integration into backoffice systems is done using common APIs and connectors. Many different payment methods are supported (Cybercash, ROI ECard, etc.). Because the product is based on Domino, it leverages the Domino value proposition: fast and low cost development of interactive content and maximum use of existing AS/400 application and data.

C.1.2.3 Positioning of ezMerchant

ezMerchant is targeted to small- and medium-sized businesses (retail and product based) that require a cost effective e-commerce solution and other internet solutions such as Internet mail, groupware, and work-flow applications. The time to deploy ezMerchant is very fast, and ezMerchant packaged with the Dedicated Domino Server offering is attractive financially. This product does not scale as large as Net.Commerce sites do, but it is not intended as a solution for high-end retailers. This product is for mid- to small-sized AS/400 customers who make up the middle tier of the market and require an online store front or business-to-business solution.

C.1.2.4 More information

For more information on BinaryTree.com, visit their site on the Web at:
`http://www.binarytree.com`

To obtain a demonstration or trial copy, send e-mail to:
`ezMerchant.info@binarytree.com`

You may also want to refer tot he following sites, which have integrated ezMerchant:

- Rawlings: `http://www.rawlings.com`
- Montana Bow Hunter: `http://www.montana-bowhunter.com`
- SporTile: `http://www.sportile.com`
- Robinson Brick: `http://www.robinsonbrick.com`
- Military Car Sales: `http://www.encs.com`

C.1.3 IP400: Web.Merchant

IP400 is an Internet-certified IBM AS/400 Business Partner specializing in Internet and e-commerce solutions for the AS/400 system.

C.1.3.1 IP400 company overview

IP400 provides leading Internet solutions to the AS/400 market with over 100 customers across all industries. They are located on the Web at:
`http://www.ip400.com/`

C.1.3.2 Web.Merchant product overview

Web.Merchant is an AS/400 based e-commerce application. Solutions include business-to-business and business-to-consumer that range from small-to-large transaction volumes and catalog size.

Such full store front features as shopping basket, product catalog, shipping, multiple stores, custom security, tax (Vertex taxing system), integrated payment (Payment Server for AS/400 and I/NET Merchant/400), and shipping (UPS, FedEx, etc.) are included. Web.Merchant is based on Tag and XML technology, which allows for easy modification of function and presentation.

Web.Merchant interfaces with existing backend applications and can be used to build both business-to-business and business-to-consumer e-business applications. Application interfaces can be called from any RPG program, and any AS/400 program can be called from Web.Merchant.

The development model used is similar to an Active Server Page (ASP) model where tags are inserted in the actual HTML are combined JavaScript. HTML templates, in conjunction with tags, call CGI programs on the AS/400 system. These programs can be existing ERP applications or any AS/400 application. A parser reads the HTML documents and calls the AS/400 modules.

C.1.3.3 Positioning of Web.Merchant

Applications are developed across multiple industries, including manufacturing, distribution, retail, financial services, insurance, transportation, real estate, and gaming. Web.Merchant enables a variety of store front and dynamic solutions. It is good for small and large stores and will handle large transaction volumes and large product catalogues.

C.1.3.4 More information

To learn more about Web.Merchant, go to the site at:
`http://www.as400.ibm.com/developer/ebiz/netcommerce/webmerchant.html`

For sample sites that employ Web.merchant, go to:

- `http:/pacsun.com`
- `http://www.ryanherco.com`

C.1.4 LANSA Inc.: LANSA for the Web Commerce Edition

LANSA provides rapid application development tools and e-business solutions for the AS/400 market. LANSA's Business-to-Business (B2B) and Business-to- Consumer (B2C) solutions allow AS/400 customers to rapidly extend their legacy AS/400 applications and databases to the Web, Windows and Wireless platforms.

LANSA's e-commerce software is used by customers in a wide range of industries. LANSA's B2C customers include:

- NEWS/400
- Harry Fox Agency
- Luxor Hotel
- IBM AS/400 Magazine
- COMMON
- Riviera Hotel and Casino
- Chown Hardware
- Odyssey Cruise Lines
- Circus Circus Hotel

LANSA's B2B customers include:

- Trek Bikes
- Global Crossings
- KTM Motorcycles
- Canada Lands Company
- Disney Vacation Group
- ITT
- Shell Canada
- Sooner Pipe and Supply
- National Music Publishers Association

C.1.4.1 Company Overview: LANSA Inc.

LANSA has been developing software for the AS/400 market since 1987. LANSA has over 6600 customers in 65 countries, along with a network of over 250 business partners worldwide. LANSA is a licensed AS/400 Application Development Partner, an IBM Partners-In-Development All-Star and is the winner of IBM's Powered by AS/400e award for excellence in AS/400 e-business.

C.1.4.2 Product Overview: LANSA for the Web Commerce Edition

LANSA for the Web Commerce Edition is a suite of Business-to-Business and Business-to-Consumer components that utilize LANSA's powerful LANSA for the Web tools. Customers can rapidly generate e-business applications that

extend existing AS/400 RPG and Cobol applications. The components include:

- **Customer Relationship Management**:
  - Product Catalog: Includes links to legacy product information and images, pricing, order history
  - Inventory/stock inquiry and allocation: Integration to legacy applications provided
  - Order Inquiry: Extensive search criteria
  - Order Entry: Shopping Cart style
  - Quick Order Entry: SKU + Quantity
  - Web order Confirmation: Automatic e-mails
  - Customer Registration: Includes links to legacy customer databases
  - Credit Card Payment Interface: Integration to 3rd party credit card software
  - Logistics tracking
- **Merchandising**:
  - Intelligent E-mailing
  - marketing information (price quotations)
  - Promotions (company newsletters)
  - New products
  - Special offers
  - Customer/Vendor product cross reference
  - User Preferences
  - Electronic Publications
- **Administration**:
  - Customer authentication
  - Security
  - Maintenance
  - Reporting
  - Contact us

The B2B and B2C functions that are generated leverage LANSA's experience in building hundreds of e-business sites for AS/400 customers worldwide over the last four years (LANSA has been building e-business applications since 1996). By incorporating best-of-breed design from some of the top AS/400 sites in the world, LANSA allows AS/400 customers to inherit these design approaches. Learning to design applications for a web environment is a

challenge that faces many companies and LANSA's Commerce Edition can help overcome that challenge.

The LANSA for the Web Commerce Edition generates application components into LANSA's Object Repository and 4th Generation Language (4GL). This means that the B2B and B2C components generated by the Commerce Edition are then easily customizable using LANSA for the Web.

LANSA for the Web is a repository based application development tool. It contains a powerful 4th Generation Language (4GL) that customers use to modify and enhance applications generated with the Commerce Edition. LANSA for the Web automates the generation of code, including RPG, C++, Java, XML, HTML, and WML. This allows developers to focus on the business design of the applications, rather than the underlying technologies

LANSA for the Web generates applications that are portable to AS/400, Windows NT, UNIX, Web, and Wireless platforms.

C.1.4.3 Positioning of LANSA for the Web Commerce Edition

LANSA's products are designed to provide very rapid delivery of applications. LANSA for the Web Commerce Edition is built for AS4/00 companies who want to build B2B and B2C applications on AS/400 in a very short period of time. LANSA allows customers to preserve their investment in legacy AS/400 applications by offering easy extension capability.

LANSA for the Web is a rapid e-business development tool that allows customers in any industry to build applications that deploy to web, windows and wireless environments.

For more information, contact any of the following outlets:

- `http://www.lansa.com`
- marketing@lansa.com
- North America, Chicago: call 630-472-1234
- Europe, London: call 44-1442-236630
- Asia Pacific, Australia: call 61-2-9928-1188

C.1.5 Magic Software Enterprises: eMerchant

Magic Software Enterprises specializes in application development tools, professional services, and e-commerce-related products. AS/400-related products include the Magic application development environment and eMerchant commerce application.

C.1.5.1 Magic Software Enterprises company overview

Magic Software Enterprises (NASDAQ: MGIC) develops, supports, and publishes Magic: a development environment based on a programming model that eliminates wasted time and repetition from the development cycle.

Magic Software Enterprises has over 300 employees worldwide, with subsidiaries in the US, UK, France, Germany, Netherlands, Italy, India, Israel, Thailand, Australia, and Japan, and distributors in more than 50 countries. Sales, marketing, support, and training are supported locally with strong backing from corporate headquarters in Israel. Research and Development activities are concentrated in the Israel headquarters.

You can visit them on the Web at: `http://www.magic-sw.com/`

C.1.5.2 eMerchant product overview

eMerchant provides a development environment to build custom supply chain management solutions. Supply chain customers have special requirements. They often know exactly what they want to buy and do not browse. This means fast and easy navigation to a site is important. Customers require specific fulfillment information—schedule and product related. Prices vary by customer depending on the “deal” or history a particular customer has. Customers also require special reporting features such as purchasing history.

Magic Software Enterprises’ eMerchant provides a development environment to build highly customized, scalable, and transaction-based, business-to-business solutions. Included in the environment are:

- **Middleware**: MQ Series, ODBC, OCI, CORBA, and EDI components.
- **Database synchronization capabilities**: Distributed environments.
- **Administrative flexibility**: You can administer the eMerchant system through existing backend administrative systems or through a Web browser.
- **Catalog management**: Create, edit, delete, and manage catalogs.
- **Customer and customer group management**: Customer type and discount rates based on vendor-defined criteria.
- **Inventory control**: Out-of-stock reports for the ability to manage response to customer (sell as usual, not sell out of stocks, or back-order).
- **Reporting**: Reports on orders, best selling items, inventory, Web site traffic data, and so on.
- **Special offers**: Customer and item related.

- **Business rules**: Various modules are customized based on vendor requirements, for example, pricing structure, catalog structure, selling process, order confirmation process, customer profile, customer identification, reports, and customer groups.
- **Security**: User-based security (login and password) and communications (SSL encryption).
- **Credit card payment**: Integrated with third-party payment servers.
- **Customer flexibility**: Customers can modify personal catalogs, re-orders forms, preferences, browsing options, rapid order, open order for approval, order history, and purchasing statistics.

C.1.5.3 Positioning of eMerchant

eMerchant is an application that offers vendors a completely configured and customized e-commerce solution. Its strengths are its integration with legacy systems, scalability, flexibility, features available, and functionality. It is focused on the business-to-business market. It is used for building feature rich and customized applications for supply chain management , from small to large high volume customers.

C.1.5.4 More information

For more information about Magic Software Enterprises and eMerchant, go to the site at: `http://www.magic-sw.com/`

You can also send e-mail to: `sales@magic-sw.com`

C.2 IBM Corporation: Net.Commerce

Net.Commerce is the IBM e-commerce solution for business-to-consumer and business-to-business transactional applications.

C.2.1 IBM Corporation company overview

It is understood that you already have a general knowledge of IBM. A reference for further reading is available on the IBM AS/400 home page at:

- `http://www.ibm.com`
- `http://www.as400.ibm.com`

C.2.2 Net.Commerce product overview

IBM Net.Commerce provides an industry-leading solution for creating and managing high-performance and high-scalability e-commerce sites. It offers

leading merchandising and content management capabilities, as well as advanced tools for creating dynamic and intelligent catalogs and storefronts.

This out-of-the-box solution gives companies the ability to start simple and grow fast. It comes complete with catalog templates, setup wizards, and advanced catalog tools. You can easily build business-to-business and business-to-consumer applications and integrate them seamlessly with your company's existing business systems to protect IT investments. Its open architecture is ideally suited as a platform for building a powerful, adaptive Internet marketing e-commerce environment.

C.2.3 Positioning of Net.Commerce

Net.Commerce is the IBM strategic commerce offering. It is an enterprise strength product that handles very large, robust online stores with many product SKUs and volumes. It uses wizards and integration features to link to legacy systems and customize storefront as required. Net.Commerce runs as a cross-platform application on IBM Universal Database and IBM HTTP Server.

C.2.4 More information

For more information on IBM Net.Commerce, visit the site at:
`http://www.software.ibm.com/commerce/net.commerce`

C.3 E-commerce product comparison

Table 5 compares the features of Net.Commerce, Ironworks, ezMerchant, Web.Merchant, and eMerchant.

Table 5. E-commerce product comparison

	Net.Commerce	Ironworks	ezMerchant	Web.Merchant	eMerchant	LANSA
Online catalog	Yes	Yes	Yes	Yes	Yes	Yes
Shopping cart	Yes	No (NC)	Yes	Yes	Yes	Yes
Caching	Yes	Yes	Yes	Yes	Yes	Yes
Order status	Yes	Yes	Yes	Yes	Yes	Yes
Order viewing and updating	Yes	Yes	Yes	Yes	Yes	Yes
Customer profile	Yes, DB2/400	Yes, DB2/400	Yes, Notes NSF	Yes, DB2/400	Yes, DB2/400	Yes
Customer registration	Yes	Yes	Yes	Yes	Yes	Yes
Shopper groups	Yes	Yes	Yes	Yes	Yes	No
Discounts	Yes	Yes	Yes	Yes	Yes	Yes
Address book	Yes	No (NC)	Yes	Yes	Yes	Yes
Tax calculation	Simple Calculation and Tax API to legacy or other tax calculation programs	Yes, RPC to legacy program	Simple Tax Calculation & Tax API to legacy or other tax calculation programs	Yes, Vertex Taxing System	Yes	No
e-mail confirmation	API to Notes	No (NC)	Yes	Yes	Yes	Yes
Shipping calculation	Yes	No (NC)	Yes	Yes	Yes	Yes
Credit card processing	API to other program	API to other program	API to other program	IBM Payment Server Merchant/400	Yes, integrated third-party product	Yes, integration to third-party products
Business to consumer	Yes	No (NC)	Yes	Yes	Yes	Yes
Business to business	Yes	Yes	Yes	Yes	Yes	Yes
Legacy system integration	Yes via APIs	Yes via RPC	Yes, Jacada CS	Yes, native	Yes	Yes, native

	Net.Commerce	Ironworks	ezMerchant	Web.Merchant	eMerchant	LANSA
Database	DB2/400	RPC to legacy DB	Notes NSF	DB2/400	DB2/400 and OEM	DB2/400 and Windows NT
Web server	HTTP Server for AS/400	HTTP Server for AS/400	Domino Web Server	HTTP Server for AS/400 or I/NET Commerce Server/400	HTTP Server for AS/400 and OEM	HTTP Server for AS/400, I/Net, IIS
Data import	Yes	Real-time access to DB2/400	Yes	Real-time access to DB2/400	Yes	Yes
Multiple instances	Yes	Yes	Yes	Yes	Yes	Yes
NLV	Yes	No	No	No	Yes, NLS	Yes
Security	Access, SSL, SET	Access, SSL, SET	Access, SSL, SET	Access, SET, SSL	Access, SSL, SET	SSL, Access
Store creation	Yes, built-in tools	No (NC)	Yes, native wizard	Yes, built-in tools	Yes, Visual Basic GUI and browser	Yes
Administratio n	Yes, browser	No (NC)	Lotus Notes Client	Yes, browser	Yes, Visual Basic GUI and browser	Yes
Online product assistant	Yes	No (NC)	No	Yes	Yes	No
Speed	Good	Excellent	Good	Very Good	Good	Excellent
NC = Function provided by Net.Commerce						

C.4 Application development tools

There are many tools and middleware available for e-business application development enablement from IBM and IBM Business Partners. Due to the large number of vendor tools available, it is not possible to cover each one in this redbook. There is a solution database and application development tools Web site, which we referenced earlier, where you can view the most current and complete Application Development Tools available.

Refer to the IBM Tools network at http://www.as400.ibm.com/developer/tools for a resource listing of offerings and service providers.

The products in this category are too numerous to profile in detail. They provide quick and easy access to host systems via Web browser. Users can access these systems remotely using such Java technologies as JavaBeans, JavaServer Pages, and Java Servlets and perform various transactions. These features correspond to IBM Host On-Demand (9.1, “Host On-Demand” on page 197), Host Publisher (9.3, “Host Publisher” on page 201), or Ironsides from Ironworks.

A list of vendors and products is shown here:

- Farabi – HostFront: http://www.farabi.com
- Seagull Software – J Walk: http://www.seagullsw.com
- Advanced BusinessLink – Strategi: http://www.businesslink.com
- Better-on-line Solutions (BOS) – Jadvantage: http://www.jadvantage.com
- Touchtone Corporation – Thinview: http://www.thinview.com
- Hummingbird – Exceed: http://www.hummingbird.com
- Attachmate – e-Vantage: http://www.attachmate.com
- Walldata – Rumba 2000 Web to Host: http://www.walldata.com
- Core Technology Corporation: 5250 for Java: http://www.ctc-core.com
- I/Net – Webulator/400: http://www.appsmall.com (Search: I/Net)
- LANSA – LANSA for the Web: http://www.lansa.com

Refer to the developer Web site for a listing and information for many complementary products. The IBM Tools Network site is located at: http://www.as400.ibm.com/developer/tools/

C.5 Payment solutions

This section references solutions oriented toward payment in e-business. That is, what options are available to handle the accounts receivable or accounts receivable (payment for receipt of product or service) using the Internet.

C.5.1 IBM Payment Suite

IBM provides a suite of products to perform secure payment:

- IBM Consumer Wallet
- IBM Payment Server
- IBM Payment Gateway
- IBM Payment Registry

You can find information on the Web at: `http://www.ibm.com/payment`

The IBM Payment Suite supports the SET Secure Electronic Transaction protocol that was developed by MasterCard, Visa, IBM, and others. The specifications are managed by SETCo LLC.

IBM Payment Server for AS/400 (5773-PY1) requires OS/400 V4R3 and is included in Net.Commerce V3 for AS/400. This product has browser-based administration and configuration.

C.5.2 ROI JavaCard Payment Server

ROI JavaCard Payment Server is a line of native AS/400 software products that provide processing for all kinds of payment transaction in all environments.

The transactions supported include:

- Full credit card support with SSL and SET.
- All major credit cards: AmEx, Carte Blanche, Master Card, Novus, Diners, Discover, Visa, private label, and so on.
- All major authenticating networks: AmEx, MAPP, Nabanco, NDC, Nova, Paymentech, Visanet, and so on.
- Merchant can select the best network for the best rate and get competitive bids.
- Credit, debit, purchasing, procurement, and bank cards.
- Merchant private label cards are accepted.
- Features include authorization, sales pre-authorization, post-authorization, book, ship, credit, reversal, incremental, force, and so on.

ROI JavaCard Payment Server accepts Internet orders from any AS/400 Web Server and acts as an enterprise payment server to handle authorization requests from external Web servers, native AS/400 Web servers, and native applications. JavaCard can hand simultaneous connections to different

authorization networks. It supports interfaces to Net.Commerce and Net.Data, Domino applications (ezMerchant), legacy systems with green screens, and external Web servers.

JavaCard includes the following features:

- Scalable in price, performance, and functionality
- Fast authorizations (.06 seconds or better)
- Test transactions can be run when the system is live
- 24x7x365 toll-free support line

For more information, refer to the following sites:

- `http://www.roiconnect.com`
- `http://www.as400.cc`

C.5.3 Merchant/400 from I/NET

Merchant/400 accepts MasterCard, Visa, AmEx, and Discover cards. In addition, other credit card types can be enabled. It authorizes or denies transactions immediately over the Web by pre-authorizing (book) charges or post-authorizing (ship) transactions. Pre-defined connections to existing providers include Anacom Communications and Credit Card Network.

Merchant/400 is enabled via an API and uses SSL protocol.

Integration with Net.Commerce is included via special objects that replace the Net.Commerce payment function. API and Macro registration functions are included for a seamless extension.

The Merchant/400 payment API can also be called from many other applications, including Web-based CGI script, front office applications (POS), and other e-commerce applications.

Merchant/400 requires Commerce Server/400 (from I/NET).

Appendix D. e-business Product Reference

This appendix is a customer and sales person's reference to each of the products listed in this redbook. It includes the product name, number, the date or version and release it became available, the date it will be (or was) withdrawn from marketing (if announced), and the date service is to be discontinued.

Discontinuation of service means that work to resolve defects discovered within the product itself is not done. Typically products go out-of-service some time after the product is enhanced for feature and function.

When a product is withdrawn from marketing, typically, improved and equivalent function is available in a product produced at a later time. In this chart, the last column "*Product providing replacement or comparable function*" represents the later product.

Table 6. e-business product reference

Product name	Product number	Date or OS/400 Version Release available	Date withdrawn from marketing, if announced	Date service is discontinued, if announced	Product providing replacement or comparable function
OS/400 V4R3	5769-SS1	09/11/1998		01/31/2001	V4R5 or V4R4
OS/400 V4R4	5769-SS1	05/21/1999			V4R5
Cryptographic Access Provider 40-bit	5769-AC1	V4R4		05/31/2001	
Cryptographic Access Provider 56-bit	5769-AC2	V4R4		05/31/2001	
Cryptographic Access Provider 128-bit	5769-AC3	V4R4		05/31/2001	
WebSphere Application Server for AS/400	5769-AS1	V4R5		05/31/2001	

Product name	Product number	Date or OS/400 Version Release available	Date withdrawn from marketing, if announced	Date service is discontinued, if announced	Product providing replacement or comparable function
SecureWay Host on Demand Version 4.0	5648-C54	V4 9/99			
Cryptographic Support for AS/400	5769-CR1	V4R4			
Screen Customizer for Host Integration Version 1.2	5648-D01	V1 9/99			
SecureWay Host Publisher Version 2	5648-D31	V2 2/2000			
CICS for AS/400	5769-DFH	V4R5		05/31/2001	
HTTP Server for AS/400	5769-DG1	V4R5			
Firewall for AS/400	5769-FW1	V4R4	12/29/2000	05/31/2001	see http://www.as400.ibm.com/firewall
AS/400 Toolbox for Java	5769-JC1	V4R5		05/31/2001	
Advanced Job Scheduler	5769-JS1	V4R5		05/31/2001	
AS/400 Developer Kit for Java	5769-JV1	V4R5			
Lotus Domino Doc	5769-LDD	V3.0			
Net. Commerce for AS/400, Version 2	5798-NC2				5798-WC4 or 5798-NC3

Product name	Product number	Date or OS/400 Version Release available	Date withdrawn from marketing, if announced	Date service is discontinued, if announced	Product providing replacement or comparable function
Net.Commerce for AS/400, Version 3.1	5798-NC3	04/30/1999 V4R3			5798-WC4
Net Question for AS/400	5769-NC5	V4R3		05/31/2001	
Payment Server for AS/400, Version 1.2	5733-PY1	V4R3		01/31/2001	5733-PY2
WebSphere Payment Manager for AS/400, Version 2.1	5733-PY2	V4R4			
OfficeVision JustMail for AS/400	5798-TBT	V4R2			
WebSphere Application Server V3.0.2, Advanced Edition for AS/400 (56-bit)	5733-WA2	V3R0M2		07/31/2001	
WebSphere Application Server V3.0.2, Advanced Edition for AS/400 (128-bit)	5733-WA3	V3R0M2		07/31/2001	
WebSphere Commerce Edition for AS/400, Version 4.1	5798-WC4	V4R4 05/26/00			

Appendix E. Step-by-step guide for building a Web presence site

This appendix provides a detailed description for each step to establish a presence on the Web. We selected the case of building a Web presence site because every one has to pass this stage. Plus, the methodology remains valid for transactional and dynamic data types of Web sites.

E.1 How to establish a Web presence

This section provides information necessary to establish a Web presence. With this information, you will be able to publish a Web site to convey information about your company, products, and services. Millions of Web viewers can access information about your company and products through their Web browser.

There are three different kinds of Web sites: Internet, intranet, and extranet. All three use the same technology. The difference is who gets to see the information. On the Internet, everyone with Internet access can view your Web pages. On an intranet, only people within your company can view the information. On an extranet, people your company works with, for example suppliers and distributors, can access the Web site. The type of information to publish on the Web site determines the type of Web site.

To establish a Web presence, you need to accomplish these tasks in order:

1. Read about the technology you need to have a Web presence. Understand what your environment should look like and what technology is required at each stage of the Web presence development cycle.
2. Learn about what needs to happen before one Web page is produced. In this pre-Web site stage, you set the business objectives you want the Web site to reflect.
3. Learn about the process of developing a Web site. This appendix includes steps to follow when developing a Web site.
4. Look at ways to publish the site to ensure that people visit it.
5. Understand which AS/400 products allow you to build a Web presence and be prepared for the next phase of e-business, the dynamic site.

Note: To achieve the benefits of this appendix, you should understand what the World Wide Web is prior to reading it. You should also have beginner's knowledge of Hyper Text Markup Language (HTML), which is the markup language that allows Web browsers to translate your information for a Web

user. To understand HTML, refer to Chapter 5, “HTTP Server for AS/400” on page 89.

E.1.1 Technology and architecture definitions

This section describes the terminology of the technology required (or available) for a Web presence in e-business. The components are displayed in Figure 51 and discussed in the following sections.

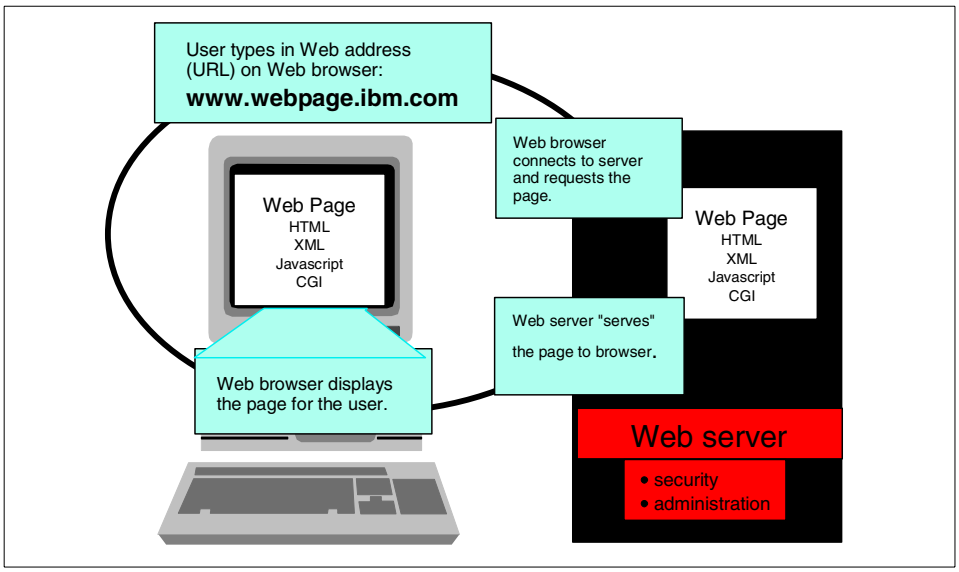

Figure 51. How a Web server works

Web site

A Web site is a linked collection of Web pages in an organized structure that resides on a Web server. The Web site is identified by a Universal Resource Locator (URL), which is the Web address, through a Web browser.

Web pages

Web pages display text and graphics through Web browsers. Create these pages in HTML, or a combination of HTML and XML, because each are markup languages. Then, add CGIs and Java Script to add interactive functionality to the Web pages.

These two languages are discussed in the following sections.

HTML

Hypertext Markup Language (HTML) is a simple authoring language to display content over Web browsers. It allows for the “mark up” of content with tags and tag elements so a Web browser can read it. You can create HTML code with any word processing software, but special Web-authoring software allows you to add more style to your Web pages without having to remember all the HTML tags.

XML

Extensible Markup Language (XML) is a markup language that assigns meaning and structure to the content of Web pages. XML is a subset of the Standard Generalized Markup Language (SGML) for defining markup languages to represent structured data.

Many say that XML is to data as HTML is to display. The main point of XML is that, by defining your own markup language with the Document Type Definition (DTD), you can encode the information of your documents more precisely than is possible with HTML.

For more information on XML and its uses, visit the IBM Developer Works Web pages at: `http://www.ibm.com/developer`

Cascading Style Sheets

Cascading Style Sheets (CSS) describe how content appears on the Web. Unlike HTML, where a designer gives tag elements the same description repeatedly, a designer describes, with one style sheet, how a page or a group of pages look.

CGI

Common Gateway Interface (CGI) is a programming language that allows Web pages to call applications for use within the Web site. CGIs are commonly used to display dynamic data on Web pages. However, you can use them to allow searches of your Web site and offer dynamic links to static information.

JavaScript

JavaScript is a scripting language that allows users to interact with Web page information. All the code is defined in one HTML page and doesn’t have to call any applications to work. For example, when you roll your mouse over an image on a Web page, the interaction changes the image.

Web browser

A Web browser is a client program to initiate requests to a Web server and display information that the server returns. Netscape Navigator and Internet

Explorer are the two most popular Web browsers. They are described in Chapter 5, “HTTP Server for AS/400” on page 89.

Domain name
A domain name is a name that your Web site is known as on the Internet. This is your Web address. For example, ibm.com is the IBM domain name.

The domain name represents your Web server’s IP address on which your Web site resides. Also, the domain name is a part of the Web site’s URL:
`http://www.ibm.com`

You can sign up for a domain name through a number of registrars.

Web server
A Web server is an application that transmits a file to a Web browser. The Web server serves the pages to the user through a Web browser.

The general sequence of operation for a Web server is:

1. A Web browser requests a document.
2. The HTTP server sends the requested document.
3. The Web browser interprets the document and displays it

Security policy
A security policy is a plan to secure the files on the Web server and the access to Web pages viewable through a browser. On the server side, you secure files at the file or directory level on the Web server by limiting access to who can manipulate them. At the browser level, you can limit access to who views the Web pages by setting up an authentication application. See 4.1, “Integrated functionalities of OS/400 for e-business” on page 83, for more information on Web security.

Administration controls
This is an application to measure the number of times a user accesses a Web page and delivers tracking reports to show the amount of activity on your Web server. This is important for expansion purposes. When you know which pages are the most popular, you can expand your Web site in that direction and scale server resources accordingly.

E.1.2 Pre-site considerations: Planning the site

This section takes you through the steps necessary before writing any Web pages. Prior to developing the site, set the business objectives you want the Web site to achieve. Determine the site’s purpose and ensure that the content is what your potential audience needs.

E.1.2.1 Determine the site's purpose

Before you code one page of HTML and place it onto the World Wide Web, you need to realize what the Web means to your company. It means a global presence. Your Web site and information about your company and its products are viewable by millions of people all over the world. A Web site that is created well is important to your company's image.

Answer the question: Why do you want a Web site? Consider these criteria:

- Do you want to inform people about your products and persuade them to place orders?
- Do you want to persuade other businesses to do business with your company?
- Do you want to inform people about your company?
- Do you just want to be on the Web because everyone else is?

Thoroughly understand every reason why your company wants a Web site.

Here’s an exercise describing how this activity is done:

1. List all of the reasons your company wants a Web site.

   Example: I want to have a Web site because:

   - My competitor has one.
   - I want to get new customers.

2. Translate those reasons to state a purpose.

   Example: The Web site will:

   - Give me an equal presence on the Web as my competitor.
   - Show people why these products best fill their needs.

A typical site about a company includes this information:

- About the company
- Products
- Services
- What’s new
- Contact us

Regardless of the content you place on Web pages, it must follow the site’s purpose, which is the site’s reason to exist in the first place.

E.1.2.2 Understand the site's audience

In this stage, you need to determine:

- The demographics of the audience
- What the audience needs from your Web site
- What the audience can do with this Web site
- The kind of technology your audience uses

Each of these considerations helps you determine the information to place on the Web pages. For example, if you know that your existing customers are small to medium businesses, ask how you can target information about your company to this market segment.

The audience's needs and what they can do with the information drives what content you should place on the site. For example, if a large number of your customers often need to know local sellers of your product, include a Web page that lists the local sellers.

Knowing what technology your audience has can prevent your site from scaring away visitors with inaccessible pages, long loading times, and annoying animations. Creating Web pages that have large graphic files inconveniences the audience because they take forever to load.

Consider how people see the information you present by knowing what modems, browsers, plug-ins (do they even know what plug-ins are?), and screen size before investing time and money into developing the latest and greatest Web site, only to find out your audience can't view it.

E.1.3 Developing a Web site

When you turn the Web site's purpose into a statement, you create project objectives. This section describes the development cycle for Web sites. Once you complete these steps, you have a Web site ready to publish.

The Web development cycle stages consist of:

- **Plan:** You've completed most of this phase by determining the site's purpose and audience. Other planning tasks, such as establishing and understanding the budget, schedule, equipment, and staff, can take place with regular project management procedures.
- **Create**: Create the design of the site, the content, and the code.
- **Test**: Have multiple people go through your site to ensure all the links work and the content is correct. View the pages through different browsers and different types of computer displays to ensure that all the colors and pages appear and work as you intended them too.

E.1.3.1 Planning your Web site

You've established the project objectives by determining the site's purpose.The rest of the planning phase involves typical project planning such as staff, budget, schedule, and assessment.

E.1.3.2 Creating the Web site

In this stage, you need to design and produce the Web site and pages. This section covers the elements involved in this stage.

The Web site design tasks include:

- Organizing site structure
- Determining content that fills the structure
- Labeling the categories

Organize the structure and organization of the information you want to present on the site. A hierarchical structure is common for a simple Web presence. Ensure that as people navigate throughout your site, they always understand where they are and where they are going.

As you plan your site's structure, refer to the book, *Information Architecture on the World Wide Web* by Louis Rosenfeld and Peter Morville, to get a complete overview of all the elements that go into planning a site structure.

For example, a company that wants to publish a site to inform people about their company and products could have a site structure like the example in Figure 52 on page 262.

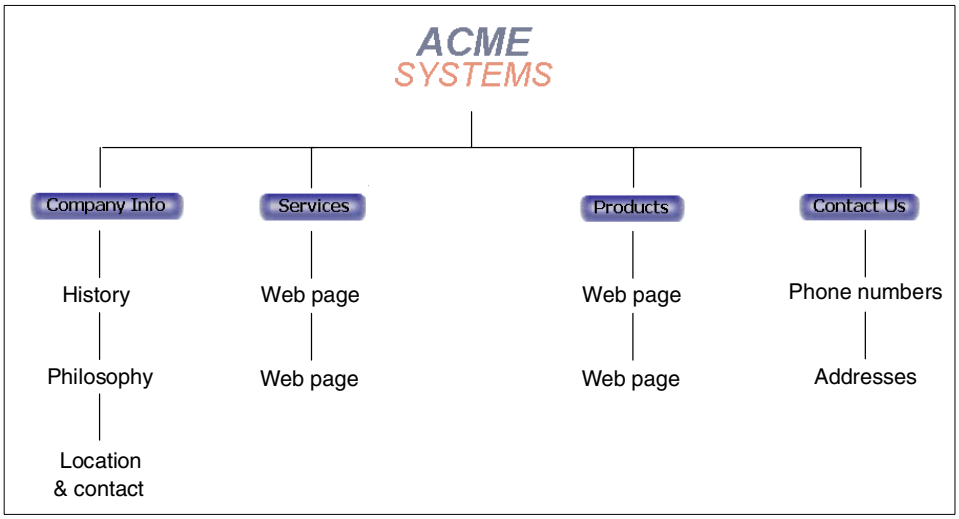

Figure 52. A simple site hierarchy

All information that goes on this site should fall under one of the listed categories. If it doesn't, consider whether that information is appropriate for the site's purpose.

The content is categorized according to this structure, and each category needs a label. Labelling is more complex and goes beyond the scope of this section (see the *Information Architecture* book). It is important to consider labelling because it's how your audience can navigate throughout your site.

Label each category with terminology appropriate for the audience. If people cannot find the information they need within your site, they leave it with the click of a mouse. Do your homework and make sure your site speaks the audience's language. Refer to Appendix B, "NLS considerations" on page 227, to understand other language support.

E.1.3.3 Web page

Web page design includes the following elements:

- Laying out the pages
- Determining the text and graphics for the pages
- Designing the navigation

As you design the Web pages, ensure they follow the site's purpose and match the expectations of the site's audience.

For more information on Web page layout, text and graphics, and navigation, read the *Yale Web Style Guide* by Peter Lynch and Sarah Horton. It's available online at: `http://info.med.yale.edu/caim/manual/`

Note

If you do not have the design skills necessary to complete this part of the process, give it to some one in your company who has experience with Web design and graphic design. This part of the development cycle is about design.

The production stage of creating Web pages involves the actual coding and file management. Your pages can be simple HTML or involve CGI code and JavaScript to add a dynamic and interactive element to the Web page's appearance. An example is shown in Figure 53.

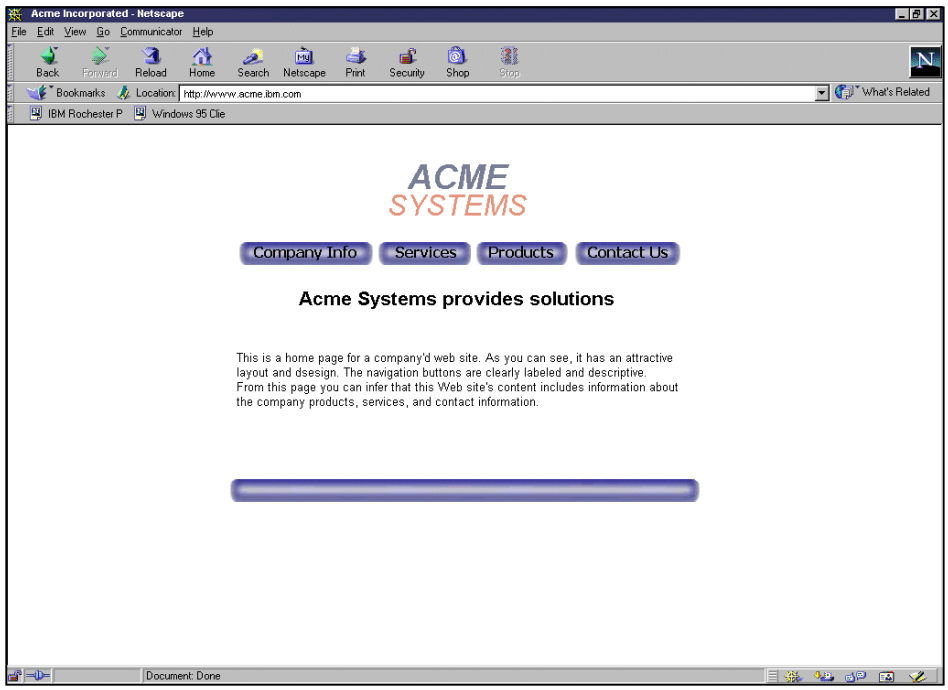

Figure 53. Sample company home page

Consider using a template for all the Web pages in each category to ensure consistency for your users and easier implementation for the developers.

It's important to test the initial templates for how they look on different browsers and browser versions because of functional differences.

Also, view the templates over different speed modems. A 47 KB Web page takes a lot longer to load over a 28K modem than a LAN connection.

Because many Web site's require the work of several developers and designers, construct file management procedures for the staff. This ensures that all work can be accounted for and there are no file overwrites.

E.1.3.4 Testing your Web site

To ensure that anything with your company's name attached to it works perfectly, test the information. The steps to test your Web site are:

1. Stage the site.
2. Conduct quality assurance test.
3. Conduct performance testing.
4. Observe users accomplishing a set of tasks.
5. Test in the client environment.

Stage the site

As you develop Web pages, move them onto a shared Web server that is protected from public view. This gives you more accurate test results because you are viewing the site as if it was on the World Wide Web.

Conduct quality assurance tests

There should be a final check on the content to make sure everything is correct. Ensure the following points:

- Standard spelling and correct grammar
- "Alt" attributes are set for all graphics
- Links go to the correct locations
- Pages, graphics, and scripts display and behave correctly

Conduct performance testing

Ensure that your pages load quickly over slower and faster modems. Long page loading times are an inconvenience for the user.

Observe users accomplishing a set of tasks

Ask users to accomplish a set of tasks with all the pictures and text in place. Verify that:

- Users can find the information they need to find
- Users know where they are in the site
- Users know what is a link and what is not a link
- Users can see important information immediately

Testing in the client environment
Web pages can look and behave very differently depending on the browser, operating system, screen resolutions, and Internet connections. The appearance of colors vary based on what monitors the users are using. The only sure way to get an accurate picture of how your site looks is to view the Web pages on their systems.

Test your pages on all targeted browsers. The following items, in particular, behave differently across different browsers and browser versions:

- HTML and HTML extensions (particularly HTML 3.2 extensions)
- JavaScript and other scripting code
- Page layout

Making a backup
Make a backup so that, if necessary, you can restore your files to the server.

E.1.4 Publishing the Web site

Your Web site is ready to go and you've tested it exhaustively. Now it's time for the world to know your company is out on the Web. This section discusses the final steps to accomplish to publish your Web site and advertise its existence.

E.1.4.1 Moving the site to the destination server

Move the site to the destination server where it will be a part of the World Wide Web. If availability is important for your site, make this move during a low usage time such as the middle of the night. If the files take some time to copy, you may want to take the servers off the network temporarily so that the site is not corrupted with a combination of old and new files.

E.1.4.2 Making search engines find your site

Search engines look for meta information about your site to see if it matches terms for which people are searching. This meta information, or information about the information, is in the form of meta HTML tags. Place descriptive words, key words, subjects, and search terms, for example, in these meta tags to ensure that search engines find your site and return it to a user.

E.1.4.3 Announcing your site on relevant news groups and bulletin boards

Internet news groups are a great way to reach a targeted audience. Many Web users read news groups, and there is no fee for sharing information. Your news group notice should read as a pointer to information of interest rather than as an advertisement. Follow the etiquette and rules of the group.

E.1.4.4 Advertising on major sites

Some sites for Web searches, such as Yahoo and Netscape, provide a way for you to advertise your site. Large numbers of Web users visit these search engines, and you can reach some of these people with an advertisement. These sites charge fees to place ads, so this suggestion applies mainly to commercial sites.

E.1.4.5 Advertising through other media

Attract users to your site by advertising in other media. Radio, television, billboards, and store signs all provide ways to advertise your site.

Advertise your company's Web site address on all communications from your company. Place the address on e-mail signatures, business cards, company stationery, and company brochures.

Remember, your Web site now holds information about your company. The site is the brochure that describes your services, the sales person that sells your product, and it's the packaging in which you wrap your company. Most of all, the Web site is an important part of your company's image. Place the Web site address anywhere you want your company's name to appear.

E.1.5 Site maintenance

Once your site is published, keeping it current and working 24 hours a day and 7 days a week is crucial. If your Web site is down or a link is dead when a customer visits it, they walk away with the impression that your site and your company are unreliable and in ill repair.

Keep in mind these important steps explained in the following sections when managing the Web site.

E.1.5.1 Maintaining links

Broken links frustrate users. Check all of your links periodically, and correct or remove the ones that no longer work. Check an external link more than once before deleting it. It may be only temporarily inaccessible if its server is down.

E.1.5.2 Tracking site activity

The more you know about user activity at your site, the better prepared you are to plan future updates. Tracking reports generated by server software provides you with the following information:

- The number of visits your site receives, which indicates how well it is advertised and how popular it is with users

- The number of disconnects, which indicates technical problems that need correcting
- The pages users link from when they connect to your site, which can help you refine your advertising strategy and even make you aware of categories of users you had not previously considered
- The order in which users view your pages, which help you assess your navigation and information design

E.1.5.3 Keeping users up-to-date on content changes

When appropriate and practical, tell users what content you changed, and when you changed it. This information helps them find new material easily. Provide a “What's New” section that displays from the home page, or link directly to the new material from your home page.

E.1.5.4 Maintaining version control

Keep all versions of your site organized so you can update files or refer to previous versions efficiently. Maintain the naming and file directory system you established during the original development of the site. Continue to back up your files and store them safely. Document your procedures for naming and structuring files so others can learn your system easily.

E.1.6 Testimonial

Here is a testimonial from a company that planned and implemented their presence on the Web. It helps put in perspective the affects of becoming Web-enabled.

Fueling the future: A successful Web presence story

When the Danish oil distribution company, Hydro Texaco, was formed three years ago as a merger of the Danish subsidiaries of Texaco and Norsk Hydro, the new company was faced with the challenge of creating a new brand in a very competitive market. The first step was to create a new design and marketing material including the Hydro Texaco loyalty card and a presence on the Web. Hydro Texaco wanted its brand and its Web site to connote excellent customer service, not just pretty pictures.

The Hydro Texaco Web site, located at `http://www.hydrotexaco.dk` provides customers with a wide range of information and services. Danish winters are known for cold and snow. Forward thinking is key for home owners if they don't want to be caught without enough heating oil. To alleviate the need to calculate when the tank will run dry, Hydro Texaco worked with IBM to create an online service to permit home owners to order emergency deliveries of

heating oil or to set up an automatic delivery schedule based on tank size, weather, and temperature predictions.

Hydro Texaco is firmly committed to respecting the environment. The site contains pertinent information for all of Hydro Texaco's customers, from home and car owners to factories. It describes the chemicals used in the company's products and how they should be disposed of, and, in a worse case scenario, how to handle accidents due to spills. Information and updates that were previously mailed out to corporate customers are now easily available on the Web site so that security manuals can be kept up-to-date.

The Hydro Texaco Internet site was created using Lotus Domino running on a Windows NT server. The Internet solution links to Hydro Texaco's backoffice systems and databases stored on IBM AS/400 servers.

The leveraging of the company's existing information systems combined with the ease of use of Domino makes it simple for Hydro Texaco to keep its services and information fresh.

The combined launch of Hydro Texaco's Internet services and loyalty card have positioned the company as one of the leading oil companies in Denmark. Corporate customers, such as factories, can now download pertinent information to keep them environmentally sound. The Web site reduces the need for printing lengthy manuals and decreases the number of calls to the Hydro Texaco Hot Line service. Most importantly, Danish home owners can now sleep soundly with the knowledge that they will stay warm all winter.

Appendix F. Special notices

This publication is intended to help the AS/400 marketing force and AS/400 customers who are looking to evolve their AS/400 systems to an e-business environment. The information in this publication is not intended as the specification of any programming interfaces that are provided by OS/400 nor Domino for AS/400. See the PUBLICATIONS section of the IBM Programming Announcement for OS/400 5769-SS1 for more information about what publications are considered to be product documentation.

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CICS/VSE	CICS/400
CICS/6000	Current
DataJoiner	DataPropagator
DB2	DB2 Universal Database
DRDA	Hummingbird
IBM	IBM Consumer Wallet
IBM Payment Gateway	IBM Payment Registry
IBM Payment Server	Intelligent Miner
Manage. Anything. Anywhere.	MQSeries
Net.Data	Netfinity
Network Station	OfficeVision
OfficeVision/400	Operating System/400
OS/2	OS/390
OS/400	PartnerWorld
RS/6000	SAA
S/390	SecureWay
SP	System/390
VisualAge	Visual Warehouse
WebSphere	Wizard
400	Lotus
cc:Mail	Lotus Notes
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Appendix G. Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

G.1 IBM Redbooks publications

For information on ordering these publications see “How to get IBM Redbooks” on page 281.

- *AS/400e System Handbook,* GA19-5486
- *AS/400 e-commerce: Net.Commerce,* SG24-2129
- *IBM SecureWay Host On-Demand: Enterprise Communications in the Era of Network Computing*, SG24-2149
- *AS/400 e-commerce: Internet Connection Servers,* SG24-2150
- *Building AS/400 Client/Server Applications with Java,* SG24-2152
- *AS/400 Internet Security: IBM Firewall for AS/400,* SG24-2162
- *Building AS/400 Applications with Java V2,* SG24-2163
- *IP Network Design Guide,* SG24-2580
- *AS/400 Internet Security: Protecting Your AS/400 from HARM in the Internet,* SG24-4929
- *Unleashing AS/400 Applications on the Internet*, SG24-4935
- *Cool Title About the AS/400 and Internet,* SG24-4815
- *AS/400 TCP/IP Autoconfiguration: DNS and DHCP Support,* SG24-5147
- *Net.Commerce V3.2 for As/400: A Case Study for Doing Business in the New Millennium,* SG24-5198
- *Using MQSeries on the AS/400,* SG24-5236
- *Web-to-Host Integration Solutions*, SG24-5237
- *Lotus Notes and Domino R5.0 Security Infrastructure Revealed,* SG24-5341
- *Lotus Domino for AS/400: Integration with Enterprise Applications*, SG24-5345
- *IBM Storage Solutions for e-business,* SG24-5356
- *Building e-commerce Solutions with Net.Commerce: A Project Guidebook,* SG24-5417

- *Lotus Domino for AS/400 R5: Implementation*, SG24-5592
- *Performance Considerations for Domino Application*s, SG24-5602
- *Web Enabling AS/400 Applications using WebSphere Studio*, SG24-5634
- *Building AS/400 Applications for IBM WebSphere Standard Edition 2.0,* SG24-5635
- *AS/400 Mail: Multiple SMTP Domain Names Behind a Firewall,* SG24-5643
- *Lotus Domino for AS/400: Developing an e-business Application*, SG24-6052

G.2 IBM Redbooks collections

Redbooks are also available on the following CD-ROMs. Click the CD-ROMs button at http://www.redbooks.ibm.com/ for information about all the CD-ROMs offered, updates and formats.

CD-ROM Title	Collection Kit Number
System/390 Redbooks Collection	SK2T-2177
Networking and Systems Management Redbooks Collection	SK2T-6022
Transaction Processing and Data Management Redbooks Collection	SK2T-8038
Lotus Redbooks Collection	SK2T-8039
Tivoli Redbooks Collection	SK2T-8044
AS/400 Redbooks Collection	SK2T-2849
Netfinity Hardware and Software Redbooks Collection	SK2T-8046
RS/6000 Redbooks Collection (BkMgr)	SK2T-8040
RS/6000 Redbooks Collection (PDF Format)	SK2T-8043
Application Development Redbooks Collection	SK2T-8037
IBM Enterprise Storage and Systems Management Solutions	SK3T-3694

G.3 Other resources

These publications are also relevant as further information sources:

- *Net.Commerce for AS/400 Installing and Getting Started Guide, V3.2,* GC09-2864
- *TCP/IP Tutorial and Technical Overview,* GG24-3376
- *Demonstration CD-ROM,* GK3T-2318
- *Network Products Reference,* GX28-8002

- *Net.Commerce Technologies,* G310-0705
- *IBM e-commerce Solutions,* G310-0712
- *Net.Commerce AS/400 Spec Sheet,* G325-6345
- *Work Management Guide*, SC21-8078
- *AS/400 International Application Development V4R2*, SC41-5603
- *e-business with Net.Commerce,* SR23-8849
- *Audio Tape - Global Commerce in Info Age,* SV31-3974
- Morville, Peter and Rosenfeld, Louis. *Information Architecture on the World Wide Web*. O'Reilly & Associates, March 1998 (ISBN: 15-659228-24).
- *Yale Web Style Guide* by Peter Lynch and Sarah Horton. This document is located on the Web at: `http://info.med.yale.edu/caim/manual/`

Consultant papers and white papers

- *Platform Availability Data: Can you spare a minute?* Gartner Group, October 1998.
- *Server Selection: Reversing the trend of rising IT costs*. IDC, December 1998.
- *AS/400 equals cost-effective ERP*. Meta Group, April 1999.
- *Lotus Notes Agent of Change: The Financial Impact of Lotus Notes on Business*, IDC study.
- *Analysis of AS/400 Dedicated Server for Domino versus PC Server*, IDC.

G.4 Referenced Web sites

These Web sites are also relevant as further information sources:

- View the Jupiter Communications Online Holiday Season Study at: `http://www.jup.com`
- Visit the IBM Firewall for OS/400 home page at: `http://www.as400.ibm.com/firewall`
- The *Performance Capabilities* manual, an online resource for V4R5 information, can be accessed at: `http://www.as400.ibm.com/infocenter`
- View the Andersen Consulting study, *Problems Unlikely to Deter Net Shoppers,* at: `http://www.andersenconsulting.com/news/`
- You can find information about the IBM HTTP server on the Web at: `http://www.as400.ibm.com/products/`

- Visit the IDC Research home page at: http://www.idc.com
- A wealth of WebSphere information can be found on the Web at: http://www.as400.ibm.com/tstudio/websphere/docs/doc.htm
- View the IDC Research home page at: http://www.idcresearch.com/Press/default.htm
- For additional information about IBM Payment Server for AS/400, refer to the Web site: http://www-4.ibm.com/software/webservers/commerce/payment/
- Although DB2/400 Universal Database is not covered in this redbook, you can find more information on the Web at: http://www-4.ibm.com/software/data/db2/
- For details on the OS/400 integrated functions of TCP/IP, refer to the Web site at: http://www.as400.ibm.com/tcpip
- For initial sizing of AS/400 for WebSphere Application Server, visit the Web site at: http://as400service.ibm.com/estimator
- Visit the AS/400 WebSphere Application Server home page at: http://www.as400.ibm.com//tstudio/websphere/docs/doc.htm
- Visit the IBM e-business home page at: http://www.software.ibm.com/e-business
- Visit the AS/400 North America home page at: http://www.as400.ibm.com/na
- Link to various AS/400 products and their PTFs at: http://www.as400.ibm.com/misc/map.htm
- For the latest versions of WebSphere products supported for the AS/400 system, refer to: http://www.as400.ibm.com/products/websphere/index.htm
- Complete details on the PTF and service information for WebSphere are available at: http://www.as400.ibm.com/tstudio/websphere/services/service.htm
- For the most current information on IBM WebSphere support, go to the site at: http://www.software.ibm.com/webservers
- For information on EJBs, refer to the Sun Microsystems Enterprise JavaBeans Technology Web pages at: http://java.sun.com/products/ejb/index.html
- For case studies of AS/400 and WebSphere interaction, see the site at: http://www2.software.ibm.com/casestudies/swcsweb.nsf/swgSearch?SearchView&Query=AS/400+AND+WebSphere
- For information about SET Secure Electronic Transaction, refer to the Web site at: http://www.setco.org

- Visit the IBM Net.Commerce home page at:
  http://www-4.ibm.com/software/webservers/commerce/servers
- Visit the AS/400 Information Center at:
  http://www.as400.ibm.com/infocenter
- Visit the BinaryTree.com e-business product solutions home page at:
  http://www.binarytree.com
- Information about Lotus Domino is available online at:
  http://www.lotus.com
- For information about Domino Designer and other Domino development tools and services, visit: http://www.lotus.com/developers
- Information about the DB2 Client Import Library and a Related Products link to download it is available at: http://www.as400.ibm.com/domino
- Developer information about Lotus Domino for AS/400 can be accessed by clicking the All About Notes/Domino link at: http://www.notes.net
- Visit the IBM Lotus Domino for AS/400 Web site at:
  http://www.as400.ibm.com/notes
- RPG is a strong requirement for most customers that have the AS/400 system installed. RPG APIs are available at:
  http://www.as400.ibm.com/snippets

  Use the search function and specify Domino as the first keyword.
- Information about the DB2 Client Import Library and a Related Products link to download it is available at: http://www.as400.ibm.com/domino
- For information about Client Access/400, go to the site at:
  http://www.as400.ibm.com/clientaccess
- Information on Domino for AS/400 software licensing, hardware, and software requirements can be found at: http://www.as400.ibm.com/domino/
- The IDC white paper, *Analysis of AS/400 Dedicated Server for Domino versus PC Server*, is available on the Web at:
  http://www.as400.ibm.com/conslt/dsd_tco.htm
- For information regarding the Toolkit for Java product, visit the Web site at:
  http://www.as400.ibm.com/domino/DomDevTools.htm
- Visit the AS/400 PartnerWorld for Developers Web site at:
  http://www.as400.ibm.com/developer
- Visit the LANSA home page at: http:www.lansa.com

- Lotus encourages customers and Business Partners who have concerns or further questions to contact Lotus directly through the eSuite Web site at: `http://www.lotus.com/esuite`
- Visit the Domino Application Studio Web site at: `http://www.lotus.com/home.nsf/welcome/appstudio`
- Domino for AS/400 case studies are available on the Web at: `http://www.as400.ibm.com/casestudies/GRPW`
- To view the AS/400 case study *United States Olympic Committee raises the bar with Lotus Notes and AS/400*, visit the Web site at: `http://www.as400.ibm.com/CASEST/OLYMPIC.HTM`
- For all your sizing for Domino for AS/400 questions, visit the Web site at: `http://www.as400.ibm.com/domino/domsz2.htm`
- Visit the IBM Technical Support Technical Information Web site at: `http://www.software.ibm.com/is/ibm-lotus`
- A NotesBench audit is an independently verified measurement of the capacity and price-performance of a platform (hardware and operating system combination) running a standard Domino mail workload. For more information, see the Web site at: `http://www.notesbench.org`
- Visit the Domino for AS/400 Performance home page at: `http://www.as400.ibm.com/developer/domino/perform/index.html`
- View the Maximizing application and server performance in Domino document at: `http://www.as400.ibm.com/developer/domino/perform/maxperform.pdf`
- View the AS/400 case study *Longmont Police Department* at: `http://www.as400.ibm.com/CASEST/LONGMONT.HTM`
- View the AS/400 case study *Copart celebrates salvage success with AS/400e and Domino* at: `http://www.as400.ibm.com/CASEST/COPART.HTM`
- View the AS/400 case study *Saab pulls into fast lane with e-business on AS/400e* at: `http://www.as400.ibm.com/CASEST/SAAB.HTM`
- Visit the MQSeries Family Web site at: `http://www-4.ibm.com/software/ts/mqseries`
- For information about CICS, an application server that provides industrial-strength and online transaction management for mission-critical applications, visit the Web site at: `http://www-4.ibm.com/software/ts/cics`
- The Tools Network program, a resource used for IBM and non-IBM tools that currently sponsors over 100 business partners, is described at: `http://www:as400.ibm.com/developer/tools/index.html`

- Visit the AS/400 Online Information Library at: http://publib.boulder.ibm.com?go=IBM+Online+Publications/pubs/html/as400/onlinelib.htm
- Visit the AS/400 Tools and Middleware Web site at: http://www.as400.ibm.com/developer/tools/
- For demonstrations, product information, partner information, and Ironworks and Ironside Technologies support, visit the Web site at: http://www.ironside.com/
- For information about the ROI JavaCard Payment Server, visit the Web site at: http://www.roiconnect.com
- For information about the ROI JavaCard Payment Server, visit the Web site at: http://www.as400.cc
- For information about Web.Merchant, visit the Web site at: http://www.as400.ibm.com/developer/ebiz/netcommerce/webmerchant.html
- For information about Magic, a development environment based on a programming model that eliminates wasted time and repetition from the development cycle, visit the Web site at: http://www.magic-sw.com
- Tools and vendors for e-business solutions can be found on the Web at: http://www.as400.ibm.com/solution/
- Visit the Farabi Technology Web site at: http://www.farabi.com
- Visit the Seagull Software Web site at: http://www.seagullsw.com
- Visit the Advanced BusinessLink Web site at: http://www.businesslink.com
- Visit the Jadvantage Web site at: http://www.jadvantage.com
- Visit the Touchtone Corporation—ThinView Web site at: http://www.thinview.com
- Visit the Hummingbird enterprise software and solutions Web site at: http://www.hummingbird.com
- Visit the Attachmate Web site at: http://www.attachmate.com
- Visit the Rumba Host Access Software Web site at: http://www.walldata.com
- Visit the Core Technology Corporation Web site at: http://www.ctc-core.com
- Visit the software distributor Appsmall.com at: http://www.appsmall.com
- For information on XML and its uses, visit the IBM Developer Works Web pages at: http://www.ibm.com/developer

How to get IBM Redbooks

This section explains how both customers and IBM employees can find out about IBM Redbooks, redpieces, and CD-ROMs. A form for ordering books and CD-ROMs by fax or e-mail is also provided.

- **Redbooks Web Site** http://www.redbooks.ibm.com/

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This information was current at the time of publication, but is continually subject to change. The latest information may be found at the Redbooks Web site.

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IBM employees may register for information on workshops, residencies, and Redbooks by accessing the IBM Intranet Web site at http://w3.itso.ibm.com/ and clicking the ITSO Mailing List button. Look in the Materials repository for workshops, presentations, papers, and Web pages developed and written by the ITSO technical professionals; click the Additional Materials button. Employees may access **MyNews** at http://w3.ibm.com/ for redbook, residency, and workshop announcements.

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☐ Credit card number

Credit card expiration date Card issued to Signature

We accept American Express, Diners, Eurocard, Master Card, and Visa. Payment by credit card not available in all countries. Signature mandatory for credit card payment.

Glossary

24x7 An availability requirement meaning 24 hours per day, 7 days per week, with few or no exceptions.

Active Server Pages A dynamic Web page, with the extension .ASP, created with Visual Basic Script or JavaScript. It displays information as a part of the HTML.

Application Programming Interface (API) A predefined set of program subroutine calls that allows one program to communicate with another without either knowing how the other does its job.

Application Server Mediates between the Web and business applications (for example, WebSphere Application Server Standard Edition). It is a set of routines or software that allow the user to run server side applications, such as servlets, JavaServer Pages and Enterprise JavaBeans. These applications can serve as a link to the existing “legacy” applications or database information.

Cascading Style Sheet (CSS) A method that describes the format, style, or look of a marked-up document (for example, a document that uses a markup language to describe its contents).

cookies Bits of information that a Web site gives to a client’s browser. Anytime the client browser requests that site, the site can retrieve the cookie and customize the pages for the client.

Customer Relationship Management Involves supporting, developing, and retaining profitable customers by using e-business technology.

Central Processing Unit (CPU) The part of a computer that includes the circuits that control the interpreting and running of instructions.

cryptography The transformation of data to conceal its information content, prevent its undetected modification, or prevent its unauthorized use.

Dynamic Host Congifuration Protocol (DHCP) The protocol that allows a networked computer to get its networking configuration from a server on the network.

Digital Certificates In computer security, a digital document that binds a public key to the identity of the certificate owner, and therefore, enables the certificate owner to be authenticated. A certificate authority issues a certificate.

Domain Name Service (DNS) A network service protocol that provides a domain name (such as `www.as400.ibm.com`) to IP address (such as `192.27.22.20`) mapping.

Document Type Definition (DTD) A method of defining the tags used in a markup language such as XML or SGML.

e-business A business process transformed to leverage the World Wide Web (Internet, intranet, and extranet) technology for business benefit.

e-business cycle Provides companies a blueprint for how to move through each phase when c eating and deploying applications and providing support for e-business initiatives. Its steps are: build, leverarge, run, and transform.

e-commerce Selling products and services on the Internet.

Enterprise JavaBeans (EJB) A specification of Sun Microsystems, Incorporated, that is part of the WebSphere Application Server Advanced Edition. EJB support allows your application to include sophisticated business components that run on your server. These components may include business logic with automatic distributed transactions and persistence to a relational database.

extranet An intranet whose access for travelling employees or privileged customers and suppliers is partially allowed through a firewall to the Internet.

firewall A special type of network router that connects two networks but only allows

controlled traffic between the two. For example, it allows employees on their intranet to gain access to the Internet but block all access from the Internet in.

FTP In TCP/IP, an application protocol used for transferring files to and from host computers. FTP requires a user ID and possibly a password to allow access to files on a remote host system. FTP assumes that the Transmission Control Protocol is the underlying protocol.

HyperText Markup Language (HTML) A document formatting language in which a specific set of *tags* describe the contents of a Web page, including the headings, bold and italic text, included images, and hypertext links.

HyperText Transport Protocol (HTTP) The protocol that defines how a Web client interacts with a Web server, requesting and receiving Web pages.

HTTP server A server that “serves” Web pages to client browsers over HTTP.

IBM International Business Machines.

Internet A collection of interconnected LANs and WANs that use the Internet Protocol (IP) to route traffic within it.

Internet The “official” global IP network.

intranet An “internet” and the computers and services available on that network whose access is limited to a particular company or organization. If connected to the Internet, it is usually through a firewall.

Internet Protocol (IP) The protocol that provides for the passing of packets of data between LANs, forming an inter-network of LANs known as an Internet.

ITSO International Technical Support Organization.

Java An object-oriented programming language for portable interpretive code that supports interaction among remote objects. Java was developed and specified by Sun Microsystems, Incorporated.

JavaScript An interpreted programming or scripting language.

JavaServer Pages Pertaining to the Sun Microsystems, Inc., technology that allows dynamic content to be inserted into an HTML page before the HTTP server sends the page back to the browser for display. These pages have a .jsp extension that signals the HTTP process to call the WebSphere Application Server to handle the embedded Java code (known as a scriptlet) or to refer to a JavaBean.

Java Virtual Machine (JVM) The part of the Java environment that is responsible for interpreting the Java codes.

Local Area Network (LAN) A network that allows a number of computers to transmit data between each other directly, usually between any pair of computers but occasionally from one computer to all others on the local network.

Lightweight Directory Access Protocol (LDAP) A network service protocol that allows simple directory-type information (such as names and addresses) to be looked up in an easy and efficient manner.

protocol A set of rules to be followed for some sort of communication. At low levels, it may be definitions of voltage levels on wire and physical cabling, while at high levels it may be the sending of text greetings and responses that establish a conversation.

public key encryption In secure communication, an algorithmic pattern used to decrypt messages that were encrypted by the corresponding private key. A public key is also used to encrypt messages that can be decrypted only by the corresponding private key. Users broadcast their public keys to everyone with whom they must exchange encrypted messages.

router A network device that connects two or more LANs or WANs together to form an Internet.

servlets A Java-based alternative to CGI, running on the server in response to some action by the user such as clicking on a link.

Standard Generalized Markup Language (SGML) A document formatting language in

which *tags* that are extensible and defined within a DTD, describe the content of a document. It is older and more generalized than XML.

Simple Mail Transport Protocol (SMTP) The protocol that allows text messages (e-mail) to be stored and forwarded from the sender to the receiver.

Secure Sockets Layer (SSL) A protocol with which you can establish secure connections between server applications and their clients. SSL has become an industry standard for securing communication between clients and servers.

SET Secure Electronic Transaction A specification for securing payment card transactions over open networks such as the Internet. SET was developed by Visa, MasterCard, IBM, and other technology companies.

tags Sequences of text in a document that are not normally meant to be seen by the reader but rather provide instructions to the application displaying the document on how to display it.

Transmission Control Protocol (TCP) The protocol that provides for the sending of a stream of data from one process on one computer to another process on another computer over packet-based network protocols such as IP. Takes care of breaking the stream into packets, reassembling them in order, and retransmitting packets that are lost or corrupted.

Transaction Server An extension of the application server. A transaction server is required when a customer wants to extend e-business across the entire spectrum of business processes to encompass transaction processing and running the actual state of the business.

Universal Resource Locator (URL) The address of information on the World Wide Web. It is the fully-qualified domain name of a Web site.

World Wide Web (WWW) A network of servers that contain programs and files. It displays specially formatted files that can be hyperlinked to other files throughout the Internet.

Web page Any document that can be accessed by a URL on the World Wide Web.

Web presence A Web site on the World Wide Web. Also the first phase in the e-business phases of adoption.

Web server An HTTP server that “serves” files to a Web browser on a client machine.

Web site A collection of Web pages that resides on a Web server that is managed by a single entity (an organization or an individual). Each Web site has a home page and a URL.

Extensible Markup Language (XML) A document formatting language in which *tags* that are extensible and defined within a DTD, describe the content of a document while the look is defined within CSSs. It is a newer subset of SGML that is easier to work with.

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IBM Redbooks review

Your feedback is valued by the Redbook authors. In particular we are interested in situations where a Redbook "made the difference" in a task or problem you encountered. Using one of the following methods, **please review the Redbook, addressing value, subject matter, structure, depth and quality as appropriate.**

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Document Number **Redbook Title**	SG24-5694-00 AS/400e e-business Handbook: A Technology and Product Reference
Review	
What other subjects would you like to see IBM Redbooks address?	
Please rate your overall satisfaction:	O Very Good O Good O Average O Poor
Please identify yourself as belonging to one of the following groups:	O Customer O Business Partner O Solution Developer O IBM, Lotus or Tivoli Employee O None of the above
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IBM

Redbooks

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250 <-> 459 pages

AS/400e e-business Handbook

A Technology and Product Reference

Build and deploy Web-based applications for a competitive advantage

Extend your business critical AS/400 applications to the Web

Discover AS/400e for extreme e-business solutions

This reference guide targets IBM marketing personnel, Business Partners, and AS/400 customers who are looking to extend and expand their information server into e-business. It positions e-business on the AS/400e against other solutions in the marketplace. Plus, it describes how the AS/400 system competes in the business-to-business and business-to-consumer marketplace.

This book shows the solid potential of the AS/400 system in each facet of e-business solutions. By reading this handbook, you'll gain a broad understanding of how the AS/400e serves in an e-business environment. In addition, you'll learn how to sell the AS/400e for e-business solutions, including Web presence, dynamic data, and a transactional site.

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