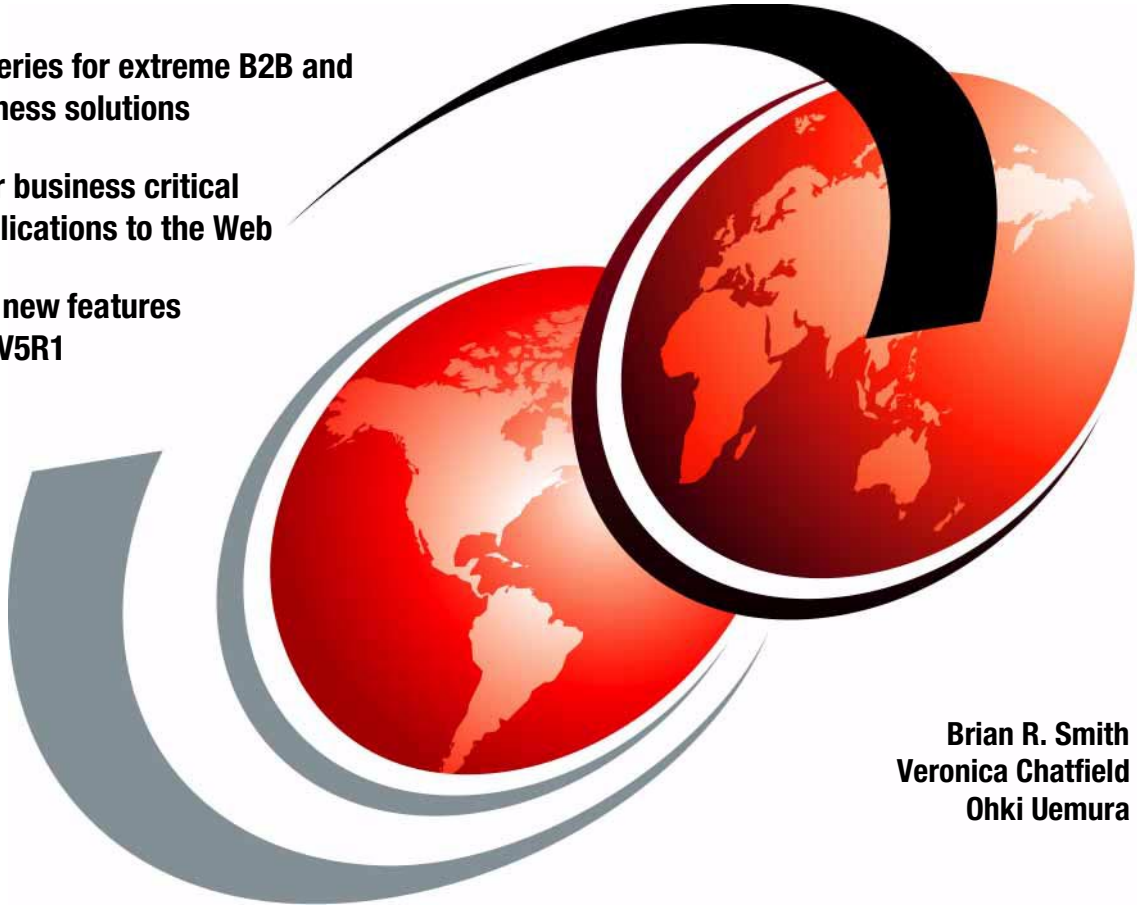
IBM

IBM @server iSeries e-business Handbook

A V5R1 Technology and Product Reference

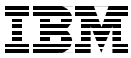
- Discover iSeries for extreme B2B and B2C e-business solutions
- Extend your business critical OS/400 applications to the Web
- Explore the new features for OS/400 V5R1



Brian R. Smith
Veronica Chatfield
Ohki Uemura

Redbooks

ibm.com/redbooks



International Technical Support Organization

IBM @server iSeries e-business Handbook: A V5R1 Technology and Product Reference

October 2001

SG24-6711-00

Take Note! Before using this information and the product it supports, be sure to read the general information in “Special notices” on page 341.

First Edition (October 2001)

This edition applies to Version 5, Release Number 1 of OS/400, Program Number 5722-SS1.

Comments may be addressed to:
IBM Corporation, International Technical Support Organization
Dept. JLUB Building 107-2
3605 Highway 52N
Rochester, Minnesota 55901-7829

When you send information to IBM, you grant IBM a non-exclusive right to use or distribute the information in any way it believes appropriate without incurring any obligation to you.

Contents

Preface

This IBM Redbook – a technology and product reference guide – targets IBM marketing personnel, Business Partners, and AS/400e and iSeries customers who are looking to extend and expand their information server into e-business. It provides a bottom-up approach to learning about base OS/400 features and functions that provide a rock-solid foundation for e-business. Like adding a layer to an onion, it adds details about the networking aspects of e-business that are based primarily upon the TCP/IP protocol suite. The next layer describes the built-in Web serving features of both the original and powered by Apache HTTP servers.

OS/400 is built for e-business.

But the implementation e-business today does not stop at an HTTP server. It is the evolutionary movement of your presence on the Web from static Web pages, to dynamic data, and finally to a transactional site – a business-to-business (B2B) or business-to-consumer (B2C) marketplace.

To this end, we provide information to help you organize your understanding of some of the major e-business application environments available on your iSeries with V5R1 of OS/400. This includes the WebSphere Application Server, WebSphere Commerce Suite, Lotus Domino for iSeries, and Host Integration programming information for those who would rather extend an e-business environment themself.

To round out this study of e-business on the iSeries, this IBM Redbook looks at sizing and performance, national language support, and systems management. It also serves as a fantastic reference for the myriad of Web sites, white papers, manuals, and other Redbooks that allow you to dive into greater detail once you have chosen the road down which you will take your business to e-business.

Important note to the reader: This book is written for V5R1 of OS/400. The new V5R1 functions that have been added to this redbook are identified by *italic text*. For a look at the same topics for V4R5, see *iSeries e-business Handbook: A Technology and Product Reference*, SG24-5694.

Note: This redbook reflects the IBM @server iSeries server name. Throughout this redbook, we use the shortened version “iSeries” to refer to both AS/400e and iSeries servers. These servers, of course, run OS/400.

You can also find many references to the new integrated adapter named the Integrated xSeries Server for iSeries. The shortened named is Integrated xSeries Server. In this redbook, the name is also used to refer to the predecessor technology of integrated server adapters. That is, the name is used to indicate the Integrated Netfinity Server (INS), Integrated PC Server (IPCS), and Integrated File Server IOP (FSIOP).

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.

Brian R. Smith is a Sr. Consulting I/T Specialist in the IBM International Technical Support Organization (ITSO) Rochester Center. The first half of his career was spent in the Rochester Lab with the design, coding, and testing of the System/38 and AS/400 in the area of communications. He then “jumped the wall” into technical marketing support in 1990 to pursue the life of teaching and writing. Brian is the team leader of the iSeries e-business team at the ITSO Rochester Center. You can reach Brian at brsmith@us.ibm.com

Veronica Chatfield is a iSeries Technical Specialist with IBM Australia. She began her career with IBM UK Software Support in 1993 and then moved to Australia in 1999. She spent two years with IBM Global Services in iSeries outsourcing. In September 2000, she moved into her current role with IBM Australia in pre-sales technical support for Australian and New Zealand Business Partners and IBM Sales Representatives. She holds a degree in Business Information Systems from Portsmouth University and previously spent time with the ITSO writing extensively about Y2K issues. You can reach Veronica at vchatf@au1.ibm.com

Ohki Uemura is an I/T Engineer in Global Services for IBM Japan. He has worked at IBM for three years and has two years of experience in working with the iSeries and AS/400e servers. He specializes in the WebSphere Family products and other e-business related products. His current role is technical Q&A support on iSeries applications by telephone for Japanese Business Partners and customers. You can reach Ohki at uemr@jp.ibm.com

A special thanks to the previous authors of this IBM Redbook:

Masahiko Hamada
YesSong Johng
Toru Kawashima
Thierry Petit
Susan Powers

Stephen Quan
Nitin Raut
Suehiro Sakai
Matthias Schmidt
Shlomo Vanunu
Kristin Zibell

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

Masahiko Hamada
YesSong Johng
International Technical Support Organization, Rochester Center

Anna Sue Parker
IBM iSeries Americas Advanced Technical Support

Bjarne Matzen
Mid-Comp Director - Product Development

Mike Smith
System Chief Engineering Manager, iSeries Software, Rochester Center

Bill Rapp
Internet Technologies, Rochester Center

Mike Schambureck
iSeries Technology Center, Rochester Center

Sandeep Goyal
e-commerce Software Developer, Toronto

Edward Gondek
Product Market Manager for WebSphere Site Analyzer, Raleigh

Nancy Roper
Consulting IT Specialist, IBM Canada

Jan Roelofs
IBM Software Support, IBM Netherlands

Todd Gabriel
Global Product Support Team @server iSeries Services Offering Manager, Rochester Center

Special notice

This publication is intended to help Chief Information Officer (CIO) and the Chief Executive Office (CEO) to extend and expand their iSeries server into e-business. The information in this publication is not intended as the specification of any programming interfaces that are provided by Version 5, Release 1 of OS/400, Program Number 5722-SS1. See the PUBLICATIONS section of the IBM Programming Announcement for Version 5, Release Number 1 of OS/400, Program Number 5722-SS1, for more information about what publications are considered to be product documentation.

IBM trademarks

The following terms are trademarks of the International Business Machines Corporation in the United States and/or other countries:

e (logo)® 
IBM ®
Advanced Function Printing
Advanced Function Presentation
Advanced Peer-to-Peer Networking
AFP
AIX
AnyNet
APPN
AS/400
AS/400e
AT
CICS
COBOL/400
CT
Current
DataJoiner
DB2
DB2 Universal Database
DRDA
IBM Electronic Services for AS/400
IBMLink
IBM Payment Server
Infoprint
Integrated Language Environment
Intelligent Printer Data Stream
IPDS
iSeries
Redbooks
Redbooks Logo 
Print Services Facility
PartnerWorld
PowerPC
pSeries
RMF
RPG/400
RS/6000
SAA
S/390
SmoothStart
SP
SP1
System/36
System/370
System/38
System/390
ThinkPad
Tivoli
Tivoli Enterprise
VisualAge
WebSphere
xSeries
XT
zSeries
400

Language Environment
MQSeries
MVS
Net.Commerce
Net.Data
Netfinity
NetView
Network Station
OfficeVision
OfficeVision/400
Operating System/400
OS/2
OS/390
OS/400

Lotus
Approach
Lotus Notes
Domino
eSuite
iNotes
Lotus eSuite
Lotus Sametime
Notes
QuickPlace
Sametime
Tivoli
NetView
Tivoli Enterprise

Comments welcome

Your comments are important to us!

We want our IBM Redbooks to be as helpful as possible. Send us your comments about this or other Redbooks in one of the following ways:

- Use the online **Contact us** review redbook form found at:

  ibm.com/redbooks

- Send your comments in an Internet note to:

  redbook@us.ibm.com

- Mail your comments to the address on page ii.

Part 1

A brief introduction to e-business

e-business: The process of using Web technology to help businesses streamline processes, improve productivity, and increase efficiency. Enables companies to easily communicate with partners, vendors, and customers; to connect back-end data systems; and to transact commerce in a secure manner.

In its simplest sense, e-business is the use of Internet technologies to improve and transform key business processes. Most companies understand this and have begun the evolution from traditional business practices to e-business. Many are well on their way. They have begun to Web-enable core processes to strengthen customer service operations, streamline supply chains, and reach existing and new customers. The accessibility and broad reach of the Internet have forever changed customers' expectations regarding support and response. They expect accurate, round-the-clock service. Therefore, companies require a massively scalable, reliable, and secure electronic foundation that includes

reliable and available servers, industry-leading software and middleware, and worldwide consulting services from experts with industry-specific knowledge. And all of this must be supported by a scalable and robust infrastructure. With this need comes the solution – the IBM @server iSeries server.

This part introduces e-business and gives you a taste of how you can exploit the the built-in qualities and e-business environments that the iSeries offers.

1

The how, what, and why of iSeries e-business

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, businesses will miss a large opportunity and be at a disadvantage to competitors who are Web enabled.

At the highest level, your business will survive and grow if you can increase revenue or decrease expense at rates faster than your competitors. Business-to-customer (B2C) transactions can increase your revenue as a new channel to market. Business-to-business (B2B) has the power to both decrease expenses and increase revenue depending on how you can align your business as a buyer or seller (or both) in the online marketplaces of today. If you are interested in a focus on iSeries B2B, skip to Chapter 10, “B2B: Transforming business processes for e-business” on page 235, as soon as you have read this chapter.

This chapter reviews the role of the iSeries server in this new technology area and the various tools and methods available for implementing e-business solutions on the iSeries. Did you notice that the questions *when* and *where* are missing from the title of this chapter? That is because the when is now and the where is on the iSeries.

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 a 17 January 2001 report by Jupiter Research (the worldwide authority on Internet commerce), U.S. consumers spent $10.8 billion shopping online during the 2000 holiday season – a 54 percent increase over the $7 billion spent in 1999 – despite concerns of a poor holiday season. The latest Jupiter Post-Holiday 2000 Consumer Survey reveals that during the holiday season, approximately 36 million consumers purchased online and spent an average of $304 worth of merchandise.

Growth also occurs geographically as more people surf and shop online. In fact, a 8 June 2000 IDC study found that the Western European Internet access market continues to grow rapidly, driven by sustained growth in new users, the success of subscription-free and un-metered access services, the emergence of broadband access technologies, and continuing price erosion. Total user spending on Internet access services is forecasted to increase at a 28% compound annual growth rate from 1999 to 2004, with great variation between countries and access technologies.

This foreshadows a similar explosion to what has happened in the U.S.

More information: For more information, refer to the following Web sites:

- **Jupiter Communications**: http://www.jup.com
- **IDC Research**: 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 (B2B) and business-to-consumer (B2C) 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 iSeries 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 e-business. 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 29.

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 the World Wide Web (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 the business-to-business (B2B) and business-to-consumer (B2C) 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 and no longer just a vision. This is called *pervasive computing (PvC)*. 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, which is a project that 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 Internet resources (the bandwidth), you can’t download it instantly. With Internet2, a new channel will be open for the 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 ARPAnet. 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 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 twenty-first 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 (DoS) attacks on leading Internet companies, such as Amazon.com, e*Trade, Datek, eBay, Yahoo, CNN, and Buy.com, have brought security issues to the front pages of the popular media. Standards and technology, like the examples listed here, provide protection against such attacks:

- SSL and TLS encryption
- Digital certificates
- SET Secure Electronic Transaction
- encrypted e-mail
- Firewall

In addition, server security, including vulnerable features and access points, needs to be managed by the system administrator.

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 anti-virus software. The best anti-virus 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 enter 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 1-1 illustrates the forces that have fragmented national markets and changed the business environment.

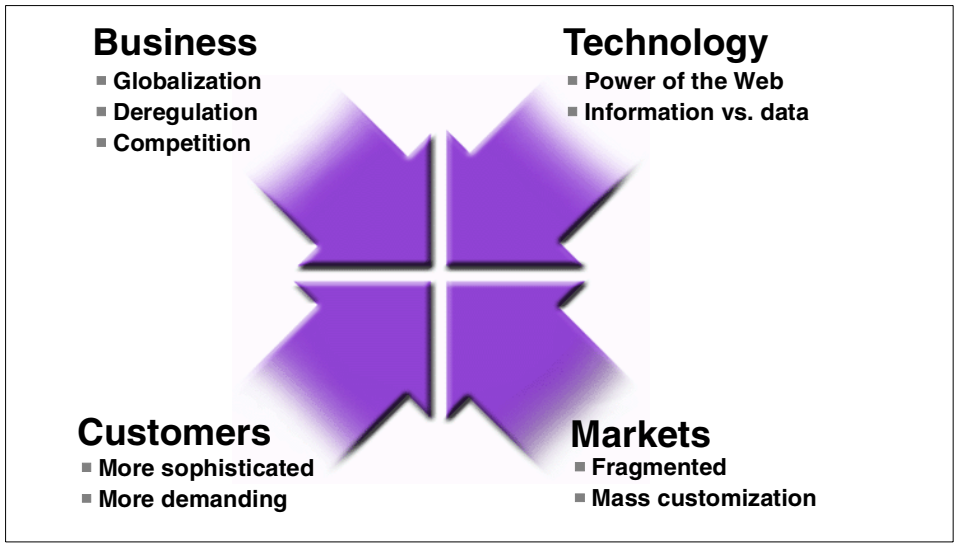


Figure 1-1 Why e-business? The changing business environment

Six 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. 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.

e-business is not a license to print money

Their have also been a number of well publicized failures in the .com business recently. For an example, go to Living.com's Web site at http://www.living.com to read all about their bankruptcy filings.

The simple point is that e-business is about leveraging all the good old-fashioned and pragmatic business values and strength that you have now with your iSeries server. Business leaders that can both manage the core value-add that your company provides, while at the same time, use e-business to leverage new opportunities for revenue growth and reduced expense will win.

Those that think that e-business is a license to print money will lose.

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 connect 50 million people 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* found that almost 25% of suppliers are already online. 67% have started commerce initiatives to build a lead in market share. Figure 1-2 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

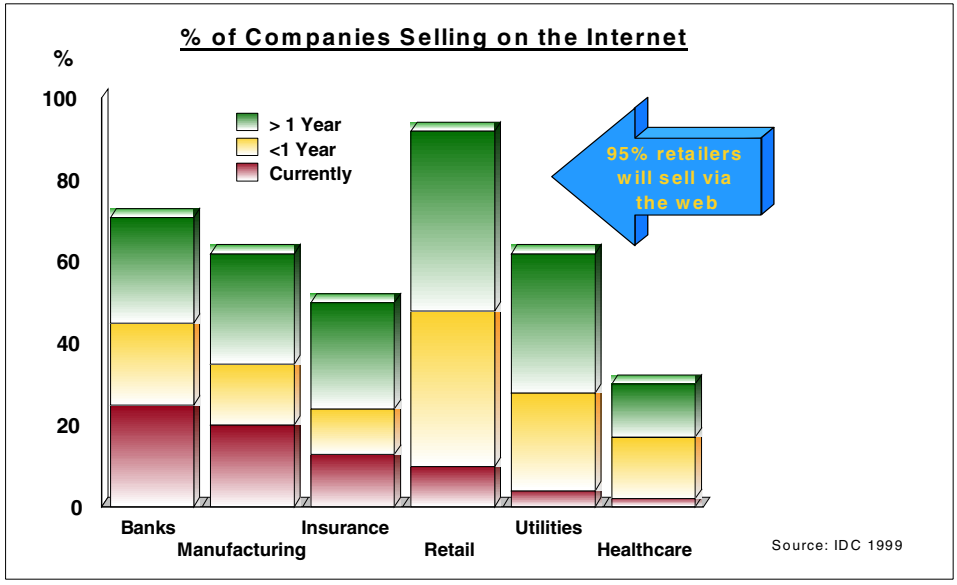


Figure 1-2 Selling through the Web is transforming industries

In 1999, an IDC paper reported that the B2B model for e-commerce will reach 9% of the total B2B trade (Figure 1-3).

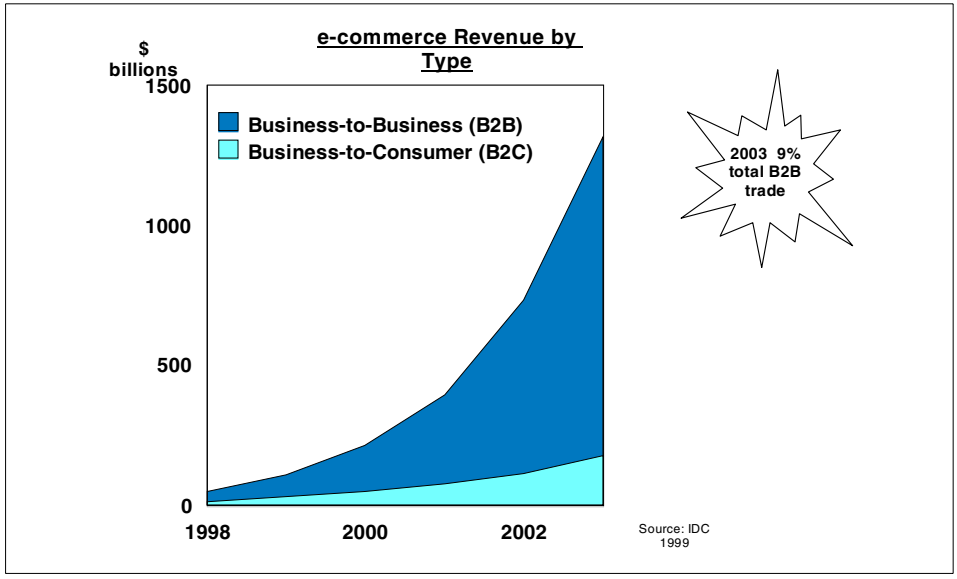


Figure 1-3 E-commerce revenue business-to-business and business-to-consumer trend

Rapid return on investment

There are many references to show you how putting an “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 iSeries server is the right choice to handle your business needs, now and in the future.

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, you can reap different benefits. 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 and 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 1-4 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.

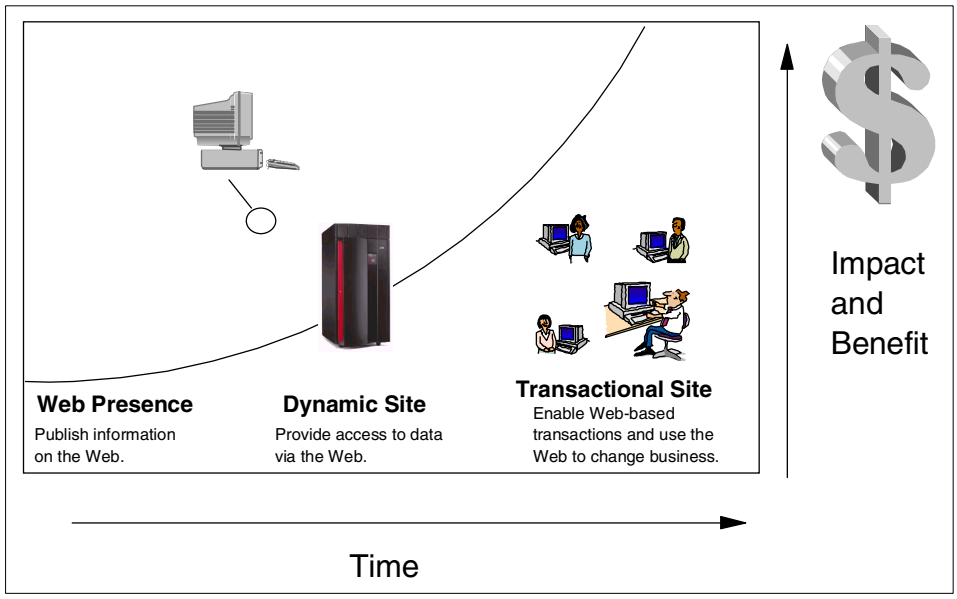


Figure 1-4 e-business development overview

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 (toll free) 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). In a B2B environment, the users would purchase agents for other businesses that you supply.

Note that, in Figure 1-4, the vertical axis has a big dollar sign. You might first think this is cost of implementing a solution. In part, you would be correct. But a better way to look at the vertical axis is as a return on investment. It is the ROI on the investment you are making on your business that gives you the impact and benefit from your Web presence.

This redbook is organized around these phases so you can understand where your business is in this process, read about the tools and technologies that 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 29.

Note: The Rochester Opportunity Center serves as an e-business resource and solution provider. Experts can be reached at (888) 426-9851 in the United States or at 1-507-253-7056 worldwide. Contact them to explore the offerings and services available or to initiate an e-business analysis.

1.4 IBM Framework for e-business

The IBM Framework for e-business (Figure 1-5) 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 iSeries fully supports and participates in this framework.

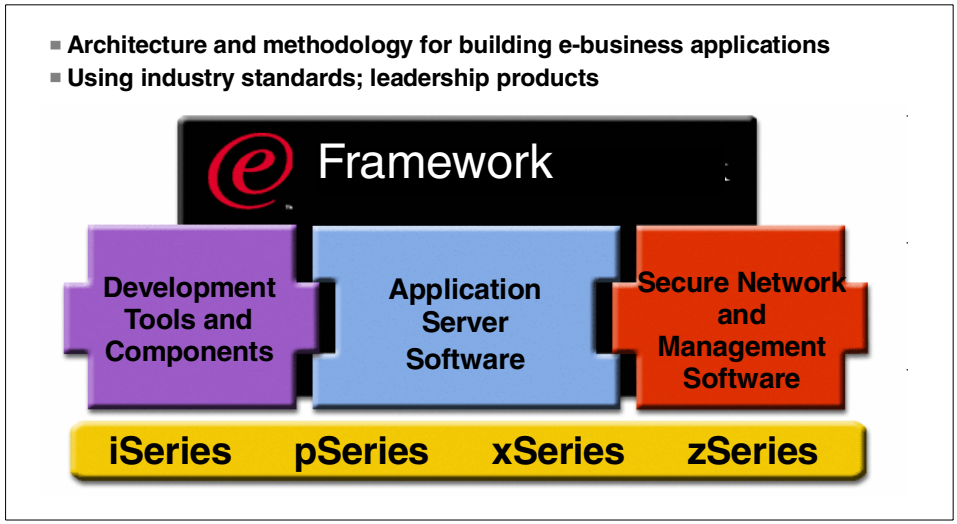


Figure 1-5 IBM Framework for e-business

The Framework provides the right supporting foundation for your new or existing iSeries 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, and 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 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 iSeries server is strongly committed to participate in this “vision”.

1.4.1 Framework overview

The IBM 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 1-6 and are explained in the following list.

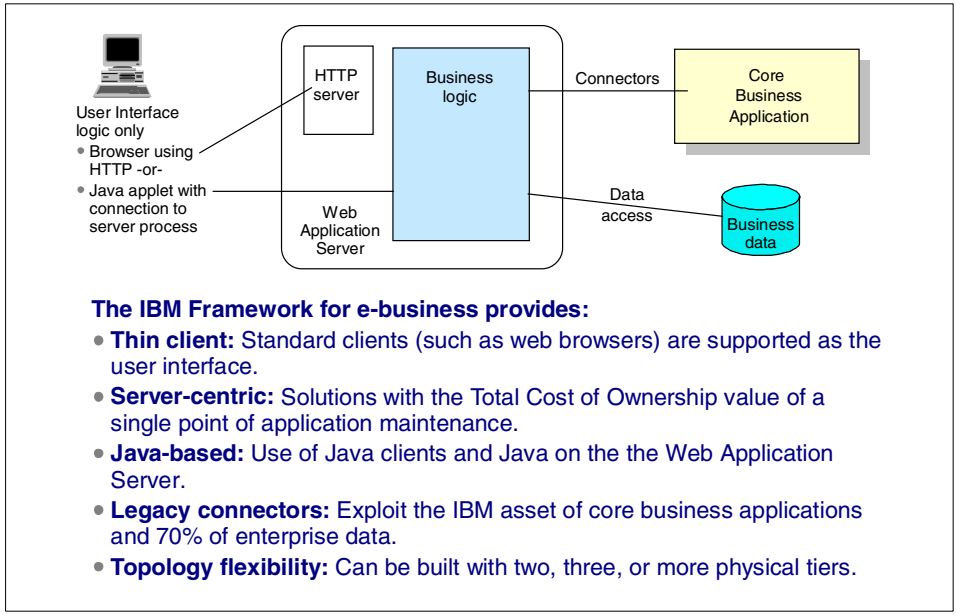


Figure 1-6 The e-business application model

- **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 provides 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, and so on.

  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 two 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:

- Domino Designer and Lotus Tools
- IBM WebSphere Development Studio
  - VisualAge Family (includes Java)
  - WebSphere Studio for iSeries
  - WebFacing Tool and other Host Integration products
  - CoOperative Development Environment (CODE)
  - ILE languages such as RPG, C, C++, COBOL
  - Application Development ToolSet (ADTS)

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 Framework for e-business is a set of application servers for building, running, and managing advanced e-business applications:

- IBM HTTP Server for iSeries (original and powered by Apache)
- Lotus Domino
- IBM WebSphere Application Server
- WebSphere Commerce Suite (previously called Net.Commerce)
- DB2 Universal Database (UDB)
- MQSeries family of products
- CICS Transaction Server for iSeries

Each of these servers is mature, secure, feature-rich, field-tested, and 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 Tivoli family of security 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
- Host Publisher
- 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 1-7 and is entitled the *IBM e-business cycle*. The IBM e-business cycle provides a basis for the IBM 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 businesses to act more quickly and decisively when faced with business threats or opportunities.

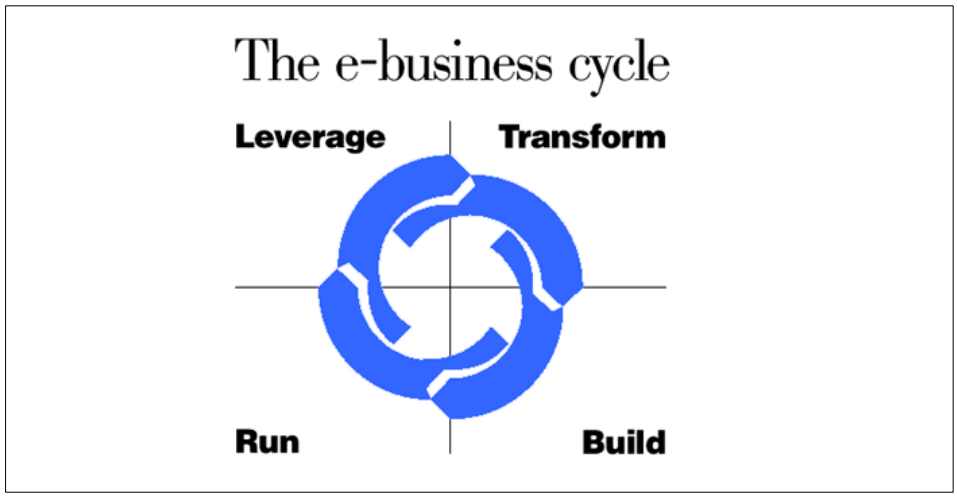


Figure 1-7 The e-business cycle

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

- **Transform core business processes**: This stage 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 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 businesses 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 that are all handled in a secure, manageable way. The iSeries 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. It 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 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 1-8) shows the variety of 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 company's valuable data. This data is not only valuable for the actual business, but also for suppliers (for example, production or inventory information) and customers (for example, order status or support).

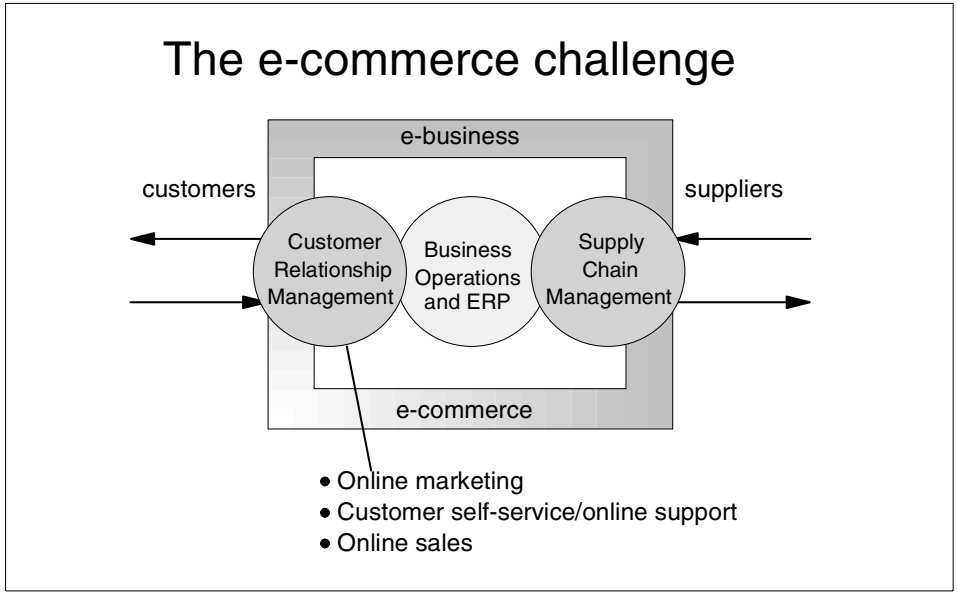


Figure 1-8 End-to-end solution model

For iSeries customers, this data is typically almost entirely housed on an iSeries server, 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, and so on), 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

CRM involves supporting, developing, and retaining profitable customers. It 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 back-end 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 back-end 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 obtain 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. 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 information, funds transfers, and others provided by e-business; and 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, just-in-time (JIT) 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 access 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 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 update all 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 in which these applications run 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, an so on.
- **Interoperability among systems**: Synchronization of updates, real-time currency, sharing of data, common business rules, and so on.
- **Availability around the clock**: Continuous access to data, workload management, redundancy, backup 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, and 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 iSeries server fares in the e-business game

To put it simply, it fares 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 iSeries server what it is today. They continue to be the value propositions that make it such a good e-business server.

It makes sense that if your business data and applications are on your iSeries, “Web-enabling” those applications and providing access to that information should be done directly from your iSeries.

The IBM Framework for e-business provides the iSeries server 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 the iSeries server? Let us explain the top advantages that the iSeries 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 stand-alone firewalls, security appliances, and security options in both hardware (routers and hubs) and software.

  The iSeries server 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) and supports Secure Sockets Layer (SSL) and virtual private network (VPN) natively. SET Secure Electronic Transactions support is available with the WebSphere Payment Manager V2.2 (5733-PY2) and is ready to integrate with your own applications in addition to secure e-commerce engines like WebSphere Commerce Suite. And last but not least, there has never been a known virus on the iSeries server.

- **Reliability and availability:** These benefits are key because e-business solutions are 24x7 operations, and downtime equals lost money and customers.

- **Scalability:** 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 iSeries strength because of its modern architecture. The iSeries server delivers up to a 24-way processor, over 18.9 TB of disk capacity for data, up to 128 GB of “memory” on a single machine, and over 330 times the 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, with features like Management Central, part of Operations Navigator, you can easily manage multiple iSeries servers centrally. The iSeries server can also integrate Windows NT applications through the Integrated xSeries Server for iSeries, 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 iSeries server is everything except an old system. The iSeries 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 iSeries server is now ready for the next step – 128-bits, without disruption.
- **Logical partitioning (LPAR):** Released in OS/400 V4R4, LPAR allows one iSeries server to have multiple server functions running at the same time (requiring at least one processor 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 iSeries server offers a broad range of capabilities, sometimes underestimated or, even worse, unknown. Through extensive development, the iSeries server has optimized OS/400 for running complex, multi-threaded Java applications that are coming to market. The iSeries server also supports the WebSphere Application Server (WAS), which lets ordinary Web servers run Java servlets on the iSeries server with links to DB2 Universal Database for iSeries (DB2 UDB for iSeries).

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

Because of this, the iSeries performs very well in Java-related benchmarks. For a white paper on the subject, please see:
http://www.iseries.ibm.com/whpapr/jbob400.htm

- **Cost of ownership**: With scalability, security, and reliability built in from the ground up, the iSeries platform is designed to enable you to conduct business-to-business and business-to-consumer Internet transactions. The iSeries delivers all those things for the lowest total cost of ownership. For more information, refer to the following sites:
  - http://www.idc.com/
  - http://www.metagroup.com/

Clearly, the iSeries 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 iSeries server supports the latest enabling technologies for e-business. In combination, these qualities make the iSeries server a good choice for not only extending existing applications, but also for deploying new solutions that require attributes that are iSeries standard features.

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 tends to evolve through phases:

- Phase 1: Web presence
- Phase 2: Dynamic site
- Phase 3: Transactional site
  - Business to customer (B2C)
  - Business to business (B2B)

2.1 e-business development model

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 for the classic B2C, and then move on to a dynamic site.

Figure 2-1 provides a high-level overview of the three phases, including the typical functionality for each phase.

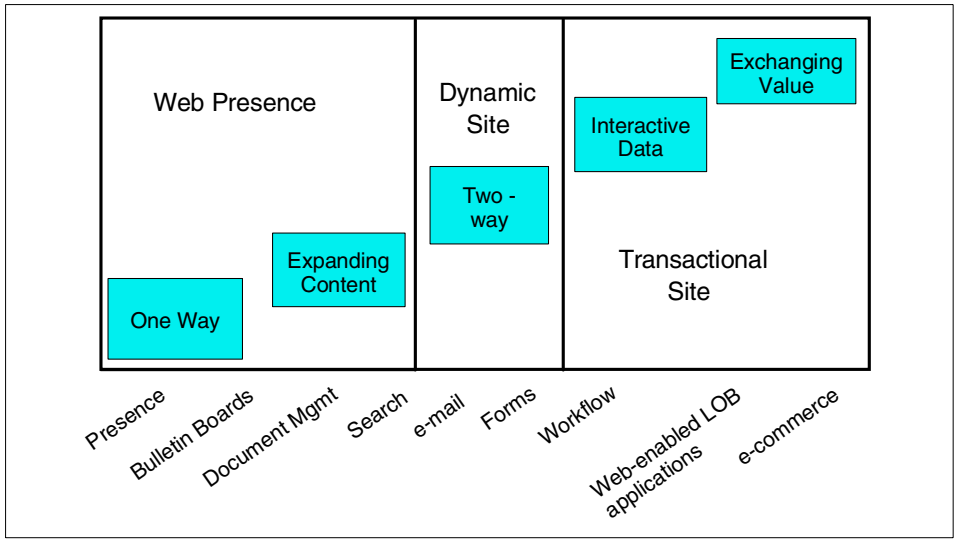


Figure 2-1 Overview of the e-business evolution phases

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 2-2 illustrates a high-level view of the technology presented at each of the three phases of e-business.

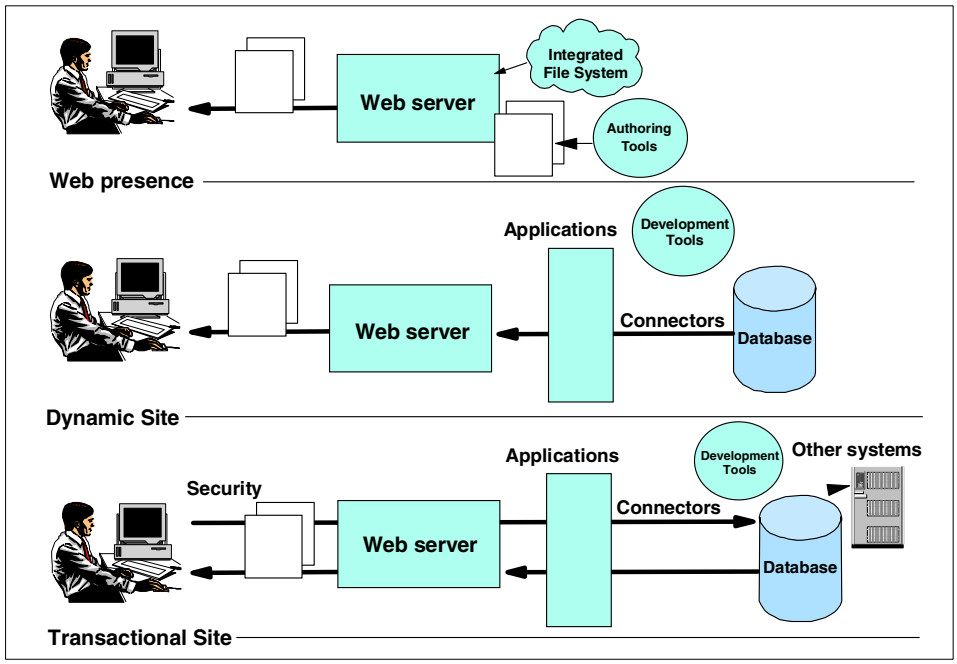


Figure 2-2 Technology overview of the phases of e-business adoption

The phases in Figure 2-2 are further explained here:

- **Phase 1: Web presence**: Users interact only with a Web server, and the 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.
- **Phase 2: Dynamic site:** Users interact with databases, and the Web server and the users can 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.
- **Phase 3: 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 (SSL, TLS, SET and so on). Transactions now occur, and the business needs to manage a variety of systems management and integration issues.

2.1.1 Phase 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 2-3 shows which products support Web presence technology. To draw Figure 2-3, we simply took the horizontal Web presence view of Figure 2-2 on page 31 and drew it vertically, adding the details of the products available on the iSeries to support your Web presence.

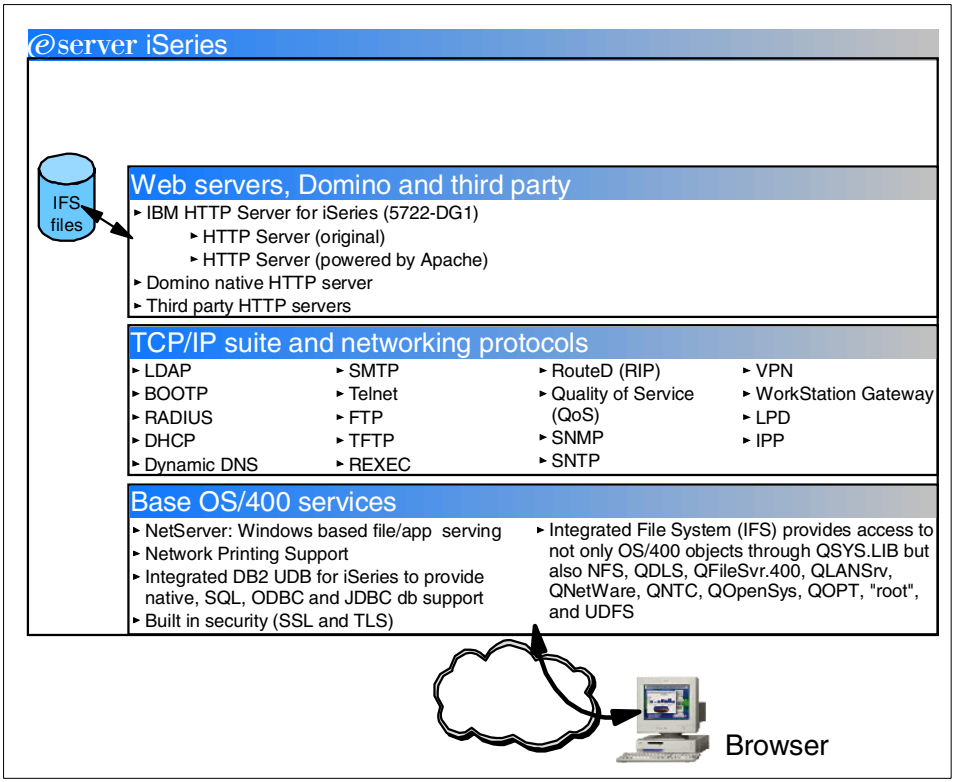


Figure 2-3 Phase 1: Web presence products view of e-business adoption

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.

To support a Web site, you must have the integrated support of the base operating system and a TCP/IP suite of networking protocols. We list a few of the functions and features of OS/400 and its built-in TCP/IP support that allows you to serve Web pages with confidence.

An example of one of the integrated support features in OS/400 to support your Web presence is Secure Sockets Layer (SSL), which allows you to encrypt your data (not always necessary in this Web presence phase) to protect it from harm as it passes through public networks.

2.1.2 Phase 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 2-4 shows which products support dynamic site technology.

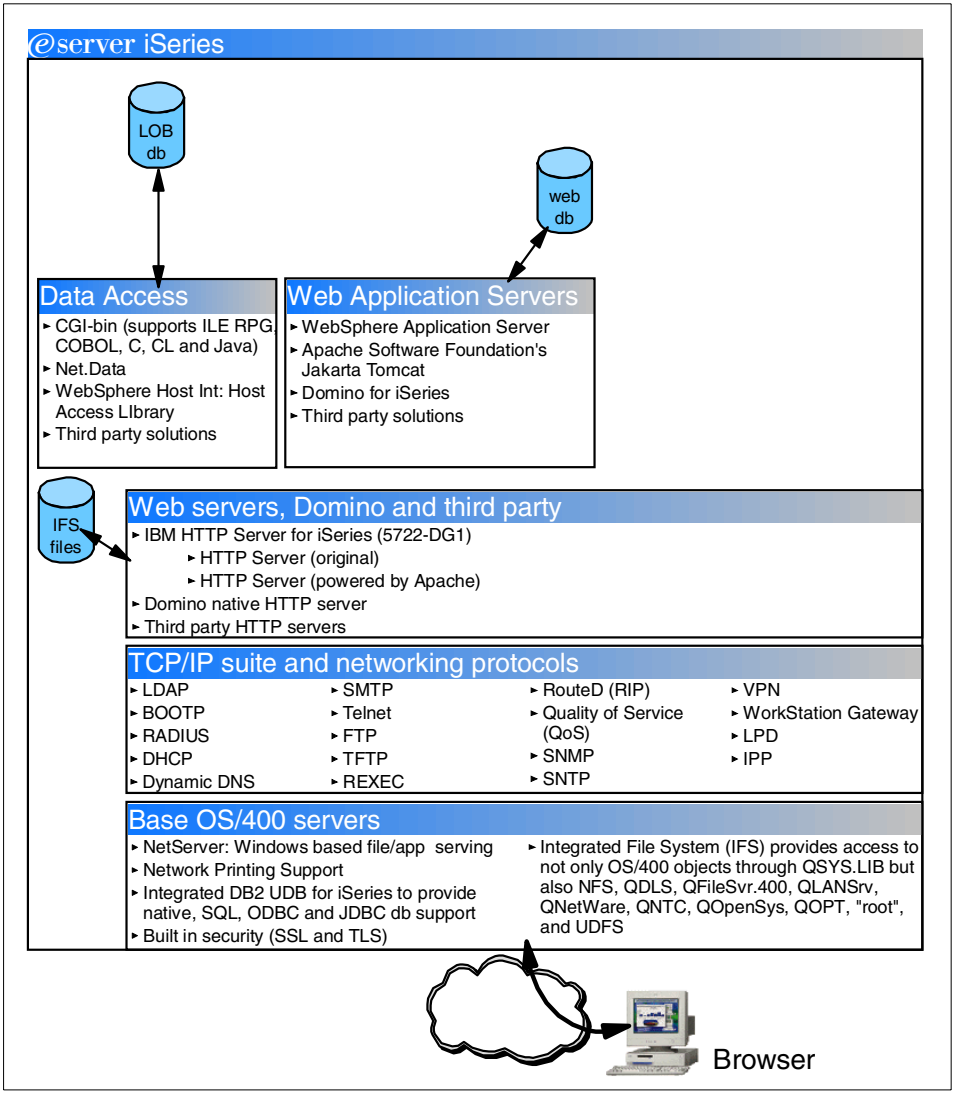


Figure 2-4 Phase 2: Dynamic site products view of e-business adoption

Notice that the tools to support a dynamic site reside above the HTTP server. That is, you must have a solid HTTP server foundation upon which to create your new e-business applications.

Data access to your line-of-business (LOB) data can be provided by applications written (in most any iSeries language) to the CGI-bin programming interface. In addition, IBM provides Net.Data to allow you to write scripts to generate HTML with dynamic content, often automatically extracted out of your LOB databases directly.

More complete and sometimes more complex applications can be created using Domino, WebSphere Application Server, or other third-party solutions. These all allow you to map an incoming request from the HTTP server (originally from the user sitting at the Web browser) to an application that will dynamically generate content from just about any database or program.

2.1.3 Phase 3: Transactional site

With a transactional site, the user can interact with information, for example, order a product or fill 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 2-5 shows the products that support transactional site technology.

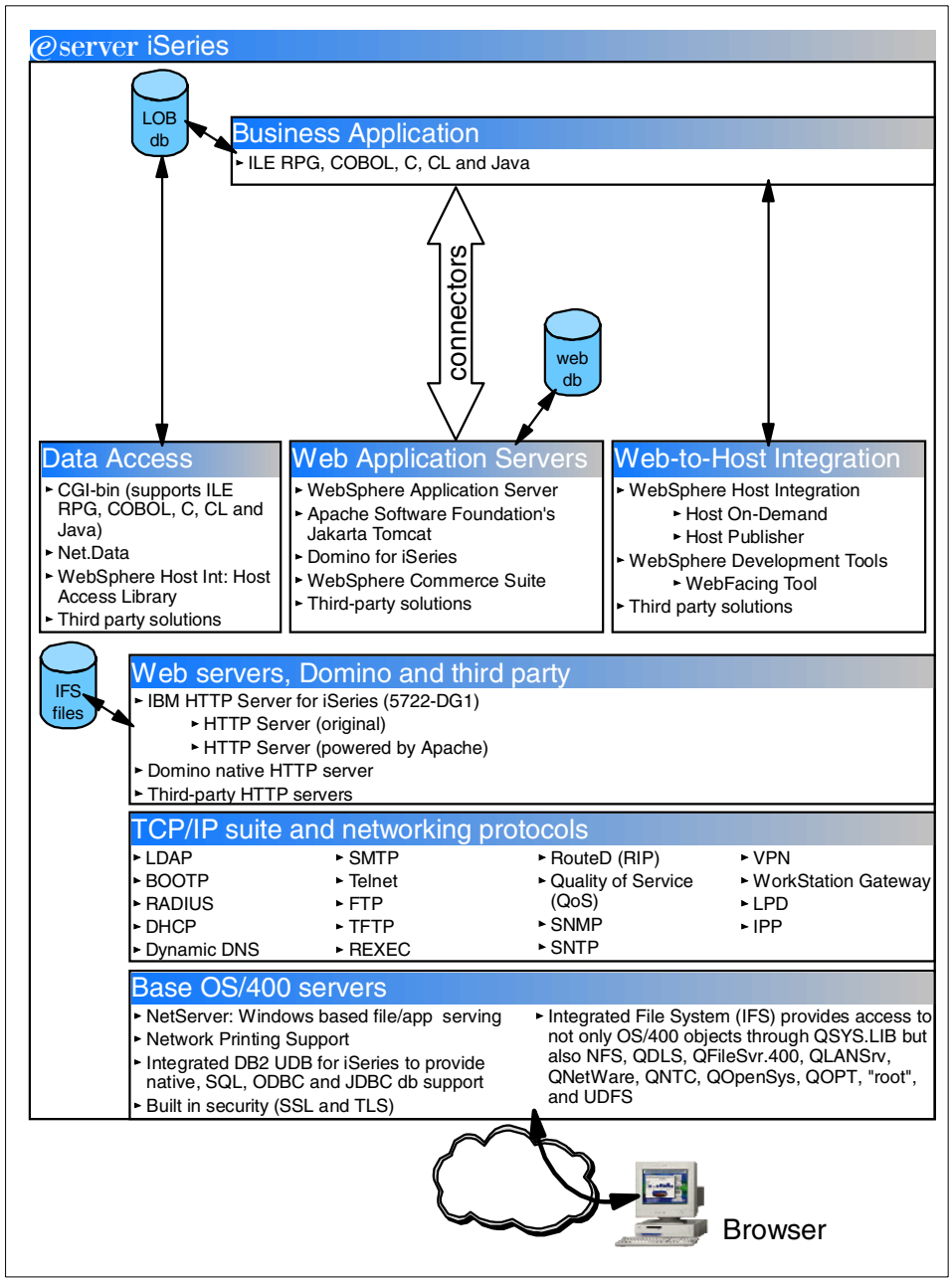


Figure 2-5 Phase 3: Transactional site products view of e-business adoption

In this transactional site view of products, you can see the additional software tools (or middleware) that will support your advanced requirements.

Web-to-host Integration's focus is on preserving existing LOB business applications data, logic, and programs. Nothing you can write today will perform as well as an application that has been tried, tested, and improved over the past decade.

In addition, powerful connectors are available to tie Web Application Servers (which are perfectly tailored to the programming environment of HTML and HTTP) and your existing business applications. Such connectors include the IBM Toolbox for Java, MQSeries, eXtensible Markup Language (XML), and other solutions.

IBM provides numerous e-business products for iSeries 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 IBM Redbook discusses these technologies and products in detail so you can understand the IBM suite of offerings and apply the appropriate technology to your situation.

Part 2

OS/400: Built for e-business

While other systems were working hard at being a good game platform, OS/400 was being built for business applications.

While other systems were touting fast floating point operations and clock speeds, OS/400 was focussed on a balanced server transactions.

While other systems have made entire applications obsolete when moving from 16 to 32, and 32 to 64 bits, OS/400 has made the transition to 64 bits (years ago) without all the fuss.

OS/400 is built for e-business. Let's study it (Chapter 3, "OS/400: Your foundation for e-business" on page 41), and two very valuable Licensed Program Products (LPPs) (Chapter 4, "TCP/IP: Fundamental to the network computing paradigm" on page 89, and Chapter 5, "The Web server: The core to your e-business" on page 105) that are free with your purchase of OS/400.

3

OS/400: Your foundation for e-business

Source: Study by IBM Server Group, June 2001.

An economic slowdown hasn't stopped the e-business movement from picking up steam according to a recent IBM study. The report conducted by the IBM Server Group, which looked at 33,000 companies of various sizes around the world, found that 93% use the Internet for e-business. Nearly 80% use the Web only for simple tasks. But, as concluded in the study, some of the more Internet-savvy companies are using the Internet for online commerce or supply chain management applications, online marketing and sales, and Web services to automate business processes.

The iSeries server has tremendous availability and reliability features coupled with a wide variety of integrated OS/400 products making it the e-business @server of choice.

3.1 OS/400 (5722-SS1) overview

The iSeries hardware and OS/400 base functions make up a rock solid base for e-business. The optional Licensed Program Products (LPPs) further enhance this package. The rest of this chapter describes the available functions and features.

3.1.1 V5R1 packaging

Figure 3-1 shows the V5R1 base and optionally charged products for the iSeries server. It shows that the base OS/400 for the iSeries provides a very solid e-business platform with additional popular e-business tools for successful e-commerce on the iSeries platform.

Another way to look at Figure 3-1 is from the bottom up. With your purchase of OS/400, you receive many functions and features that make it an outstanding server for e-business. For example, a suite of TCP/IP applications like Telnet, SMTP, and FTP, come with the TCP/IP Connectivity Utilities for iSeries (5722-TC1), which is shipped with the same media as OS/400. In addition, two very powerful and full function Web servers are included, the HTTP Server for iSeries (original and powered by Apache) (5722-DG1).

In addition, the “No charge” box in the middle represents a set of very powerful, separately orderable features that further extends the value of OS/400.

And, the top of Figure 3-1 shows other middleware that can be integrated with OS/400 to increase the functionality that will make your journey to e-business easier.

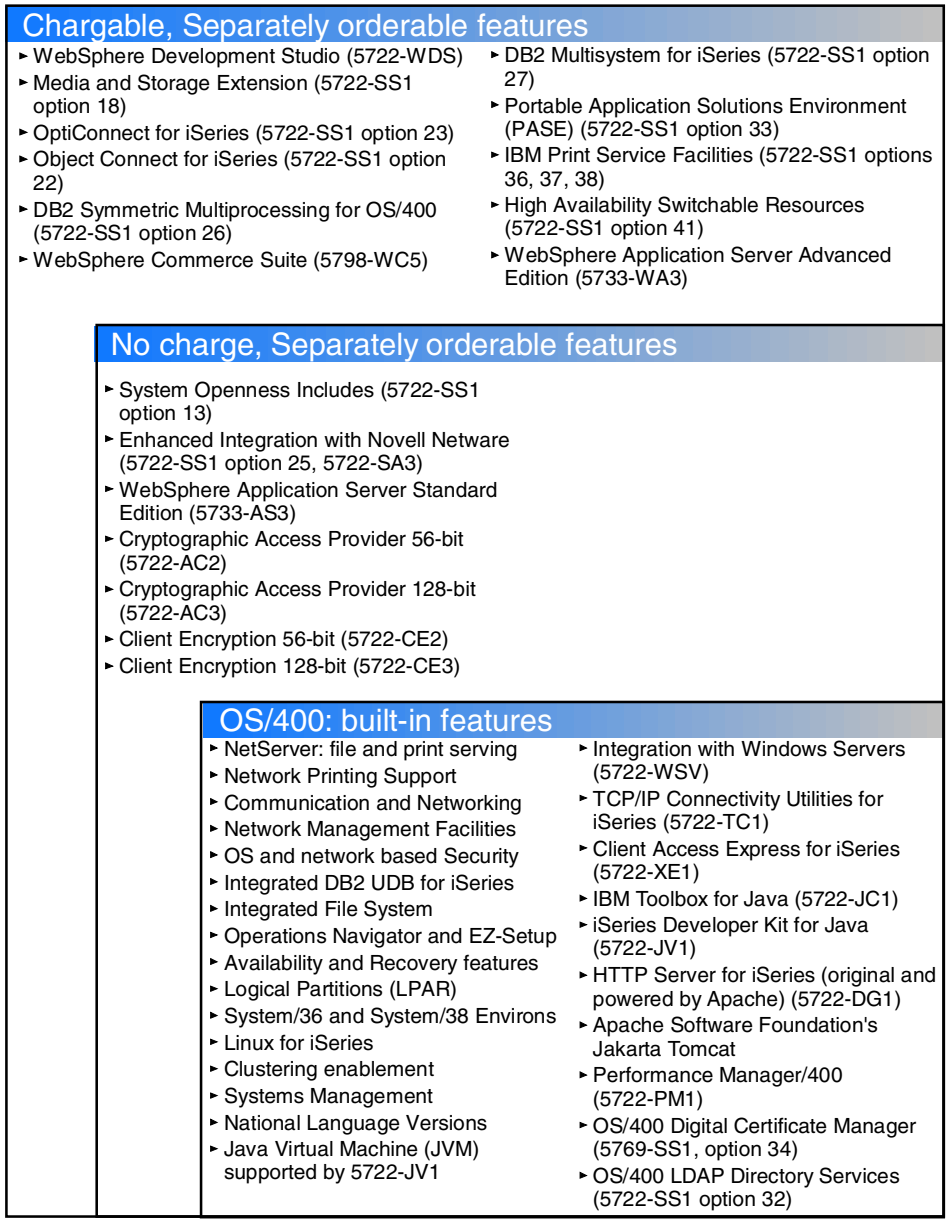


Figure 3-1 OS/400 V5R1 e-business packaging

In addition to the base and optionally charged features listed in Figure 3-1 on page 43, there are more e-business related products and features, such as Lotus Domino and Linux, which are discussed later in this book. For information on Lotus Domino, see Chapter 7, “Domino Application Server for AS/400 (5769-LNT)” on page 153.

3.1.2 iSeries: The flexible server

There are many different paths toward a complete e-business solution. Figure 3-2 shows how the iSeries server is flexible enough to incorporate a wide variety of different products and functions while at the same time broadening its platform-base to other operating systems such as Linux and application environments for AIX using PASE (Portable Applications Solutions Environment). There are a wide range of tools available to help you set up your system as a Web application server, and create the Web client (browser) interface and the back-end server portions of the applications. There are tools available to help you connect your existing RPG (or any high-level language like COBOL, for example) back-end applications to your Web browser front end. WebSphere Application Server, HTTP server, TCP/IP, Lotus Domino, and WebSphere Commerce Suite are a few of the tools that are discussed in this book.

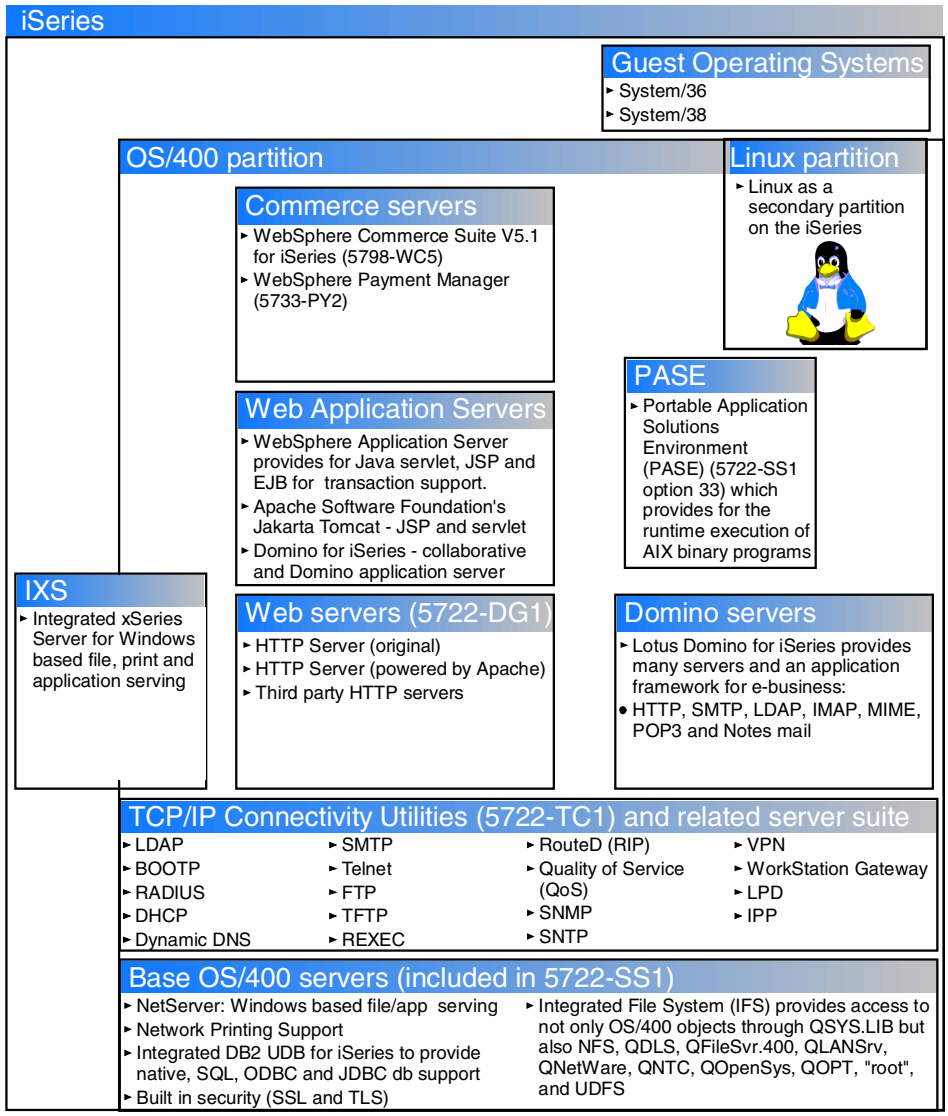


Figure 3-2 iSeries: The flexible server

3.1.3 Communication and networking

OS/400 offers many integrated capabilities and functions that enable communications with a variety of IBM and non-IBM systems, either in batch or interactive modes. Worldwide standard TCP/IP or the traditional SNA hierarchy, as well as SNA peer networks and SAA standards, are supported and offer the user the greatest flexibility possible in network design now and in the future. The iSeries platform also supports TCP/IP and SNA together over frame relay.

Many network protocols are supported by OS/400. This support provides a basis for integration of customer business systems, and therefore, business solutions. Here is a list of some of the iSeries servers support protocols and networks:

- 1 Gbps Ethernet
- 100/10 Mbps Fast Ethernet
- IBM Token Ring 100/16/4 Mbps Network
- ATM 155 Mbps LAN
- X.21
- X.25
- ISDN Data Link Control (IDLC)
- T1/E1/J1 and Fractional T1 Networks (high bandwidth)
- Asynchronous
- Binary Synchronous
- Synchronous Data Link Control (SDLC)

OS/400 includes the following communication facilities:

- TCP/IP Support (see Chapter 4, “TCP/IP: Fundamental to the network computing paradigm” on page 89)
- Advanced Peer-to-Peer Networking (APPN)
- SNA/SNADS
- Autodial Support
- 3270 Device Emulation
- ISDN Support
- File Transfer Support
- IPX/SPX Communications

All of these facilities are part of OS/400. Other communication facilities are available as licensed programs, such as IBM Communications Utilities for iSeries. See Figure 3-1 on page 43 for details of the OS/400 components.

Network computing

The network computing capabilities of the iSeries server allow electronic business to be carried out over the Internet and intranets. The following functions of the OS/400 operating system play an integral part in network computing:

- Support for an unlimited number of Lotus Domino Servers for iSeries V5.01 (5769-LNT)
- Support for Lotus Enterprise Integrator for iSeries (5769-LNP)
- AS/400 Developer Kit for Java is optimized for use in an iSeries environment (5722-SS1 and 5722-JV1)
- IBM Toolbox for Java (5722-SS1 and 5722-JC1)
- Network Security integrated into OS/400
- Lightweight Directory Access Protocol (LDAP) integrated into OS/400
- Digital Certificate Manager
- Virtual Private Networks
- Network Management Facilities

Several communications and systems management functions are available to manage the iSeries servers. Some are integrated into OS/400, and some are separately-priced features. These functions help manage and control local systems and distributed systems that may operate within a network controlled by a host System/370 or by another iSeries server. The functions that are available for the iSeries server are:

- Systems Management in TCP/IP Networks
- Alerts support to NetView, System/36, System/38, and iSeries
- Distributed System Node Executive (DSNX)
- Management Central Pervasive (see , “Pervasive computing” on page 81)

3.1.4 Web-enabling functions

This section discusses the Web-enabling functions of OS/400, such as the WebSphere family, HTTP servers. These topics are discussed later in more detail.

The iSeries server contains numerous tools to enable your applications to the Web including:

- IBM HTTP Server for iSeries, including both the original server and one powered by Apache
- Apache Software Foundation's Jakarta Tomcat provides a JSP and servlet application server environment when used with the HTTP Server (powered by Apache)
- WebSphere Application Server, Standard Edition
- WebSphere Application Server, Advanced Edition high-performance EJB server
- CGI-bin and Net.Data support
- WebSphere Commerce Suite and Payment Manager

- 5250 Gateway and emulator
- Webserver Search (formerly known as NetQuestion)

The iSeries server is a perfect fit for the Java platform, not only for development itself, but also for runtime. A Java-compatible Java Virtual Machine (JVM) is integrated under the iSeries Technology Independent Machine Interface (TIMI) to optimize Java software performance. Java programs are compiled into platform-independent object code interpreted by the run-time support (JVM) on each platform. OS/400 V5R1 includes Java Toolbox and the Java Development Kit, which provide the starting tools.

JVM is the centerpiece of the Java platform. It is the Java “engine”. The JVM is responsible for running Java programs on any given hardware or software and is platform-dependent. Every company that wants to implement Java on any given platform must implement Java on their hardware or software platform. The JVM generally includes these components:

- Class loader
- Bytecode verifier
- Bytecode interpreter
- Garbage collector
- Java Native Interface (JNI)
- Other miscellaneous components

3.1.5 Security

The iSeries 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 Digital Certificate Manager (DCM). Virtual Private Networking (VPN) support (L2TP, IKE, IPSec) is the key technology to protect data in business-to-business relations. In fact, OS/400 has sufficient integrated features to be a firewall in itself. VPN is discussed in 3.3.18, “Virtual private network” on page 74.

You can find more useful information on this topic in the redbook *IBM @server iSeries Wired Network Security: OS/400 V5R1 DCM and Cryptographic Enhancements*, SG24-6168.

3.2 OS/400 V5R1 new functions and enhancements

V5R1 was a major new software version that provided new LPAR functions, Linux support, and many other new e-business features that we will discuss later. Table 3-1 shows a summary of the V5R1 new products and enhancements and points you to the sections in the book where these topics are discussed in greater detail.

Table 3-1 V5R1 new and enhanced functions

New function or enhancement	Description	Reference
DB2 UDB for iSeries	Additional e-business functions and performance enhancements.	3.3.2, “DB2 UDB for iSeries (5722-SS1 base)” on page 53
Netserver	Enhanced so that the iSeries can operate as the logon server for Windows clients.	3.3.12, “NetServer: File and print serving” on page 64
Linux	An added application environment that provides the leading open source operating system.	3.3.14, “Linux” on page 68
Virtual LAN	Provides 16 independent high speed Internet bus-to-bus communication paths between logical partitions over TCP/IP.	3.3.15, “Virtual LAN” on page 70
PASE	Improved function for porting UNIX applications to iSeries; now provides 64-bit support for AIX Version 4.3.3.	3.3.16, “OS/400 Portable Application Solution Environment (OS/400 PASE, 5722-SS1 option 33)” on page 70
TCP/IP	Dynamic Domain Name System and Network Quality of Service are the newly supported features.	3.3.17, “TCP/IP Connectivity Utilities (5722-TC1)” on page 73
Java	Support for three versions of Java, all having been enhanced functionally and for improved performance.	3.3.19, “Java” on page 76

New function or enhancement	Description	Reference
High Availability for Switchable Resources (HSL Clustering)	HSL OptiConnect is much faster and lower cost than SPD OptiConnect. Switchable disk with switchable independent ASPs offers a way to switch applications and data to a backup system to keep the data constantly available. V5R1 offers support only for IFS files.	3.3.10, “High Availability Switchable Resources (5722-SS1 option 41)” on page 59
Integration with Windows Server	iSeries is enhanced at V5R1 with additional Windows server integration facilities.	“Integration with the Windows server” on page 63
PSF/400 and Internet Printing Protocol (IPP)	Provides Web-enabled worldwide print support.	3.3.20, “Print Services Facility/400 (5722-SS1 options 36, 37, 38)” on page 77
Operations Navigator	Offers twice the growth in advanced graphical user interface functionality and many new setup wizards.	3.3.21, “Operations Navigator” on page 79
Management Central Pervasive and Pervasive Computing (PvC)	Leading-edge capability to manage multiple systems via an Internet-capable phone, Personal Digital Assistant (PDA), or Web browser.	, “Pervasive computing” on page 81 and , “Management Central Pervasive” on page 83
LPAR	Server consolidation focus that allows multiple copies of OS/400, plus Linux, on a single system. Reduced or eliminated IPL requirements when changing LPAR configurations and resources.	3.3.13, “Logical partitioning (LPAR)” on page 67
Wireless Capabilities	This built-in feature enables B2B solutions and connects mobile devices to core business solutions with XML enablers built into OS/400.	3.3.22, “Wireless capabilities” on page 81

New function or enhancement	Description	Reference
OS/400 Directory Services, provided by Lightweight Directory Access Protocol (LDAP).	Supports IBM Tivoli Directory Version 3.2 providing distributed functions support for products such as WebSphere, Policy Director, MQSeries, and the HTTP server. LDAP is now built into the OS/400 base.	3.3.25, “Lightweight Directory Access Protocol (5722-SS1 base)” on page 86

3.3 OS/400 base and optional features

Table 3-2 lists the V5R1 base and optional products that aid in fully supporting a complete e-business solution on the iSeries platform.

Table 3-2 OS/400 base and optional features

Product name	Product number	Option number	Release	Ordering
OS/400	5722-SS1	base	V5R1	B N/C
UDB DB2 for iSeries		base	V5R1	B N/C
LDAP		base	V5R1	B N/C
System Openness Includes		13	V5R1	S N/C
Media and Storage Extensions		18	V5R1	S C
OptiConnect/400		22, 23	V5R1	S C
DB2 Symmetric		26	V5R1	S C
DB2 Multisystem		27	V5R1	S C
PASE		33	V5R1	S C
Print Services Facilities/400		36, 37, 38	V5R1	S C
HA Switchable Resources		41	V5R1	S C
iSeries Integration for Windows Server	5722-WSV		V5R1	B N/C
TCP/IP Connectivity Utilities for iSeries	5722-TC1		V5R1	B N/C
WebSphere Application Server for iSeries (Standard)	5733-AS3		V3.5	S N/C

Product name	Product number	Option number	Release	Ordering
WebSphere Application Server for iSeries (Advanced)	5733-WA3		V3.5	S C
HTTP Server for iSeries (including Apache)	5722-DG1		V5R1	B N/C
IBM Toolbox for Java	5722-JC1		V5R1	B N/C
iSeries Developer Kit for Java	5722-JV1		V5R1	B N/C
Performance Manager/400	5722-PM1		V5R1	B N/C
iSeries Client Access Express for Windows	5722-XE1		V5R1	B N/C
Key: B = Base option of OS/400 S = Separately ordered option or product N/C = No charge feature				

3.3.1 OS/400 base

OS/400 is a 64-bit operating system that runs on all iSeries RISC models. OS/400 with its base functions provides ease of implementation, management, and operation in one totally integrated object oriented operating system.

Several products are included as part of the base OS/400. Some appear as separate products in the “Software Resource Listing”, but it is not necessary to order these products separately. Some of the products included as part of OS/400 base are Client Access Express, Java, HTTP Server, and TCP/IP Connectivity Utilities. The following functions are supported in the base operating system as either no charge or chargeable options:

- Single integrated operating system for all models
- Advanced GUI management
  - Easy setup of the system
  - Setup and management of the TCP/IP function
  - GUI database functions
  - User and printer job administration
  - System management
  - Software distribution
  - Performance monitoring
  - Centralized management of multiple systems
  - Plug-in GUI support for Domino, BRMS, and others

- Network computing
- Integrated file system support
- Logical partitions
  - Different versions and releases of OS/400
  - Linux
- Clustering and shared resources
- High system availability
- Client/server support
- Integrated DB2 Universal Database for iSeries
- Transaction processing
- Batch processing
- Ease of installation, use, and maintenance
- Extensive run-time application function
- Openness standards
- Systems management
- Electronic Customer Support
- Comprehensive security for system resources
- Interfaces to system functions
- Printed output support
- Multiple operating environments
- Connectivity to remote devices, systems, and networks
  - Office host services
  - National language versions and multilingual support

3.3.2 DB2 UDB for iSeries (5722-SS1 base)

DB2 Universal Database (UDB) for iSeries is fully integrated into the OS/400 operating system software. It does not appear as a separate product or option of 5722-SS1. DB2 UDB for iSeries offers state-of-the-art database functions and open-systems standards based technology, while providing the maturity, stability, and ease of use that has become the trademark of the iSeries server.

The iSeries server can be used for both traditional, transaction processing and decision support and data warehousing applications. Advanced parallel processing and advanced query optimization techniques support queries of large decision support databases.

An integrated iSeries database offers many advantages. As an integrated part of OS/400, DB2 UDB for iSeries is installed with the system providing automatic startup and recovery functions when the system is IPLed. Integration also allows the database commands and display interfaces to have a look and feel that is consistent with the rest of the system. For example, database objects are automatically included as part of the system-wide cross reference facilities and

the basic system administration commands for save, restore, security, and object management can be used to administer the database. This allows the database to exploit new system functions and hardware for improved availability, recovery, security, concurrency, and performance as they are introduced.

Conformance to industry database standards, advanced functions, and distributed data capabilities with supporting performance allows DB2 UDB for iSeries to operate equally well with centralized database applications, or as the database server in complex heterogeneous client server networks. The DB2 UDB for iSeries unique combination of function and reliability make the iSeries the ideal database server for many customers' needs.

V5R1 enhancement

Application flexibility, in terms of porting existing applications and the development of new applications, has been greatly enhanced in V5R1. New SQL statements and database functionality make it much easier to port SQL-based applications to and from the iSeries server. The improved DB2 functionality that allows business logic to be embedded in the database also simplifies the time it takes to develop new e-business and business-to-business applications.

The main DB2 UDB enhancements at V5R1 are:

- *Enhanced support for database triggers*
- *User-defined function using Java*
- *SQL enhancements*
  - *SELECT...FETCH FIRST n ROWS ONLY extension*
  - *Enhancements for LIKE predicate*
  - *New RIGHT OUTER JOIN support*
- *Large Object data size increased to 2 GB*
- *Non-distributed table size increased to 1 TB*
- *DRDA application server support of procedures with result sets*

For more information on DB2 UDB and the V5R1 enhancements, go to:
http://www-1.ibm.com/servers/eserver/iseries/db2/db2v5r1annc.htm

3.3.3 System Openness Includes (5722-SS1 option 13)

The functions in System Openness Includes are based on industry standards from Portable Operating System Interface (POSIX) and the single UNIX specification. These standards enable source code portability of applications over platforms such as OS/400, OS/2, AIX, MVS, and other non-IBM operating systems.

Pthread (POSIX-based) APIs are included in OS/400 as option 13 System Openness Includes. They allow Business Partners or iSeries application developers to take advantage of new system support for kernel threads. Creating an iSeries thread is faster than creating an iSeries job and is a more efficient way to spin off portions of application or server processing into parallel tasks.

The Pthread APIs are based on open APIs described in the ANSI/IEEE Standard 1003.1, 1996 Edition (also known as ISO/IEC 9945-1: 1996) and the Single UNIX Specification, Version 2, 1997 standards.

Note: These APIs shipped as PRPQ 5799-XTH in previous releases.

3.3.4 Media and Storage Extensions (5722-SS1 option 18)

For software developers who want to customize their own storage management applications, Media and Storage Extensions provides an API to enable application monitoring and control of media usage, including volumes to be selected and volume expiration dates. The API also enables fast search for IBM 3480, 3490, 3490E, and 3575 tape drives.

An API is provided to handle the interruption that occurs when an application tries to open a database file that has been migrated to offline media. The API enables an on-demand recall of a database file from offline media to DASD and resumption of the application. Application changes are not required.

These APIs provide support to use or build applications to manage tape usage and the recall of data from offline media to DASD. This feature is a prerequisite feature when acquiring Backup Recovery and Media Services for iSeries (BRMS/400) (5722-BR1). It is also required when developing Hierarchical Storage Management (HSM) dynamic retrieval functions.

3.3.5 Object Connect for iSeries (option 22)

Object Connect for iSeries provides support to simply and efficiently move individual objects, entire libraries, or entire integrated file system (IFS) directories from one iSeries server to another over a standard communications connection or over a high-speed fiber optic bus. Systems can be connected via standard APPC (using APPN), TCP/IP communications lines (using AnyNet), or a fiber optic bus (using OptiConnect for iSeries). The economy of not requiring intermediate save file procedures and copies to distribution queues saves DASD and improves performance in a manner that is non-disruptive to system operations.

3.3.6 OptiConnect for iSeries (5722-SS1 option 23)

OptiConnect for iSeries provides high-speed transparent access to data through fiber optic bus connections and performance enhancements to iSeries Distributed Data Management (DDM).

The mechanism used by OptiConnect for iSeries to access database files on connected systems is modeled after DDM. Just as DDM uses a DDM file and APPC communications to redirect file access operations, OptiConnect for iSeries uses DDM files and a specialized transport service to redirect file access operations to a target system.

Because OptiConnect for iSeries operates only among systems sharing the same bus (connected with fiber optic cables), it can achieve transport efficiencies not possible with more general purpose, wide-area communications protocols.

With OptiConnect for iSeries, customers can offload the database application CPU cycles of up to 13 iSeries servers.

The major advantages of OptiConnect for iSeries are realized by customers who are rapidly approaching system capacity limits, or who intend to implement distributed database application servers within a data center or short-distance campus environment. Customers planning to implement distributed application servers can also benefit from using OptiConnect for iSeries.

When used with the Object Connect for iSeries facility, OptiConnect for iSeries provides a high-efficiency migration aid for the iSeries Advanced Series.

3.3.7 DB2 Symmetric Multiprocessing (5722-SS1 option 26)

DB2 Symmetric Multiprocessing for OS/400 expands on the parallel capabilities of DB2 UDB to improve the performance of the database for the iSeries server. This improved performance is critical, especially in a data warehouse or decision support environment. The performance gains allow for business decisions to be made in a timely manner.

DB2 Symmetric Multiprocessing for OS/400 further enables DB2 UDB for iSeries with symmetric multiprocessing (SMP) on any of the iSeries N-way systems. This form of SMP allows multiple database operations to take place simultaneously on multiple processors. Each database operation runs on a single processor, therefore, optimizing DB2 UDB for iSeries for online transaction processing.

With the availability of DB2 Symmetric Multiprocessing for OS/400, DB2 UDB for iSeries becomes optimized for decision support processing. DB2 UDB for iSeries is one of the few databases that can take full advantage of an SMP architecture for online transaction processing environments and decision support environments.

Parallel index build capability is included in DB2 Symmetric Multiprocessing (SMP) for iSeries. An index build can use multiple processors at the same time. Or in other words, it can work on multiple parts of the index in parallel. This allows significant performance increases in cases where an index is created or rebuilt. You can benefit from faster resolution of queries involving a join or group-by operation without needing to create and maintain indexes over the tables involved in the query.

Both SQL and native database interfaces are supported for queries. To achieve this parallelism with multiple processors, an individual query is split into many smaller sub-tasks. Each sub-task runs independently on a separate processor. Once the sub-tasks complete, the results of each sub-task are combined to form the complete query result. Because of single-level store architecture of OS/400, these sub-tasks efficiently process information on the behalf of a user query request. Queries involving table scans, index scans, joins, or group-by operations can realize the greatest performance benefit from SMP database parallelism.

DB2 Symmetric Multiprocessing for OS/400 can be configured differently for each user of the system. This allows a system administrator to have the greatest control over how parallelism is used on a system and therefore greater control over how system resources are used. Part of this enablement process allows the selection of just how much parallelism is used, or in other words, how many sub-tasks are used for each query. Using fewer sub-tasks than processors available allows a greater amount of the total system resources to be used by other users. Using more sub-tasks than processors available, allows an individual user to use more of the total system resources. This flexibility allows administrators to balance the needs of all system users with the available resources.

3.3.8 DB2 Multisystem for iSeries (5722-SS1 option 27)

DB2 Multisystem for iSeries allows multiple iSeries servers to be connected so the processing power and storage capacity of all the servers can be used. From a database perspective, these interconnected iSeries servers appear as a single large system. It is intended for use when iSeries servers are used for large data warehouse installations.

3.3.9 Enhanced Integration for Novell Netware (5722-SS1 option 25)

OS/400 Enhanced Integration for Novell NetWare provides NetWare client and integration services for iSeries users, operators, and applications. This is achieved using a Network Loadable Module (NLM) that runs on either NetWare 3.12 or 4.1x servers. It supports the NetWare servers regardless of whether there is an Integrated PC Server installed on the system. A license is required for each NetWare server.

TCP/IP support in OS/400 is used to connect the iSeries using a token-ring adapter, an Ethernet adapter, IPCS, X.25, or frame relay adapters. OS/400 Enhanced Integration for Novell NetWare provides user profile and password integration from the iSeries to NetWare. iSeries user or group profiles can be propagated to multiple NetWare Directory Services (NDS) trees or NetWare 3.12 servers. When iSeries users change their passwords, the change is propagated to NetWare.

IPX support in OS/400 is used to connect the iSeries server using a LAN adapter or a communications adapter using X.25 or frame relay services.

OS/400 Enhanced Integration for Novell NetWare provides iSeries to NetWare printing support. iSeries users' printed output is sent from an iSeries output queue to a printer queue managed by the NetWare server. OS/400 host print transform services are used to translate the output to print on common PC printers.

Integrated file system support is provided, which allows iSeries users, including Client Access users, and applications access to files and directories in multiple NDS trees or NetWare 3.12 servers throughout the network. Full integration with NetWare security ensures that each iSeries user of these services is fully authenticated in NetWare Directory Services or the NetWare 3.12 binders. Another use of the file system is to access files on NetWare servers to be served by OS/400 Internet connection support. At V4R3 and later, this is performed by the HTTP Server for iSeries.

Server configuration and management tasks can operate from iSeries interfaces. This is not intended to provide full management and operations of a NetWare server. However, iSeries operators can manage user connections and disk resources. Facilities are provided for creating/extending and mounting/dismounting volumes on NetWare servers.

Integration for Novell Netware (5722-SA3)

This feature provides support to run Novell NetWare 4.10 on the Integrated PC Server.

Note: You need to purchase the corresponding NetWare server software or license from a NetWare distributor.

The support allows the ability to install Novell NetWare on the Integrated PC Server. It also allows the iSeries disk to be used for NetWare file serving and enables the file, print, and application serving functions of Novell NetWare.

3.3.10 High Availability Switchable Resources (5722-SS1 option 41)

High Availability (HA) Switchable Resources provides the ability to achieve a highly available environment using switchable resources. The resources are physically switched between systems so that only one copy of the resource is required.

Option 41 includes support for:

- **Switchable independent ASPs**: Allow you to move the data to a backup system to keep the data constantly available. The data is contained in a collection of switchable disk units such as an I/O tower.
- **IBM Cluster Management Utility**: Allows you to create and manage a simple two-node, switched disk cluster. The utility includes wizards and help text to simplify the tasks involved in defining and managing the cluster.

To define switchable independent ASPs or to use the IBM Cluster Management Utility, OS/400 option 41, HA Switchable Resources is required. A valid license key for option 41 is required.

3.3.11 iSeries Integration for Windows Server (base as 5722-WSV)

Note: Integrated xSeries Server hardware is required for this feature to function. When a system upgrade occurs, this program is installed automatically on servers that currently have OS/400 option 29 installed. Option 29 is deleted when the system upgrade occurs.

In a single combination server, customers can run their mission-critical business applications on the iSeries server, while also running the Windows NT or Windows 2000 server for file, print, personal productivity, and other applications. Some advantages of running the Windows NT server on the Integrated xSeries Server for iSeries are:

- Flexibility for iSeries applications and Windows NT services in a combination server
- Improved hardware control and availability with reduced maintenance costs
- Simplified user administration and server operations

iSeries Integration with Windows Server enables Microsoft NT server version or Windows 2000 to be installed on the Integrated xSeries Server for iSeries. The product comes with OS/400 at no charge and is shipped automatically with OS/400. A separate license for the Windows operating system has to be purchased. The software installs as separately licensed program 5722-WSV.

Note: At V4R5, the software is included in OS/400 5769-SS1, option 29 (Integration with Windows NT Server), and it is 5722-WSV (Integration for Windows NT 4.0 and Windows 2000) at V5R1.

iSeries Integration for Windows Server has two options to allow an iSeries with multiple Integrated xSeries Servers installed to have a combination of servers with either Windows NT Version 4.0 or Microsoft Windows 2000:

- Option 1 allows support for the Integrated xSeries Server to run Microsoft Windows NT Server Version 4.0 or Microsoft Windows NT Server Terminal Server Edition Version 4.0.
- Option 2 allows support for the Integrated xSeries Server to run Microsoft Windows 2000 Server and Terminal Server Services.

Features

The features of iSeries Integration for Windows Server include:

- Integrated save and restore of Windows files from the iSeries.

  Save and restore capabilities of Windows servers enable individual file backup and recovery through the iSeries server. This support is enabled through the iSeries NetClient file system (QNTC) of the integrated file system. Incremental saving of files and the Windows registry associated with an Integrated xSeries Server for iSeries can be incorporated into an existing system backup procedure. The registry and files saved through this method can be individually restored if needed. Saving Windows server files in this manner can be used with full system save procedures for disaster recovery.

- Operations Navigator Support for Windows Server Management.

  Operations Navigator is the GUI for managing the iSeries server. It is enhanced to manage Windows servers installed on an Integrated xSeries Server for iSeries. You can start, stop, and display the status and properties of the server, which is installed with either Windows NT Version 4.0 or Windows 2000.

- Increased drive size.

  iSeries storage availability to the Integrated xSeries Server for iSeries is increased from 8 GB per drive to 64 GB per drive. The system drive remains at a maximum of 8 GB. The increase in storage size enables almost 1 TB of storage available per Windows server.

- System drive installation.

  The Windows server installation is enhanced to enable the system disk to reside on the C drive.

- Shared LAN adapter support is not available.

  For iSeries Models 8xx, 270, SB2, and SB3 servers, LAN adapters cannot be shared between iSeries and Windows servers on the Integrated xSeries Server for iSeries. The iSeries server and the Integrated xSeries Server each require their own LAN adapters if LAN connectivity is required for both environments.

- Integrated xSeries Server for iSeries hardware.

  The new Integrated xSeries Server for iSeries includes an Intel 700 MHz Pentium III processor and support for up to 4 GB of memory. The faster processor and increased memory capacity provide increased performance and capacity for Windows applications. This version of the Integrated xSeries Server is supported on the iSeries models.

The iSeries operator can start and stop the Windows NT server, improving server management in remote branch office and dealership installations. The system operator can also manage Windows NT disk resources, allocating disk space from the system's disk pool. The system operator can also better manage server operations since hardware error messages and event logs from the Windows NT server are sent to the system message queue. Maintenance costs are reduced compared to a PC-based server, since Integrated xSeries Server for iSeries maintenance charges are included in the iSeries server maintenance offering. iSeries integration with the Windows NT server allows customers to share hardware resources between the iSeries and Windows NT Servers. The iSeries CD-ROM drive and tape drives can be allocated to Windows NT for installing an application or for data backup. The CD-ROM drive can be concurrently switched among multiple Integrated xSeries Servers for iSeries and the iSeries servers. Multiple applications can access a CD.

Tape backup utilities written for Windows NT can back up data to the system tape drive. Both Windows NT Backup and Seagate Backup Exec Version 6.11 have been tested. Other backup utilities written for Windows NT are being tested. For the latest information on product testing, see:
http://www.ibm.com/eserver/iseries/windowsintegration/

iSeries integration with the Windows NT server provides simplified user administration of a combined network environment. Network operators can create both iSeries and Windows NT user profiles in a single step. Users can change their password on the iSeries server and have it automatically updated on the Windows NT server. An iSeries administrator can submit Windows NT commands directly to the Windows NT Integrated PC Server from the iSeries server with output returned to a job log, integrated file system, or spooled file. This saves the administrator from switching back and forth between the two systems. iSeries integration with Windows NT Server provides an internal connection between the iSeries and Windows NT Server. This internal TCP/IP link provides a reliable and secure connection for applications and database integration utilities between the two systems, protecting the application from local area network hub failures.

Prerequisites

An Integrated xSeries Server and a minimum of 64 MB of memory are required to install the Windows NT server. A PC screen, keyboard, and mouse must be attached to the Integrated xSeries Server to provide a console for the Windows NT server.

Integration with the Windows server

V5R1 enhancement

The iSeries is enhanced at V5R1 with additional Windows server integration facilities. These enhancements enable the iSeries to support larger and more complex Windows applications and offer additional tools to help reduce the cost of managing Windows server environments.

Attachment of n-way xSeries servers

iSeries supports the attachment of n-way xSeries servers via the High Speed Link. With the Integrated xSeries Adapter, select xSeries servers running the Windows 2000 server can be used to extend Windows application scalability, while retaining the storage consolidation and systems management advantages of the Integrated xSeries Server.

Enhanced hardware support

Enhancements for the Integrated xSeries Server includes support for:

- *Up to 32 servers on select iSeries models*
- *1 GB Ethernet LAN adapter*
- *iSeries DVD device*
- *Operations Navigator Support for Windows Disk and User Management*

Additional facilities are added to Operations Navigator to manage Integrated xSeries Servers and xSeries servers that are directly attached to iSeries via the Integrated xSeries Adapter. In addition to server management, Operations Navigator now supports disk and user management for these Windows servers. Enhancements include the capability to create, delete, copy, link, unlink, and show status for Windows server disks. Administrators can manage OS/400 user profiles that are enrolled into a Windows server environment.

Increased storage capacity and availability

iSeries Storage Area Network support for Windows servers has the following enhancements in V5R1:

- *The number of storage spaces that can be defined is doubled to 32.*
- *A storage space supports up to 64 GB of disk. Each Windows server can access approximately 2 TB of disk space.*
- *Up to 16 of storage spaces can be added without requiring a shutdown of the Windows 2000 server.*
- *Improved availability via Independent Auxiliary Storage Pools (iASPs).*

With the introduction of IASPs, additional availability options are available for the integrated Windows environments. Since the Windows operating system and data can be installed in an IASP, the storage spaces associated with Integrated xSeries Servers or Direct Attached xSeries servers can be switched to another iSeries server with a duplicate hardware environment.

Note: The Windows NT server (Version 4.0) or Windows 2000 is packaged, priced, and supported by Microsoft and must be purchased separately from a Microsoft dealer.

3.3.12 NetServer: File and print serving

iSeries NetServer is used to satisfy file and print serving needs for end users. NetServer unites the integrated file system and iSeries printers into the Microsoft Network Neighborhood. One of the many user benefits includes better control of user visibility to resources. The only directories or printers that can be seen by end users are those set up as “shared” by an administrator or resource owner.

NetServer brings the following additional benefits versus using built-in PC file and print serving functions, including:

- There are no background tasks (such as cwbuitsk, cwbnpred, cwbsvd, cwbbs), which previously used extra battery power on laptops.
- When using network drives to access integrated file system information or network printers to use iSeries network printers, these resources are visible to all end users on the iSeries server.

NetServer allows the administrator or owner of a resource to control its visibility to end users. Creating a “share” enables viewing of that resource. If no share exists, users do not see the directories or printers.

Desktop users can fully satisfy their file and print serving needs through the iSeries NetServer function. Therefore, all the file and print serving functions currently existing in the other iSeries Client Access clients have been removed from the Express client. To use the iSeries NetServer, only the client for Microsoft Networks (shipped with Microsoft 32-bit operating systems) with file sharing enabled need to be installed on the PC.

iSeries NetServer file and printer “shares” are easy to create, locate, and manage by using the Operations Navigator printer list and IFS list. The current file shares can be listed separately to make it easy to quickly explore the contents of a file share or map a drive to it. File shares support EBCDIC to ASCII conversion. The AFP Workbench Viewer is also provided so iSeries spooled files

(AFP and SCS) or PC files (such as GIF, TIFF, and JPEG formats) can be viewed directly by a PC user. The AFP Viewer provides many end-user productivity aids such as the ability to zoom in or search for specific portions of a stored document.

Network printing support

Distributed print support provides a connection to LAN-attached ASCII printers and support for Advanced Function printers. It also facilitates the distribution of printed output throughout iSeries networks. The iSeries server provides a seamless path for customers to direct printed output through an iSeries network and to other print servers. SNA or TCP/IP protocols (LPR/LPD and Internet Print Protocol server (IPP)) can be used to transport the spool file and its attributes to the remote system.

This integrated operating system function supports printing of text, images, graphics, barcodes, electronic forms, multiple fonts, logos, signatures, and more. As a result, it provides the basis for business solutions like business reports, preprinted forms, customer statements and invoices, and letters. Double Byte Character Set (DBCS) documents that enable printing of Chinese, Korean, Japanese, or Thai characters are also supported.

OS/400 supports IBM and non-IBM printers, which vary in price, function, speed, and use.

Host Print Transform

Most printers are designed to work with a specific data stream, so OS/400 includes a function to automatically transform the program-generated data stream to that required by the printer to which it is sent. It is not necessary for the application to generate the correct data stream; the system will automatically transform it as necessary at print time. Customization objects are provided for over 125 popular IBM and non-IBM ASCII printers, such as Hewlett Packard PCL, Lexmark PPDS, and HP LaserJet TIFF Packbit. An API brings the capabilities of Host Print Transform to the iSeries application developer.

Printer Load Balancing

Local and remote output queues permit more than one active writer, allowing spooled output on one output queue to be printed on multiple printers. In addition, a limit can be placed on the size of spooled files printed during a specified time period. With these features, large print jobs can be deferred to print during non-peak hours.

NetServer V5R1 enhancements

NetServer was enhanced at V5R1 in the following ways:

V5R1 enhancement

- *Logon*

  i*Series NetServer is enhanced so that the iSeries can operate as the logon server for a Windows clients. The iSeries can be used to authenticate logging onto Windows, provide the home directory, and logon scripts to the Windows user. In addition, Windows user profiles including Desktop, Start Menu, Favorites, and policies can be stored and retrieved from an iSeries server. A Windows NT or Windows 2000 server is no longer needed in the network to provide these functions.*

- *Profile management*

  iSeries NetServer has dramatically reduced the number of times that OS/400 user profiles become disabled due to Windows programmatically attempting invalid signons to access the OS/400 without compromising security. In addition, when users cause their user profiles to become disabled due to several attempts with different invalid passwords, iSeries NetServer provides new GUI support through a Disabled User IDs menu item off the iSeries NetServer menu of Operations Navigator to re-enable those user profiles. This support has also been made available through an API on OS/400. These changes can reduce the number of times that user profiles become disabled and improve the ease with which disabled users can be managed.

- *Password length*

  iSeries has enhanced the allowable characters in a password and the length of a password to be more compatible with Windows. This helps customers who prefer their Windows and iSeries passwords to match. iSeries NetServer also provides support for the NTLMV2 password hash that the Windows PCs can be configured to use to provide better password protection on the network.

- *User ID length*

  User IDs longer than 10 characters are now truncated to 10 characters instead of being rejected when checking for an iSeries user ID. Now a user ID, such as Administrator on Windows, would be the same as “administra” on the iSeries. This should help compatibility between Windows and iSeries user IDs.

- *NetServer Setup Wizard*

  A new iSeries NetServer Setup Wizard is now part of Operations Navigator that guides you through setting up your iSeries NetServer based on the types of Client Access clients being used. This new Setup Wizard also helps the user configure logon support.

- *Larger file size*

  iSeries NetServer now supports access of files larger than 2 GB in the integrated file system.

- *Better tracking of iSeries NetServer Sessions*

  Through Operations Navigator and APIs, a new Session Identifier can be used to allow better management and tracking of iSeries NetServer Sessions. This is extremely important in a Windows Terminal Serving environment where many users have sessions through a single Windows system. Now sessions can be ended or properties observed on single sessions rather than all the sessions coming from a single system.

- *Windows NT Background services*

  Windows NT Background services can now access the iSeries NetServer without user intervention.

- *Printer Shares*

  Printer Shares can now be published in Directory Services (LDAP) for use by Windows 2000 systems using Active Directory to find printers.

- *Performance*

  V5R1 brought various performance and scalability improvements to help customers consolidate file and print serving on an iSeries server.

3.3.13 Logical partitioning (LPAR)

Logical partitioning (LPAR) enhances the role of the iSeries as a consolidated server. LPAR is of value to customers who need server consolidation, business unit consolidation, mixed production, and a test environment, as well as integrated clusters. With LPAR, companies have both the power and flexibility to address multiple system requirements in a single machine.

LPAR lets you run multiple independent OS/400 instances or partitions (each with its own processors, memory, and disks) in an n-way symmetric multiprocessing AS/400e 6xx, Sxx, or 7xx and uni- or n-way on the iSeries 270 and 8xx models. It allows you to address multiple system requirements in a single machine to achieve server consolidation, business unit consolidation, mixed production and test environments, and integrated clusters.

Partitions have different system names and may have a different primary or secondary national language, or they may operate using different time zones. Each partition's system values can be set independently. This flexibility is ideal for banks and other multinational companies to centralize operations in a single

location, yet retain the national characteristics of each system. Logical partitions are ideal for companies to run mixed interactive and server workloads on a single iSeries. Logical partitions allow the interactive performance of an iSeries to be flexibly allocated between partitions.

V5R1 enhancement

OS/400 V5R1 introduces a new concept for logical partitioning that allows partitions to share partial processors. V5R1 supports up to four partitions per processor, which therefore opens up the uni-processor iSeries 270 and 820 models to be partitioned into four partitions. In addition, a 2-way iSeries Model 820 can support up to eight partitions (2 x 4), a 4-way iSeries Model 830 can support up to 16 partitions (4 x 4), and so on with a maximum of 32 partitions, whichever comes first.

With OS/400 V5R1 LPAR, the minimum processor allocation requirement to create a new partition is also reduced to one-tenth of a processor instead of a full processor for the iSeries servers only. This allows the primary partition processing requirements to be reduced to a minimum with the remaining processing units used up to support additional partitions.

One of the advantages of LPAR is resource movement between partitions. Processor, memory, and I/O resources can be moved between OS/400 and Linux partitions. On selected iSeries models, one-hundredth of a processor movement between partitions is supported. On iSeries models that support only dedicated processors, processor movement between partitions is supported in whole processor increments. Moving resources to or from a Linux partition requires the Linux partition to be restarted.

3.3.14 Linux

V5R1 enhancement

V5R1 delivered native support for the PowerPC Linux kernel, running in a secondary logical partition (LPAR) of OS/400. iSeries is an ideal server for Linux with its significant resource flexibility, scalability, availability, and ease-of-use attributes. Linux running inside an iSeries is easier to manage than multiple boxes. iSeries provides a fast pipe between hardware resources and applications, and OS/400 partitioning provides integrity across the system images. The beauty of iSeries is that, in addition to Linux, users can also deploy Java, UNIX, Windows 2000, and Domino applications, all on a single system!

With an OS/400 V5R1 primary partition, IBM has enabled Linux to run in a secondary partition. Multiple Linux partitions are supported. Each partition has its own Linux environment. These Linux environments can be different, for example, each partition could run a different Linux distribution.

The shared processor partitions (introduced at V5R1 and described in 3.3.13, "Logical partitioning (LPAR)" on page 67) can run OS/400 V5R1 and/or Linux. On other iSeries models, dedicated processors are required in the Linux partition.

Note: Moving resources to or from a Linux partition requires the Linux partition to be restarted.

What Linux brings to the iSeries server

IBM is committed to supporting your choice of platform and operating systems, a commitment we have extended to include Linux, the open-source operating system. Linux offers the following benefits:

- New generation of Web-based applications
- Provides flexibility and another choice of application environment
- A way for iSeries to capitalize on the open source environment
- Leverages Linux's virtual world-wide development team
- Encourages broad skill base to deliver iSeries-based solutions
- Leverages other IBM investments in Linux (hardware, software, and services)

What the iSeries server brings to Linux

iSeries has been enhanced to offer support for Linux at OS/400 V5R1. However, it already offers the following benefits:

- Reliable server: iSeries delivers excellent availability for a single server
- Scalable server: iSeries 1 to 24-way servers offer great scalability alternatives
- Resource sharing and management: iSeries implementation of Linux capitalizes on existing facilities to share resources: logical partitioning and the Integrated xSeries Server for iSeries
- LPAR provides failure isolation from other workloads
- iSeries can consolidate heterogeneous workloads with support for ILE, OS/400 PASE, Domino, Java, and WebSphere
- With over 700,000 shipments, iSeries is installed in commercial establishments around the world

Linux: The future

For a white paper about Linux and the iSeries, go to the home page at: http://www-1.ibm.com/servers/eserver/iseries/linux/ and then click **Linux on iSeries white paper**.

3.3.15 Virtual LAN

V5R1 enhancement

Virtual LAN is new with OS/400 V5R1. Virtual LAN provides 16 independent high speed internal bus-to-bus communication paths between logical partitions and supports TCP/IP protocol.

Virtual LAN provides the additional granularity to set up high speed communications between partitions by being selective on which partitions or applications within that partition are allowed to communicate with other logical partitions on the system. More importantly, it allows high speed bus-to-bus communication between OS/400 partitions and Linux partitions.

The enablement and setup of virtual LAN is easy and does not require an IPL or any special hardware or software. Once a virtual communications port is enabled for a given partition, a communication resource (CMNxx) is created for that partition. The user can then create a high speed 1GB Ethernet line description over this resource and set up TCP/IP configuration appropriately to start communicating to another platform. A maximum of 16 virtual ports can be enabled for high speed communications per partition.

Note: Virtual LAN does not require any additional software (other than V5R1 OS/400) or hardware and provides the ability to provide multiple communication paths between applications that are executed in each of the partitions.

3.3.16 OS/400 Portable Application Solution Environment (OS/400 PASE, 5722-SS1 option 33)

Note: PASE is a separately charged option of OS/400 at V4R5 and V5R1. The charge is minimal.

OS/400 PASE is a technology designed to expand the solutions portfolio of iSeries. It is an integrated runtime environment that simplifies UNIX application porting. It is integrated with the OS/400 file systems and work management. It exploits PowerPC's ability to switch runtime modes for applications. Plus, it has been enhanced to support AIX 4.3 64-bit application model and it is enabled for national language versions.

OS/400 PASE provides a broad set of AIX interfaces in a runtime that allows many AIX binaries to execute directly on the PowerPC processor of iSeries. The strategy for OS/400 PASE is to use the new technology to enhance and expand its solutions portfolio in specific industry and application segment targets.

OS/400 PASE is supported on all iSeries models as well as any AS/400e servers 6xx, Sxx, or later models. OS/400 PASE applications run directly on the hardware and take advantage of OS/400 services such as file systems, security and DB2 Universal Database. OS/400 PASE applications run in a normal OS/400 job and are managed using standard OS/400 operations and management facilities.

OS/400 PASE is not an operating system. It does not provide support for developing UNIX applications. Any changes or additions required to port UNIX applications to OS/400 PASE are compiled and linked on an RS/6000 workstation running a level of AIX supported by OS/400 PASE. Applications deployed using OS/400 PASE run in a normal OS/400 job and are managed using standard OS/400 operations. Serviceability, backup and restore, and other administrative tasks are performed using standard OS/400 operations and system management facilities.

OS/400 PASE contains the same Call Level Interface (CLI) set of APIs for DB2 UDB iSeries that is supported for ILE. Data returned from DB2 UDB iSeries can be presented in ASCII format, which is expected by the majority of UNIX applications.

OS/400 PASE applications can be fully integrated with other iSeries servers applications, for example, an ERP application implemented in ILE, a WebSphere application written in Java, or Lotus Domino. Figure 3-3 shows the structure of PASE. As you can see, a suite of applications can run together in a job mix or be separated into their own logical partitions, depending on the performance and scheduling requirements of the customer.

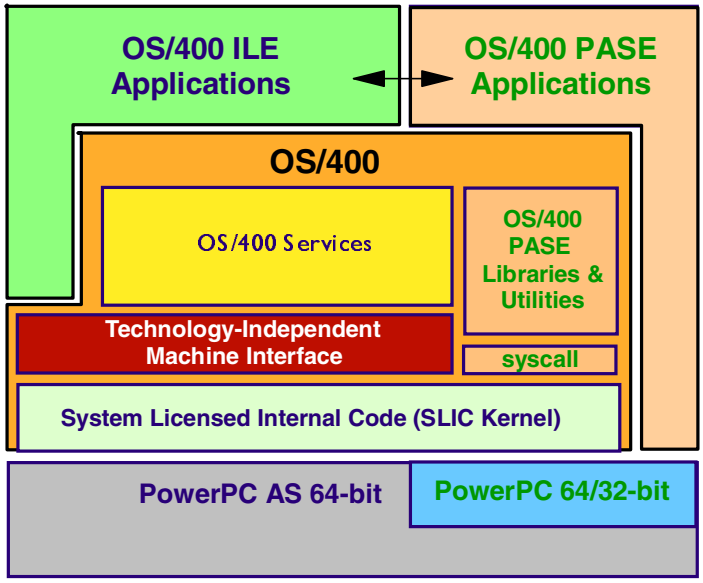


Figure 3-3 OS/400 PASE structure

V5R1 OS/400 PASE enhancements

V5R1 enhancement

The PASE enhancements in V5R1 include:

- *Support for the AIX 4.3 16-bit application model*
- *National language version (NLV) enablement including translated message catalogs for IBM-supplied runtime libraries and utilities*
- *Documentation for OS/400 PASE runtime, shells, and utilities in the IBM iSeries Information Center*
- *Header and export files for OS/400 PASE extensions now packaged with OS/400 PASE option 33*
- *SQL Call Level Interface (CLI) server mode support*
- *Additional locales, runtime APIs, and utilities*
- *Updated versions of the AIX C++ and FORTRAN language runtime libraries*

References

For more information about OS/400 PASE, see *Porting UNIX Applications using AS/400 PASE*, SG24-5970.

Or you can refer to the Application Factory – OS/400 PASE Web site at:
`http://www.iseries.ibm.com/developer/factory/pase/`

Point of interest: What kind of application would be ported to the iSeries server using PASE? You do not need to look any further than the new V5R1 Dynamic DNS. The code running on the iSeries at V5R1 is AIX binaries. With a graphical user interface provided by Operations Navigator, the Network Administrator cannot even tell the new DNS is running as a PASE application. See 4.1.12, “Dynamic Domain Name System (DDNS) server” on page 100, for more information.

3.3.17 TCP/IP Connectivity Utilities (5722-TC1)

The TCP/IP communication protocol function, along with related administration and configurations, is packaged with OS/400. TCP/IP applications, such as Telnet, Simple Mail Transfer Protocol (SMTP), File Transfer Protocol (FTP), Routing Information Protocol 1 and 2 (RIP), and LPR/LPD (remote print support) remain part of the TCP/IP Utilities. These TCP/IP Utilities are automatically shipped to all customers that order OS/400.

TCP/IP is fundamental to the network computing paradigm. Much of the new iSeries e-business infrastructure runs exclusively on TCP/IP, including Lotus Domino, Java, WebSphere Application Server, Web serving, and IBM Network Stations. Recent TCP/IP enhancements make iSeries an even more powerful e-business server.

V5R1 TCP/IP enhancements

V5R1 enhancement

TCP/IP Connectivity Utilities software enhancements in V5R1 include:

- *Domain Name System (DNS): Now reaches industry level BIND 8.2.3 and dynamic update capabilities (DDNS). Combined with enhancements made to Dynamic Host Configuration Protocol (DHCP), it allows configuration information to be sent dynamically to update the DNS.*
- *Network Quality of Service (QoS): The iSeries QoS functions for managing TCP/IP traffic provide the ability to drop, mark, and shape TCP/IP traffic based on the QoS policy to be applied.*
- *Performance and security enhancements to OS/400 File Transfer Protocol (FTP).*
- *Security and usability enhancements to SMTP.*
- *Security enhancements to OS/400 Telnet.*
- *Network Security and VPN: iSeries Virtual Private Network (VPN) support is enhanced to provide additional security, greater reliability, improved performance, and ease of use.*

- *VPN configuration:* Use the VPN wizard to set up and implement your network security policy.
- *Networking Software Management and System Setup (new in V5R1):* Several TCP/IP management enhancements in V5R1 give the network administrator more control when monitoring their TCP/IP network and troubleshooting networking problems. The enhancements include:
  - A graphical version of network status (NETSTAT) command to allow you to view interfaces, routes, and connections.
  - The ability to trace the route a TCP/IP packet takes through the network via the Trace TCP/IP Route (TRACEROUTE) command.
  - Address resolution protocol (ARP) cache monitoring. You can monitor and manage the ARP cache now.
- *Internet Setup Wizard:* The iSeries Internet Setup Wizard simplifies the steps required to connect your iSeries to the Internet and provide application and Web serving.
- *Point-to-Point (PPP) connectivity enhancements:* Operations Navigator enhancements improve the ease of use when configuring and managing PPP connectivity. DHCP can now be used to dynamically assign IP address to clients dialing into the iSeries server via PPP.
- *Support for Lightweight Directory Access Protocol (LDAP) Directories:* New support has been added to allow information about iSeries printers and NetServer print shares to be published into LDAP directories.
- *Internet Printing Server for iSeries:* The Internet Printing Protocol (IPP) defines an industry-standard method of delivering print jobs using Internet technologies providing for Web-enabled print compatibility around the world.
- *Multilink:* The PPP Multilink Protocol (MP) allows to group multiple PPP links together to form a single virtual link.
- *RADIUS:* RADIUS is the widely used standard for user authentication, authorization, and accounting. This, among many other things, can be used to assign IP addresses to clients dialing into the iSeries server via PPP.

See Chapter 4, “TCP/IP: Fundamental to the network computing paradigm” on page 89, for more information on TCP/IP enhancements.

3.3.18 Virtual private network

A virtual private network is an extension of your company’s private intranet over the existing framework of a public network. iSeries virtual private networking support is based on industry standards that include:

- IP Security Protocol (IPSec)
- Internet Key Exchange (IKE)
- Layer 2 Tunneling Protocol (L2TP)

The iSeries VPN solution applies to the following environments:

- **Intranets**: Secure connections within an intranet
- **Extranets or ValueNets**: Secure connections between intranets of different companies
- **Remote office or branch office**: Secure connections between intranets of the same company
- **Mobile workers**: Secure connection from a mobile worker, using different Internet Service Providers (ISPs) to an intranet

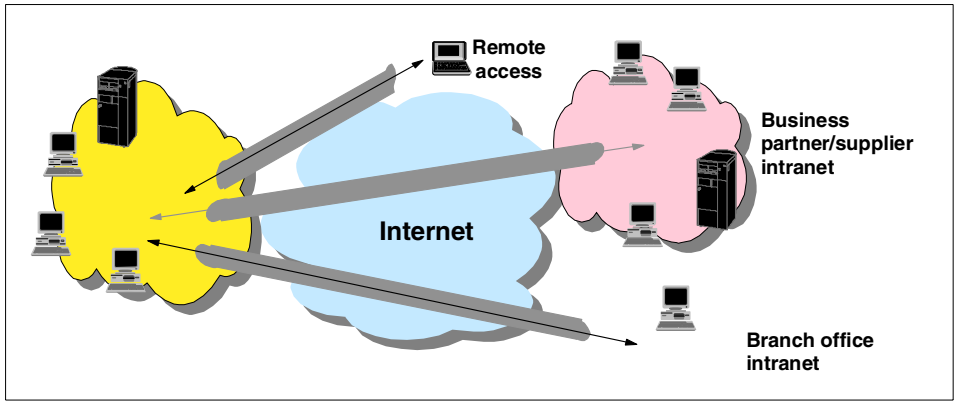


Figure 3-4 Virtual private network

V5R1 VPN enhancements

V5R1 enhancement

iSeries VPN support was first introduced with OS/400 V4R4. VPN has been enhanced at V5R1 to provide additional security, greater reliability, improved performance, and more ease of use. Operations Navigator has been redesigned to intuitively navigate VPN configurations, and you can use the VPN wizard to set up and implement your network security policy. Digital certificates provide a scalable and secure mechanism for cryptographic operations. With OS/400 V5R1, you can use them in your VPN configurations to authenticate the identities of the VPN endpoints. An integral part of iSeries VPN is IP Packet Filtering. In V5R1, this component is enhanced to allow filter activation and deactivation on a per-interface basis.

References

For more information, go to the iSeries Information Center at:
http://publib.boulder.ibm.com/pubs/html/as400/infocenter.html

On this site, choose your desired language and then select **Networking** -> **Networking Security** -> **VPN**.

You can also refer to the IBM Redbooks Web site at:
http://www.redbooks.ibm.com

3.3.19 Java

Java is a complete computing environment that reaches new standards for program portability and programmer productivity. Java provides an object-oriented programming environment that is dramatically simpler than C++. iSeries Java implementation provides improved scalability compared to other Java platforms and synergy with the iSeries object-based architecture.

A Java-compatible Java Virtual Machine (JVM) is integrated under the iSeries machine interface (MI) to optimize Java software performance. Java programs are compiled into platform-independent object code interpreted by the run-time support (JVM) on each platform.

Remote Method Invocation (RMI) is built into the iSeries Java software. It can be used to communicate with the IBM Toolbox for Java support running on any platform.

iSeries Developer Kit for Java (5722-JV1) and IBM Toolbox for Java (5722-JC1) are included with every OS/400 order of V4R2 and later.

Java includes these primary functions and capabilities:

- An Object-Oriented Programming Language, developed at Sun Microsystems
- A Java Virtual Machine (run-time environment) that can be integrated in Web browsers (such as Netscape Navigator and Microsoft Internet Explorer), and operating systems (such as OS/400)
- A standardized set of Class Libraries (packages) that support:
  - Creating GUIs
  - Controlling multimedia data
  - Communicating over networks
  - Accessing data in stream files and relational databases

There is also a Java “static compilation” option, designed for improved performance, that compiles Java into iSeries-dependent object code. Java's primary benefit is its ability to develop portable client/server applications using the Internet and intranets, whose “objects” can run on many different platforms in the same network.

A Java SSL package is included with OS/400 to leverage the integrated SSL function built into the iSeries server. You can easily build more secure client/server applications using Java. All data exchanged between the client and the server can be encrypted using the SSL protocol.

SQL is embedded in the Java programming language at V4R4 and later. Supported SQL statements include SQL data-manipulation statements to operate on data stored in tables in relational databases.

3.3.20 Print Services Facility/400 (5722-SS1 options 36, 37, 38)

Print Services Facility for OS/400 (PSF/400) provides support for high-function Advanced Function Presentation (AFP) electronic printing and print management of Intelligent Printer Data Stream (IPDS) printers. With AFP, application output can be transformed into fully graphical documents with electronic forms, image, graphics, barcoding, lines, boxes, and text in a wide variety of fonts. This flexibility enables the production of electronic documents that are more effective and enables the re-engineering of business processes.

Documents and reports can be produced using a variety of enabling tools, including the new Infoprint Designer for iSeries (5733-ID1). Other enabling tools include OS/400 printer file keywords (for front and back overlays, N-Up, and duplex), DDS printer files, iSeries page and form definitions, Advanced Print Utility (APU), and AFP Toolbox. Output created by network and client applications can be transformed to AFP and, therefore, managed by PSF/400 to IPDS printers. V5R1 includes new capabilities (Infoprint Server for iSeries) to handle PCL, PostScript, and PDF output with PSF/400 print management.

PSF/400 is the OS/400 subsystem driving the interactive management of IPDS printers. IPDS is a bi-directional print architecture that ensures that the printing process can be managed every step of the way. When an OS/400 writer is started to an IPDS printer, PSF/400 provides the following services:

- Establishes communication, query printer capabilities, and status
- Manages overlay, image, and font resources required in the printer
- Transforms the iSeries spooled file (from AFP, IPDS, or SCS) into a printer-specific IPDS data stream

- Manages the print process, including handling error conditions and managing error recovery down to the page level

The net effect of this level of print management is to ensure each page of each spooled file is printed completely and accurately. PSF/400 enables all parameters of the printer file and all DDS print keywords (subject to printer limitations). IPDS printing takes on added significance across the network. TCP/IP print support is much more limited than traditional AS/400 print management. The Send Network Spooled File (SNDNETSPLF) (LPR in TCP/IP terminology) simply sends a spooled file with limited instructions and no feedback as to whether it was received and printed correctly. Applying IPDS to a TCP/IP network restores the same level of print support (as described above) as twinax-connected printers. This includes sending standard SCS spooled files across the network.

To create an Intelligent Printer Data Stream (IPDS) printer on the iSeries server, you must create a printer device description with parameter IPDS *YES. Any printer defined as Type (*IPDS) and AFP (*YES) needs the Print Services Facility (PSF) of OS/400. Twinax connected IPDS printers may be defined as AFP(*NO) and, therefore, would not require PSF. Regardless of connection type, AFP (*NO) means that there will be no AFP resource management for fonts, images, or overlays. All IP-connected IPDS printers must be configured with AFP(*YES) and, therefore, require PSF/400.

The PSF feature of OS/400 required is based on the speed of the fastest printer measured in Impressions per Minute (IPM), not by the servers processor group. The number of printers is irrelevant; the speed of the fastest is the important factor.

PSF/400: V5R1 enhancement

V5R1 enhancement

PSF/400 has the following enhancements at V5R1:

- *Automatic e-mail of output (PDF) function.*
- *Infoprint server provides the PDF server functions and handles the transformation of iSeries output to PDF format. The start page group and end page group keywords in DDS (OS/400) provide the triggers for PDF segmentation (multiple PDF files from one input print file). The multiple PDF files can be e-mailed to different IDs. User exits provide for customization and address book lookup.*
- *Expanded page definitions for output formatting.*
- *HLL applications can output records of output data (via DDS) or classes of output data (Java) that flow to the new page definition record format interface. The new Infoprint Designer provides the design platform for creating page*

definitions so all of these changes in design and application interfaces integrate.

- *Changes in DDS page composition keywords to create page content, including:*
  - *Enhanced color specification (more than eight colors)*
  - *Color for line and box elements*
  - *Constant text can be "placed" on the page by position*
  - *Outline fonts support both horizontal and vertical scaling (that is, you can create short wide or tall thin characters)*
  - *Shading within boxes*
  - *Easier control of bar code size*
- *Improved management of TCP/IP-attached IPDS printers.*

There are three tiers of print speed range: 1-45 IPM, 1-100 IPM, and "anyspeed". Table 3-3 shows which OS/400 option number relates to which speed.

Table 3-3 PSF/400 options

OS/400 option of 5722-SS1	Description
36	1-45 Impressions per Minute (IPM)
37	1-100 Impressions per Minute (IPM)
38	Any Speed

Note: An unlimited number of printers within each tier is supported.

3.3.21 Operations Navigator

Operations Navigator provides a graphical interface to systems administration functions. It is designed to be highly integrated with Windows and is shipped as part of the Client Access Express family.

V5R1 enhancements

V5R1 provides AS/400 and iSeries customers with major advances in ease of use. Operations Navigator, the GUI for AS/400 and iSeries servers, has undergone a major expansion in this release. New areas covered by Operations Navigator include:

- *The Network folder (used to graphically configure and administer most all TCP/IP servers) has been redesigned and enhanced. See 4.1.1, "GUI configuration support" on page 90, for more details.*
- *Work management (active jobs, subsystems, job queues, memory pools)*
- *Backup and Recovery (BRMS GUI plug-in)*

- *Logical partitioning (LPAR)*
- *System values, including system comparison and update via Management Central*
- *Distributed user/group administration via Management Central*
- *Product and fix creation, distribution, and installation via Management Central*
- *Job and Message monitors*
- *Graphical Collection Services Data to show performance history*
- *More DASD management functions including creation and management of new Independent Auxiliary Storage Pools that can be switched between iSeries servers under new Operations Navigator - Cluster creation and management (Simple Clusters)*
- *Simple two-node cluster configuration*
- *Integrated xSeries Server: Windows user/group and disk administration*
- *Graphical command prompting*

Client Access packaging at V5R1

The iSeries Client Access Family (5722-XW1) is a product designed for customers accessing iSeries servers. The focus of iSeries Client Access is to bring all the power of the iSeries to the end-user desktop and to tightly integrate its software into the desktop environment on which it is running. The iSeries Client Access Family includes the following functions:

- IBM iSeries Client Access Express for Windows Client
- iSeries Access for Web
- WebSphere Host Publisher

Operations Navigator is an optionally installed component of the IBM AS/400 Client Access Express for Windows (5722-XE1).

Notes:

- Client Access Express ships with OS/400 at no charge. The PC5250 display and printer emulation and Data Transfer functions of Express require the iSeries Client Access Family (Product 5722-XW1). All other functions can be used without acquiring the iSeries Client Access Family (Product 5722-XW1).
- Starting with V4R4, enhancements to Operations Navigator are delivered in Client Access Express only.

References

You can find more information on Operations Navigator for V5R1 in the following Redbooks, which will be available in first quarter 2002:

- *Managing Your iSeries V5R1 with Operations Navigator - Volume 1*, SG24-6226
- *Managing Your iSeries V5R1 with Operations Navigator - Volume 2: Advanced Topics*, SG24-6227

In addition to these Redbooks, there is significant information about Operations Navigator within the V5R1 Information Center (http://www.ibm.com/eserver/iseries/infocenter) and Operations Navigator online help.

You can find more information on Client Access at:
http://www.ibm.com/servers/eserver/iseries/clientaccess

3.3.22 Wireless capabilities

The first wave of e-business solutions that have been developed during the past several years was primarily targeted the desktop environment, using the Internet as the backbone for deploying e-business solutions and services. A second wave of e-business solutions is being enabled by the emergence of the wireless Internet. This second wave of e-business will provide greater mobility and convenience to users of e-business solutions.

The wireless Internet is in its infancy, and the market opportunity is high. Competing standards are evident in the variety of wireless networking protocols being used for mobile computing solutions today. There is also a wide variety of mobile computing devices in use today. That number will likely continue to increase as more specialized form factors are produced for e-business solutions. All of these factors suggest that flexibility needs to be a key attribute of mobile e-business solutions; the ability to adapt to a technology landscape will continue to evolve.

Pervasive computing

The iSeries server provides a wide range of application enablement options for extending business solutions to pervasive and wireless devices. In addition to solutions from IBM, such as Management Central Pervasive, a number of IBM Business Partners for iSeries provide wireless solutions. The Business Partners include LANSA, Seagull, Jacada, and Advanced Business Link.

Pervasive computing is a common term that is applied to the set of solutions and technology aimed at leveraging the wireless Internet to gain application mobility. It is characterized by a variety of small, typically handheld, mobile devices used to access e-business solutions.

Some examples include:

- Cell or mobile phones
- PDAs (IBM Workpad)
- Pagers
- Wearable devices
- Your standard telephone

The primary goal of pervasive computing is to provide solution access to customers whenever and wherever it is required.

References

For more information, see the white paper “Salutation Service Discovery in Pervasive Computing Environments” at:
http://www-3.ibm.com/pvc/tech/salutation.shtml

Bluetooth

An all-American iSeries shop near you may soon be flying the Bluetooth flag. Bluetooth, a standard for connecting mobile phones and PDAs to computers over short-range wireless connections, was named after Harald Bluetooth, a tenth century Viking king of Denmark and Norway.

Although the specification is still in its infancy, products based on Bluetooth began hitting the market in Japan a couple of months ago. Such big vendors as Compaq, IBM, Hewlett-Packard, and Microsoft are building their own Bluetooth products. IBM already markets Bluetooth solutions for its ThinkPad line, and the IBM alphaWorks site offers the BlueDrekar (Drekar were the dragon-headed ships of the Vikings) protocol driver (middleware based on Bluetooth specifications), which you can download from:
http://www.alphaworks.ibm.com/tech/bluedrekar

Existing Bluetooth solutions can work with the iSeries without IBM building any support into the hardware or operating system. But so far, iSeries shops have shown little interest in the technology. Bluetooth is proximity-based, and connections can only be made within 10 meters. Therefore, the usefulness of connecting directly to an iSeries box over a Bluetooth connection is limited. Still, there are several ways iSeries users can put Bluetooth to work.

Users will likely have a client, such as a PC or mobile device connected to an iSeries server, to act as a liaison between iSeries and Bluetooth. For example, a wireless device might talk to a kiosk over Bluetooth, but the kiosk connects to an iSeries through more conventional means like TCP/IP. One iSeries shop in Washington plans to use Bluetooth only for PDA communication for their phones to use Management Central Pervasive, but no direct iSeries Bluetooth communication. For more information and a copy of this story, go to the iSeries Network at http://www.as400network.com/nwn/story.cfm?ID=10769 (requires username and password to log in).

Management Central Pervasive

Management Central Pervasive is shipped with OS/400 and based on the industry standard protocols Wireless Application Protocol (WAP) and Wireless Markup Language (WML). It allows iSeries operators to monitor their iSeries servers from a pervasive device. Using an Internet-capable cellular phone (mobile), a PDA with a wireless modem, or a Web browser, the administrator can monitor and manage iSeries operations. With V5R1, you can both monitor system messages and jobs and, now, manage jobs and run commands.

Management Central Pervasive allows one or more iSeries servers to be monitored and managed from a mobile device (cell phone or PDA) or desktop browser. Management Central Pervasive provides a subset of the total Management Central function provided with Client Access.

Note: The initial set of Management Central Pervasive function was delivered in October 2000. An enhanced set of features is available with V5R1.

V5R1 enhancement

A number of new features were added in V5R1 that extend basic monitoring functions to include the ability to take action to actually manage system behavior. The new features include:

- *The ability to monitor and control job level activity on one or more servers. This includes the ability to suspend, resume, or end jobs running on a monitored iSeries server.*
- *The ability to monitor message queues.*
- *The ability to submit commands for execution on one or more iSeries servers. Typically, this will be a command that has been predefined to Management Central, but the interface does not allow for entry of arbitrary commands from the phone or PDA interface.*
- *The ability to manage Integrated xSeries Servers associated with an iSeries server. This includes the ability to monitor status, startup and shutdown servers, and submit commands for execution.*

- *Support to restrict specific users to “read-only” operations supported by Management Central Pervasive. Read-only users would be able to monitor system status but would not be able to issue commands or manipulate jobs running on the system.*

3.3.23 IBM DB2 UDB XML Extender (5722-DE1)

Extensible Markup Language (XML) is one of the key technologies fueling growth of e-business and mobile e-business solutions. XML is becoming the standard way to represent data in a portable, reusable format for use in a number of solutions, ranging from B2B solutions that link together trading partners, to pervasive computing applications that connect mobile devices such as cell phones to core business solutions.

V5R1 enhancement

OS/400 includes a wide range of XML applications enablers with V5R1:

- *XML parsers (common building blocks) used to work with data in new Java and C++ applications*
- *XML parsing interfaces to extend enablement options to existing applications written in RPG, COBOL, and C*

IBM DB2 UDB XML Extender is a new iSeries licensed program (5722-DE1) that provides two-way data interchange between XML and DB2 relational database formats. It provides new data types to allow XML documents to be stored in DB2 UDB databases plus utilities to work with the new database formats.

3.3.24 Digital Certificate Manager (5722-SS1 option 34)

Digital Certificate Manager (DCM) has been enhanced at V5R1 in a number of ways. The DCM interface has been redesigned to make it easier to use for managing your certificates and the applications that use them. Also, there are several new advanced functions available for working with certificates.

The following list describes some of the more important functional digital certificate management enhancements:

- Object signing and signature verification certificates

  You can use DCM to create and manage certificates that you can use to digitally sign objects to ensure their integrity and provide proof of origination for objects. You can also create and manage the corresponding signature verification certificates that you or others can use to authenticate the signature on a signed object to ensure that the data in the object is unchanged to verify proof of the object's origination. You can also use DCM or the appropriate APIs to sign an object and verify the signature on a object.

- Application definitions

  You can now use DCM to create and update application definitions and manage the certificates that they use. This allows you to easily use DCM to manage certificates that applications that you write or obtain from other sources need for secure functions. You can define the type of application (server, client, object signing). Depending on the type of application, you can specify whether it performs CRL processing, requires client authentication, or requires a CA trust list.

- Certificate Revocation List (CRL) locations

  DCM now supports using CRLs to provide a stronger certificate and application validation process. You can use DCM to define the location where a specific Certificate Authority CRL resides on a Directory Services (LDAP) server so that DCM and other applications that perform CRL processing can verify that a specific certificate has not been revoked.

- Certificate store password reset

  You can now easily reset the password for a certificate store when necessary to prevent being locked out of the certificate store when the password is lost or changed and not communicated properly.

- Certificate renewal improvements

  Prior to V5R1, when you used DCM to renew a certificate from a public Internet CA, the renewal process required that you create a new certificate to replace the existing certificate. Now you can use the renew function to update the existing public Internet certificate itself.

- PKIX CA support

  You can now use DCM to obtain and manage certificates from CAs that support the newer Public Key Infrastructure X.509 (PKIX) standards by defining the location of the CA that you want to use. You can then use DCM to access the URL for the PKIX CA directly to obtain a certificate from the CA.

- IBM 4758-023 PCI Cryptographic Coprocessor support for more secure key storage

  If your system has a IBM 4758-023 PCI Cryptographic Coprocessor installed, you can use it to store your certificate keys more securely. When you use DCM to create or renew certificates, you can choose to store the key directly in the coprocessor or to use the coprocessor master key to encrypt the private key and store it in a special keystore file.

For more information, go to the iSeries Information Center at:
http://publib.boulder.ibm.com/pubs/html/as400/v5r1/ic2924/index.htm

3.3.25 Lightweight Directory Access Protocol (5722-SS1 base)

OS/400 provides a Lightweight Directory Access Protocol (LDAP)-accessible directory server and corresponding APIs that communicate with other LDAP directory servers. APIs are provided for both OS/400 and Windows applications written in Java, C, and C++. LDAP-enabled applications, such as Internet mail clients, can access, update, and manage the iSeries directory.

You can develop OS/400 applications to use LDAP for managing distributed information across the Internet and intranets using LDAP directories for both IBM and non-IBM platforms. iSeries user information, such as e-mail addresses, is accessible to mail clients and other LDAP applications.

Directory Services implements Tivoli Directory for OS/400. This provides support for LDAP V3. LDAP V3 includes support for internal characters (UTF-8), which supports national language data and is a mixed, multibyte codepage. LDAP V3 also provides support for dynamic schema where the schema is stored in the directory and is managed by the LDAP server. The schemas can be updated using the new Directory Management Tool, imported from a Lightweight Directory Access Protocol Data Interchange Format (LDIF) file, or from LDAP command line utilities.

Directory Management Tool (DMT) is used to administer directory contents and schema. DMT is a GUI tool used to manage LDAP directory content. It is part of the Windows LDAP client, which is included with iSeries Directory Services. Use the Directory Management Tool to:

- Browse the directory schema
- Add, edit, and delete object classes and attributes
- Browse and search the directory tree

Tivoli Directory schemas support the IBM standard object classes and attributes to enable your LDAP directory for applications using the IBM schema.

Simple Authentication and Security Layer (SASL) is supported and is a method for adding authentication support to connection-based protocols. The SASL External mechanism can be used to establish secure client connections that use SSL client authentication. The SASL CRAM-MD5 mechanism provides a one-way encryption mechanism to securely authenticate clients without incurring the overhead associated with SSL.

LDAP Directory Support: New in V5R1

V5R1 enhancement

New support is added to allow information about iSeries printers and NetServer print shares to be published into LDAP directories. This allows the user to write applications that query the LDAP directory for iSeries printer information such as a printer's location or capabilities. It also allows the user to configure iSeries printers directly on their Windows 2000 desktop by using the Add Printer wizard available in Windows 2000 and specifying that the information necessary to publish the printer must be obtained from the Windows 2000 Active Directory.

Note: With V5R1, LDAP has been included in the OS/400 base, but still shows as option 32 for backwards compatibility with all applications. In the future, we expect 5722-SS1 option 32 to no longer be displayed when using GO LICPGM, option 10 (Display installed licensed programs).

3.3.26 HTTP Server for iSeries (5722-DG1)

HTTP servers are the core foundation of technology at the heart of all e-business applications. They handle the communication with the client (typically browsers or XML-rendering devices such as palm pilots) and provide the entry point into server resources. These resources can range from simple HTML and GIF files to e-business and e-commerce applications, all the way to full-blown business-to-business, collaborative enterprises.

For the iSeries servers, network computing is supported with IBM HTTP Server for iSeries. An iSeries server can access a vast network of computers as if they were a single entity. Everyone and everything can access and distribute information, applications, and services provided by the network.

Two distinctly different Web servers are offered with the iSeries server:

- HTTP Server (original)
- HTTP Server (powered by Apache)

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

The HTTP Server (powered by Apache) is based on the open-source server code provided by the Apache Organization. This version is based on the “alpha” code for Apache Version 2.0. It will be updated as future Apache versions are made available. While the iSeries source code will not be published, IBM will offer the enhancements it develops to the Apache Organization in an open-source form for inclusion in the Apache server. The Apache server has been integrated into V5R1 OS/400 as 5722-DG1.

For details about the original IBM HTTP server and the powered by Apache server, see Chapter 5, “The Web server: The core to your e-business” on page 105.

3.4 References

For more information on Software Subscription, contact your IBM Sales Representative or Business Partner, or refer to the appropriate announcement letter.

You can find the announcement information for V5R1 of OS/400 at
http://www.ibmlink.ibm.com

First select your geography, and then click **Announcements**. Next, select **Announcements search** and search for all announcements for the day April 23, 2001.

You can find V5R1 information at:
http://publib.boulder.ibm.com/pubs/html/as400/infocenter.html

4

TCP/IP: Fundamental to the network computing paradigm

TCP/IP is an extremely popular protocol and is now regarded as the standard for computer networking. iSeries servers come with a complete and robust suite of TCP/IP protocols, servers, and services. It is easy to implement full-featured intranets by simply cabling iSeries servers and workstations together and starting the desired services. In most cases, no additional software or hardware is required.

Operations Navigator, the graphical interface to system administration, has been enhanced over the years making it the de facto way to configure and administer your iSeries TCP/IP network and server applications.

This chapter provides many TCP/IP related functions that run on iSeries servers.

4.1 TCP/IP Connectivity Utilities for iSeries (5722-TC1)

The TCP/IP Connectivity Utilities for iSeries (5722-TC1) has a rich suite of servers and services. This product is automatically shipped without additional cost to all customers that order OS/400. This section describes many of the product functions.

4.1.1 GUI configuration support

TCP/IP networking on the iSeries server is easier than ever to administer and manage the TCP/IP server from a single graphical interface. You can define Dynamic Host Configuration Protocol (DHCP), Dynamic Domain Name System (DDNS) servers, and many others directly from Operations Navigator running on a PC client.

iSeries TCP/IP configuration can be managed through all new graphical user interfaces that are now integrated with iSeries Operations Navigator. A graphical wizard is included that provides simplified step-by-step guidance for configuring TCP/IP. A service to centrally administer all workstation configuration data for IP networks is included with OS/400. This service is based on DHCP. iSeries server network administration has never been easier.

The TCP/IP protocol stack on the iSeries is tuned for robust, secure, and scalable TCP/IP services and servers. This results in significant capacity improvements for TCP/IP users.

Figure 4-1 shows just a portion of the TCP/IP configuration you can work with when using Operations Navigator.

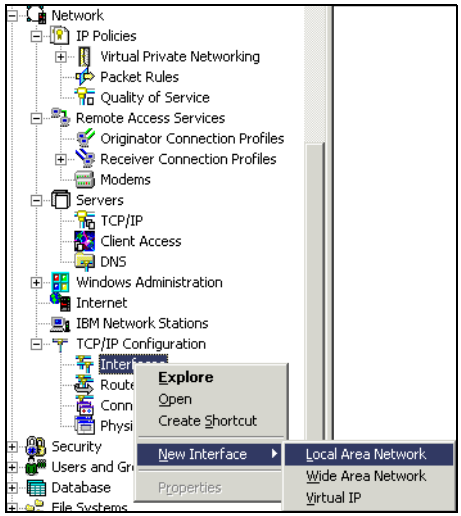


Figure 4-1 Operations Navigator configuration screen

New in V5R1

New TCP/IP configuration folders are available in V5R1 Operations Navigator. The following list shows the new folders:

- *Interfaces: Allows you to manage and configure TCP/IP interfaces, view the interfaces associated routes and packet rules, add new routes, and manage the ARP cache.*
- *Routes: Allows you to monitor the status of routes.*
- *Connections: Allows you to monitor the status of connections, connection jobs, and job logs.*
- *Physical Interfaces Activity: Allows you to monitor the activity of physical interfaces.*

On V5R1, Operations Navigator enhances the TCP/IP utilities such as:

- *Ping: Ping sends an Internet Control Message Protocol (ICMP) echo-request packet to a gateway, router, or host with the expectation of receiving a reply. A successful reply means that you have a working network connection. This function has been available since V4R5 in Operations Navigator. With V5R1, it is available as a utility for TCP/IP Configuration.*

  Figure 4-2 shows an example of how you can use the PING utility from Operations Navigator.

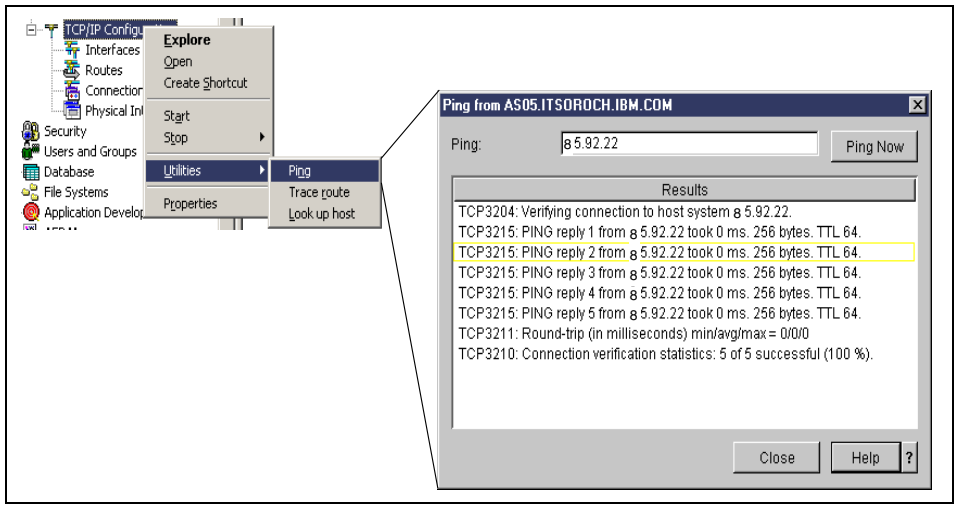


Figure 4-2 Ping utility

- *Trace Route: Trace route traces the route taken by IP packets to a user-specified destination system. The route can involve many different systems along the way. Each system along the route is referred to as a hop. You can trace all hops along the route, or you can specify the starting and ending hops to be traced. The route is traced by sending packets (called probes) to the destination system. Each probe contains an upper limit (called Time To Live (TTL)) on the number of hop systems through which the probe can pass. A route is traced by successively incrementing the TTL of the probe packets by one hop. The trace ends when a probe response is received from the destination system, or when the probe TTL value equals the maximum allowed (255). With Operations Navigator V5R1, Trace Route is available as a utility for TCP/IP Configuration. The Operations Navigator graphical user interface allows the trace route results to be shown in tabular fashion.*
- *Look Up Host: This function is also known as "NSLOOKUP" command. The Operations Navigator Look Up Host utility allows:*
  - *An IP address to be resolved to a host name*
  - *A host name to be resolved to an IP address*

As mentioned before, these utilities can be used from the Operations Navigator.

Network Quality of Service (QOS): New in V5R1

New in V5R1

In V5R1, iSeries provides the ability to control and manage TCP/IP traffic in the network and take advantage of the leading-edge networking QoS functions contained in routers and switches. The iSeries QoS functions for managing TCP/IP traffic provide the ability to drop, mark, and shape TCP/IP traffic based on the QoS policy being applied. In addition, QoS admission control capability is provided for controlling bandwidth management requests. The QoS functions supported are:

- *Resource Reservation Protocol (RSVP) including an iSeries RSVP agent*
- *RSVP APIs (X/Open standard APIs) for applications*
- *Differentiated Services (DiffServ)*
- *QoS policies based on the TCP/IP 5-tuple (Source IP address, Destination IP address, Source Port, Destination Port, and Protocol), address ranges, and wild cards. This support includes a policy agent, and a wizard-based GUI in Operations Navigator for configuring the QoS policies.*
- *QoS monitoring APIs and a GUI for monitoring the effectiveness of QoS policies*

4.1.2 Multi Protocol Transfer Network (MPTN): AnyNet/400

AnyNet/400 Sockets over SNA allow applications written to the sockets interface to communicate between iSeries servers in an SNA environment. AnyNet/400 provides this with little or no change to application programs. AnyNet/400 Sockets over SNA is compatible with AnyNet/2 and AnyNet/MVS and, therefore, provides connectivity to workstation and host environments.

4.1.3 Simple Network Management Protocol (SNMP)

Simple Network Management Protocol provides a means for managing an Internet environment. SNMP is used in each node of a TCP/IP network that is monitored or managed by an SNMP manager. An iSeries SNMP agent provides support for the exchange of network management messages and information among hosts. OS/400 supports Management Information Base II (MIB-II). The features included in SNMP for iSeries are:

- SNMP APIs for managing applications have the ability to manipulate management data via local or remote SNMP agents. Using AnyNet/400 support, information can be retrieved from systems on SNA or TCP/IP networks. This makes it easier to discover and manage potential problems anywhere within the network.
- SNMP agents are extendable, and APIs are provided that allow the dynamic addition of sub-agents to show additional information needed to make good

management decisions. OS/400 also supports a Host Resources Management Information Base (MIB) for hardware and software inventory of an iSeries server. Independent Software Vendors (ISVs) can use the SNMP APIs to write iSeries management applications to collect inventory data, monitor and change resources in the network, and perform a variety of other tasks. They can also write sub-agents that allow access to additional iSeries management information from management applications running on other platforms.

- The SNMP management function is split between two kinds of entities, named the “manager” and the “agent”. The SNMP agent function runs on the iSeries server and allows it to be managed by network management stations that have implemented the SNMP manager function. The OS/400 SNMP agent provides configuration, performance, and problem management data concerning TCP/IP to an SNMP manager. The Management Information Bases that are supported include:
  - MIB-II
  - Transmission Groups
  - APPN
  - Private
- Placing printers in a TCP/IP network on a LAN is common practice today. SNMP management gives you the option to send print files to those printers and manage responses from those printers in this network. This option is configured in the OS/400 printer device description and is based on the industry-standard SNMP. It supports SNMP printers that support the printer message information block (MIB).

4.1.4 Dynamic IP routing (RIP and RIP2)

Routing Information Protocol (RIP) is a dynamic IP routing protocol that communicates with adjacent routers, informing each other of their respective network connections. Dynamic routing protocols make network maintenance easier and improves network performance and reliability. The iSeries server includes both RIP version 1 and RIP version 2. Version 2 of RIP adds security and efficiency features.

4.1.5 Point-to-Point Protocol (PPP)

Point-to-Point Protocol is an open protocol for wide area network TCP/IP connectivity that can support both dial and leased lines. It can be used to extend an enterprise intranet across multiple locations. It is also the de facto standard for connecting to the Internet through an Internet Service Provider (ISP). PPP is a more robust alternative to Serial Line Internet Protocol (SLIP), when used as a

dial-up protocol. PPP ISDN support enables iSeries to attach to ISDN switched networks. Using PPP, the iSeries provides an excellent integrated solution for remote LAN access and as a remote office gateway into an organization's intranet.

New in V5R1

- *Operations Navigator enhancements improve ease of use when configuring and managing Point-to-Point connectivity. Significant enhancements in the functionality and GUI capabilities improve iSeries Point-to-Point connectivity.*
- *Multi-link Protocol (MP) allows multiple PPP links to be grouped together to form a single virtual link or bundle. The links that make up the bundle must be the same type, for example, all L2TP lines, all PPP analog leased, all PPP ISDN switched, etc. If a switched line connection is used, the PPP connection could be configured to use multiple links for one connection.*

  MP requires that MP support is implemented on both ends of a PPP link. MP can be implemented with both Originator and Receiver Connection Profiles. The benefits of MP include:

  – *Reducing the latency of data sent between systems by increasing the total effective bandwidth.*
  – *Increased reliability through the use of multiple lines. If a line fails, the link is maintained as long as one line in the MP bundle remains operational.*

  The ability to dynamically add and remove lines from a bundle allows bandwidth to be supplied as needed, making more efficient use of the bandwidth available.

4.1.6 Sockets and SSL support

Sockets programming uses the socket application program interface (API) to establish communication links between remote and local processes. The sockets API is located in the communications model between the application and the transport layers. The sockets API allows applications to interface with the transport or networking layers on the typical communications model. It is shipped as part of OS/400. The sockets API is part of the open environment on the iSeries server. The sockets API, along with the integrated file system, eases the effort that is required to move UNIX applications to iSeries servers.

New in V5R1

With V5R1, OS/400 now also supports Transport Layer Security (TLS). Support for TLS is the latest protocol and the industry-standard definition of Secure Sockets Layer (SSL) support.

The TLS protocol is an evolutionary upgrade of the SSL Version 3.0 protocol. TLS Version 1 and SSL Version 3 share the same basic record construction and line flows. TLS provides the same function as SSL and is compatible with SSL, but includes new features and clarifications for protocol flows. TLS helps standardize the SSL definition and implementation, making the SSL protocol more secure, and the specification of the protocol more concise and complete.

TLS support on the iSeries server allows customers continued access to take advantage of the latest technology implementation of Internet application security enablement in the industry. TLS support is automatically part of any SSL-enabled application, like HTTP and Telnet servers. Parameter values on the SSL APIs enable TLS for business partner and customer-provided SSL applications.

4.1.7 Virtual private networks

VPN allows you to make the transition from the traditional private network to the modern private network.

A VPN is an extension of your company's private intranet over the existing framework of a public network, such as the Internet. VPN technologies allow you to control network traffic while providing important security features, such as authentication and data privacy. This is typically achieved by defining a secure tunnel through which data flows in an encrypted form, and is indecipherable to eavesdroppers or hackers.

VPN provides convenience and security while allowing you to communicate with branch offices, Business Partners, and remote users at a cost equal only to your ISP fee.

In general, there are three types of VPN implementations that are well suited to most business needs:

- Branch office connections
- Business partner/supplier connections
- Remote user connections

For detailed information about VPN on iSeries, refer to 3.3.18, “Virtual private network” on page 74.

4.1.8 FTP client and server

FTP allows you to send or receive copies of files to or from systems across a TCP/IP network. FTP also provides functions for renaming, adding, and deleting files.

OS/400 TCP/IP supports the following FTP functions:

- Transferring database files of up to 1 terabyte (10^{12} bytes or 1,000,000,000,000 bytes).
- Transferring save files and members in physical files, logical files, distributed data management files, and source physical files.
- Transferring binary files “as is”.
- Using exit points to pass control to exit programs for anonymous FTP and security controls.
- Sending text files in EBCDIC format or converting them to ASCII (the default format).
- Creating and deleting libraries, files, and members using iSeries FTP server subcommands.
- Creating and deleting folders and directories using iSeries FTP server subcommands.
- Running FTP unattended in batch mode.
- Converting double-byte character set (DBCS) data from iSeries EBCDIC code pages to and from Internet ASCII code pages.
- Ability to transfer database files containing null field data.
- Support for popular graphical FTP clients and Web server development tools. This enhancement includes support for UNIX format file listings from the iSeries FTP server.
- Ability to use directories other than database libraries as the initial working directory for the iSeries FTP server.
- Options to create new database files using the system or user default CCSID.
- Ability to transfer files larger than 2 GB in all file systems that support these file sizes.

New in V5R1

In V5R1, some FTP functions are enhanced, such as:

- *New defenses for attacks*
  - *Support of SSL/TLS for the FTP server*
  - *Invalid password timer to slow attacks*
  - *Client and server assign random data ports (anti-port stealing)*
  - *Reduce the usefulness of Bounce Attack*
  - *Limited access to specific FTP operations*
- *Selectable subsystem for FTP server job*

- *Optimizations for better file transfer performance*
  - *Larger transfer buffers*
  - *Sockets asynchronous I/O support*
  - *Larger spaces to store temp files for maximum record length calculations*
- *FTP client can specify server port*

4.1.9 Trivial File Transfer Protocol

The Trivial File Transfer Protocol (TFTP) is used by thin clients, such as IBM Network Station, to receive their initial program load. The iSeries TFTP server includes an extension called *broadcast TFTP*, which dramatically improves load time when many Network Stations are requesting loads simultaneously (for example, after a power outage).

4.1.10 LDAP on the iSeries

Base OS/400 provides an LDAP-accessible directory server and corresponding APIs that communicate with other LDAP directory servers. APIs are provided for both OS/400 and Windows applications written in Java, C, and C++. LDAP-enabled applications, such as Internet mail clients, can access, update, and manage the iSeries directory. For detailed information, refer to 3.3.25, “Lightweight Directory Access Protocol (5722-SS1 base)” on page 86.

4.1.11 Simple Mail Transfer Protocol (SMTP)

Simple Mail Transfer Protocol is used to send or receive electronic mail. For consistency with other iSeries mail functions, SMTP interoperates with Systems Network Architecture (SNA) Distribution Services (SNADS) through AnyMail/400. SNADS and AnyMail/400 are part of OS/400.

SMTP supports mail objects up to 2 GB (10^9 bytes or 1,000,000,000 bytes), SMTP distribution, MIME, optional automatic enrollment of senders of incoming mail, in the system distribution directory and alias tables, and OfficeVision for iSeries notes, messages, and attachments. You can tune SMTP depending on the mail load on your system, and therefore, enable greater scalability.

New option to enable journaling for mail delivery status tracking and mail statistics. Like Telnet and FTP, SMTP supports both client and server functions on iSeries. It can serve as a mail gateway to Interconnect SNADS and TCP/IP SMTP electronic mail networks.

iSeries SMTP has the following features:

- Increased simultaneous connection support. iSeries SMTP is no longer restricted to a maximum of 16 inbound and 16 outbound simultaneous mail connections.
- Enhanced domain name system resolver support. The iSeries SMTP client processes all mail exchanger (MX) records returned by a domain name server query. This means that there is less undeliverable mail when sending to large Internet Service Providers.
- New option to enable journaling for mail delivery status tracking and mail statistics.
- New option to require all mail received by iSeries SMTP to be processed by the iSeries Mail Services Framework (MSF) to improve security.

New in V5R1

With V5R1, the following functions are enhanced:

- *New SMTP extensions*
  - *ETRN-dialup retrieval*
  - *Delivery Status Notification (DSN)*
  - *8-Bit MIME*
- Selectable subsystem for SMTP
- *Dual Stack Support*

  Dual Stack Support is available at V4R2 through V5R1. It allows you to run Domino and the iSeries SMTP server natively.
- *Multiple domain support*
- *Mail filtering to prevent virus proliferation*
- *Controlling unwanted mail traffic (SPAM)*

  The previous method (V4R4 through V4R5) for controlling unwanted mail traffic, or "SPAM", is by blocking or preventing the relay of mail through by using the iSeries SMTP server. At V5R1, the ability to block relays and restrict access is configured via Operations Navigator.

Note: The Domino server also has an SMTP function. For more information, refer to Chapter 7, "Domino Application Server for AS/400 (5769-LNT)" on page 153.

4.1.12 Dynamic Domain Name System (DDNS) server

OS/400 includes a full-function DNS server. It can be configured for primary, secondary, and caching roles. DNS configuration data from other platforms can easily be migrated to the iSeries DNS server. In addition, a migration utility that moves existing iSeries host table information into the DNS configuration databases is provided.

New in V5R1

OS/400 DNS services are enhanced significantly in V5R1. The V5R1 OS/400 DNS services are based on the widely used industry-standard DNS reference implementation. Topping the list of enhancements are the new dynamic update capabilities, which have transformed the DNS into a Dynamic DNS (DDNS).

Combined with enhancements made to the iSeries Dynamic Host Configuration Protocol (DHCP) server that allow it to be configured to send dynamic DNS update transactions, iSeries now supports an integrated Dynamic IP solution that automatically manages TCP/IP addresses and their associated DNS host names on the networks.

4.1.13 Dynamic Host Configuration Protocol (DHCP) server

Deploying DHCP to centrally control all TCP/IP workstation configuration tasks can dramatically reduce the cost of managing a TCP/IP network. DHCP is a standard protocol supported natively by most popular workstations including Windows 95/NT, UNIX, and IBM Network Station. Using DHCP, all IP configuration data (IP addresses, subnet masks, default routers, etc.) is dynamically assigned when new workstations are added to the network. Furthermore, DHCP can automatically recover and recycle network resources when workstations are removed from the network. These capabilities eliminate the time-consuming and error-prone task of manual workstation configuration.

OS/400 includes a full-function DHCP server with an intuitive GUI administrative interface. OS/400 also comes with a DHCP relay agent (also called a *BOOT-P relay agent*) that can be deployed to route DHCP requests from multiple subnetworks to one or more central DHCP servers.

4.1.14 Internet Printing Protocol (IPP) server for iSeries

The Internet Printing Protocol defines an industry-standard method of delivering print jobs using Internet technologies providing for Web-enabled print around the world. The IPP was developed by the Printer Working Group, a consortium of all major companies involved in network printing. IPP is fast becoming the single standard interface for printing on the Internet, with broad vendor implementation and customer acceptance.

The IPP server for iSeries, included in OS/400, provides an IPP Version 1.0 compatible print server for the iSeries. The IPP Server for iSeries allows anyone working remotely to submit and manage print jobs on a distant iSeries. IPP is built on top of HTTP, which in turn, runs over TCP/IP. Customers can now use the same print solution on local area networks, intranets, and the Internet. The same process used to send a print document to the department printer down the hall can be used to send the document to the corporate printer across the country.

The IPP Server for iSeries provides security features for user authentication and encryption of print jobs using Secure Sockets Layer 3 (SSL).

Figure 4-3 shows the IPP Server configuration screen, which you can access from a Web browser.

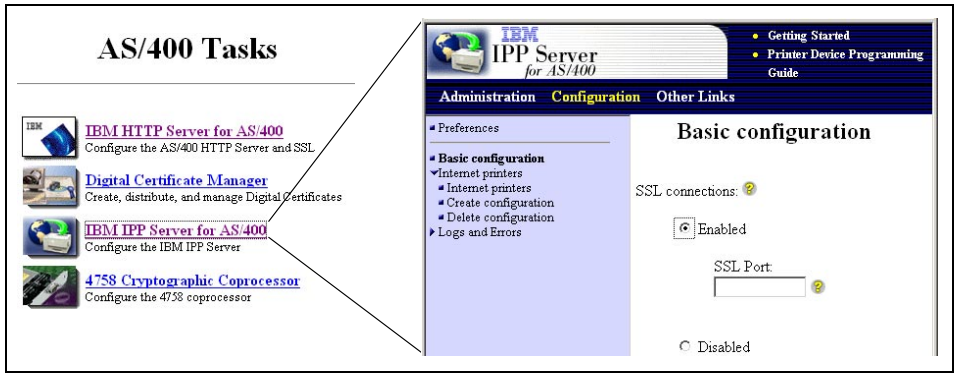


Figure 4-3 Internet Printing Protocol Server

4.1.15 Line printer requester (LPR) and line printer daemon (LPD)

Line printer requester and line printer daemon (LPD) allow you to print a spooled file from any system in a TCP/IP network. LPR is the sending or client portion of the spooled file transfer. LPD is the receiving or server portion of the spooled file transfer. On the iSeries, the Send TCP/IP Spooled File (SNDTCPSPLF) CL command allows you to print a spooled file on a remote system and specify appropriate printing operations. You can send files to other iSeries servers and non-iSeries servers.

4.1.16 Telnet client and server

The Telnet protocol allows a system (the Telnet client) to access and use the resources of a remote system (the Telnet server) as if the Telnet client's workstation were locally connected to the remote system. iSeries Telnet provides both the Telnet client and the Telnet server functions. The Telnet protocol

provides a mechanism for the client and server to negotiate options that control the operating characteristics of a Telnet connection. Among other things, these negotiations involve determining the best terminal type supported by both the client and server.

Depending on the terminal type negotiated, the iSeries Telnet client operates in one of the following full-screen modes: TN5250, TN3270, VT220, or VT100. The iSeries Telnet server operates in ASCII line mode or in one of the following full-screen modes: TN5250, TN3270, VT220, or VT100. The functions available in a Telnet session depend on the operating mode. Security and automation features are included in the iSeries Telnet 5250 server.

New in V5R1

Telnet functions are enhanced in V5R1 for both the client and server:

- *Client supports a new parameter for connection status information*

  The Telnet client supports the new option that allows for diagnostic information to be sent to the client. The client informs the server that it accepts and handles Display Confirmation Records. These records contain a return code indicating whether the connection attempt was successful and why it was unsuccessful.

- *Both the Telnet client and server can handle a passphrase of up to 128 bytes in mixed case*

- *Some RFC 2877 (TN5250E) features are added to the client*

  The Telnet server now supports RFC 2877 (TN5250E) negotiations. The iSeries Telnet client can now specify a device name, session settings, and automatic signon features for terminal sessions

- *Client certificate authentication is now enabled from Digital Certificate Manager (DCM)*

  At V5R1, client authentication enablement is now handled through DCM. Configuring client certificate authentication done at V4R4 or V4R5 will not migrate to V5R1. Client certificate authentication gives additional security to your Telnet connections. This can be beneficial when making connections from the Internet. The Telnet server listens for SSL traffic on port 992 by default. This port number can be changed via the Services Table in TCP/IP Configuration.

- *Support for SHA1 password encryption*

  Before V5R1, the iSeries Telnet server supported DES7 password encryption. At V5R1, the Telnet server supports SHA1. The system value QPWDLVL (password level) determines whether DES7 or SHA1 is used.

- *Provides connection feedback to the client*

  The Telnet server supports the new option being defined that allows diagnostic information to be sent to the client. If the iSeries Telnet server receives this new parameter, it provides information to the client on such things as why automatic sign-on failed.

4.2 References

For more information, refer to the following relevant Web sites and Redbooks:

- Web sites:
  - TCP/IP for OS/400: `http://www.ibm.com/servers/eserver/iseries/tcpip/`
  - Technical Studio: `http://www.iseries.ibm.com/tstudio/`
- Redbooks:
  - *AS/400 Internet Security Scenarios: A Practical Approach*, SG24-5954
  - *V4 TCP/IP for AS/400: More Cool Things Than Ever*, SG24-5190
  - *AS/400 Internet Security: Implementing AS/400 Virtual Private Networks,* SG24-5404
  - *TCP/IP Tutorial and Technical Overview*, GG24-3376

5

The Web server: The core to your e-business

Your iSeries Web server is the center of most all e-business applications. HyperText Transfer Protocol (HTTP) is the protocol used to communicate between a client (browser) and your Web server. This HTTP protocol can be used to carry the order from your customers and allow you to respond with a thank you.

Network administrators know how to configure your firewalls to allow the HTTP protocol through between your private intranet and the public Internet. They also know how to force people to signon before accessing sensitive portions of your Web site and even encrypt the data using powerful protocols such as SSL and TLS. These powerful tools are available to your network administrator via a GUI configuration – not through complex programming.

Application servers, such as WebSphere Application Server (WAS), Domino, and many other third-party solutions all have plug-ins directly into your Web server to allow them to dynamically extend the power of your HTTP server core features and functions. E-commerce with WebSphere Commerce Suite (WCS) is then built upon the WAS implementation of standard Java servlet support. All enjoy the support and services provided by the HTTP servers on the iSeries.

This chapter provides information about your Web server choices on the iSeries.

5.1 Web server basics

We usually use Web sites from a browser without thinking about how they work. This section describes the exchanges between the client and the server when we use Web sites.

Figure 5-1 shows the simple view of exchanges between the client and the server.

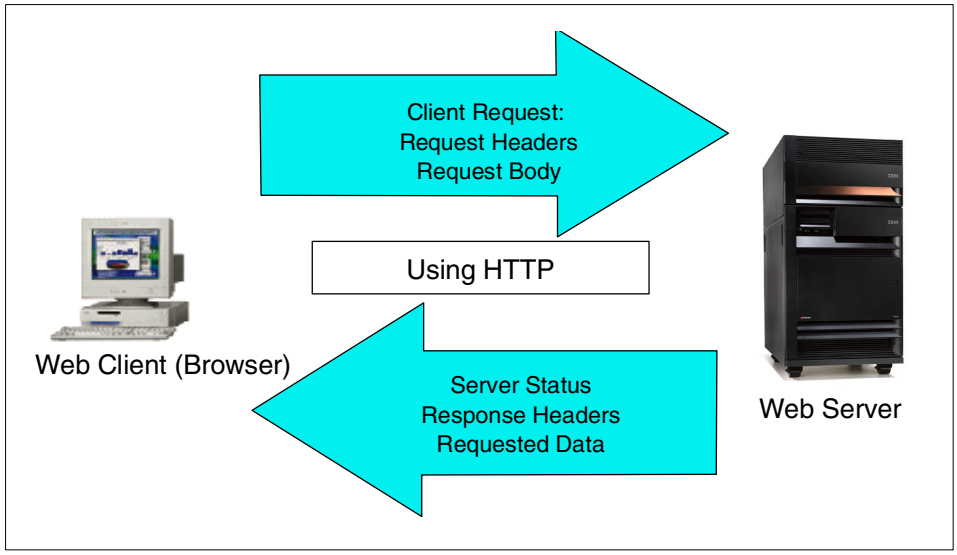


Figure 5-1 HTTP exchanges

The purpose of the Web 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 client (browser). On the iSeries server, 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. World Wide Web (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 Web server sends the requested document.
3. The Web browser interprets the document and displays it.

If you take another quick look at the three phases of e-business development (see 2.1, “e-business development model” on page 30, for more details), and in Figure 5-2, you can see how central the Web server is to your e-business.

- **Web presence**: This phase is the simplest. To establish a presence on the Web, you need a Web server that can retrieve files from an IFS. Your users have the client software, a Web browser, to view the pages you place on the Web server such as IBM HTTP Server for iSeries. For more information about the Web server products, refer to 5.2, “Introduction to Web server products on iSeries” on page 109.
- **Dynamic site**: 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). You can build such a dynamic site using Web servers as primary software backbones and with the following architectures:
  - Domino for iSeries to provide direct access to iSeries database or Domino data.
  - CGI-bin: A legacy API that allows you to write an application to provide dynamic content for some of your Web pages.
  - Net.Data: This is a server-side scripting language that is packaged as part of the IBM HTTP Server for iSeries (5722-DG1). Net.Data extends Web servers by enabling the dynamic generation of Web pages using data from a variety of data sources.
  - JavaServer Pages (JSP): Similar to Net.Data in that JSPs enable you to dynamically generate Web pages using data from a variety of data sources. JSPs require some form of Application Server (such as WebSphere Application Server).
  - Java Servlets: Server (iSeries) side applications that allow you to program dynamic content.
- **Transactional site**: With a transactional site, the user can interact with information, for example, order a product or fill out a form. Applications and connectors ensure that database information reflect these changes and the user sees the correct information over the Web browser. You can create transactional site with the following architectures:

- CGI-bin
- Net.Data
- Servlets
- Enterprise JavaBeans (EJB): The key technology to deal with distributed transaction and complex persistence issues in a Web application

Persistence is the ability to keep track of a user data during an entire transaction. It can be accomplished with CGI-bin and Net.Data. But servlets and EJBs make this aspect of creating a Web application much easier.

All architectures provide connectors to back-end solutions such as DB2 UDB for iSeries.

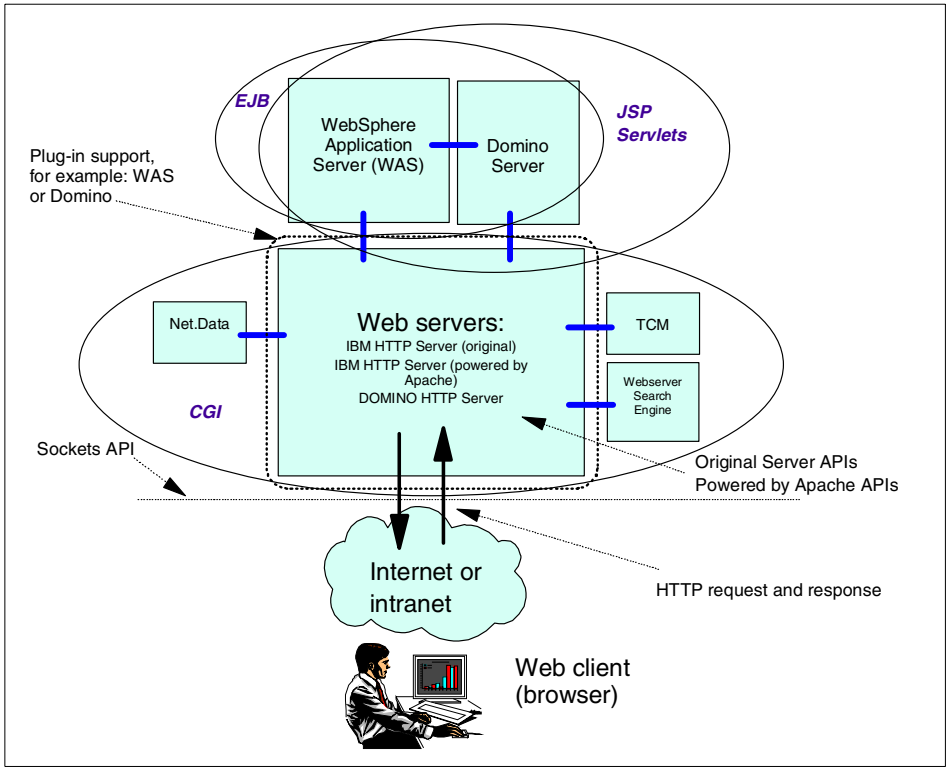


Figure 5-2 Phased approach (by product)

5.2 Introduction to Web server products on iSeries

Through all e-business site development phases, the role of the Web server is very important. It works as a primary software backbone. For the iSeries platform, several Web servers are available. Each product has their own advantages and helps to evolve the e-business site phases. When you use these products as a primary software backbone, and with other IBM e-business-related products, you can reach all three phases of e-business.

5.2.1 The IBM HTTP Server for iSeries (5722-DG1)

The IBM HTTP Server for iSeries Licensed Program Product (LPP) gives you the ability to create two different types of Web servers:

- HTTP Server (original)
- HTTP Server (powered by Apache)

The IBM HTTP Server for iSeries (5722-DG1) consists of the components in Table 5-1.

Table 5-1 The IBM HTTP Server for iSeries (5722-DG1) components

IBM HTTP Server for iSeries component	Description
HTTP Server (original)	Same as the Web server that has been available since V3R2. Based on a European Laboratory for Particle Physics (CERN) Web server implementation.
HTTP Server (powered by Apache)	Included with 5722-DG1 V5R1 base and by PTF at V4R5. Based on the popular Apache HTTP Server Project implementation.
Net.Data	Allows you to build Web applications with data from a variety of data sources.
CGI-bin	The purpose of CGI-bin is to extend the capability of an HTTP server by providing framework in which the HTTP server can interface with a program that is specified on a URL.
Triggered Cache Management (TCM)	Provides a mechanism to manage dynamically-generated Web pages.
Webserver Search Engine	Allows you to perform full text searches on HTML and text files stored in an iSeries file system from any Web browser.

HTTP Server (original)

The HTTP Server (original) is one of the Web servers packaged with the iSeries server. The original HTTP server originates from CERN. The fundamental ideas behind and the basic design of the World Wide Web evolved from work being done at the European Laboratory for Particle Physics (CERN) in Geneva, Switzerland.

It is the Web server component of the WebSphere Application Server for iSeries. It can also act as a gateway between the client and the iSeries database, using the CGI interface and Net.Data. Any Web design tool can be used to create content on top of the preferred HTTP server.

HTTP Server (powered by Apache)

Most HTTP servers originate from CERN or National Center for Supercomputing Application (NCSA). The Apache server originates from NCSA. The fundamental ideas behind and the basic design of the World Wide Web evolved from work being done at CERN in Geneva, Switzerland. In its roots, the Apache server was developed at NCSA, and it was based on the NCSA HTTP daemon (NCSA HTTPd 1.3).

The NCSA Web server, at that time, was adopted and used by a large number of webmasters in the market. In mid-1994, however, the development for this Web server stalled and left many webmasters to find their own solutions to problems encountered in their environments. Some of them developed their own extensions and problem fixes, which could apply to other webmasters searching for the same solution.

In February 1995, a group of webmasters volunteered to consolidate all information related to the server and placed it in a publicly accessible domain for all webmasters to access. The Apache Group was then formed from people who had made substantial contributions to the Apache server. NCSA later revived the suspended development of their NCSA Web server, and two members from that development team joined the Apache Group so that ideas and contributions could be exchanged among both projects. The Apache Group reviewed some of the enhancements and bug fixes and added them to their own server for testing purposes. In April 1995, the Apache server made its first public release with Version 0.6.2. It was given this name because it was the “patched” version (A PAtCHy server) of the NCSA HTTPd 1.3 Web server. In May through June 1995, some general overhaul and redesign was made to fine-tune the Apache server, along with the introduction of some new features in the Version 0.7.x. The next release of the Apache server with Version 0.8.8 in August 1995 brought about a change in the architecture of the server with the modular structure and API features. The latest level available for the Apache server is Version 1.3, while development is in progress for Version 2.0.

The top servers for Web sites on the Internet include:

- 60.53% Apache
- 27.91% Microsoft IIS
- 2.34% iPlanet (Netscape)

Source: July 2001 Netcraft (http://www.netcraft.com/survey/)

Apache, a freeware HTTP server, is open-source software that implements the industry standard HTTP/1.1 protocol. The focus is on being highly configurable and easily extendable. It is built and distributed under the Apache Software Foundation and is available at on the Web at: http://www.apache.org

The benefit of Apache to iSeries users is that the HTTP Server (powered by Apache) is based on the open-source server code provided by the Apache Software Foundation. This version is based on the “alpha” code for Apache Version 2.0. It will be updated as future Apache versions are made available. While iSeries source code will not be published, IBM will offer any enhancements it develops to the Apache Software Foundation in an open-source form for inclusion in the Apache server. As with any supported product, IBM will provide defect support for the HTTP Server (powered by Apache). IBM has long been active in Apache development.

5.2.2 HTTP Server (original and powered by Apache) coexistence

As mentioned before, the original server and Apache server can coexist. The administration screen allows you to create and manage HTTP servers. Figure 5-3 shows the GUI Administration screen.

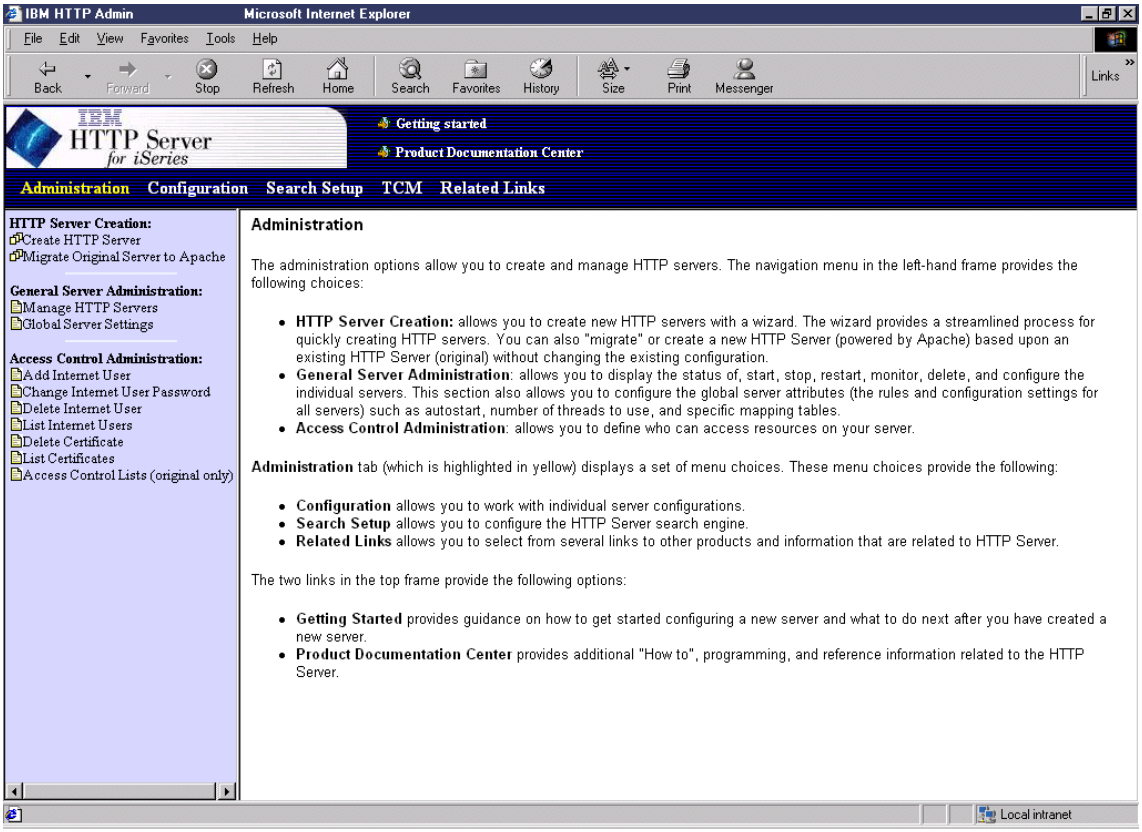


Figure 5-3 IBM HTTP server configuration GUI

The navigation menu in the left-hand frame provides the following choices:

- *HTTP Server Creation*: Allows you to create new HTTP servers with a wizard. The wizard provides a streamlined process for quickly creating HTTP servers. You can also “migrate” or create a new HTTP Server (powered by Apache) based upon an existing HTTP Server (original) without changing the existing configuration.
- *General Server Administration*: Allows you to display the status of, start, stop, restart, monitor, delete, and configure the individual servers. This section also allows you to configure the global server attributes (the rules and configuration settings for all servers) such as autostart, number of threads to use, and specific mapping tables.
- *Access Control Administration*: Allows you to define who can access resources on the server.

Note: When you want to use powered by Apache on OS/400 V4R5, Group PTF SF99035 is required to enhance 5769-DG1 product. This version is based on “alpha” code from the Apache Software Foundation.

5.2.3 Domino HTTP Server

A Domino HTTP Server is available with Lotus Domino Server for iSeries. It can be used as an alternative for the HTTP Server for iSeries and it is functionally equivalent to the HTTP Server for iSeries (original). The main strength of The Domino HTTP Server is its unique ability to dynamically translate Notes documents into HTML and allow a Domino database to be seen as HTML documents on the Web. For detailed information about this product, see 7.2.3, “Domino HTTP server” on page 162.

Note: The Domino HTTP Server and HTTP Server for iSeries can coexist. Each use port 80 by default. Depending on whether each server is attempting to bind to the same TCP/IP interface, there may be a port conflict. To resolve this, refer to 7.2.3, “Domino HTTP server” on page 162.

5.2.4 Third-party products (I/NET)

I/NET provides some products that enable you to create and manage Web sites on iSeries, for example:

- **Web Server/400**: Provides a commercially available Web server for the iSeries.
- **Commerce Server/400**: Provides iSeries customers worldwide the ability to conduct secure, encrypted financial, and other transactions over the Internet.
- **Webulator/400**: Provides instant Web access to existing iSeries applications without code changes.

For detailed information about I/NET, go to: http://www.inetmi.com/

5.2.5 Security-related products

Security features are very important to protect you from any obstruction to your Web Sites. The iSeries server provides some products to enhance security on your Web site.

- Cryptographic Access Provider
- Digital Certificate Manager

Secure Sockets Layer (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 SSL V3 protocol. IBM includes the Cryptographic Access Provider as a no-charge LPP with OS/400 to use with SSL.

Once the server has a digital certificate, SSL-enabled browsers, such as Netscape Navigator, can communicate securely with the 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 iSeries uses 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.

Some versions of the Cryptographic Access Provider include:

- 5722-AC2 provides 56-bit encryption
- 5722-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 iSeries server is installed. This version complies with United States export laws for computer encryption products and local laws of the country.

Another product is the Digital Certificate Manager (DCM). You can install this as option 34 of the OS/400 base installation. DCM 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 iSeries server. 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.

5.3 HTTP Server (original and powered by Apache) features

You know both original HTTP server and powered by Apache server have their own advantages, but which product should you choose? This section provides a functional comparison about these products to help answer this question.

5.3.1 HTTP Version 1.1

Both original and Apache

Both products support HTTP Version 1.1. The HTTP protocol implementation in Apache was chiefly architected by one of the HTTP version 1.1 authors. Most current versions of popular Web browsers support HTTP Version 1.1. Apache is normally configured to detect popular browsers that do not properly support HTTP Version 1.1, and use only HTTP Version 1.0.

5.3.2 GUI configuration and administration

Both original and Apache

You can configure and administrate HTTP Server instances from Web browsers. To show the configuration and administration screen, type the following URL from a Web browser:

```
http://hostname:2001
```

Figure 5-4 and Figure 5-5 show the screen. The configuration screens are different between the original and the powered by Apache servers, but you can reach each screens from the same URL.

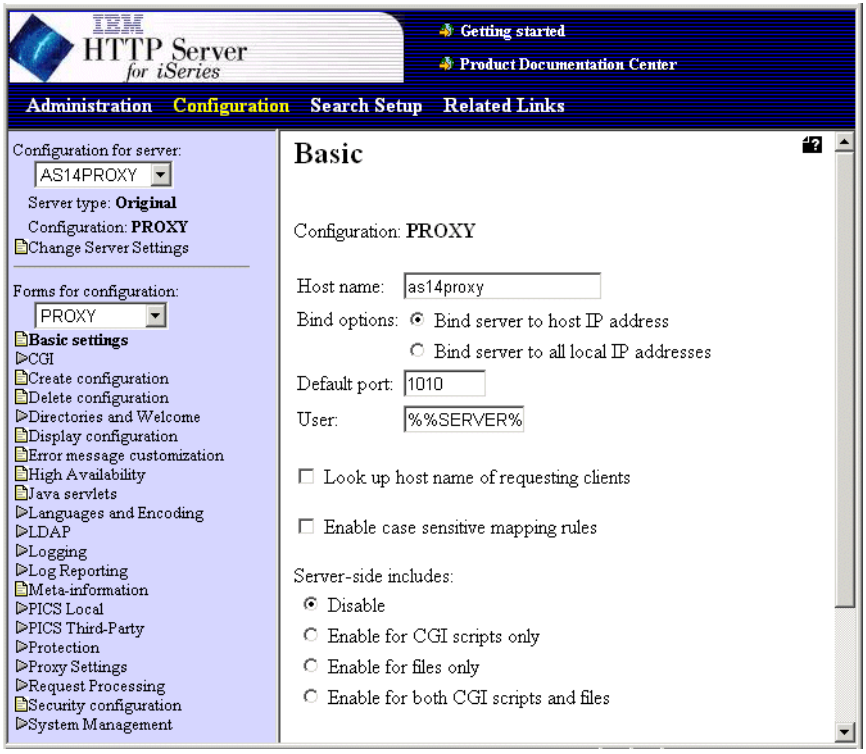


Figure 5-4 Original server configuration screen

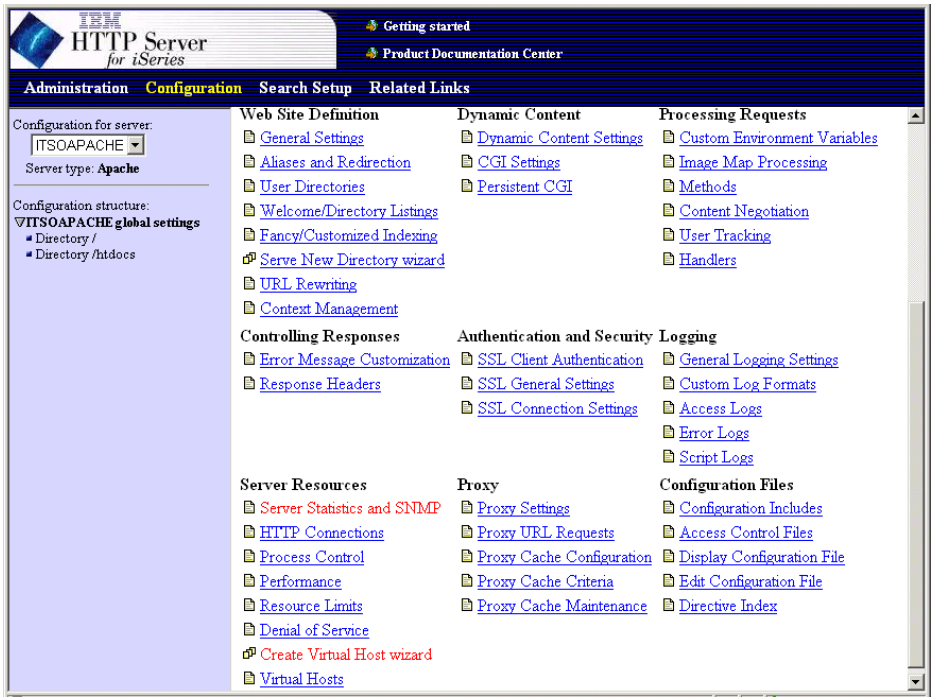


Figure 5-5 Apache server configuration screen

5.3.3 Persistent connections

Both original and Apache

When you enter a URL into your browser's address line or click 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 overhead is required to establish and terminate each connection. Persistent connections are the default behavior for an HTTP server that implements the HTTP 1.1 protocol.

5.3.4 Virtual hosts

Both original and Apache

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 ISP services to clients.

5.3.5 Dynamic virtual hosting

Only in Apache

The dynamic virtual host allows you to dynamically add Web sites (host names) by adding directories of content. This approach is based on automatically inserting the IP address and the contents of the Host: header into the pathname of the file that is used to satisfy the request.

5.3.6 Proxy caching

Both original and Apache

The IBM HTTP Server for iSeries 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 the 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.

With caching enabled, the proxy server can act as a high-speed local store of previously accessed Web pages. When you configure the 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 iSeries server. 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 iSeries proxy service so that it periodically performs “garbage collection” to remove expired files from the cache.

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. For example, the information can be used in a charge-back system to understand and track marketing trends.

5.3.7 Local memory cache

Both original and Apache

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 iSeries 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 iSeries, 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.

5.3.8 Server-side includes

Both original and Apache

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 that you send to the client. This is functional on both the original and powered by Apache servers, but their processes have little differences.

5.3.9 CGI programming

Both original and Apache

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). The server needs to hand the input from the form to a program for processing.

Typically, on the iSeries server (and most other platforms), this program is a CGI program, or it contains Net.Data macros, which place 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 iSeries server, 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.

CGI programs written for the original server function the same way for the powered by Apache server.

5.3.10 LDAP support

Both original and Apache

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.

5.3.11 Webserver Search Engine

Both original and Apache

The HTTP Server search engine allows you to perform full text searches on HTML and text files stored in the iSeries file system from any Web browser. The iSeries Webserver Search Engine is available at no charge with IBM HTTP Server for iSeries (5769-DG1 or 5722-DG1) starting at OS/400 V4R4. You can control what options are available to the user and how the search results are displayed through customizable Net.Data macros.

Some of the features of the Webserver Search Engine include:

- Indexes documents for fast searching:

  The AS/400 Webserver Search Engine indexes html or text files into a format that allows a large number of documents to be searched quickly. Multiple indexes can be created, and documents from multiple directories can be placed in a single index.

- Exact word indexing:

  The Webserver Search Engine uses an exact word indexing scheme rather than a keyword indexing scheme used by many search engines. All words are indexed; nothing is left out. Exact word indexing provides for faster index building and more precise searching than keyword indexing, but requires additional disk space. Documents are searched using consecutive character matching, which is essential for proper support of double-byte languages.

- Advanced search functions:

  The AS/400 Webserver Search Engine supports advanced search capabilities such as exact search, fuzzy search, wild card search, proximity search, English word stemming, case-sensitive search, boolean search, and document ranking.

- Customizable search forms:

  The search forms and search results form are completely customizable by the end user using the Net.Data scripting language. This gives the user the ability to specify the type of search to be done and how the results are to be displayed. The information that can optionally be displayed on the results page includes the number of documents satisfying the search, number of

occurrences of the search term, number of documents returned on this page, the URL associated with each document, the document's ranking, and the last modified date and size. Any and all of this information can be displayed however the user chooses.

- Web-based administration:

  Administration of the search indexes is handled as part of the IBM HTTP Server Configuration and Administration Web pages. The search administration forms allow you to create and delete search indexes, update search indexes when documents are modified, and view the status of an index.

- Multiple language support:

  The Webserver Search Engine supports multiple national languages including double-byte languages Chinese, Japanese, and Korean.

5.3.12 Web-based Distributed Authoring and Versioning (WebDAV)

Both original and Apache

WebDAV provides a network protocol for creating interoperable, collaborative applications. Major features of the protocol include:

- Locking (concurrency control):

  Long-duration exclusive and shared write locks prevent the problem of overwriting, where two or more collaborators write to the same resource without first merging changes. To achieve robust Internet-scale collaboration, where network connections may be disconnected arbitrarily, and for scalability, since each open connection consumes server resources, the duration of DAV locks is independent of any individual network connection.

- Properties:

  XML properties provide storage for arbitrary metadata, such as a list of authors on Web resources. These properties can be efficiently set, deleted, and retrieved using the DAV protocol. The DAV Searching and Locating (DASL) protocol provides searches based on property values to locate Web resources.

- Namespace manipulation:

  Since resources may need to be copied or moved as a Web site evolves, DAV supports copy and move operations. Collections, similar to file system directories, may be created and listed.

For more information about WebDAV, refer to: http://www.webdav.org/

5.3.13 Access log reporting and Web usage mining

Only in original

The HTTP Server (original) provides the log reporting and Web usage mining function. If you are using powered by Apache, you can obtain the IBM WebSphere Site Analyzer to provide a similar function.

5.3.14 Platform for Internet Content Selection (PICS)

Only in original

PICS support enables labels (metadata) to be associated with Internet content. Originally designed to help parents and teachers control what children access on the Internet, it also facilitates other uses for labels, including code signing and privacy.

5.3.15 Domino plug-in

Only in original

The Domino plug-in allows the HTTP server to access documents stored in Notes. See Chapter 7, “Domino Application Server for AS/400 (5769-LNT)” on page 153, for details.

5.3.16 WebSphere Application Server plug-in

Both original and Apache

The IBM HTTP Server for iSeries handles static content, CGI program invocations, and proprietary plug-ins. The run-time environment (WebSphere Application Server) plugs into IBM HTTP Server for iSeries using plug-in APIs. This extends the support of the HTTP Server to include an implementation of the Java 2 Platform Enterprise Edition (J2EE) specification from SUN Microsystems. See Chapter 8, “WebSphere Application Server” on page 183, for details.

5.3.17 Apache Software Foundation’s Jakarta Tomcat

Only in Apache

The HTTP Server (powered by Apache) includes an industry-standard Java Servlet and JavaServer Pages engine based on technology from the Apache Software foundation's Jakarta Tomcat open source code base. Lightweight and easy-to-use software extends the IBM HTTP Server (powered by Apache) server and is compliant with the Java Servlet 2.2 and JavaServer Pages 1.1 specifications of the Java 2 Platform Enterprise Edition (J2EE) specification from SUN Microsystems.

Apache Software Foundation's Jakarta Tomcat for iSeries support can be used as a simple starting point for business partners and customers interested in learning about or piloting Java Servlet applications.

This function is scheduled to be available via a PTF in fourth quarter 2001 (NLS enabled but available only in English). For more information, refer to the iSeries Web Page at: http://www.ibm.com/eserver/iseries/software/http

5.3.18 Original Server API

Only in original

Server APIs are not supported on iSeries Apache. The strategic direction of IBM is to extend the function of the Web server using Java servlets rather than with modules or Server APIs. So this function can only be used in HTTP Server (original).

5.3.19 Support for the TRCTCPAPP command

Only in Apache

The Trace TCP/IP Application (TRCTCPAPP) command can be used to trace the server, but only one instance at a time. It can be started while the server is running.

Note: The old -vv (very verbose) still works at startup much like the original server (and -vi, -ve, which stand for informational and error tracing, respectively). The Dump User Trace (DMPUSRTRC) and Display Physical File Member (DSPPFM) commands can be used to see the results, but TRCTCPAPP is the suggested trace method.

In addition to these functions, the following functions are provided only in powered by Apache:

- *Headers control*: Has the ability to control headers. It has the ability to control expires and other headers.
- *SSL*: This is more specific customization of SSL
- *CGI*:
  - Controls the number of CGI jobs started with the server and their user profile
  - OS/400 PASE CGI programs (UNIX binaries)
- More customization of directory listings
- Automatic restart of multi-threaded child job monitored by parent job
- Configuration file support in threadsafe IFS file systems (not just QSYS.LIB)

5.3.20 Triggered Cache Management (TCM)

Both original and Apache

Triggered Cache Manager provides a mechanism to manage dynamically-generated Web pages. TCM is a separate server that can be used in conjunction with the HTTP Server to allow a Web designer to build dynamic pages. It only updates the cache when the underlying data changes, thereby improving the performance of a Web site.

5.3.21 Highly available HTTP server

Only in original

If Web serving is a critical aspect of your business, you may want high availability for your Web server environment. A highly available Web server takes advantage of iSeries clustering technology and makes it possible to build a highly available Web site. This improves the availability of business-critical Web applications built with Common Gateway Interface (CGI) programs.

5.4 References

For more information, refer to the following sources:

- For the IBM HTTP Server for iSeries (original and powered by Apache): http://www-1.ibm.com/servers/eserver/iseries/software/http/index.htm
- HTTP Server (powered by Apache) support for WebSphere Application Server is available via a PTF from: http://www.iseries.ibm.com/products/websphere/docs/apacheWebServerSupport35.html

  Note: A newer version of the WebSphere plug-in will be released in conjunction with the follow-on version of the IBM HTTP Server (powered by Apache). There are expected changes in the interfaces supported by the IBM HTTP Server (powered by Apache), so an upgrade to the matching level of WebSphere plug-in will be mandatory at that time. Currently, the plug-in is for use with WebSphere (Advanced or Standard) 3.5.2 and later releases.

- The Redbook *AS/400 HTTP Server Performance and Capacity Planning*, SG24-5645

Part 3

iSeries e-business environments

So far in this IBM Redbook, we have been building a “bottom-up” solution for your e-business. Here’s where we stand at this point:

The bottom	OS/400: Your foundation for e-business
The middle	TCP/IP: Fundamental to the network computing paradigm
Near the top	Web servers: The core of e-business

The above technologies are, in themselves, the path to your e-business. Up until this point, it has been easy.

Built on top of the iSeries Web servers are a number of IBM and non-IBM solutions. These e-business environments provide application programming interfaces that allow you to program your own solutions or to extend those already provided for you.

In the figure on page 127, we tried to simplify your view of the many different e-business environments available to you.

In light of the power of these e-business environments, the Web servers (HTTP servers) that you studied in Chapter 5, “The Web server: The core to your e-business” on page 105, are really little more than “fancy file servers”. They are good for only the first phase of your e-business journey – Web presence.

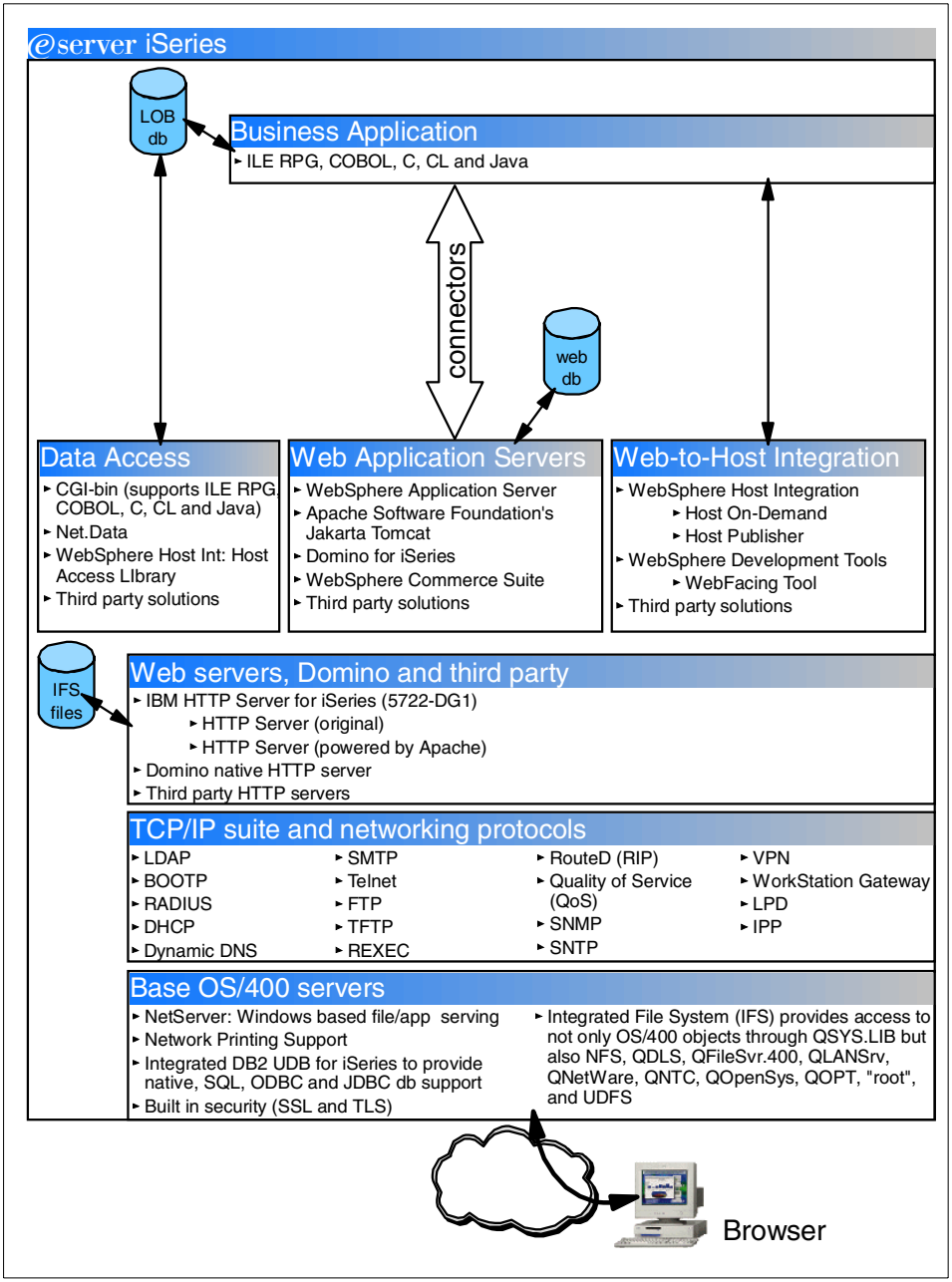
In this IBM Redbook, we have already covered many of the Data Access technologies that are very useful during the second phase of your e-business journey – Dynamic site. But, you need to do more than just to provide access to dynamic data to succeed.

To extend your business to the Web requires that you select one (or a few) of these environments and extend or grow your business to an e-business. This is really a business transformation through an application transformation.

Web-to-host integration promises to preserve much of your investment in your current business application logic and data. For established iSeries business applications this may be the first place you study. See Chapter 6, “e-business-out: Extending core applications to the Web” on page 129.

Web Application Servers provide an application development environment that has been created specifically for the Web. Services built into WebSphere Application Server, Domino for iSeries, and WebSphere Commerce Suite, can help you, for example, to keep track of a transaction by managing a persistent connection between your iSeries server and your client. For more details on these e-business environments, see:

- Chapter 7, “Domino Application Server for AS/400 (5769-LNT)” on page 153
- Chapter 8, “WebSphere Application Server” on page 183
- Chapter 9, “WebSphere Commerce Suite for iSeries V5R1 (5798-WC5)” on page 203



The big picture: iSeries e-business environments

6

e-business-out: Extending core applications to the Web

Today, there is a new and ever evolving economic environment. The Internet has fundamentally altered the way businesses operate. In addition to the core operations (accounting, payroll, inventory, and so on) needed to run an enterprise, businesses have moved to the world of e-commerce. The iSeries server provides a broad set of application development tools and technologies that help extend many aspects of an enterprise to implement superior business-to-business (B2B) and business-to-consumer (B2C) solutions.

This chapter introduces you to the e-business development environment for the iSeries server and covers the following topics:

- An introduction to the wide variety of application development environments that can be used on the iSeries to “get the job done”.
- IBM can leverage your core application suite running on the iSeries through a wide range of tools. Such tools can do everything from dynamically converting your 5250 into HTML to programming environments that will allow you to support both traditional 5250 clients and Web clients, all with one set of source code. Section 6.2, “Comparison of the IBM suite of host/server access products” on page 132, provides an overview of these tools.
- IBM WebSphere Development Studio for iSeries and the IBM WebSphere Development Tools for iSeries.

6.1 The flexible application server

The iSeries platform supports a wide range of solutions that were built using many different application technologies or environments. As shown in Figure 6-1, it supports a number of distinct, yet interoperable application environments that share common system services:

- *Java*: Including a Java Virtual Machine (JVM) implementation, standard Java class implementations, and a suite of Java-based components for accessing iSeries data and program resources. iSeries also offers the WebSphere application development and runtime environment, which supports the Java standard.
- *Integrated Language Environment (ILE)*: Supports a number of programming technologies (RPG, COBOL, C/C++).
- *OS/400 PASE*: A runtime environment for porting UNIX applications to iSeries.
- *Linux on iSeries*: Enables a native PowerPC Linux kernel to run in a secondary logical partition using either a shared or dedicated processor of OS/400. This is an additional server consolidation opportunity for iSeries.
- *Integrated xSeries Server* and *Integrated xSeries Adapter:* Make it possible to run and manage multiple Windows NT or Windows 2000 servers all managed from a central iSeries server, significantly simplify management of those environments.
- *Lotus Domino*: Provides a scalable, reliable infrastructure as the basis for communication, decision making, and document management.

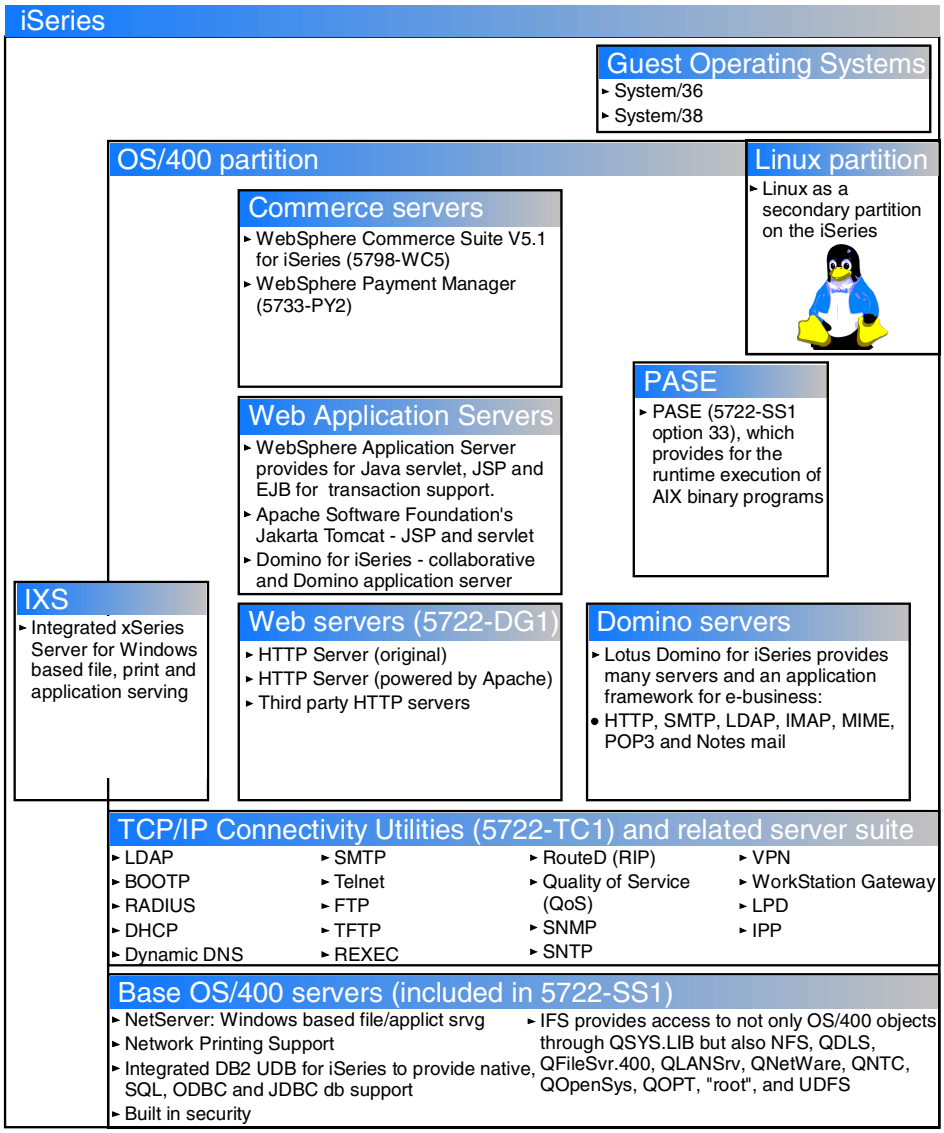


Figure 6-1 iSeries: The flexible server

The iSeries aggressively supports the transformation of business applications to an e-business model, while also minimizing disruption within the enterprise environment. It has business-proven values (reliability, security, scalability, low cost of ownership) and supports the latest enabling technologies for e-business. In combination, these two qualities make the iSeries an excellent choice for extending existing applications and deploying new solutions.

Our focus, then, is on using different ways to transform an existing iSeries host business application with 5250 interfaces into a modern, distributed, thin-client application that can be integrated with new e-business applications.

6.2 Comparison of the IBM suite of host/server access products

IBM has continually provided many end user, server-access related product choices for its customers. Recently it has been extending its product choices to include more Web-to-host e-business solutions. Some of these product solutions may appear to overlap with other IBM products. However, each solution has a different focus. Let's first review the focus of the products available from IBM.

As you read through the following sections, Figure 6-2 can help you see the big picture about how all these products inter-relate. For example, looking at the very bottom of Figure 6-2 can help you decide which product to use depending on the level of control you have over the client environment. WebSphere Application Server is required for many of these products, which brings a certain level of independence from the client, but raises the minimum system size (CPW and memory) for your iSeries server.

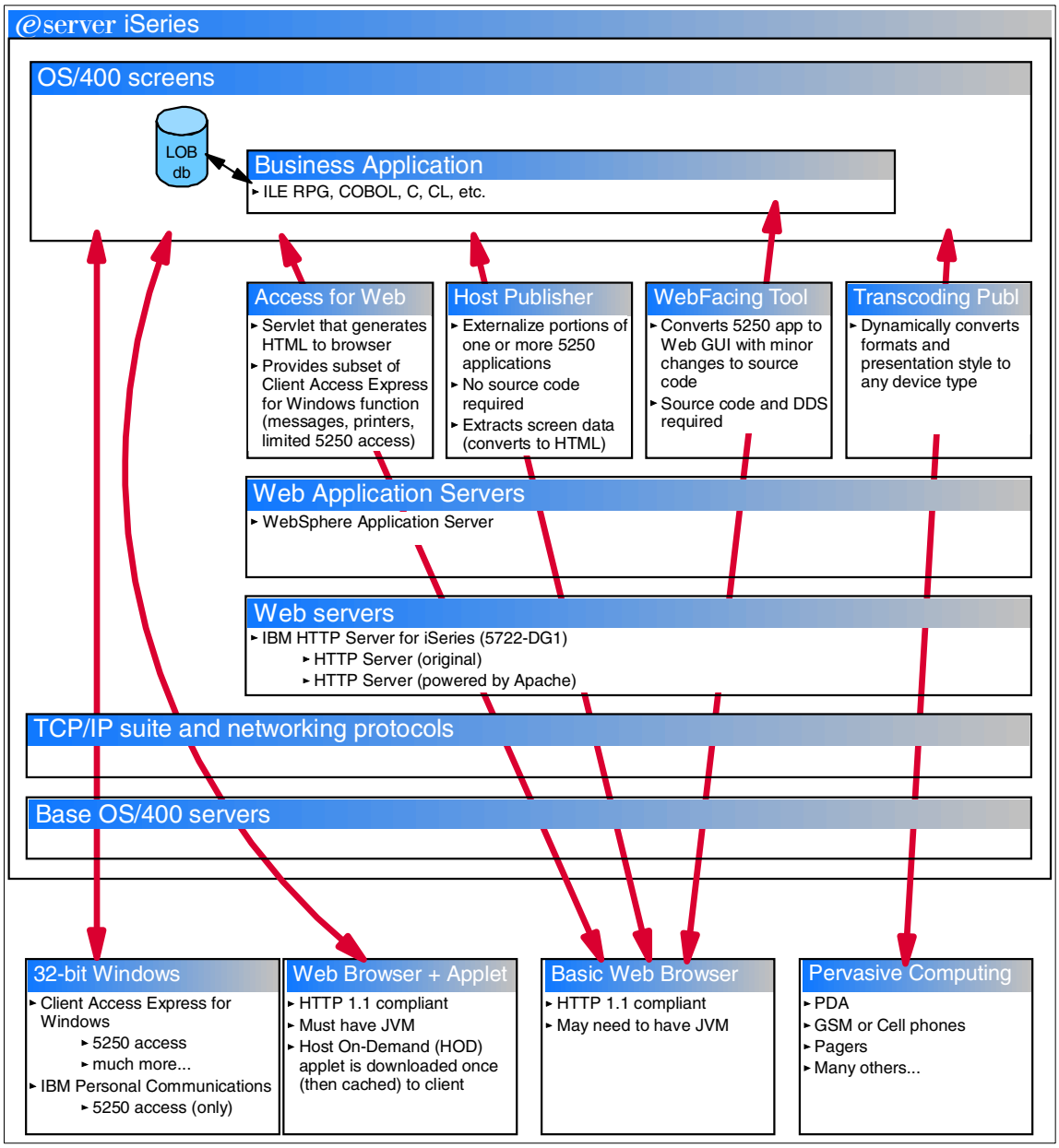


Figure 6-2 Comparison of IBM host/server access products

6.2.1 iSeries Client Access family of products

Client Access products are targeted for customers accessing iSeries servers. The focus of Client Access products is two-fold:

- Bring all the power of the iSeries server to the end-user desktop.

  Some examples in Client Access Express are Operations Navigator (the OS/400 GUI), an ODBC driver fine-tuned to work with DB2 UDB for iSeries, Data Transfer that provides a wizard to create new File Definitions for users uploading data to DB2 UDB for iSeries, using a built-in NetServer function for PC file and iSeries server print serving.

- Tightly integrate the client software into the desktop environment on which it is running.

  Client Access Express is tightly integrated with the Windows desktop. For example, you can change your OS/400 passwords through the Microsoft Windows Password panel; you can create new shortcuts or icons for iSeries connections simply by right clicking the Windows desktop area; and you can use Operations Navigator Application Administration to control what Client Access functions can be used to access your iSeries servers.

6.2.2 IBM Host Integration family of products

The WebSphere Host Integration products support multiple host application environments, including the iSeries, zSeries, and pSeries environments. The Host Integration product set focuses on:

- Providing the same end-user look and feel whether running on a Windows 32-bit operating system or another platform.

  Some examples of this are that IBM Personal Communications runs on Windows 32-bit systems, OS/2, and Windows 3.x. The Host On-Demand product runs in many additional desktop environments such as Linux, Sun Solaris, and so on.

- Providing a common and consistent interface to a variety of servers and host systems.

  This family of products provides many tools to enable access to applications and data that reside on midrange servers, enterprise servers, and ASCII hosts. For example, they provide Host Access Beans for Java and the Java Interface for Host Access Class Library (HACL) that can be used to provide an enhanced user interface to existing back-end applications.

6.2.3 Comparison of current end-user products

IBM offers two end-user products that are designed to run natively on Windows 32-bit systems:

- **Client Access Express for Windows**: Provides TCP/IP connectivity to users running Windows 95, 98, Me, NT 4.0, and 2000. Client Access Express has 5250 emulation, access to DB2 UDB for iSeries through its Data Transfer (including Excel add-ins for uploading and downloading data through the spreadsheet interface), and uses NetServer for working with the OS/400 Integrated File System and printers. It includes a variety of middleware for using and developing client applications to access OS/400 resources via ODBC driver, OLE DB driver, and other iSeries enablers such as Data Queues, Remote SQL, and other Remote Command support, as well as Emulator High-Level Language Applications Programming Interface (EHLLAPI) for 5250 applications. It also includes Operations Navigator, the OS/400 GUI, for administering the iSeries server. For more information, see: http://www.ibm.com/eservers/iseries/clientaccess
- **IBM Personal Communications**: Provides TCP/IP and SNA/APPC connectivity to users running Windows 95, 98, NT 4.0, and 2000. Personal Communications provides 3270, 5250, and VT emulation, File Transfer to store PC files on the host, and ODBC driver to access any host supporting DRDA. It also provides HACL and EHLLAPI for working with host applications. For more information, see: http://www.ibm.com/software/enetwork/pcomm

IBM has two end-user products that are designed to run in a browser environment:

- **WebSphere Host On-Demand (HOD)**: This is an applet that runs on servers with JVM 1.1, and its applet can be downloaded to browsers with JVM 1.1 (such as Netscape or Internet Explorer). HOD is IBM's answer for the Java-based host access through 3270, 5250, and VT emulation. It is primarily designed to meet the needs of intranet and extranet users. It is for users who are familiar with the original host application screens, and users who are considered power users who require a full function customizable emulator. HOD is a good alternative when a user needs extended connection times. It also provides host-to-client file transfer as well as local print capability.

  For more information on HOD, see 6.6.1, “Host On-Demand” on page 146. Also see http://www.ibm.com/software/webservers/hostondemand
- **iSeries Access for Web**: This is a servlet that runs on OS/400 JVM and generates HTML output to a browser (such as Netscape or Internet Explorer). iSeries Access for Web provides a subset of the capabilities provided in Client Access Express for Windows or IBM Host On-Demand. Its advantage is ease of deployment (no code to install or maintain on the end-user workstation). It

is designed for users who need either quick or infrequent 5250 access to the iSeries servers, a need to access DB2 UDB for iSeries data, work with OS/400 printers or printer output, and send/receive messages. A beta version is currently available and can be downloaded from the Web. Additional function has been added to this product and has been delivered as part of the iSeries Client Access Family product since 28 September 2001.

For more information, see:
http://www.ibm.com/eservers/iseries/clientaccess/beta/webaccess.htm

6.2.4 Programming Tools

IBM offers a variety of tools to enable host applications to run in a Web environment. Some of these are:

- **IBM WebSphere Host Publisher**: Runs on OS/400, OS/390, AIX, Sun Solaris, and Microsoft Windows NT operating environment and enables applications created with its Host Publisher studio to run unchanged in a WebSphere Application Server environment. You can externalize selected portions of an application to the Web, as well as consolidate pieces of multiple host applications into a single HTML page. These users typically connect periodically for short periods of time and expect typical Web response times. This solution requires both a development and runtime investment. No source code is required.

  This product is included in iSeries Client Access Family, 5722-XW1, and in the WebSphere Host Integration Solution.

  For more information on HOD, see 6.6.1, “Host On-Demand” on page 146. You can also see: http://www.ibm.com/software/webservers/hostpublisher

- **WebFacing Tool**: Converts a 5250 host application into a Web GUI application with only minor changes required to the host application source code. This same application can support both the standard 5250 interface and the new Web GUI interface. This allows dedicated users to access their applications in the traditional manner and provide a Web interface for casual users. This tool allows iSeries server developers to extend legacy applications to the Web using existing skills. Most developers will take advantage of the customization capabilities of the WebFacing Tool to enhance the Web interface. This is an 5250-only solution. This solution requires a development time investment and access to the source code. This product is included in WebSphere Development Tools for AS/400.

  For more information on HOD, see 6.6.2, “WebFacing Tool” on page 148. Also see http://www.ibm.com/software/ad/wdt400

- **WebSphere Transcoding Publisher**: Enables customers to run their existing Web applications from hand-held information devices. It brings legacy data from the Web and dynamically converts formats and the presentation style of

host data to a new breed of personal data assistants. WebSphere Transcoding Publisher runs on AIX, Linux, OS/400, Solaris, Windows 2000, and Windows NT. IBM WebSphere Transcoding Publisher V3.5, 11K8034/11K8036 is a standalone product.

For details, go to: http://www.ibm.com/software/websphere/transcoding

- **IBM Screen Customizer**: Converts host screens into graphical presentations. This solution requires a development investment, but does not require access to source code. This product is included in Host Access Client Package and WebSphere Host Integration Solution and works through an emulator, such as the ones included in Personal Communications, Host On-Demand, and V4R5M0 and V4R4M0 Client Access Express (not available for V5R1M0 Express).

  For more information, see:
  http://www.ibm.com/software/network/screencustomizer

- **WebSphere Development Tools for iSeries** (V5.1, Product Number 20P4567/20P4568): A suite of tools to help customers develop e-business applications. It consolidates the key application development tools into one host-based package. The package includes the following host components: Application Development ToolSet, ILE RPG (RPG IV), ILE COBOL, ILE C/C++ compilers, and Application Development Toolset. It also includes the following workstation components: WebSphere Development Studio for iSeries, VisualAge for Java for iSeries, CODE/400, VisualAge RPG, and WebFacing Tool.

  For more information on HOD, see 6.4, “IBM WebSphere Development Tools for iSeries” on page 141. Also see
  http://www.ibm.com/software/ad/wdt400/

6.3 IBM WebSphere Development Studio for iSeries

The products that make up the WebSphere family can support any kind of e-business, large or small. They offer advanced, end-to-end, integrated e-commerce features that seamlessly link to your existing systems. They can adapt as your goals, strategies, and target markets change – providing the ideal base for building or expanding your business on the Web.

Figure 6-3 shows the various WebSphere-related products as they apply to the iSeries. We explain the WebSphere Development tools (WDT) for iSeries that are part of WebSphere Development Studio (WDS) for iSeries.

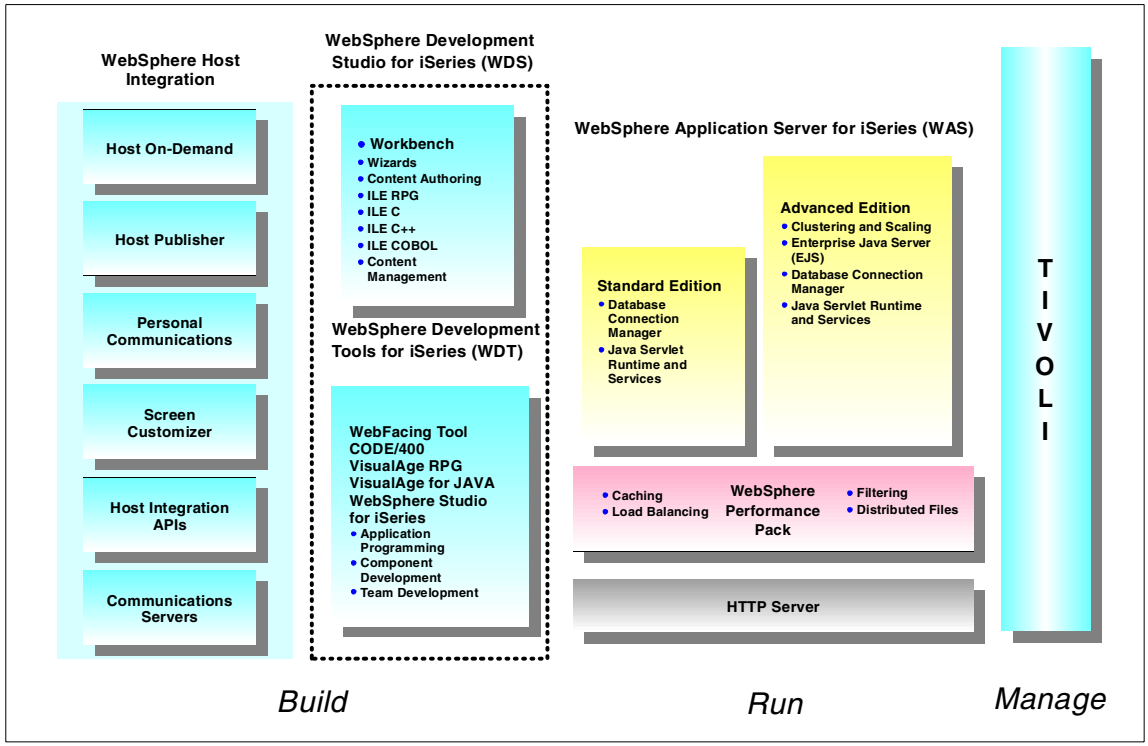


Figure 6-3 WebSphere family with a focus on iSeries application development

The IBM WebSphere Development Studio for iSeries gives customers and solution providers rapid and cost-effective ways to increase the number of Web-enabled, e-business applications for the iSeries server. It marks a major shift in the packaging of IBM application development tools for the iSeries server. Rather than continuing to sell individual tools and compilers, this package consolidates all the key iSeries development tools, both host and workstation, traditional and new, into one attractively-priced iSeries offering.

This product is a consolidated set of host and workstation tools optimized for a complete application development solution built on the iSeries server. However, you may as well use the WDS tools to develop applications for other Web servers.

With the WDS for iSeries, you can:

- Convert existing 5250 interfaces to Web interfaces with minimal changes to the host application with the new Webfacing Tool.

- Use the Studio-generated default servlets, beans, and database-accessing logic, or customize your code or create new business logic with VisualAge for Java.
- Write business logic for new e-business applications in ILE RPG or ILE COBOL with added interoperability enhancements for Java.
- Enhanced debugging functionality is included with the industry-leading debug capabilities of CODE/400.

Figure 6-4 shows the host and client components of WDS for iSeries.

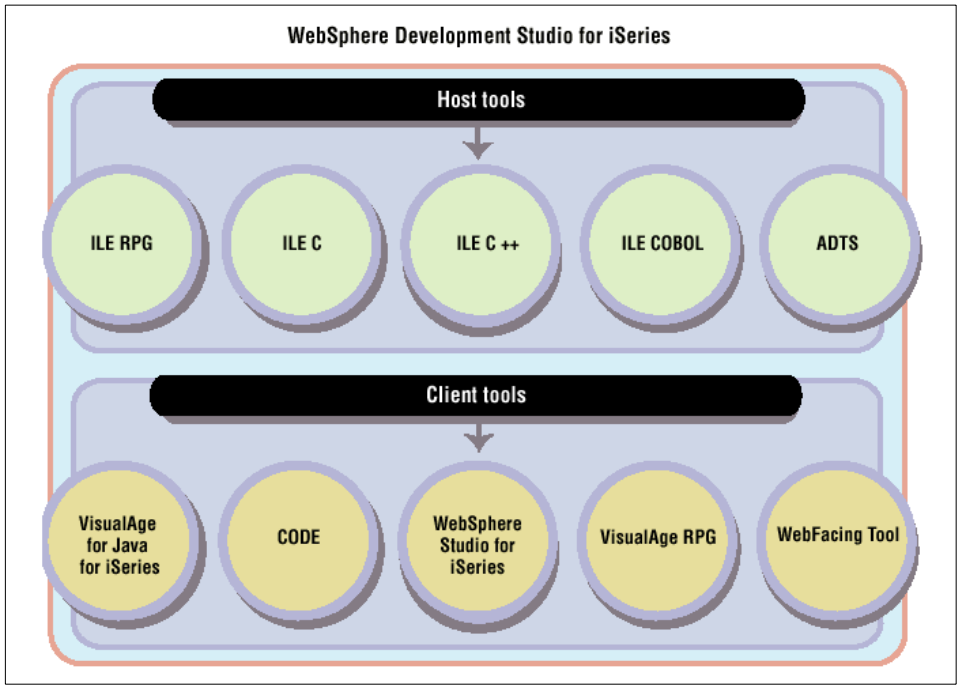


Figure 6-4 WDS host and client components

The WDS for iSeries gives application developers, with traditional iSeries programming skills, the ability to quickly develop e-business applications without having to learn Java and other Web-application skills. It provides a set of wizards, as part of the WebSphere Studio client software, that takes you through the steps required to create Web input and output pages. It allows you to define the parameters associated with the design-time controls on the Web pages and link the fields on the Web pages to the parameters in the business logic. You can do this without having to deal with JavaServer Pages, JavaScript code, and servlet code.

The WDS for iSeries client tools are bundled into a package called *IBM WebSphere Development Tools for iSeries*, which is discussed in 6.4, “IBM WebSphere Development Tools for iSeries” on page 141.

The WDS for iSeries host components are introduced, in brief, in the following subsections.

6.3.1 ILE RPG

ILE RPG is the compiler for RPG IV, the latest generation of RPG, enriched with the new functions you've been asking for. With ILE, you have the power of a suite of compilers for multilanguage interoperability and faster call performance. Your investment in RPG applications is protected with full upward compatibility. A conversion aid helps you easily convert your RPG III applications to RPG IV language definition.

To know about the V5R1 enhancements made for RPG IV, go to:
`http://www-4.ibm.com/software/ad/wds400/about/ile_rpg.html`

You can also refer to the following IBM Redbooks about RPG programming on the iSeries:

- *Moving to Integrated Language Environment for RPG IV*, GG24-4358
- *AS/400 Programming with VisualAge for RPG*, SG24-2222
- *Who Knew You Could Do That with RPG IV? A Sorcerer's Guide to System Access and More*, SG24-5402

6.3.2 ILE C/C++

The ILE C/C++ Compiler supports program development on iSeries servers in both the C and C++ programming languages.

The C compiler is a high-performance, high-function compiler for C development on the iSeries platform. You have the combination of function-rich C and the power of ILE. ILE gives you fast calls and a uniform runtime model, which are definite benefits for call-intensive C.

With the C++ Compiler, you can develop object-oriented, mission-critical applications – for the client, iSeries server, or both in a client/server solution. It is a single, powerful object-oriented C++ programming development environment that integrates cooperative processing with graphical user interface development.

To learn about the V5R1 enhancements made for ILE C/C++, go to:
`http://www-4.ibm.com/software/ad/wds400/about/ile_ccpp.html`

6.3.3 ILE COBOL

The ANSI-85 functions of ILE COBOL let you easily port code from other platforms to the iSeries server. Your investment in applications is protected, and you can move confidently into the future.

To learn more about the V5R1 enhancements made for RPG IV, see:
http://www-4.ibm.com/software/ad/wds400/about/ile_cobol.html

6.3.4 Application Development ToolSet (ADTS)

ADTS for iSeries is a well-integrated set of host-based development tools you can use with confidence as you build your applications. It combines established tools, like PDM, SDA, and SEU, with new utilities. Also in the package are two optional features that are especially well suited for helping you in planning, managing, and developing applications in a multideveloper organization:

- Application Development Manager/400
- Application Dictionary Services/400

  To learn more about ADTS, go to:
  http://www-4.ibm.com/software/ad/wds400/about/adts.html

6.4 IBM WebSphere Development Tools for iSeries

WebSphere Development Tools for iSeries is a complete package of premium iSeries program development tools. These tools help you quickly develop iSeries-based applications for e-business using your choice of traditional 5250 green screen interfaces, HTML browser interfaces, or GUI-based interfaces on workstations running the Windows operating system. You can generate Java to Web-enable your RPG applications; write host or server code with the CODE workstation-based client/server development environment; and develop and maintain applications in many iSeries languages, including RPG and Java.

A good place to start your understanding of what you can accomplish with this family of products is *IBM WebSphere Development Tools for AS/400: An Introduction*, REDP0503, which is found at http://www.redbooks.ibm.com/

The following components are included in WebSphere Development Tools for iSeries:

- WebFacing Tool (First Edition)
- WebSphere Studio, Professional Edition, with iSeries-unique features
- VisualAge for Java, Professional Edition, with iSeries-unique features (Enterprise Toolkit for iSeries)

- CODE (CoOperative Development Environment)
- VisualAge RPG

6.4.1 WebFacing Tool

The WebFacing Tool is introduced to help build a Web interface to existing 5250 applications. The WebFacing Tool creates the Web interface by converting, at development time, the display file source into JavaServer Pages and Java databeans. These Java components are deployed to the WebSphere Application Server and in combination with the WebFacing runtime, provide a Web interface to the existing 5250 application.

Little or no change is required to the application's business logic, and the same logic can support both a 5250 and Web interface. There is no dual maintenance. The conversion process is easy and cost-effective. There are no separate tool costs or runtime charges associated with the WebFacing Tool.

6.4.2 WebSphere Studio, Professional Edition

WebSphere Studio is IBM's premier Web development tool. To this, we added display file-like Web palette parts including entry fields with validity checking and editcode support and subfile parts. These generate standard HTML and JavaScript. There is also a wizard for generating a functional Web user interface to existing programs and service programs and a wizard to simplify publishing on the iSeries. It is easier to create Web applications that access iSeries data and applications with this version of WebSphere Studio than with any other Web development tool.

6.4.3 VisualAge for Java, Professional Edition

VisualAge for Java is recognized as the best IDE for creating Java applications for the iSeries server. To the Professional Edition, we added the Enterprise Toolkit for iSeries. The toolkit provides easy access to all of the iSeries server functions as well as wizards to generate code to access iSeries data and applications.

You can develop “100% Pure Java” applications, applets, and JavaBeans. In addition, access support for common iSeries functions is fully-integrated into this release. The Java Development ToolKit for iSeries, combined with VisualAge for Java, Enterprise Edition, provides a comprehensive development environment for building applications for the Web and electronic commerce.

One of the most important features of VisualAge for Java is the *WebSphere Test Environment*. This feature provides application and Web server environments on a development machine that enables you to test and debug the resources of a Web site locally.

Note: Other editions of VisualAge for Java exist outside the packaging provided by the IBM WebSphere Development Tools for iSeries. See http://www.ibm.com/software/ad/vajava/ for more details.

6.4.4 CODE

CODE is a client/server development environment for writing host or server code. It allows you to develop or maintain applications in ILE RPG, RPG/400, ILE COBOL, COBOL/400, ILE C, ILE CL, CL, DDS, and Java. It is an easy, cost effective and productive way to work with iSeries host applications on your Windows 95/98 and NT workstations.

You can use Client Access, Personal Communications, or TCP/IP to connect to the iSeries server. However, CODE doesn't require continuous connection to the iSeries. Many of the CODE features can function in a disconnected mode.

CODE includes a set of flexible workstation and host tools for developing and maintaining iSeries application programs. Workstation tools include the editor, screen, report and database designer, syntax checker, program verifier, project organizer, and a debugger front end. Host components include the compiler, library system, and debugger back end.

This combination of tools provides you with the productivity of the PC environment as well as the integrity of the iSeries server.

CODE includes the CODE Designer, a what you see is what you get (WYSIWYG) utility for designing display files and printer files. This new, powerful, and easy-to-use interface can make designing your DDS screens, reports and physical files both fast and fun.

Another useful feature of CODE is the CODE Project Organizer. This utility allows you to access and manipulate iSeries objects with greater ease than PDM.

With CODE Project Organizer, you can create a project and set up filters to gain quick GUI access to your frequently used OS/400 objects, members, ADM projects, groups, and parts. Use the pop-up menus on these items to perform actions such as edit, compile, and debug. Use the CODE Actions notebook to create and manage user-defined actions.

6.4.5 VisualAge RPG

VisualAge RPG is the IBM premier development tool, compiler, and runtime for creating GUI applications that run on Windows or any GUI-capable client and provide seamless access to iSeries data and applications. The VisualAge RPG compiler is based on RPG IV.

VisualAge RPG features point and click simplicity for RPG programmers at the workstation. Use VisualAge RPG to capitalize on your existing RPG skills and start developing powerful e-business applications.

When built, your applications run on a workstation and can access the iSeries host data and objects. VisualAge RPG integrated components allow application developers to preserve their current skills and easily develop OS/400 applications with graphical user interfaces. With VisualAge RPG, you can build an application from the top down. You start by focusing on the look and feel of the interface. Then, you tie all the parts together with workstation RPG logic that you write in the VisualAge RPG language. You can reuse RPG logic and display files (DSPF) from an existing application.

You can now generate Java applications and Java applets from the VisualAge RPG source, making RPG a powerful e-business language. VisualAge RPG offers:

- A Visual Development Environment
- An RPG compiler on the workstation
- A programmable language-sensitive editor
- A Display file import facility
- Transparent PC-to-OS/400 connectivity
- Source-level debugger

6.5 Web-to-host integration positioning

IBM has aligned its strategic Web-to-host e-business solutions on a common technological foundation, centered around Java technology and IBM Framework for e-business. The transition for an enterprise to go to a Web-based solution for applications can be divided into three stages of development as shown in Figure 6-5. IBM has products to provide the solution for each step of the way.

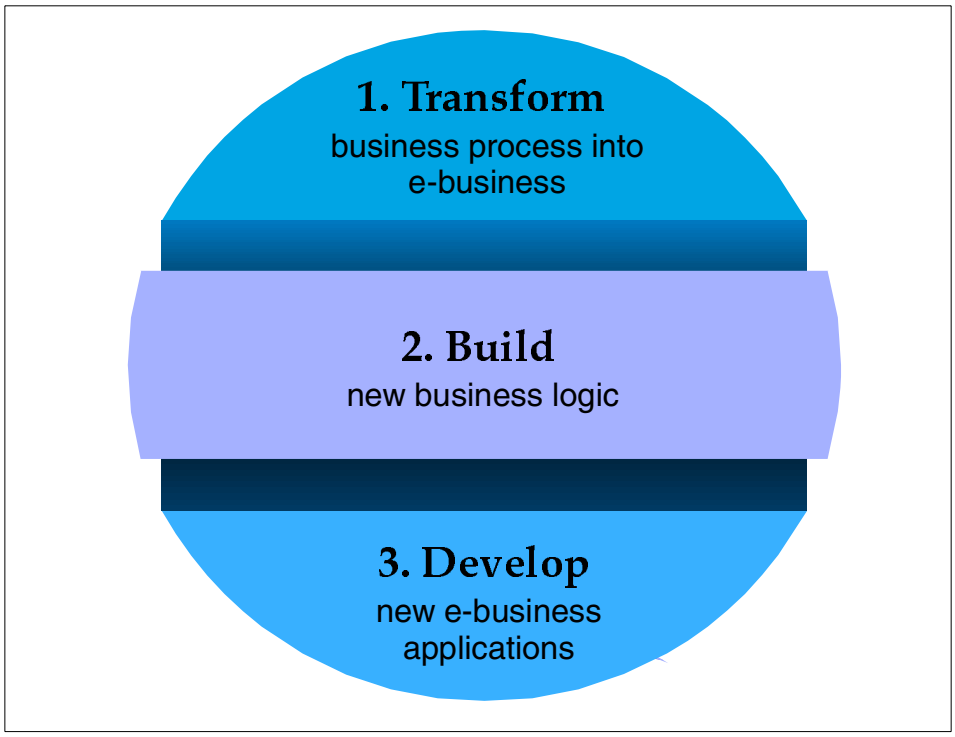


Figure 6-5 Web-to-host integration stages

The stages in Figure 6-5 are explained in the following list:

- Stage 1 involves implementing Web-to-host application integration solutions that open up applications to intranets, and then extranets, and last to the Internet, without requiring changes to the host applications. The WebSphere host integration products and WebSphere Development Studio for iSeries provide the quickest way to Web-enable existing host applications requiring little or no new business logic. They provide solutions for different needs and complement each other to provide a total solution.
  - Host On-Demand
  - Host On-Demand with Screen Customizer
  - WebFacing tool
  - Host Publisher
  - Web interaction wizard (WebSphere Studio for iSeries)
- Stage 2 begins by adding new business logic to existing Web-to-host application implementations.
  - *Host Publisher*: Host Publisher applications can be enhanced using such products as WebSphere Studio and VisualAge for Java.

– *Web interaction wizard (WebSphere Studio for iSeries)*: Web Interaction wizard applications can be enhanced using such products as WebSphere Studio and VisualAge for Java.

- Stage 3 involves developing new e-business applications. WebSphere Application Server (WAS) and Studio provide a Java infrastructure for the development and execution of Java applications and servlets. It focuses on adding new business logic to existing applications or deploying totally new Web applications.

The staging of the transformation to e-business delivers a leading edge solution for both the integration of existing applications and the deployment of new applications on the Internet.

6.6 Web-to-host integration tools comparison

This section introduces four different IBM software components available to access the iSeries server applications from the client with a Web browser.

6.6.1 Host On-Demand

IBM WebSphere Host On-Demand (HOD) is an IBM product that gives Web users access to host programs through a Web browser and gives application developers a set of self-contained and portable core host access reusable components for direct manipulation of host application data. Figure 6-6 shows an overview of Host On-Demand.

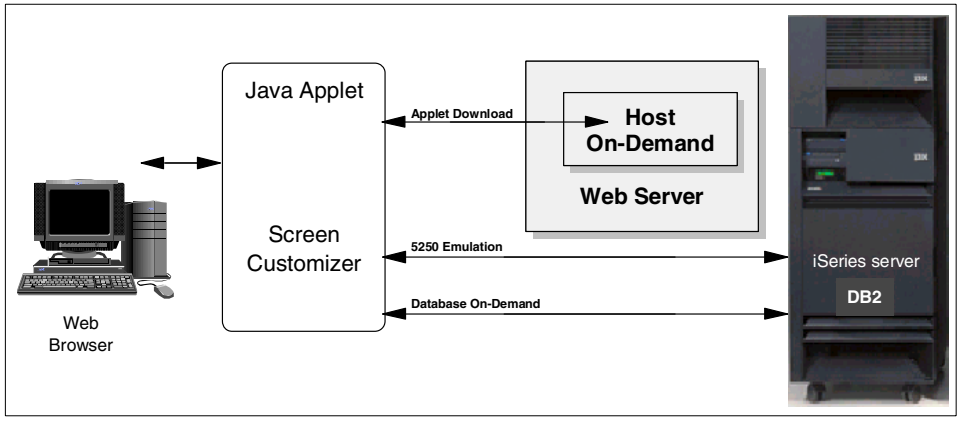


Figure 6-6 Host On-Demand overview

Browser access to host systems is provided through the use of Java applets downloaded into the client Web browsers, although the applets can also be installed as stand-alone clients.

Database On-Demand, included with Host On-Demand, provides access to DB2 information stored on iSeries servers using a JDBC driver. It allows users to access iSeries databases by running SQL statements online. It uses the OS/400 JDBC client that has been integrated into Host On-Demand.

Host On-Demand includes an application development environment that includes Host Access Beans for Java, Host Access Class Library for Java, Host Access Controls for ActiveX, ECLApplets, and Open Host Interface Objects.

For more information about the Host On-Demand, please, refer to *IBM WebSphere Host On-Demand: Version 5 Enhancements,* SG24-5989, or to the Internet site:
http://www-4.ibm.com/software/webservers/hostondemand/library.html

Host machine requirements

The requirements for the host machine are:

- OS/400 V4R3 or higher

  Recent cumulative service is recommended. See also iSeries fixes, downloads, and updates on the Web at:
  http://as400service.rochester.ibm.com/
- IBM HTTP Server for iSeries, 5722-DG1 for OS/400 V5R1, and 5769-DG1 for previous releases
- Developer Kit for Java, 5722-JV1 for OS/400 V5R1, and 5769-JV1 for previous releases
- The IBM Toolbox for Java, 5722-JC1 for OS/400 V5R1, and 5769-JC1 for previous releases
- Qshell Interpreter, 5722-SS1 for OS/400 V5R1 (5769-SS1 for previous releases) option 30 is recommended
- TCP/IP Connectivity Utilities for iSeries 5722-TC1 for OS/400 V5R1, and 5769-TC1 for previous releases (installed and configured)

Client machine requirements

The requirements for the client machine are:

- Windows NT (with Service Pack 5) or Windows 2000
- A Web browser:
  - Netscape Navigator 4.6 or higher
  - Microsoft Internet Explorer with IBM SP1 5.0 or higher

6.6.2 WebFacing Tool

You can use the WebFacing Tool with applications where DDS source code was used to create 5250 display screens. The tool has user-friendly wizards that facilitate selecting your original application's DDS source, converting the source, and deploying the new browser-based interface to your program as a WebSphere application. The conversion creates JavaServer Pages and JavaBeans that substitute for your DDS code and make Web access possible. After your DDS code is converted, you can access the application through a browser or continue to use 5250 displays.

Basing the interface on your applications on JavaServer Pages allows for more flexibility in customizing their appearance. Before your DDS code is converted, you can use the Style wizard to change the look and feel of the pages that will be generated for you. Styles allow you to define attributes in your Web pages such as graphics, fonts, colors, and layouts. You can use one of the supplied styles or create your own. If you want to update the appearance of a previously converted project, simply run the WebFacing Tool again and select a new style.

When using WebFacing Tool for converting 5250 interfaces to Web based interfaces, the ILE program remains the same. All the maintenance to that program will be done on the host code. That is, you have to use the enhancements and technologies provided for the host ILE language used.

Host machine requirements

To deploy and run your Web applications, you must ensure the following requirements are installed and configured on your host machine:

- OS/400 V4R5 or later
- WebSphere Application Server 3.5.2: Either the Standard or Advanced versions of WebSphere Application Server can be used. WebSphere Application Server Standard for OS/400 is available as a PTF to OS/400 V4R5.

  Note: You *must* install the latest PTFs with your WebSphere Application Server. For the latest PTFs available, go to:
  http://www-1.ibm.com/servers/eserver/iseries/software/websphere/wsappserver/services/service.htm
- IBM HTTP Server (original) (5769-DG1 for V4R5, and 5722-DG1 for V5R1)
- You must enable file sharing via NetServer so that your Web application contents can be moved to the iSeries server (or publish via FTP).

Note: You can have your business application installed on an iSeries server, and have both the HTTP server and the WAS server installed on either a Windows NT, UNIX, or another iSeries server.

Client machine requirements

Before you can use the WebFacing tool to develop Web applications, you must ensure the following requirements are set up on your client machine:

- Windows 98, NT, ME, or 2000
- A Web browser, as follows:
  - Internet Explorer V5.0: For WebFacing tool run-time development
  - Internet Explorer V5.0 or Netscape V4.7: For viewing the online help in the development environment

6.6.3 Host Publisher

IBM WebSphere Host Publisher is a part of the IBM Host Integration software. Host Publisher enables enterprises to jump-start e-business applications from existing host applications and data. It does this using industry-standard HTML Web pages to support end users running non-Java browsers.

It is Java-based and supports AIX, OS/390, Windows NT, iSeries, NetWare, and Sun Solaris operating systems.

There are two major components in IBM WebShpere Host Publisher:

- *Host Publisher Studio*: Provides easy-to-use tools to assist in the creation of Web-to-host integration projects.
- *Host Publisher Server*: Consists of IBM WebSphere Application Server and Host Publisher runtime components. It provides the runtime environment for executing Web applications created with the Host Publisher Studio.

Host Publisher Studio tools create Integration Objects that encapsulates the interaction and data retrieval with host applications. It also generates fully customizable HTML output with embedded JavaServer Pages tags to invoke the Integration Objects.

Host Publisher provides you with host access capabilities without the need to build Java applications and applets yourself. You can enhance the applications built by Host Publisher, for example, by adding graphics to the pages.

Host Publisher applications run on the server, not as Java applets. The information is served to the clients as HTML. Because of this, there are no specific requirements placed on the client Web browsers, and therefore, it is appropriate for Internet use, as well as intranet and extranet.

Host machine requirements

The following software is required to be installed and configured on your iSeries server:

- OS/400 V4R4 or later
- WebSphere Application Server (WAS) V3.5 Standard or Advanced Edition
- IBM HTTP Server, original (5769-DG1 for V4R5, and 5722-DG1 for V5R1)
- JDK 1.1.8 5769-JV1 for V4R5, and 5722-JV1 for V5R1 Option 4 (JDK 1.2.2 is installed with Host Publisher Studio)

Client machine requirements

Before you can use the WebFacing tool to develop Web applications, you must ensure you set up your client machine with:

- Windows 95, 98, NT 4.0 (with Service Pack 4 or later), or 2000
- A Web browser

6.6.4 WebSphere Studio for iSeries

The Web Interaction Wizard is a component of the IBM WebSphere Studio for iSeries. This wizard is used to create the interaction between the Web pages and the ILE programs on the iSeries server. It is used to define input, output, and error Web pages and to identify the ILE program to call for a particular interaction. It also allows the user to identify the parameters that will be passed to the ILE program and to map the input and output fields from the Web pages to the ILE program parameters.

One great advantage of using the Interaction Wizard is that you can use the new Web technologies when maintaining the ILE programs containing your business logic.

Host machine requirements

The following software is required to be installed and configured on your host machine:

- OS/400 V4R4 or later
- WebSphere Application Server (WAS) Version 3.5 or later for both development time and runtime

- IBM HTTP Server (original) (5769-DG1 for V4R5, and 5722-DG1 for V5R1)

Client machine requirements

Before you can use the WebFacing tool to develop Web applications, you must ensure to set up your client machine with:

- Windows 95, 98, NT, or 2000
- A Web browser:
  - For development time: Microsoft Internet Explorer 4.0 or later
  - For run time: Netscape 4.7 or later, or Microsotf Internet Explorer 4.0 or later

6.6.5 Comparison table

Table 6-1 compares the three solutions that we've discussed for converting existing iSeries host application to Web-based applications.

Table 6-1 Comparison between the different 5250 to Web interface conversion software

	Host On-Demand	**WebFacing Tool**	**Host Publisher**	**WebSphere Studio**
Application on which logic resides and runs	iSeries server	iSeries server	iSeries server	iSeries server or client
Enhancing the appearance beyond the generated Web interface	Possible	Possible	Possible	Possible
The use of the Web and Java capabilities to enhance the application logic	Subject to the features available on the iSeries	Subject to the features available on the iSeries	Subject to the features available on the iSeries	Possible through enhancing the application logic on the client
Concurrent use of 5250 and Web interfaces	Possible	Possible	Possible	Possible *only* if the the logic on the host and client are on the same level
Application logic integration with other Web applications	Not possible	Only when using the generated HTML and JSPs	Possible through the use of the Integration Objects	Possible through the use of the application logic on the client

	Host On-Demand	WebFacing Tool	Host Publisher	WebSphere Studio
Access to different database sources	Possible through the use of the JDBC driver	Only as defined by the host application logic	Possible through the use of Host Publisher JDBC drivers	Possible through the use of the application logic on the client
Programming effort to convert host interface to Web interface	No programming necessary; may add customization with Screen Customizer	Depends on the DDS keywords supported at the time of JSP/servlet generation	- Build integration objects and JSPs with Host Publisher - Use Java to add more logic	Use Interaction Wizard to create Web pages
Supported host interfaces	- 3270 - 5250 - VT (VT52, VT100, VT220) - JDBC to iSeries - CICS Gateway applet	5250	- 3270 - 5250 - VT (VT52, VT100, VT220) - DB2 - JDBC Interface - Oracle, Sybase, other - Java applications	- 5250 - DB2 - JDBC interface - Java applications
Presentation	TN3270/TN5250 green screen or GUI with Screen Customizer functions, VT	HTML, JSP	HTML, JSP (use HTML editor to enhance output page)	HTML, JSP, Java Servlets

7

Domino Application Server for AS/400 (5769-LNT)

This chapter discusses the Lotus Domino product and how it plays a fundamental part in the iSeries e-business solution. There are several recently released products that aid in moving toward a Domino for iSeries e-business solution. These products are discussed here.

7.1 Lotus Domino overview

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. It can also build Internet-related applications, which are explained in this section.

As a server, the iSeries server provides reliability and scalability to enhance existing business applications. It can also reach new levels of collaboration and coordination, which were previously not possible with other Domino servers.

Lotus 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 iSeries server includes Dedicated Server for Domino (DSD). These are specially tuned iSeries Models 270 and 820 to give optimal performance to the Domino workloads. They are easily identified by the yellow badging. The DSD is often called the "Bumble Bee". For more information about DSD, see:
http://www.iseries.ibm.com/domino/dsd.htm

Note: New DSDs require OS/400 V5R1 and Lotus Domino for iSeries server Release 5.0.6a or later.

Domino base functions

Domino is an entire infrastructure and framework with which you can build new applications or extend existing iSeries applications to Notes or 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**: Manages the movement of documents and information through the organization.
- **Collaboration**: Helps people work together by managing information, data, schedules, documents, communication, and business processes.
- **Database**: Stores and manages 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 (messaging and replications services) and tools (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:

- **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.
- **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)
- **Search services**: Provide the capabilities of a full text search engine to search documents in databases, attachments, and files across an entire domain.
- **Security services**: Include:
  - Multiple user and object access levels
  - User groups
  - Digital signatures
  - Public key encryption
  - Object integrity checking
- **HTTP services**: Support Hypertext Transfer Protocol (HTTP), Hypertext 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 AIX, Linux, and other UNIX operating systems, as well as Microsoft Windows NT.

Lotus Domino for iSeries is the native implementation of the Lotus Domino server on the iSeries platform and is also one of the best performing servers.

7.1.1 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 UDB for iSeries and native Domino databases.

7.1.2 Domino for iSeries functions

Domino for iSeries combines the iSeries 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 iSeries is a great server on which to run Domino applications. Its 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 iSeries server because it 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.
- **Distributed environment**: Allows 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 UDB for iSeries data into these applications. For example, a customer service application could access an existing DB2 UDB for iSeries customer master file for such information as name, address, and phone number. DB2 UDB for iSeries integration works both ways. Your iSeries 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 iSeries, 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 UDB for iSeries 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 UDB for iSeries data, or an iSeries 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 Domino Designer for Notes client. With the Domino Designer, 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 a more complex workflow, GUI-based client/server, or network-centric applications.

7.1.3 Why Domino on the iSeries server

As a server, the iSeries provides reliability and scalability, which are essential in the dynamic and often unpredictable world of e-commerce. Domino for iSeries makes it easy to integrate the business data in DB2 UDB for iSeries databases with the Web-enabled applications you build with Domino. This is based on these factors:

- **Reliability:** The iSeries server boasts the most robust reliability in the market, with an incredible record of 99.97% uptime. If a specific application should fail, the iSeries server'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 benefit from this feature. You can also use logical partitioning with the iSeries and run Domino as a partition on its own.

- **Availability:** Self-diagnostics, remote administration, and the debugging capability of the iSeries server ensure maximum availability. The iSeries integrated file system architecture allows for centralized backup and recovery for iSeries 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 by clustering to provide server failover support and dynamic load balancing.

  An exclusive feature of Domino for iSeries is the automatic restart of the Domino server. IBM has built a watchdog job that starts automatically when you start a Domino server and 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 iSeries. 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 iSeries 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 iSeries server, 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 UDB for iSeries database:** Domino for iSeries applications take advantage of direct real-time access to the DB2 UDB for iSeries database. Users embed the results of an iSeries query into a Notes document without the need for programming. Domino for iSeries allows access to DB2 UDB for iSeries from Domino application development tools and APIs. This access is direct (integrated into the microcode). It enables 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 (LEI) product (a separately purchased product, formerly known as Lotus NotesPump) provides for data movement between DB2 UDB for iSeries and Domino, and direct real-time access to DB2 UDB for iSeries data from Domino applications with no programming required. The iSeries implementation adds unique capabilities to Lotus Enterprise Integrator. Using a feature of LEI, iSeries 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 iSeries 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 UDB for iSeries tables.

  For more details on positioning the various DB2 UDB for iSeries 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 iSeries include data integration and centralized management. iSeries 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 a Domino for iSeries implementation do not need to invest in an additional hardware platform, operating system software, or the skills needed to maintain this environment.

7.2 Domino architecture, products, and licensing

Domino is heavily used in places that have a direct impact on such areas 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. This section shows an example of Domino in a dynamic site, describes the iSeries Domino products that are available, and discusses the integration of Domino with other e-business products.

7.2.1 Domino dynamic site 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 iSeries-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 7-1 shows 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.

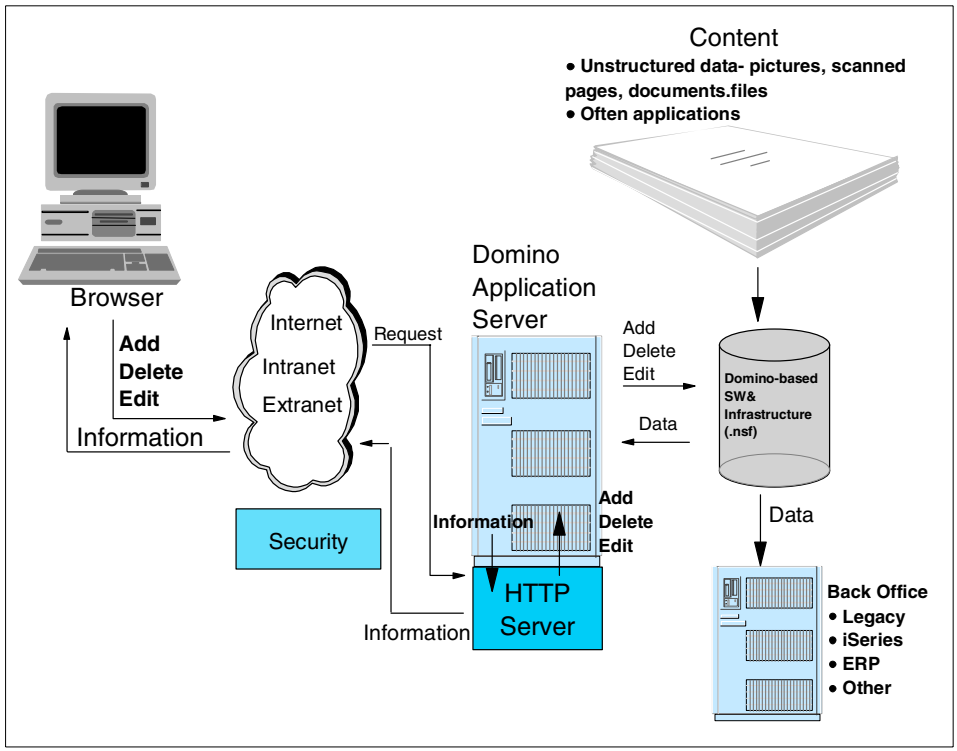


Figure 7-1 Domino dynamic site architecture

For more information on dynamic and transactional site definitions and architecture, see Chapter 8, “WebSphere Application Server” on page 183.

7.2.2 Domino servers and products

Table 7-1 shows a list of all the Lotus Domino servers and products, including the development tools and the integration products that ensure Lotus Domino is a fully integrated e-business solution.

Table 7-1 Domino servers and products

Server or product	Reference
Domino HTTP Server	7.2.3, “Domino HTTP server” on page 162
Legacy Applications	7.3.4, “ILE and traditional legacy language integration” on page 174
Lotus Enterprise Integrator	“Lotus Enterprise Integrator” on page 176

Server or product	Reference
ODBC and iSeries Data Access	“ODBC and iSeries data access” on page 178
Domino Designer	“Domino Designer” on page 166
WebSphere Studio	“WebSphere Studio” on page 168
WebSphere Commerce Suite	“WebSphere Commerce Suite integration with Domino” on page 172
Domino Toolkit for Java	“Domino Toolkit for Java” on page 169
VisualAge for Java	“VisualAge for Java” on page 169
Payment Systems	“Payment systems” on page 169
Electronic Store: ezMerchant	“Electronic Store: ezMerchant” on page 170
Lotus Domino Connectors	“Lotus Domino Connectors” on page 175
Domino Enterprise Connection Services (DECS)	“Domino Enterprise Connection Services” on page 176
Lotus Enterprise Integrator (LEI)	“Lotus Enterprise Integrator” on page 176

7.2.3 Domino HTTP server

Domino for iSeries 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 an LDAP server.

It also incorporates its own HTTP server, which may be used together or as an alternative for the HTTP Server for iSeries. The main strength of Domino HTTP Server is its unique ability to dynamically translate Notes documents into HTML, which allows 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 Version 3.0
- **HTTP**: Domino HTTP Server supports HTTP 1.1
- **NNTP**: Domino HTTP Server supports Native Internet News Protocol
- **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 Plug-in for Domino is available for WebSphere Application Server (WAS) Standard Edition V3 and WebSphere Application Server Advanced Edition V3. With the WebSphere Plug-in for Domino, it is possible to define the WebSphere Application Server as the servlet and JavaServer Pages (JSP) engine in the Domino HTTP server configuration. Additional integration functions are considered.

Note: Domino R5.0 contained the Domino plug-in for HTTP server for iSeries to allow Domino databases (*.nsf) to be served through the IBM HTTP Server for iSeries (original) instead of the Domino HTTP server. In other words, it allows you to select built-ins for HTTP or HTTP server for iSeries so that it is not necessary to configure both servers.

Coexistence of the Domino and iSeries HTTP servers

The Domino HTTP server and HTTP Server for iSeries each use port 80 by default. Depending on whether each server is attempting to bind to the same TCP/IP Interface, there may 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 HTTP Server for iSeries 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 in the QHTTPSVR subsystem. The Domino Web servers run in their designated Domino subsystem.

Domino HTTP Server versus IBM HTTP Server for iSeries

Domino HTTP server is *functionally equivalent to* V4R3 of HTTP Server for AS/400. Both products are based on the same base code. Subsequent versions were developed independently.

Generally, HTTP Server for iSeries is better tuned for static HTML and offers better functionality in its V5R1 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.

For more information on the IBM HTTP Server for iSeries, see Chapter 5, "The Web server: The core to your e-business" on page 105.

For more information on using the IBM HTTP Server for iSeries with Domino, refer to: http://www-1.ibm.com/servers/eserver/iseries/domino/domhttp.htm

Note: The HTTP Server (powered by Apache) is not currently supported by Domino R5.

7.2.4 Application server: Domino for iSeries

Performance and sizing recommendations for the Domino Application Server are covered in "Lotus Domino for iSeries" on page 310.

7.2.5 Domino for iSeries licensing

Domino can be ordered in two ways:

- From Lotus; check http://www.lotus.com for details
- From IBM as Licensed Program Product (LPP), 5769-LNT

As a Lotus product, it is ordered through Lotus authorized software resellers. Domino for iSeries is packaged on a yellow Lotus CD-ROM. A Domino for iSeries license includes the core Domino server, the SMTP Mail Transport Agent (MTA), and many facilities to support integration with iSeries 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. 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.

Purchasing maintenance at the same time as initial licenses results in a big cost savings. The maintenance (upgrade strategy) for Lotus software is handled differently from the IBM strategy for most iSeries products. By understanding this, you will avoid confusion and maintain customer satisfaction. We recommend that customers obtain detailed information from a Lotus authorized software reseller.

For volume licensing (as opposed 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 iSeries software licensing, hardware, and software requirements is on the Web at:
`http://www.iseries.ibm.com/domino/`

7.2.6 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 iSeries server is known for its security. The combination of the application security of Domino and iSeries security ensures a very secure system.

7.2.7 Development tools

Several development tools are part of the Domino package, including Domino Designer, VisualAge for Java, and WebSphere Studio. These are described in the following section.

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**: What you see is what you get (WYSIWYG) HTML authoring with complete control over page design and layout. Adds styled text, image maps, tables, Java, and ActiveX components to applications.
- **Frameset Designer**: Creates multi-paned interfaces for Web applications, without HTML coding. Automatically maintains target links.
- **Outline Designer**: Designs an entire site, links content to the site design, manage the links, and automatically generates a personalized site map.
- **Domino objects**: Rapidly build applications that access system services, such as 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**: Creates 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**: Allows you to 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 DECS. This feature offers:

- **Comprehensive connectivity**: DECS supports a wide range of enterprise systems, including DB2, Oracle, Sybase, ODBC, EDA/SQL, SAP, PeopleSoft, J.D. 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**: Allow you to 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**: Lets you 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 the different language versions at 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

WebSphere Studio

Domino is optimized for application and collaborative services (messaging, content management security, and so forth) 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, Enterprise JavaBean (EJB), and performance management.

Domino is becoming more of a development environment (with WebSphere for JSP and 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 toward an integrated and consistent Web application platform. Figure 7-2 illustrates this organization.

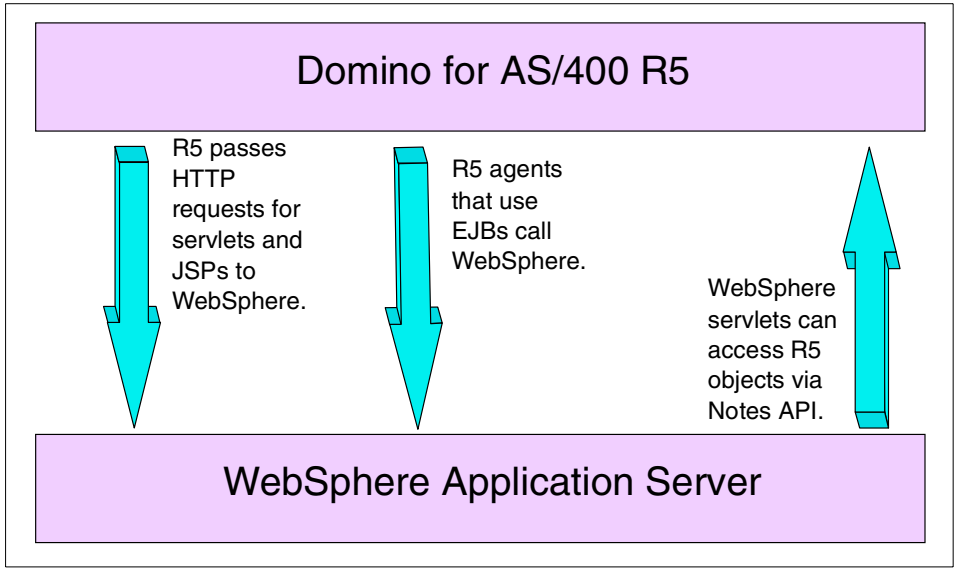


Figure 7-2 Domino and WebSphere integration

This includes common application services (directory security), common programming models (JavaBeans, servlets, JSPs, EJBs, Domino objects), a common set of developer tools (Java and eBasic as a common scripting language for JSPs), common enterprise data connectivity structure, and combined solution packages.

Refer to Chapter 8, “WebSphere Application Server” on page 183, for additional information on WAS.

Domino Toolkit for Java

Toolkit for Java enables developers to write, test, and debug Domino agents using their favorite Java Integrated Development Environment. Visit http://www-1.ibm.com/servers/eserver/iseries/domino/domdevtools.htm for further information.

VisualAge for Java

VisualAge for Java is for programmers. It is a full-blown Java IDE that has all the tools you need to write, debug, and test Java applets, servlets, and applications. It integrates with Domino through the free Domino Toolkit for Java. Go to http://www.iseries.ibm.com/developer/ for additional information.

Note: The Domino Application Studio is a comprehensive set of leading Web development tools and servers for designing and developing Web applications. Products that are not covered include NetObjects Fusion, NetObjects Bean, and Script Builder. Additional information is available at: http://www.lotus.com/home.nsf/welcome/appstudio

Payment systems

Domino allows connection to industry standard authentication authorities (Visa, MasterCard, CyberCash, Amex, and so on). It supports SET Secure Electronic Transactions and Electronic Commerce Modeling 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 it 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 a user submits a form
- Real time: When an 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

Note: Domino also supports IBM Payment Manager 5733-PY3, V2.2.

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 that 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, an IBM and Lotus Business Partner, 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, catalog, order tracking, and other functions, all implemented on Lotus Domino. 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. You can find additional information at: http://www.binarytree.com

7.3 Domino integration products

Nowadays, not only can you can combine the strengths of iSeries and Lotus Domino to position your organization for the twenty-first century, you can also integrate Domino with a variety of different products to further enhance existing business applications and reach new levels of collaboration and coordination in your organization. Such products as WebSphere Application Server, WebSphere Commerce Suite, BlueNotes, and iNotes are discussed in this section.

7.3.1 BlueNotes integrates Notes and Domino

IBMs BlueNotes family comprises Document Warehouse (BNDW), Data Merge (BNDM), Office Portal (BNOP), and soon BluePages (BNBP). BlueNotes integrates Notes and Domino with the iSeries and OS/400 file system, database, and directory. It is used for Server Consolidation, Knowledge Management, and migration from OfficeVision/400 and MS Exchange.

Figure 7-3 shows a structural overview of the BlueNotes Document Warehouse.

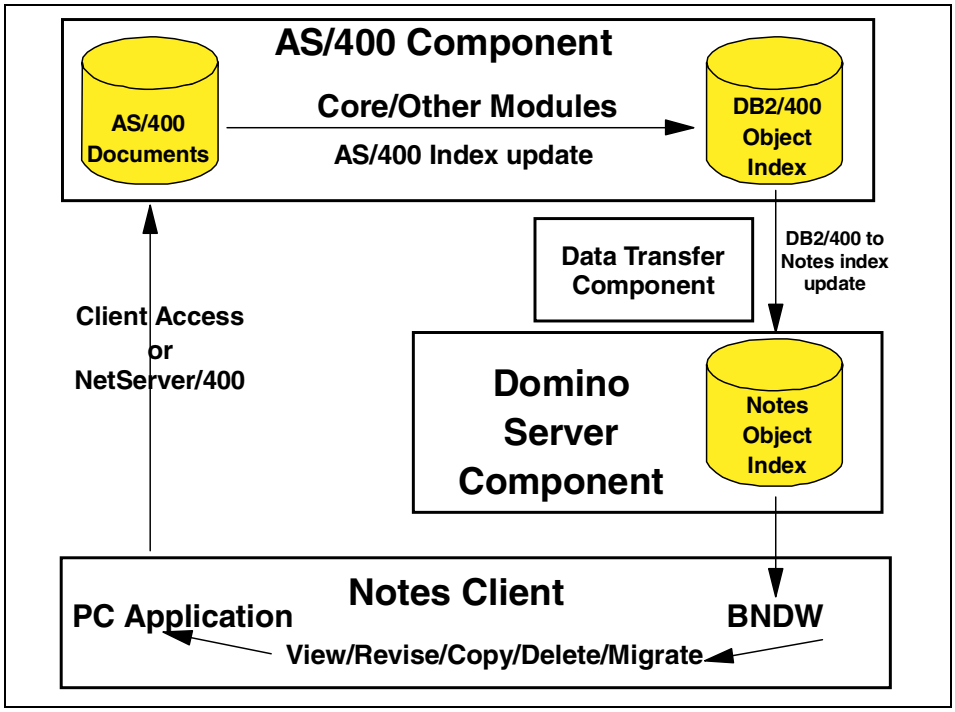


Figure 7-3 Structural overview of BNDW

For more information, you can go to the following Web sites:

- http://www.bluenotes.com/
- http://www.dominodotoffice.com/

7.3.2 WebSphere family integration with Domino

Both Domino and WebSphere are an important part of the IBM e-business strategy, not only with their customers (e-commerce), but with their business partners and suppliers (business-to-business). Domino and WebSphere are middleware, and this is the arena where integration happens.

IBM and Lotus recently announced a number of enhancements to Domino and WebSphere to more tightly integrate the two products. Customers have asked how iSeries participates in the new capabilities. This section outlines the current key integration points. It also includes some URLs to general Domino and WebSphere integration information and more specific information on their implementations on iSeries.

WebSphere Application Server integration

Domino is more sophisticated at collaboration capabilities and is much more than just e-mail. Domino is optimized for services like:

- *Application services*: Messaging, Directory, Security, Calendaring, and Search
- *Advanced services*: Workflow, Content Management, Access Control, Mobile, and Object Store

Domino is the premier platform for *convergent applications*:

- Automating unstructured business processes
- Managing work and information flow (Supply Chain Management, Customer Relationship Management)
- Building electronic relationships through focused collaboration

WebSphere Application Server is optimized for such infrastructure services as:

- Cross Web server (IIS, Domino, iPlanet, Apache, IBM HTTP Server)
- Distributed Transaction Management, Session Management
- Java programming model (Servlet, JSP, EJB)

The conclusion is that Domino and WebSphere have complimentary strengths required for e-business today. For more information on Domino and WebSphere integration, refer to the following Web sites:

- Lotus Domino for iSeries and WebSphere Integration:
  http://www-1.ibm.com/servers/eserver/iseries/domino/domws.htm
- Building Web applications using WebSphere and Domino:
  http://service2.boulder.ibm.com/devtools/news0800/art3.htm

WebSphere Commerce Suite integration with Domino

WebSphere Commerce Suite (WCS) 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 WCS transactional site with Domino workflow, messaging handling communications, and business process management in the organization.

Refer to Chapter 9, “WebSphere Commerce Suite for iSeries V5R1 (5798-WC5)” on page 203, for further information on WebSphere Commerce Suite. You can also refer to “WebSphere Application Server integration” on page 172 for further WebSphere integration details and reference Web sites.

References

To learn more about Domino and WebSphere integration, you can refer to these sources:

- *Domino and WebSphere Together: Second Edition,* SG24-5955
- Lotus Domino for iSeries and WebSphere Integration Web site: `http://www-1.ibm.com/servers/eserver/iseries/domino/domws.htm`
- *Building Web applications using WebSphere and Domino*: `http://service2.boulder.ibm.com/devtools/news0800/art3.htm`
- *Integrating WebSphere Commerce Suite with Domino Back-End Application: iSeries 400 Edition*, REDP0141

7.3.3 iNotes

iNotes is the ability for Lotus customers to obtain remote access to Domino applications and information. It has the following benefits:

- Simple deployment
- Off-line support through DOLS replication

iNotes incorporates two key products that are discussed in the following sections.

iNotes access to MS Outlook

Now organizations can improve the reliability and scalability of their messaging infrastructure and add e-collaboration, by upgrading from Microsoft Exchange to Domino without changing clients:

- *Improve your outlook*: Use Microsoft Outlook 98/2000 to access the reliable and scalable Domino Messaging.
- *Domino Messaging environment*: On any supported platform.
- *No training necessary*: The familiar Microsoft Outlook 98/2000 user experience is unchanged with iNotes Access for Outlook.
- *Hands-off deployment*: Connect all your Microsoft Outlook 98/2000 users to Domino by completing one simple form. Users connect to their new Domino Server with just three mouse clicks.
- *All the advantages of Domino Messaging*: Users get superior mobile access and high-value features like full text search. IT gets optional failover and load

balancing for mail, a choice of server platforms, easier administration, and e-collaborative applications.

iNotes Web access

iNotes Web Access transforms the Web browser experience, delivering leading messaging, collaboration, PIM, and offline support to browser users:

- A leading edge Web client

  iNotes Web access combines the simplicity and universal capabilities of a Web browser with the power of an enterprise-class, full-featured application.

- All the advantages of Domino

  Extend your enterprise or e-business by delivering Domino to customers, business partners, and end users through a sophisticated Web client.

- Provides both online and offline access

  For the first time, give Web browser users access to e-mail, calendar, group scheduling, to do lists, and personal contacts, whether they're online or disconnected!

- Rapid, no-touch deployment

  Instantly deliver Domino collaborative services to all your browser users.

- Instant messaging and collaboration

  iNotes Web Access integrates with Lotus Sametime and QuickPlace, letting browser users see who's online, send instant messages, chat with colleagues in realtime, and collaborate over the Web.

For more information, go to these sites:

- Lotus Domino site:
  `http://www-1.ibm.com/servers/eserver/iseries/domino/inotes.html`
- iNotes site: `http://www.lotus.com/inotes`
- Developer Network Domino Off-Line Services (DOLS):
  `http://www.lotus.com/dols`

7.3.4 ILE and traditional legacy language integration

Domino on all platforms offers a set of APIs to allow access to Domino databases from external applications. The iSeries server supports C and C++. Domino for iSeries also supports Java application development. iSeries applications interface with Domino applications by calling programs written using these APIs.

Data Integration for Domino applications are achieved through connectors and Domino, specifically ODBC, LEI, and 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.

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. Lotus Domino Connectors work in tandem with LEI and DECS. The architecture is shown in Figure 7-4.

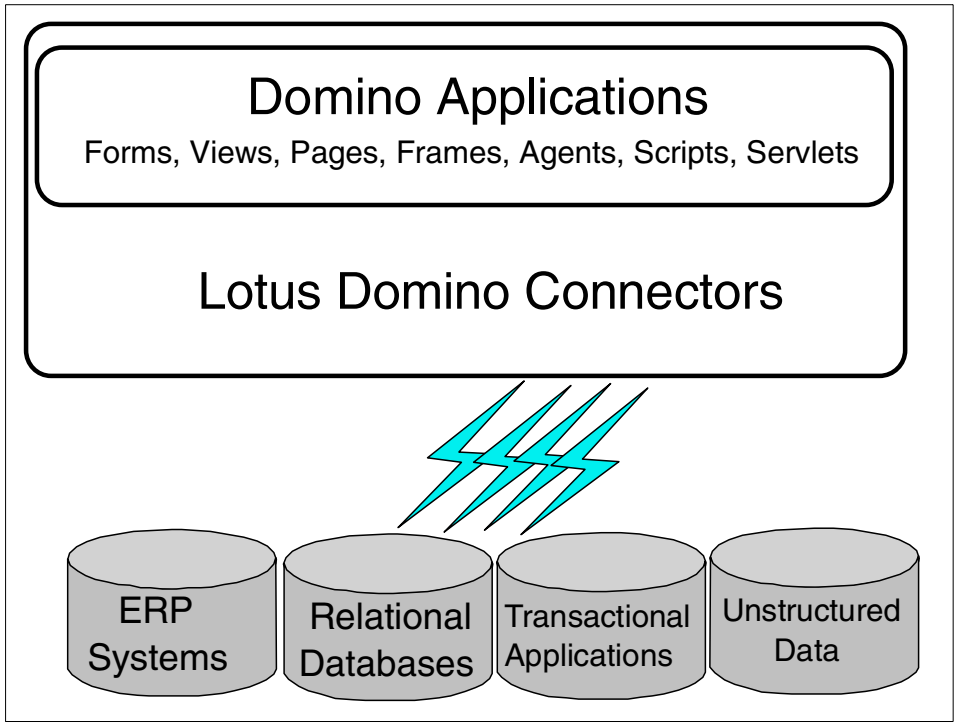


Figure 7-4 Lotus Domino Connector architecture

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.

Domino Enterprise Connection Services

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 real time. With DECS, you can view, create, update, or delete external, back-end 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 real time 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.

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 real time connection definition form. They also identify other form fields to hold query result information, supplied through real time access to an external server source, such as a DB2 UDB for iSeries table.

Users with either a Notes client or Web 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 real time.

Lotus Enterprise Integrator

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 of you who are familiar with earlier version of LEI, the LEI Connector is the enhanced equivalent to the NotesPump Link.

Lotus Enterprise Integrator features

On the iSeries server, the LEI server is a 64-bit application that executes as an ADDIN server task to a native 64-bit Domino server on the iSeries server. Access to DB2 databases, Domino databases, and file system objects is allowed using the LEI server running on the iSeries server. Direct (native API) connections to databases, such as Oracle and Sybase, are not supported on the iSeries server, nor is the ODBC Connection allowed. Access to non-DB2 data sources is achieved by using the IBM DataJoiner product on a Windows NT Integrated xSeries Server, outboard Windows NT, AIX, or HP_UX platform to reroute DRDA requests from the iSeries server to the target data source. Databases that support DRDA or an iSeries Requester/Driver can be accessed without using DataJoiner.

Note: Additional information about Lotus Enterprise Integrator for iSeries is found in the *Lotus Integrator 3.0 User Guide*. You can find this document on the Web by searching for LEI on the site at: `http://www.lotus.com/home.nsf/`

Domino applications written with LotusScript have the ability to call external applications using SQL statements. SQL can call a stored procedure that is an iSeries 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 UDB for iSeries table and have a never-ending RPG program read or update it (as a way of communicating) to process requests.

LEI/DECS purpose

LEI/DECS is a tool typically used to synchronize between Domino databases and relational data sources such as DB2, Oracle, and so on. LEI/DECS can be used with or without clustering Domino servers. However, since the iSeries server only supports LEI/DECS connections to DB2 (locally or via DRDA), an alternate platform can be used to synchronize between Domino for iSeries databases and, for example, Oracle. In that scenario, you might have a Domino for Windows NT server synchronizing between Oracle and a Domino database using LEI. Then, you might replicate those synchronizations onto a Domino for iSeries 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.

ODBC and iSeries data access

You can write Java agents and servlets that use JDBC to access DB2 UDB for iSeries (and non-IBM databases, such as Oracle). This section examines data access.

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 formula statements with an ODBC parameter specified. With Domino for iSeries, the application code looks exactly the same from the programmer's perspective.

The iSeries differentiation is what OS/400 does with the database request after it leaves Domino. When the code runs on the Domino for iSeries server, as in the case of server agents or scheduled agents, OS/400 intercepts the ODBC request and processes it by making direct calls to DB2 UDB for iSeries. 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 iSeries server, SQL, and Notes. Table 7-2 shows the terms that have similar meaning between the three environments.

Table 7-2 Database terminology

DB2 for iSeries 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 iSeries server, there are libraries that contain groups of data. This is similar to the concept of a collection in SQL and a Domino NSF database. Within a library on the iSeries server, files are synonymous with a table in an SQL collection and a view in Domino.

One example of a data item is known as a *record* in an iSeries file. This record is the same as a *row* in an SQL table and a document in a Domino database view. Within the record, there are individual data elements called *fields* on an iSeries server. A *column* is a data element within an SQL row. A data item in a document is called a *field*.

Lastly, on the iSeries server and in SQL, you create queries to obtain data from the data repositories. In Domino, you use the 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 UDB for iSeries data and iSeries applications in a Domino for AS/400 environment. In selecting the most appropriate tool, it is important to understand the trade-offs of each tool, such as where it can be used, the prerequisites, the required skills, scope of data or application access, and performance considerations.

7.4 References

This section covers the future positioning of Lotus Domino for iSeries. It then provides several useful Web sites and publications that you can refer to for more information. Finally, it lists any service offerings that are available.

7.4.1 Future direction

Lotus Sametime is a family of real-time collaboration products that provides online awareness, communication, and document sharing capabilities. Sametime brings the flexibility and efficiency of real-time communication to the business world.

IBM and Lotus are now offering a beta version of Sametime 1.5 for AS/400, as a special offer for iSeries customers who have already installed Domino. For more information, see: http://www-1.ibm.com/servers/eserver/iseries/sametime/

7.4.2 Education

For more information on Lotus Domino education, go to:
http://www-1.ibm.com/servers/eserver/iseries/domino/edsplash.htm

7.4.3 Web sites and manuals

Refer to the following publications and sites for more information:

- Additional Domino for iSeries case studies are available on the Web at:
  http://www.iseries.ibm.com/casest/casemenu.htm
- *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 iSeries server with Lotus Domino for AS/400. This redbook is written for technical specialists and programmers, who are IBM customers and Business Partners.
- *Domino and WebSphere Together*, SG24-5955
- *Developing an e-business Application Using Lotus Domino for AS/400*, SG24-6052

  This 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.
- *WebSphere V3.5 Handbook*, SG24-6161
- *New Enterprise Integration Functions for Lotus Domino for AS/400*, SG24-6203

  This redbook covers how to call OS/400 stored procedures from Domino for AS/400 and how to use Java in Domino to develop integrated Domino and AS/400 applications. There is also a section on integrating SAP R/3 with Domino for AS/400.
- *Up and Running with Domino for AS/400*, SC41-5334

  This book helps new Domino users install and configure Domino for AS/400 Release 5.0.1 or later on a Dedicated Server for Domino.
- *Evaluating Appropriate Workloads for the IBM @server iSeries 400 Dedicated Server for Domino*

  This new white paper for the latest information on how different Domino workloads perform on the new highly scalable iSeries DSDs:
  http://www-1.ibm.com/servers/eserver/iseries/domino/pdf/dsdworkloads.pdf
- Additional information about Lotus Domino is available at:
  http://www.lotus.com/domino
- Information about Lotus Domino for iSeries is available at:
  http://www.iseries.ibm.com/domino

- You can find developer information under the “All About Notes & Domino” link at: http://www.notes.net

7.4.4 Services

IBM Global Services Consulting offers the SmoothStart service offering for Lotus Domino for iSeries. SmoothStart for Lotus Domino for iSeries provides planning and installation guidance for the Lotus Domino for iSeries Service Offering. It includes various checklists, samples, and plans that are intended to provide guidelines for the services specialist in developing an installation plan for the project, for managing the execution of the project and for executing the project. This is a revised Perform Guide (August 2000), which applies to OS/400 Version 4 Release 3 and later releases.

For Version 4 Release 2 and later, Lotus Domino can be installed on the AS/400 without an IPCS. This edition covers the installation and initial configuration of Domino for iSeries R4.6 or R5 server running natively on a RISC-based AS/400 processor.

For more information, see the IBM Global Services Web sites (the latter allows you to choose your geography):

- http://www.ibm.com/services
- http://www.ibm.com/services/worldwide/index.html

For country-specific service offerings, please talk to your IBM Sales Representative or IBM Business Partner.

8

WebSphere Application Server

What is WebSphere? It 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 and transactional Web site.

The IBM WebSphere family includes many products to create a complete e-business Web site. WebSphere's architecture enables you to build business-critical applications for the Web. This chapter focuses on application serving in WebSphere and provides information about some of these products.

For information about WebSphere Commerce Suite and related products, go to Chapter 9, "WebSphere Commerce Suite for iSeries V5R1 (5798-WC5)" on page 203. For information about the application development side of WebSphere, see Chapter 6, "e-business-out: Extending core applications to the Web" on page 129.

For the most current information on the IBM WebSphere family, go to:
http://www.ibm.com/websphere/

8.1 WebSphere Application Server for iSeries

We understand WebSphere Application Server (WAS) is an important product to create a dynamic Web site, but how does it work? This section provides the answer to this question.

8.1.1 How it works

The WebSphere Application Server is a Java-based servlet engine that is built on top of the native Java Virtual Machine (JVM) on the iSeries server. 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 8-1 shows how servlet support is provided on the iSeries server. 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 is shown at the top of the figure.

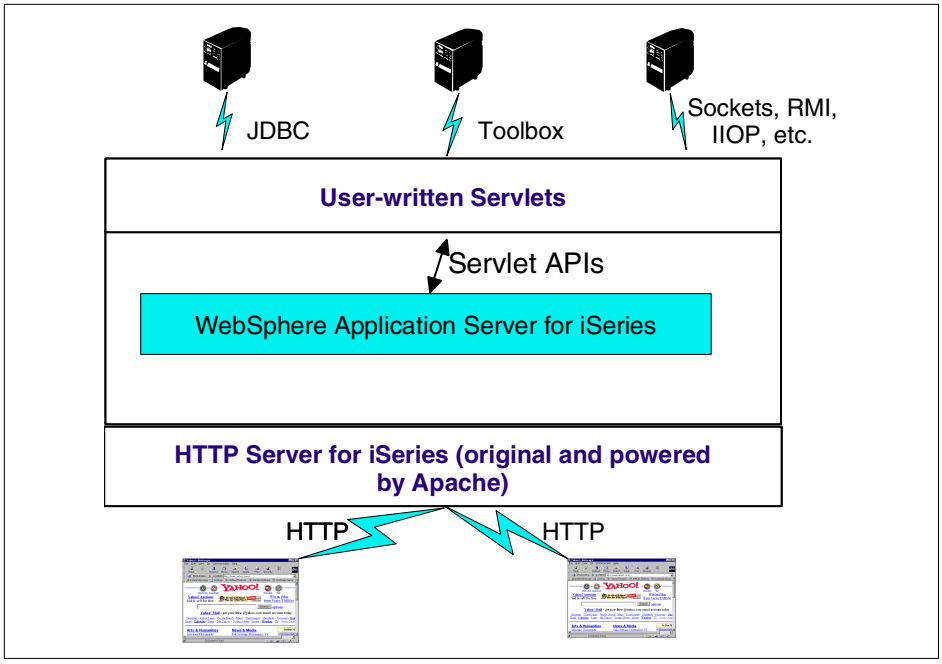


Figure 8-1 iSeries servlet support

The browser always interfaces to the Web server. In the case of the iSeries system, it is the IBM HTTP Server (5722-DG1).

The WebSphere Application Server is an add-on product to the HTTP server. It provides 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. The IBM Web server, in turn, interfaces to the browser.

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 (JSP) support. JSP technology is a simple but powerful way to dynamically generate HTML on the server side. With JSPs, you can quickly and easily create Web pages with dynamically generated content. When you write JSPs, 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.

Figure 8-2 shows how WebSphere 3.0 (and later) provides servlet and Enterprise JavaBean (EJB) support.

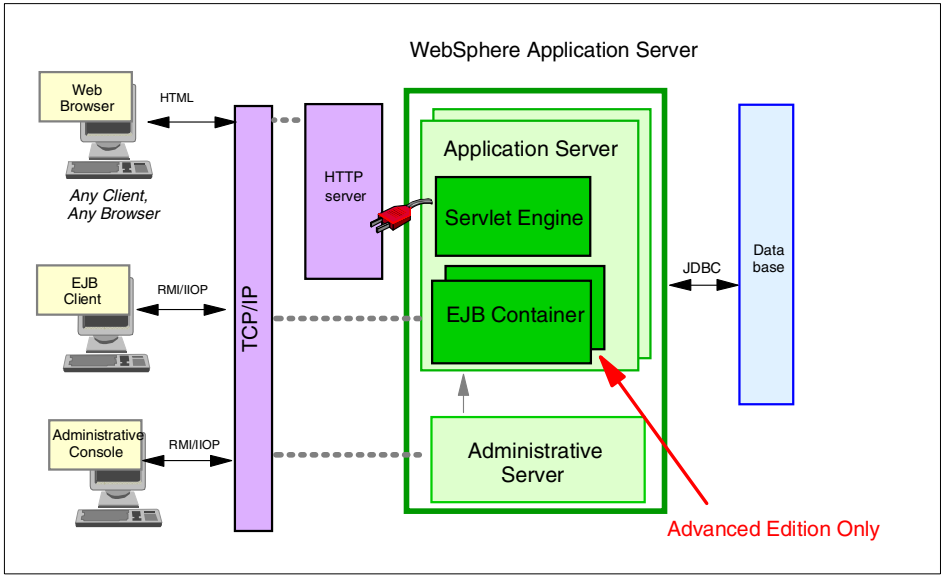


Figure 8-2 Servlet and EJB support

Starting with version 3.0, both WebSphere Application Server Standard Edition and Advanced Edition run in their own OS/400 subsystem (QEJBSBS). In version 2.0, Standard Edition runs under the control of an HTTP server job. WebSphere provides the application server, which includes a servlet engine for running servlets and JSPs, and in the case of Advanced Edition, it provides the container. The container is where Enterprise JavaBeans are deployed. An administrative server is used to configure the servlets and JSPs in the servlet engine and the EJBs in the container. An administrative console is used to communicate with the administrative server.

An end user runs a servlet or JavaServer Page from a browser. The browser interfaces to an HTTP server, which in turn, passes the request to the application server through an interface called a *plug-in*. You need to configure the application server and the HTTP server so they can communicate with each other. You do not use Enterprise JavaBeans directly, but you use them from an application. You show an EJB client (a Java application) interfacing with the container to access the EJBs. You can also have a Web application interface with an EJB. In this case, the browser interfaces with a servlet. The servlet, in turn, accesses the EJB through the container.

8.2 WebSphere Application Server features and functions

The base of these WebSphere products is the WebSphere Application Server technology. iSeries and AS/400e customers have two WebSphere options from which they can choose. The base option is WebSphere Application Server Standard Edition. The more advanced option is WebSphere Application Server Advanced Edition.

- **WebSphere Application Server Standard Edition** is a powerful Java-based development and deployment environment for e-business applications. As the core element of the IBM Framework for e-business, WebSphere Application Server Standard Edition forms the foundation of the WebSphere application server family and offers application developers a solution to build, deploy, and manage e-business Web sites. WebSphere Application Server Standard Edition provides companies with an open, standards-based Web server deployment platform and supports Java servlets as well as JSP components. It also provides an excellent way to transform your business into an e-business.
- **WebSphere Application Server Advanced Edition** is an even more powerful Java-based development and deployment environment for e-business applications. WebSphere Application Server Advanced Edition builds on and enhances the Standard Edition to provide additional support for scaling Web sites into security-enhanced, transactional-based e-business

application sites. The Advanced Edition provides EJB support for host-based transactions and offers sophisticated tools to simplify distributed, component-based application development. The EJB architecture is component-based for the development and deployment of server-based business applications. It greatly simplifies the separation of business applications from underlying system services.

Figure 8-3 provides an iSeries-specific view of the two options.

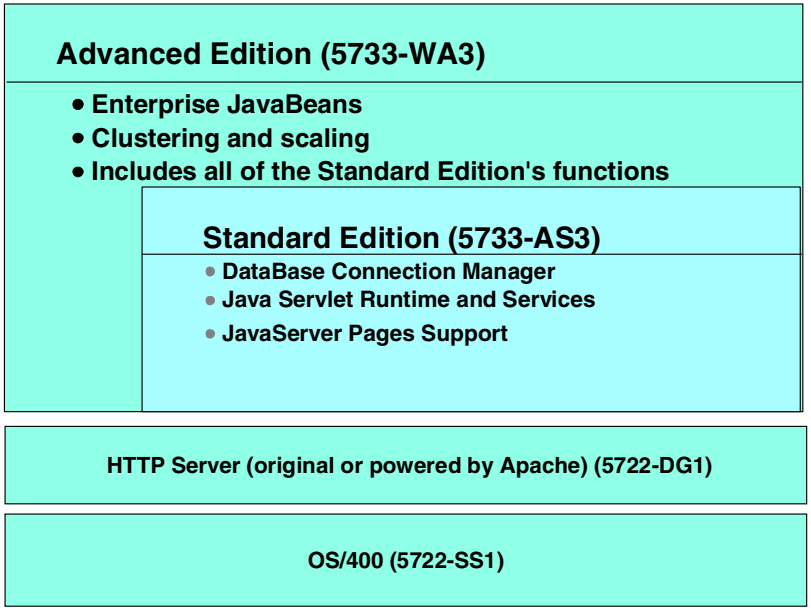


Figure 8-3 WebSphere Application Server

WebSphere Application Server Version 3.5 Standard Edition for iSeries is a no-charge Licensed Program Product (LPP), 5733-AS3. It comes with OS/400 as part of the base package.

WebSphere Application Server Version 3.5 Advanced Edition for iSeries extends the Standard Edition into the world of EJB with additional support for scaling Web sites into security-enhanced transactional e-business application sites. It provides a high-performance EJB server for implementing components that incorporate business logic. This is available as program product 5733-WA3 (128-bit encryption support). Version 3.5 does not offer 56-bit encryption support because government export regulations have been relaxed.

The iSeries server currently supports the Standard and Advanced Edition of WebSphere both at Version 3.5.3 (via PTFs).

For the latest version of the products supported for the iSeries, refer to:
http://www-1.ibm.com/servers/eserver/iseries/software/websphere/wsappserver/

This section describes the features and functions of these products.

Note: WebSphere Application Server for iSeries Version 4.0 has been announced. For more information, refer to 8.5.1, “Future direction of WAS V4.0” on page 199.

8.2.1 Administrative Console

Feature of both the Standard and Advanced Editions

The WebSphere Administrative Console is used to manage the application servers. You can control the WebSphere Application Server resources from the WebSphere Administrative Console. It is a Java program that runs on a workstation. The WebSphere Administrative Console helps easily deploy and manage EJB, JSP, and JavaBean components. Figure 8-4 shows you the Administrative Console display you can use from workstations. This console can be installed in the following environments:

- Windows NT
- Windows 2000
- Sun Solaris
- AIX

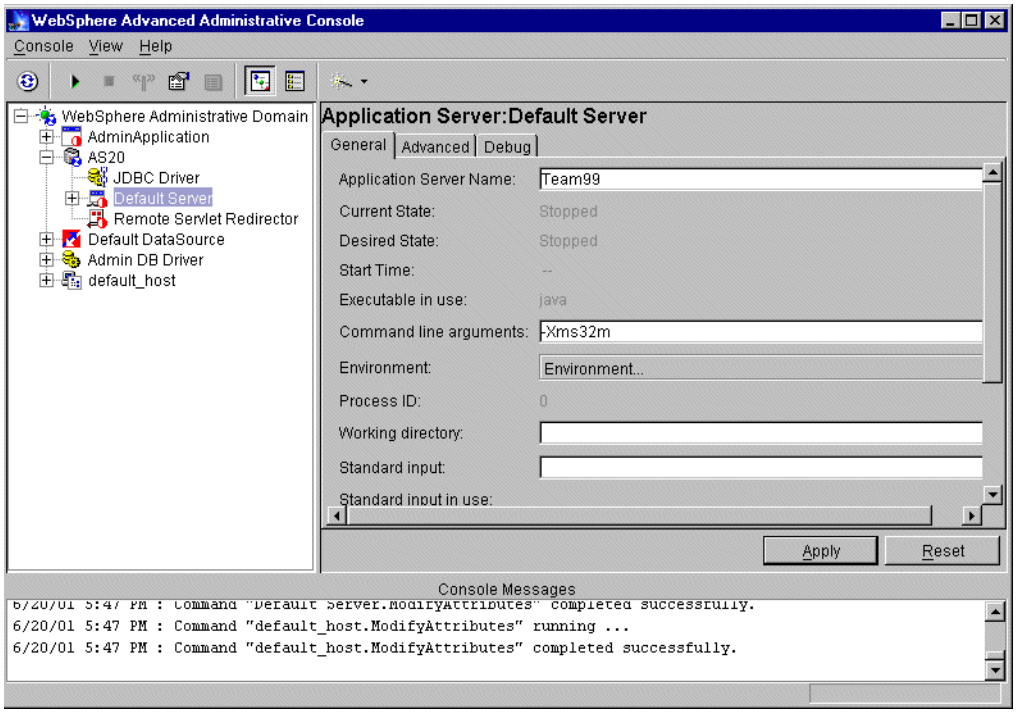


Figure 8-4 WAS Administrative Console

8.2.2 Web-based Administrative Console

Feature of both the Standard and Advanced Editions

Starting with version 3.5, there is a Web-based Administrative Console available for both the Standard and Advanced Editions. The Web-based Administrative Console allows you to administer WebSphere Application Server from a Netscape Navigator 4.5 and higher Web browser or a Microsoft Internet Explorer 5.0 and higher Web browser. You can use the Web-based Administrative Console from workstations on which you do not want to, or cannot, install the stand-alone Administrative Console.

The Web-based Administrative Console currently supports a subset of the support available from the stand-alone console. For example, you cannot modify some properties of a configuration, stop or start resources, work with the EJB container, or configure security. Figure 8-5 shows the Web-based Administrative Console display.

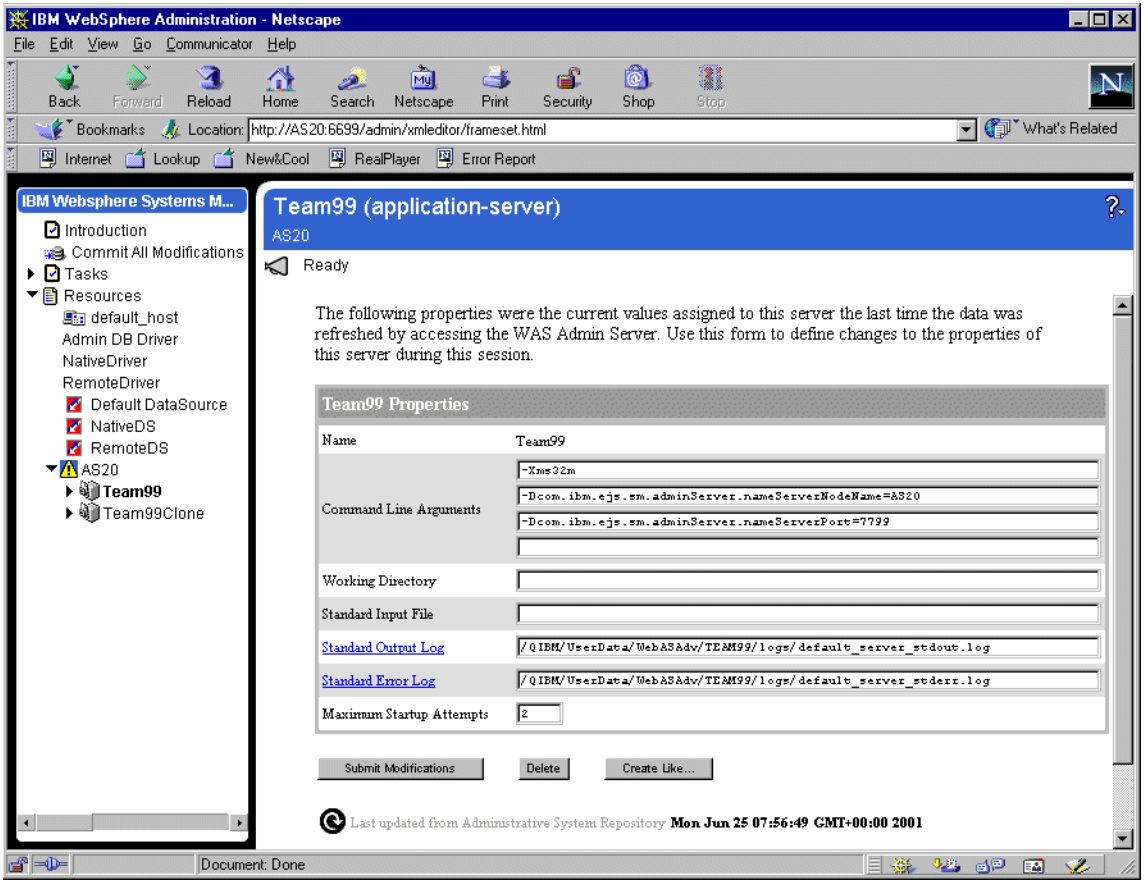


Figure 8-5 WAS Web-based Administrative Console

8.2.3 Java Development Kit (JDK) support

Feature of both the Standard and Advanced Editions

WebSphere Application Server requires a compatible Java Development Kit. The iSeries server supports multiple JDKs. The different versions of WebSphere require unique JDK support. For example, WebSphere Application Server Version 3.5 supports the Java 2 environment. The iSeries server supports the installation of multiple JDKs. JDK support is installed as options of the iSeries Developer Kit for Java (5722-JV1).

Table 8-1 shows the JDK support that WebSphere Application Server requires.

Table 8-1 JDK support required by WebSphere Application Server

WAS version	JDK requires
Version 2.0	JDK1.1.7 (option 2) or JDK1.1.8 (option 4)
Version 3.0	JDK 1.1.7 (option 2) or JDK1.1.8 (option 4)
Version 3.5	JDK1.2 (option 3)

For more information on the iSeries Developer Kit for Java, refer to 3.3.19, “Java” on page 76.

8.2.4 Servlets

Feature of both the Standard and Advanced Editions

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 pre-loaded, 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.

For more information about servlets, see the Java Servlet Technology page at:
`http://www.java.sun.com/products/servlet/index.html`

8.2.5 JavaServer Pages

Feature of both the Standard and Advanced Editions

The WebSphere Application Server servlet engine also handles requests for JavaServer Pages 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 you are now running applications and dynamic content, and not just sending static bytes back to the client.

Version 3.5 includes full support for levels .91, 1.0, and 1.1 of the JSP specification. Two additional tags are included:

- **Query tag**: For rapid building of a database connection
- **Connection tag**: For building and maintaining stated connections

The administrative console helps create and deploy servlets. JSP components focus on ease-of-use and flexibility as well as control of the execution and monitoring of these e-business applications.

For more information about JSP technology, refer to:
http://www.java.sun.com/products/jsp/

8.2.6 Enterprise JavaBeans

Feature of the Advanced Edition only

Enterprise JavaBeans are 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 World Wide Web (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.

EJBs extend 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.

WebSphere Application Server Advanced Edition 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/

8.2.7 XML

Feature of both the Standard and Advanced Editions

XML is a platform and application independent way to describe data using tags. It is similar to HTML in that it uses tags to describe document elements. It is different in that the tags describe the structure of the data, rather than how the data is to be presented to a client. XML has the facility to allow data providers to define new tags as needed to better describe the data domain being presented. WebSphere Application Server supports XML document structures and can generate, validate, parse, and serve XML context.

Both versions integrate new XML/XSL features to enable sites to take advantage of the latest technology to define and share data, while allowing data to be separated from its presentation. These updates include:

- An XML parser using the latest W3 XML 1.0, DOM 1.0, and SAX 1.0 recommendations
- W3 name spaces recommending a DTD library for local validation
- A new, enhanced XSL processor

8.2.8 Automatic configuration (XMLConfig)

Feature of both the Standard and Advanced Editions

WebSphere Application Server provides an XMLConfig command that runs on the Qshell Interface on a 5250 terminal. Using this command, you can export and import configurations from your WebSphere Application Server environment. It creates an XML source file with all actual configurations of your environment. This could be helpful to back up and restore configurations faster, compare manual configurations faster, and compare manual configurations with the information generated in an XML file.

8.2.9 Connection Manager

Feature of both the Standard and Advanced Editions

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.

8.2.10 Multiple instance support

Feature of both the Standard and Advanced Editions (only on iSeries)

The iSeries Version of WebSphere Application Server supports multiple instances of WebSphere Application Server. The motivation to create multiple server instances, enabled to run WebSphere, is the ability to have concurrent, but completely independent, versions of the instances. Each server instance can read from its own set of property files, create its own set of log and trace files, and work within its own security model. It can also invoke its own Administration Manager interface without affecting any other server instances that might be running on the iSeries server at the same time.

The ability to have multiple instances allows you to keep application developers independent from each other. For example, you could use one instance for development, one for testing, and one for serving the Web site. Each of these instances is independent. Changes made to one environment do not affect other environments.

8.2.11 Security controls

Feature of both the Standard and Advanced Editions

Security controls and application access protection are significantly enhanced with Version 3.5. The secure access control lists can be established at a more granular level than in the past. In addition to setting up security at the user and group levels, control and policies can be established for specific calls or methods within the applications themselves. A greater depth of control and protection is available within the server deployment environments. Support is also provided for LDAP-based user registries.

8.2.12 Scalability

Feature of the Advanced Edition only

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.

8.3 IBM WebSphere Site Analyzer

Note: A similar product is WebSphere Commerce Analyzer, which is part of WCS and uses Brio reporting for Business Intelligence information. It is discussed in 9.4.3, “Commerce Accelerator” on page 215.

IBM WebSphere Site Analyzer, which is based around WebSphere Application Server, provides basic Web traffic measurement functions. These functions allow a user to gauge traffic volumes and usage patterns (hits, page views, visits) to identify traffic sources (domains, subdomains, referrers) and to manage site integrity (link verification, site conformance, site summary).

The WebSphere Site Analyzer tool V3.5 provides a detailed view of what is occurring on a Web site such as site usage, visitor behavior, information about the content, and structure of the site. It provides comprehensive analysis and reporting including charting using a built-in DB2 database.

Site Analyzer uses a client server configuration. The server portion performs content and usage analysis and the client portion manages and displays results of these analyses, as shown in Figure 8-6.

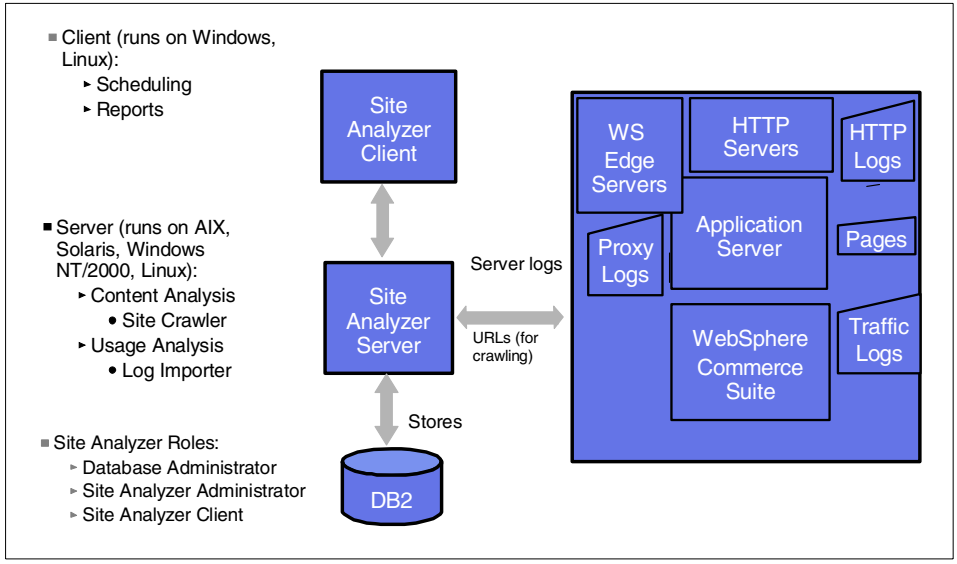


Figure 8-6 WebSphere Site Analyzer V3.5 architecture

The client is a small Java technology-based application that can run on either Microsoft Windows or Linux platforms. The WebSphere Site Analyzer Server side is run on Microsoft Windows NT or Windows 2000, IBM AIX, Linux, or Sun Solaris platforms.

The features of WebSphere Site Analyzer V3.5 include:

- Content analysis
- Usage analysis
- Comprehensive analysis and reporting, including charting
- Uses a built-in DB2 database

Site Analyzer future goals

Site Analyzer V4.0 is now completely Web-based and provides a distributed capability. Site Analyzer automatically retrieves your Web logs via FTP, including retrieval across a firewall. This is in addition to support for log files found locally or on shared network drives.

- WebSphere integration (servlet logging/analysis)
  - WebSphere Personalization (rule effectiveness and so on)
  - WebSphere Commerce Suite
  - WebSphere Edge Server
- Scalability (workload management of analysis)
- Web browser-based user interface and administration
- “Single Pixel” solution (in addition to a batch solution)
- Open Database Schema; Business Intelligence tie-in

Notes:

- WebSphere Site Analyzer V3.5 server is not designed to run on the iSeries server. However, it is designed to enable FTP of log files from an iSeries Web server or via a shared network drive to the machine upon which WebSphere Site Analyzer V3.5 server is installed.
- WebSphere Site Analyzer V4.0 is targeted for release on 28 September 2001.

8.4 IBM WebSphere Personalization for AS/400, V3.5.2.2 (5733-A47)

34% of total sales revenue on Web sites is driven by personalization and 40% of electronic businesses use personalization software. Of those that don't, 93% plan to use it next year (source: IBM market survey).

IBM WebSphere Personalization for AS/400, Version 3.5.2.2, supports the iSeries and AS/400 platforms. It provides users of WebSphere Application Server Advanced Edition and WebSphere Studio Advanced Edition with the capabilities to build a intranet or extranet Web site that delivers Web pages that are customized to the interests and needs of each site visitor. Personalization is about targeting Web content and applications to specific users. WebSphere Personalization can be used to build personalized Web sites using a resource hierarchy, rules engine, and a recommendation engine.

Attention: If you are obtaining a new installation of the product, Shop IBM will ship the V3.5.2.2 code, although the order form says "V3.5".

Note: The Blaze Rules Engine (for personalization), enhanced at V5.1 with a GUI interface (see 9.4.3, "Commerce Accelerator" on page 215) is included in the WebSphere Commerce Suite product. The IBM WebSphere Personalization product (discussed here) is a separate product that is also available for personalization of Web servers.

Personalization techniques can be made up of many different parts beginning with content. Content is the products and items you want to sell. The next consideration is customer understanding, which is based on a profile, customer information supplied by the shopper via questionnaire, or behavioral data, that is the path they took through the store to get to a product. Finally Business Intelligence supplies further information to the personalization engines such as customer purchase history or the number of times they return to the shop. See Figure 8-7.

The supported personalization techniques are rules based or collaborative filtering. The Rules Service takes user-supplied rules and presents products based on the rules that are satisfied. It requires someone with the knowledge to anticipate and write the rules. The MacroMedia LikeMinds personalization server works off data in a user profile along with the types of products that have been added to their shopping cart and the shopping path the user has taken. Based on this information, it presents different products to the user.

The LikeMinds product is packaged in the Macromedia, but can interface with WebSphere Commerce Suite. It comes with the Pro version for WebSphere Commerce Suite, which is the version that is shipped for the iSeries server.

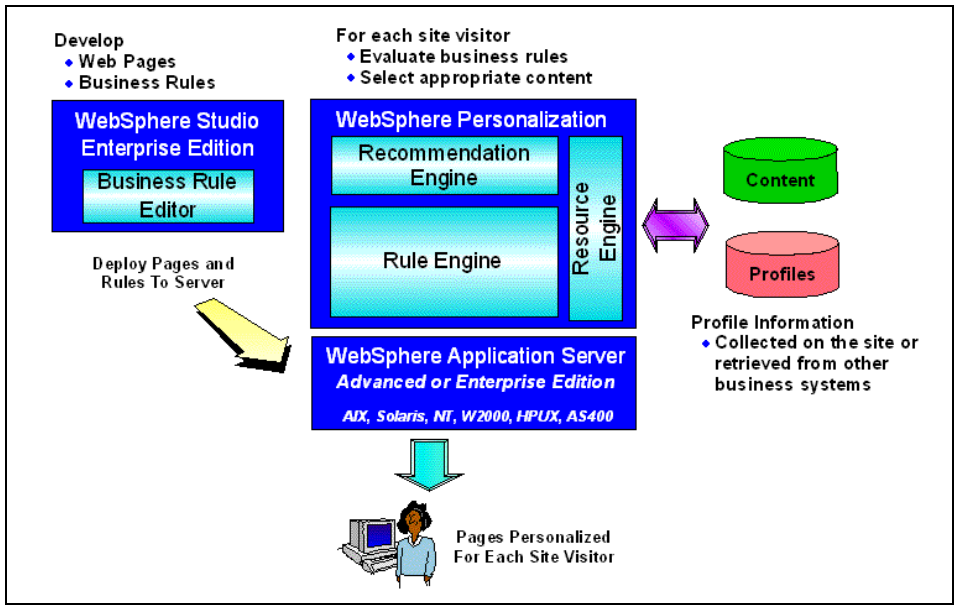


Figure 8-7 IBM WebSphere Personalization for AS/400 V3.5

Sample rules

Here are some sample rules to give you an idea of the power of WebSphere Personalization for AS/400.

Sample 1: Personalizing Web site content for each customer

Here is an example of allowing a business rule to access a page request parameter:

1. Visitor to a travel site clicks a button requesting information on midwinter vacations.
2. This creates a page request with a parameter for midwinter vacations.
3. A business rule can use this parameter to define what personalized content is displayed.

Sample 2: Alerting a customer to a possible need

Here is an example of allowing a business rule to access a session state attribute:

1. Visitor to a financial site requests that mutual fund information be mailed to them.
2. The date is 1 April, which is 14 days before U.S. tax returns are due.

3. The site maintains, as session state attributes, the fund information request, and also if an IRA kit has been requested.
4. An action rule can use these session state attributes (days before 15 April) to determine if a suggestion to request an IRA kit should be displayed to the site visitor.

Sample 3: Suggesting to a customer similar items to purchase

Here is an example of using a business rule to update a profile:

1. Each time a site visitor views ski clothing on a retail site, increment the "interested in ski clothing" property in their profile by one.
2. Use the "interested in ski clothing" profile property in a business rule to determine who should be shown ski apparel as a suggested purchase.

References

For more information, consult these sources:

- WebSphere Personalization site:
  http://www-4.ibm.com/software/webservers/personalization/
- *WebSphere Personalization Solutions Guide*, SG24-6214

8.5 References

This section lists any relevant Web sites, manuals, and outlines any future directions for this product.

8.5.1 Future direction of WAS V4.0

WebSphere Application Server Version 4.0 for iSeries announcements were made on 14 August 2001. It is new pricing and packaging for WebSphere Application Server:

- WebSphere Application Server Version 4.0, Advanced Single Server Edition for iSeries
  - 5733-WS4 product: Uses 128-bit encryption
  - Announcement letter:
    http://www.ibmlink.ibm.com/usalets&parms=H_201-229
- WebSphere Application Server Version 4.0, Advanced Edition for iSeries
  - 5733-WA4 product: Uses 128-bit encryption
  - Announcement letter:
    http://www.ibmlink.ibm.com/usalets&parms=H_201-226

The Advanced Single Server Edition provides servlet, JSP, and EJB functions required when deploying these components on a single iSeries server. The Advanced Single Server is configured via a browser-based Admin Console, which eliminates the need for a Windows NT client to support administration and configuration of the application server. The Advanced Single Server is a robust, scalable offering that works well with all the tooling that supports WebSphere 4.0. It is well documented and fully integrated with DB2 UDB for iSeries.

The Advanced Edition provides the Java application services required by our most demanding customers that run large numbers of transactions across multiple servers with a single point of administration. Such advanced features as workload management, clustering, and LTPA security are available with multi-server.

Both versions are J2EE compliant, and support Web services, EJBs, and the three different Web servers available on iSeries (Domino, IBM HTTP Server (original), and IBM HTTP Server (powered by Apache)). Both support V4R5 (and later) versions of OS/400. Both versions allow multi-tier deployments, where the Web server, Web application server, and legacy data can be deployed across the network to meet specific application needs.

WebSphere Application Server, Standard Edition Version 3.5 will continue to be supported until year-end 2002. It is a viable no-cost option for customers who need a Web application server that supports servlets and JavaServer Pages, but don't need the new function of WebSphere Application Server Version 4.0.

In addition, it was announced on 28 August 2001 that a new application server, also based upon the J2EE specification (specifically it will support Java Servlet 2.2 and JavaServer Pages 1.1), will be made available on the iSeries during fourth quarter 2001. This implementation is based on the Apache Software Foundation's Jakarta Tomcat. For more information, see the IBMLink item at:
http://www.ibmlink.ibm.com/usalets&parms=H_201-237

8.5.2 Web sites and manuals

For more information, consult the following resources:

- WebSphere Application Server for iSeries home page:
  http://www-1.ibm.com/servers/eserver/iseries/software/websphere/wsappserver/
- WebSphere installation prerequisites:
  http://www-1.ibm.com/servers/eserver/iseries/software/websphere/wsappserver/docs/as400v35std/docs/instprrq.html

- Program temporary fix (PTF) information:
  http://www-1.ibm.com/servers/eserver/iseries/software/websphere/wsappserver/services/service.htm
- *Building iSeries Applications for WebSphere Advanced Edition 3.5*, SG24-5691
- *User-to-Business Patterns for e-business: Developing AS/400e e-business Applications,* SG24-5999
- *WebSphere Scalability: WLM and Clustering Using WebSphere Application Server Advanced Edition*, SG24-6153
- *Design and Implement Servlets, JSPs, and EJBs for IBM WebSphere Application Server*, SG24-5754
- *Application Service Provider Business Model: Implementation on the iSeries Server*, SG24-6053

9

WebSphere Commerce Suite for iSeries V5R1 (5798-WC5)

Customers have become more and more Internet savvy. They are no longer satisfied with having a company Web site that simply describes the products and services they provide. When customers visit an e-commerce Web site, they expect to:

- Browse online catalogs
- Add products to a shopping cart
- Use their credit card to make a secure purchase
- Advise of a specific delivery address

WebSphere Commerce Suite (WCS) V5.1 has been greatly enhanced to provide all of this and more. You can learn more about in this chapter and in the IBM Redbook *WebSphere Commerce Suite V5.1 Handbook*, SG24-6167.

9.1 WebSphere Commerce Suite overview

WCS is the primary choice among so many nice alternatives when looking to build an e-business site because the primary interest is *e-commerce*.

WebSphere Commerce Suite for iSeries V5.1 boasts an open architecture (100% Java-based and XML), a customizable system framework (“plug-and-play”, Pervasive Computing), and a new V5R1 subsystem design based around internal processing of a WCS instance. It is based on WebSphere Application Server Advanced Edition 3.5 (included) and runs on the IBM HTTP Server for iSeries.

9.1.1 WCS V5.1 features and enhancements

E-commerce is the area where opportunity lies. Your business needs to take advantage of this trend. It 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.

While building customer loyalty, companies can reduce costs by improving order processing efficiency. They can maintain fill rates while reducing inventory and warehousing expenses. And, they can lower the actual dollar costs of sales transactions.

WebSphere Commerce Suite V5.1 for iSeries 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. Its extensive framework emphasizes 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.

WCS is a cross-platform architecture. IBM offers various versions of products for AIX, OS/390, OS/400, Solaris, and Windows NT. WebSphere Commerce Suite V5.1 for iSeries is the IBM e-commerce product for AS/400e and iSeries servers.

Table 9-1 lists and briefly describes many of the advanced features found in WCS V5.1. It also refers you to sections for more information.

Table 9-1 WCS V5.1 features and enhancements

V5.1 features and enhancements	Description
Commerce Suite Accelerator	Personalized campaigns, promotions, and pricing (see 9.4.3, “Commerce Accelerator” on page 215).
Customer Service	Adds support for a Customer Service Representative role and an Order Clerk (see 9.4.3, “Commerce Accelerator” on page 215).
Configuration Manager	Registry creation, configure caching, and access to WCS (see 9.4.5, “Configuration Manager” on page 220).
Administration Console	Allows Site and Store Administrators to perform tasks related to site and store administration (see 9.4.6, “Administration Console” on page 220).
Commerce Analyzer	Integrated, out-of-the-box Business Intelligence (BI) to enhance marketing relationships (see “BI enablement with WebSphere Commerce Analyzer” on page 217). **Note**: Another “like” product is explained in 8.3, “IBM WebSphere Site Analyzer” on page 195, and is based around WebSphere Application Server.
Store Archive File (SAR)	A portable, standalone (zip) file that contains all of the assets necessary to create a WCS store. It is used as a vehicle for delivering and packaging Sample Stores (see 9.4.7, “Store Archive File” on page 221).
Global e-commerce	Multi-cultural support for culturally sensitive interactions (see 9.4.4, “Multicultural support” on page 218).
100% Java Programming Model	Uses EJB object model, command beans, and JSP/data beans.
Mobile Commerce	Deals with customers anywhere, anytime.

9.1.2 WebSphere Commerce Suite benefits

This section explains some of the reasons why WebSphere Commerce Suite is the chosen mechanism for achieving successful B2B and B2C e-commerce.

Note: WCS is not only used for B2C, but it also plays an important role in B2B. See Chapter 10, “B2B: Transforming business processes for e-business” on page 235, for more information.

Packaged offering with robust integrated functions

WebSphere Commerce Suite is the premier IBM offering that allows many businesses to quickly conduct consumer-to-business transactions through the Internet.

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 and business-to-consumer environments.

Secured e-commerce solutions

IBM WCS works together with a relational database and a secure Web server to give users and companies a simple and secure environment. It is also combined with IBM Payment Manager and other secured payment methods such as SET Secure Electronic Transaction and CyberCash (see 9.5, “WebSphere Payment Manager V2.2 (5733-PY2)” on page 225, for more information about the IBM Payment Manager). Combined with the integrated security features of OS/400, this is a considerable advantage.

Seamless iSeries integration

WCS uses built-in Web serving, Java and database capabilities. This way, the iSeries server extends such benefits of WCS 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

Most importantly, you can maximize the impact by Web-enabling your already robust back-end applications using WCS.

Industry standards architecture

The WCS architecture itself is an industry standard implementation. It is cross-industry and cross-platform architecture, obviously including iSeries implementation.

Scalability

WCS 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 scalable WCS architecture can be greatly multiplied when it is combined with the ever-increasing hardware scalability of the iSeries server, given the new dynamic nature of LPAR at V5R1. For more information on LPAR for iSeries, see:
http://www-1.ibm.com/servers/eserver/iseries/lpar/

9.2 WCS V5.1 iSeries requirements

This section describes how WebSphere Commerce Suite V5.1 for iSeries is packaged. It includes the mandatory and optional software product requirements and the system requirements to make best use of WCS V5.1.

9.2.1 WCS packaging

When you order WebSphere Commerce Suite V5.1, the products that ship with your order are listed in Table 9-2.

Table 9-2 WCS packaging

Product	Number of CDs	Notes
WCS V5.1 for iSeries	1	
WAS Advanced Edition V3.5 for AS/400	1	
WAS Advanced Edition V3.5 for Window NT and 2000	1	
WAS Advanced Edition V3.5 for AIX	1	
WAS Advanced Edition V3.5 for Solaris Operating Environment	1	
WAS Advanced Edition V3.5 for HP-UX	1	
WebSphere Payment Manager for iSeries	3	Includes cassettes for SET, VisaNet, and CyberCash. Also available as a separate product.
Segue Software SilkPreview V1.0	1	

Product	Number of CDs	Notes
Macromedia LikeMinds for Windows NT and Windows 2000 V5.2.1	1	
WebSphere Commerce Analyzer for Windows NT and Windows 2000 V5.1	1	Available as a separate product as well.
Brio One Brio Broadcast Server V6.1 for Windows	1	

9.2.2 Software requirements

In addition to the software that is provided with a purchase of WebSphere Commerce Suite V5.1 for iSeries (5798-WC5), there are a few additional software product requirements for OS/400. Most of these products are included as part of OS/400 or are available as no-charge Licensed Program Products.

- OS/400 V5R1 or above (5722-SS1), which includes:
  - DB2 UDB for iSeries (base OS/400)
  - Lightweight Directory Access Protocol (LDAP; base OS/400)
  - Qshell Interpreter (option 30)
  - Digital Certificate Manager (option 34)
- IBM HTTP Server for iSeries (5722-DG1)

  Only the HTTP Server (original) is supported by WCS at this time. The HTTP Server (powered by Apache) is not supported.
- Cryptographic Access Provider

  5722-AC3 (128 bit)

  Note: WAS V3.5 ships 5722-AC3 (128 bit) instead of the 56-bit version.
- Java Developer Kit 1.2 (5722-JV1 and OS/400 base option)
- IBM Toolbox for Java (5722-JC1 and OS/400 base option)
- TCP/IP Connectivity Utilities (5722-TC1)

And, optionally, you can choose:

- AS/400 Client Access for Operations Navigator and 5250 access to the iSeries
  - AS/400 Client Access Family (5722-XW1)
  - Client Access/400 Express for Windows (5722-XE1)

- Domino for AS/400, V4.6.2 or above
- MQSeries: Optional; for integration with ERP
- LDAP server or servers: An LDAP server is available as part of OS/400

Note: WebSphere Application Server support for the different JDK versions is fully discussed in 8.2.3, “Java Development Kit (JDK) support” on page 190.

9.2.3 System requirements

The recommended minimum configuration for WebSphere Commerce Suite V5.1 is 1 GB memory, 96 GB DASD, and 460 CPW. The minimum recommended processors are:

- AS/400 Model 170 processor feature 2385
- AS/400 Model 720 processor feature 2062
- iSeries Model 270 processor feature 2252
- iSeries Model 820 processor feature 2396

To size a system to handle an estimated WCS workload, please use the IBM Workload Estimator for iSeries found at:
http://as400service.ibm.com/estimator/index.html

9.3 WCS V5.1 design and architecture

As shown in Figure 9-1, WebSphere Commerce Suite V5.1 for iSeries is actually a series of servers that run together to allow you to administer your e-commerce site from a collection of PC-based tools. WebSphere Commerce Server runs on top of WebSphere Application Server, Advanced Edition. WebSphere Commerce Suite has a close integration with the DB2 UDB for iSeries database where both your configuration information and store and shopper data are kept. WAS, in turn, runs on top of the IBM HTTP Server.

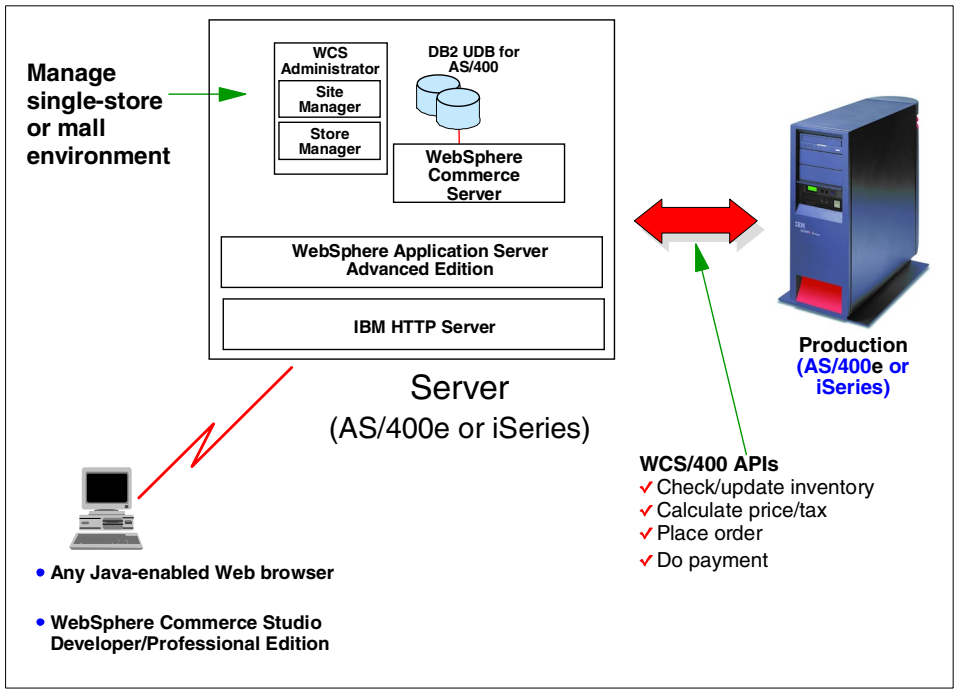


Figure 9-1 WebSphere Commerce Suite V5.1: How it works

You administer the WebSphere Commerce Server using two separate tools running on a PC (or like device).

One tool is the WCS Administrator, which includes a Site and Store Manager. These are browser-based applications. You can use any Java-enabled Web browser to work with the details of your e-commerce site. For example, you could use this administrative interface to update the price of an item or create a new shopper group (a means to give a group of shoppers a discounted price).

The other tool set is provided by the WebSphere Commerce Studio. This is a collection of very powerful Windows-based applications that allow you to access some of the advanced features of WCS including managing all the file assets such as images, HTML, and JSPs. For example, you would use the WebSphere Commerce Studio to create a new store full and complete with HTML images and then “publish” the store to the iSeries to be served.

WCS also comes with a set of APIs that allow you to override the default setup to allow integration of a WCS customer order with your existing back-end business solution. Your production iSeries server could be in the same system as the WebSphere Commerce Server. This is shown in Figure 9-1 separately as an example.

9.3.1 V5.1 and V4.1 architecture comparison

The various architecture layers of WCS underwent major changes in V5.1. At the Business Logic Layer, the commands and overridable functions have been replaced with command beans. Command beans contain the programming logic associated with handling a piece of business logic.

At the Presentation Layer, the Net.Data macros have been replaced with JSP for accessing dynamic data or presenting static data, as requested by the end user. At the Data Layer, access to the schema tables is done via entity beans interfacing to EJBs. The end user does not need to know the details of the data definitions. This is all handled by the beans.

Figure 9-2 compares the architecture of V5.1 and V4.1.

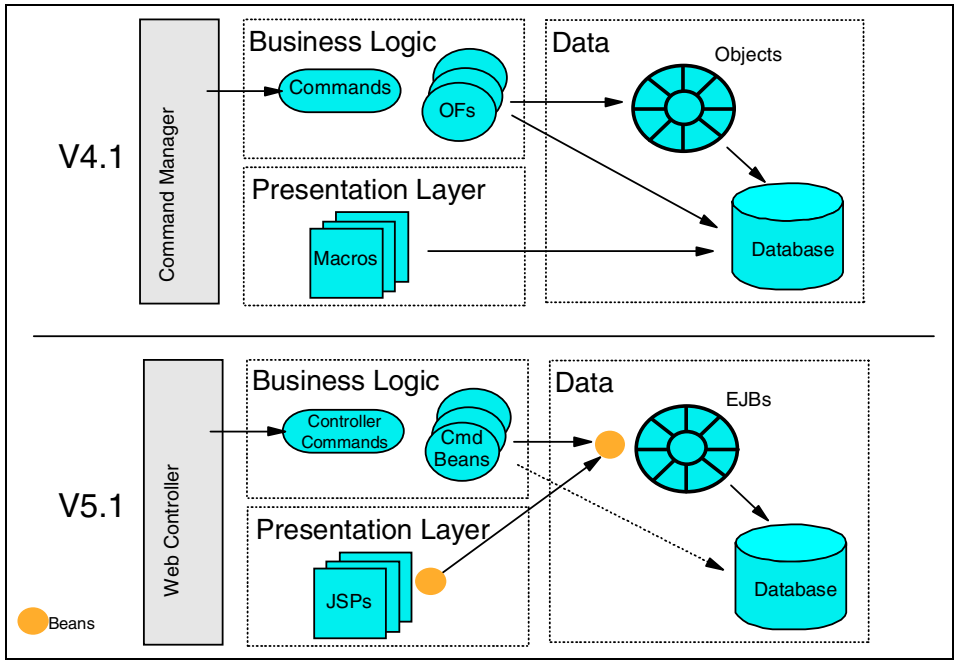


Figure 9-2 WCS V4.1 and V5.1 architecture comparison

WebSphere Commerce Suite V4.1 and WebSphere Commerce Suite V5.1 can run simultaneously on the same iSeries to enable easier transition.

9.3.2 Comparison between V4.1 and V5.1 Store Development Tools

Table 9-3 Comparison between WCS V4.1 and V5.1 Store Development Tools

Item	V4.1	V5.1	Comment
Store Creator Wizard	Y	N	Create from the sample in V5
Store Profile Editor	Y	Y	V5 browser based
Studio publish enhancements	Y	Y	V4 updates server; V5 updates store archive file
Instantiation Utility	N	Y	V4 instantiation implicitly in publish; explicit in V5
Store Models	Y	N	V4 format unique to store creator; V5 as archive
Samples	N	Y	V4 required conversion of sample to store model
Sample tax, shipping and catalog	Y	Y	V4 in proprietary format; V5 in standard archive format
Tax Editor	N	Y	Similar function to SPE
Shipping Editor	N	Y	Similar function to SPE
Remote access to tools	N	Y	V5 browser-based tools can be accessed remotely
Selection of colors	Y	Y	V5 through Studio edit of pages
Selection of layout styles	Y	Y	V5 through selection of a sample
Selection of different store flows	Y	Y	V5 through selection of different samples
Payment	Y	Y	V5 PM support in instantiation utility; no payment editor
Payment Transactions	N	Y	Multiple WCS instances can support payment transactions concurrently
Studio for up&running	Y	N	V4 WCS Studio was mandatory for up&running

9.4 WCS V5.1 product components

Several components make up the WCS suite of products at V5.1. Figure 9-3 presents these components. It is divided into layers of components based on their areas of common functionality.

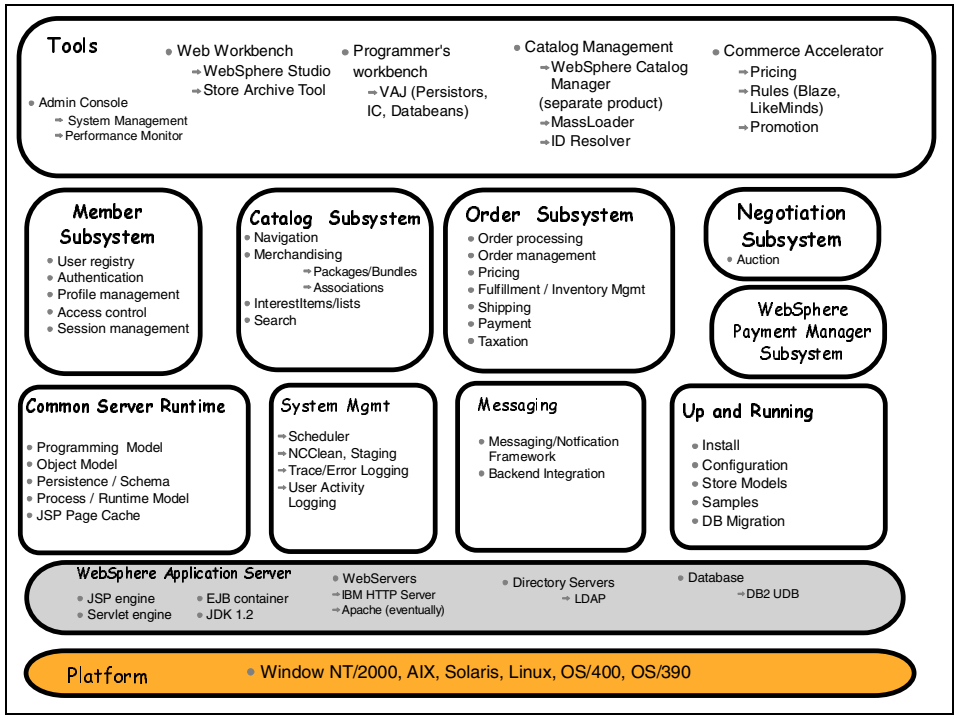


Figure 9-3 WCS V5.1 components

At the top layers are the tools that interface with WCS. New to V5.1 are the WebSphere Commerce Accelerator and an Administration Console.

The next layer down details the subsystem components that manage specific aspects of WCS and work hand-in-hand with the run-time support. The activities of the Systems Management, Messaging, and Up and Running components should be mostly familiar to V4.1 users.

The WebSphere Application Server covers the next layer. It shows the choice between IBM HTTP and Apache server and the servlet and JSP engines to handle user requests. Refer to 8.1, “WebSphere Application Server for iSeries” on page 184, for more information on WAS.

The bottom layer shows the platforms supported by WCS. Here, we are only interested in OS/400.

9.4.1 Web browsers and HTTP server components

Web browser users can be suppliers, shoppers, or merchants depending on the nature of the service being provided. Many of the interfaces to the WebSphere Commerce Suite product are also provided using Web browsers.

Some new browser-based tools are available at V5.1:

- **Create**: Allows creation of a Store Archive Report (SAR) from an existing model. WCS ships one store model.
- **Store Profile**: Allows editing of the main store properties, eg. Store name, currency, language via a notebook interface.
- **Tax Editor**: Allows the creation and editing of taxes to be applied on product purchases. WCS for iSeries does not support the WorldTax product, but allows for third-party tax applications to be intergrated into the store.
- **Shipping Editor**: Allows creation and editing of Shipping charges based on a shipping provider and jurisdiction via a notebook interface.

All these requests come into the iSeries server through the IBM HTTP Server for iSeries. Likewise, all the responses to the Web browser are served by this component.

Note: WebSphere Commerce Suite 5.1 runs on the IBM HTTP Server but *not* on the Apache server or natively on the Domino HTTP Server.

9.4.2 DB2 and UDB

Almost everything you create with WebSphere Commerce Suite V5.1 for iSeries is stored in DB2 UDB for iSeries (see 3.3.2, “DB2 UDB for iSeries (5722-SS1 base)” on page 53 for more information on DB2 UDB). DB2 UDB for iSeries plays a role in the storage of the resources required to run a WCS implementation.

Note: There are actually two databases: a WCS database and the existing back-end applications database. Technically, you can run a transactional site purely with the WCS DB, without interfacing with an existing back-end database, but this is not practical.

WebSphere Commerce Suite V5.1 for iSeries DB includes:

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

Importing business data into WCS

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

When a WCS 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 selected to install a demonstration store or mall.

The WCS database tables contain all the information WCS 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 WCS database.

This information can be added to the database from the WCS 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 back-end system for the initial dataload phase and for ongoing changes.

WCS integrates with back-end applications, such as Lotus Domino, and back-end order management applications via the Common Connect Framework with the help of the MQSeries Adapter for messaging. The options available for integration need to be considered and used for the initial loading, as well as for keeping the WCS data and the back-end system data fully synchronized. Refer to 9.6, “WebSphere Commerce Suite integration with back-end systems” on page 227, for more information.

9.4.3 Commerce Accelerator

Commerce Accelerator provides a comprehensive suite of tools for managing the online retail operation of stores:

- Targeted selling and marketing through personalized, suggestive selling and advertising
- Powerful and dynamic merchandising through online catalog editing, pricing, and discounting
- Expert customer assistance through self-service catalog search and product advice
- Operational and customer service excellence through order and user management
- Full lifecycle retailing through integrated Business Intelligence and reports

The Commerce Accelerator is the interface to allow you to maintain your store or stores. Tasks that you are allowed to perform in your role are displayed on the Commerce Accelerator home page menus. The roles defined with the product are listed in Table 9-4.

Table 9-4 Commerce Accelerator roles

Role	Description
Merchant	Manage the store setup and ongoing business
Marketing Manager	Manage customer profiles, campaigns, and campaign initiatives
Merchandising Manager	Manage products, auctions, and discounts
Order Clerk	Fulfill and process customer orders
Customer Service Representative	Manage customer information, orders for customers, and auctions for customers

The Commerce Accelerator interface consists of several notebooks, wizards, dialogs, and lists to help you complete your tasks. Help text can be launched from every page.

The Blaze products are part of the WebSphere Commerce Suite package and work in conjunction with the Commerce Suite Accelerator. The Blaze products consist of:

- **Blaze Advisor Builder**: Builds rules
- **Blaze Advisor Rules Engine**: Monitors, executes, and optimizes performance
- **Blaze Advisor Rules Server**: Is incorporated into and used by the Commerce Server to process rules and provide personalized marketing content

- **Blaze Advisor Innovator Runtime**: Allows for the creation and changing of business rules quickly and without programming

Note: The Accelerator interface only supports editing products. You must use the Mass Loader or Catalog Manager to create, delete, and associate products with one another in your store.

Campaign initiatives

Marketing and Merchandising Managers can create campaigns to target various customer profiles to either drive site sales and increase revenue or to increase customer awareness.

Two types of initiatives are currently supported (handled via personalization support):

- **Suggestive selling (cross-sell/up-sell)**: Displays products from the catalog.
- **Awareness advertisement (banner ad)**: Displays general Web content. It is intended to be used to increase a customer's awareness about activities at the online store, highlight special offers, and increase brand awareness.

Both initiatives can be deployed into e-marketing spots. This is space that can be reserved on the site's pages to dynamically display either advertisements or product recommendations. Both initiatives generate usage statistics that can be accessed via BI reports (as discussed in the following section). Both can also be dynamically deployed into production, communicating to the WebSphere Commerce Server to determine what data (if any) should be placed there.

BI enablement with WebSphere Commerce Analyzer

Business Intelligence allows the Merchant to evaluate the results of their personalization efforts by e-marketing spots logging their click-thru rate (number of accesses that go through them) and displaying their frequency. This data can then be analyzed. WebSphere Commerce Analyzer generates predefined business reports about a particular online store or stores. The reports provide information about the effectiveness of marketing promotions as well as information about product sales.

These reports are integrated with Commerce Accelerator and are browser-based. The reporting tool, being Brio Report, is included in the WCS suite of products. Brio Report runs on Windows and can run daily, weekly, or monthly reports. It uses WebSphere Commerce Analyzer to analyze the data.

WebSphere Commerce Analyzer ships with WCS V5.1 for iSeries and runs on Windows NT or Windows 2000. Although it runs on a Windows platform, it can be configured to connect to a database on a separate server such as OS/400.

Note: The Brio Broadcast Server must be installed with the WebSphere Commerce Analyzer (part of the WCS package).

9.4.4 Multicultural support

WCS V5 is designed so that a single store can work with any language. A developer needs to follow a programming model to take advantage of this feature.

Catalog and JSP

Almost all textual data in the WCS V5 database can be specified for each language supported by a store. For example, if a store supports English, German, and Japanese, then product, category, and shipping descriptions can be stored in all three languages. This requires textual description data to be externalized from the main entity table. For example, the product table is CATENTRY, but product descriptions are stored in CATENTDESC.

WCS V5 databeans allow you to display textual data in any language.

Multicultural store development

Merchants can use a single V5 store to sell to a world wide customer base. Figure 9-4 shows and example of this.

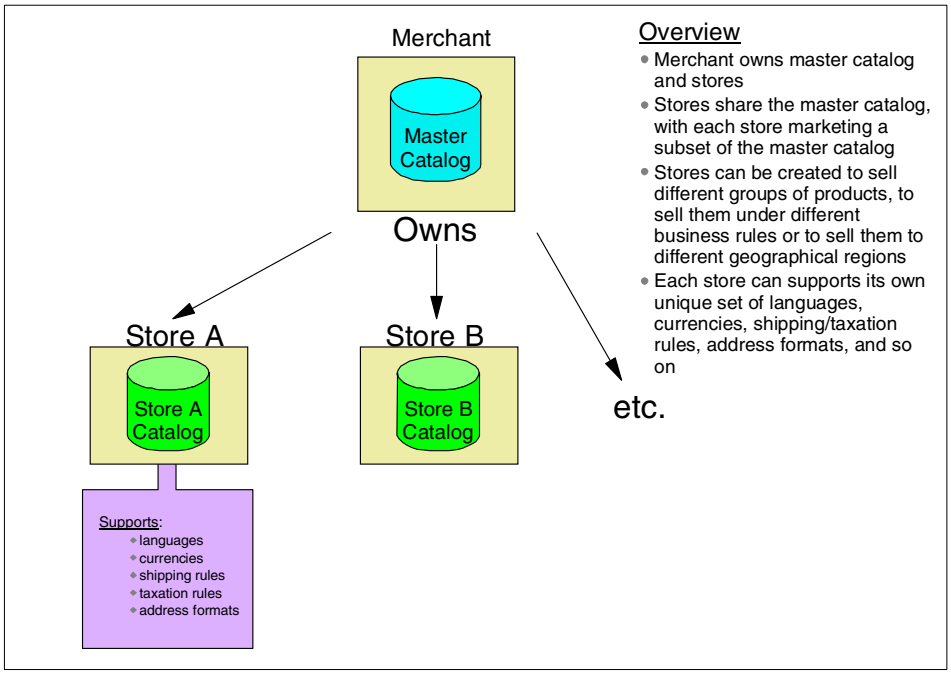


Figure 9-4 Multicultural store development

Merchants can use a single V5 store to sell to a worldwide customer base. They can define different display formats using the LANGUAGE table. Each display format represents a:

- Display language
- Catalog and product descriptions/images
- HTML page look and feel design
- Data formatting (for example, currency, date, measurements, and address formatting)

When shopping, shoppers select which format is preferred based on a selector. They have the ability to switch the format in the middle of the shopping flow.

Multiple currency support provides these benefits:

- Merchants can specify prices in each currency.
- If system can't locate price for a currency, currency conversion is attempted.
- Shoppers can switch the preferred currency in the middle of shopping.
- Current preferred currency is stored in the session and in a registered shopper account.

A region-specific catalog can take care of export restrictions. This can be done by creating a store specific to a region. In V5, multiple stores can share products. The overhead of creating a store is much less than in V4.

9.4.5 Configuration Manager

The Configuration Manager is a Java application that is provided as part of the WebSphere Commerce Suite package. The Configuration Manager can be used to create WCS database and schema. However, in some cases, it is necessary for these to be created manually. The Configuration Manager is also used to create WCS Instance.

V5R1 enhancement

The Configuration Manager has been redesigned for V5.1. In addition to its previous functionality, it now allows the user to enable or disable a variety of WCS components, such as:

- *Registry creation: An interface to use LDAP or the WCS database as your shopper registry*
- *Configure caching, logging, messaging, and store services*
- *Access to the WebSphere Commerce Analyzer (see 9.4.3, "Commerce Accelerator" on page 215)*

The Configuration Manager is no longer used to start and stop the commerce server because this functionality has been fully integrated into the WebSphere Application Server.

Notes:

- The Configuration Manager interface should only be used by one person at a time. *Do not* run it concurrently.
- The Merchant Key value is now required, no default value.

9.4.6 Administration Console

The new Administration Console tool is restricted to Site and Store Administrators. Site Administrators use the Administration Console to:

- Facilitate user and group management
- Set up the Payment Manager
- Set up the messaging configuration
- Specify command security

Store Administrators use the Administration Console to:

- Administer Blaze rules for personalization at the store level
- Manage store-level message configuration

Notes:

- The Administration Console only runs on Internet Explorer V5.5. WebSphere Commerce Suite tools do not function correctly using the Netscape browser. However shoppers can still shop using the Netscape browser.
- The Administration Console does not support Command Registration as NCADMIN did. You must use SQL commands.

9.4.7 Store Archive File

Figure 9-5 describes a WCS Store Archive File (SAR).

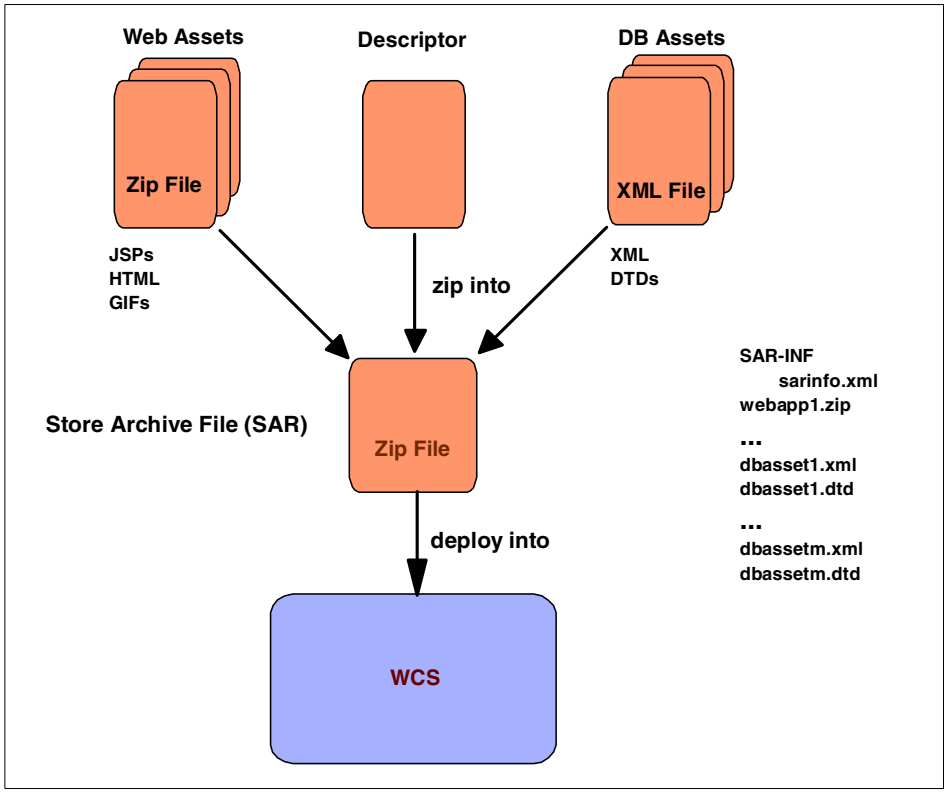


Figure 9-5 WCS Store Archive File

A Store Archive File is a portable, standalone (zip) file that contains all of the assets necessary to create a WCS store. It is used as a vehicle for delivering and packaging sample stores. The data is in XML MassLoad format and is ready to be loaded into the database. The SAR file consists of:

- **Web assets**

  Store presentation files are represented by a zip file, that contains HTML files, images, graphics, JSP files, and include files.

- **Database assets**

  - Property resource bundle
  - Store database assets

- **Payment assets**

  These include configuration information for the IBM Payment Manager. For more information, see 9.5, “WebSphere Payment Manager V2.2 (5733-PY2)” on page 225.

- **Descriptor**

  This is an XML file that describes the contents and structure of the assets within the SAR.

- **Resource bundles**

  Java ResourceBundles are packaged in the SAR and deployed to the classpath.

9.4.8 Catalog subsystem

The catalog subsystem provides online catalog navigation, merchandising features, interest lists, and search capabilities. The catalog subsystem includes all logic and data relevant to a catalog, including categories, products, and their attributes, items, and any associations or relationships among them. It interacts with the Member and Order subsystems to obtain information about viewing templates and pricing. The following features are provided:

- Groupings
- Merchandising association
- Multilanguage support

9.4.9 Member subsystem

The Member subsystem provides registration, authentication, access control and profile management services, and groups of all types of users and entities. Enhancements include improved integration with the Lightweight Directory Access Protocol (LDAP) server, membership in multiple customer groups, and the ability to manage user and organization profiles. It provides:

- Profile Management (registered shoppers)
- User Groups
- Authentication

9.4.10 Order subsystem

The order subsystem is the component of WCS that provides shopping carts, order processing, and management function support. Related services, such as pricing, taxation, payment, and fulfillment, are also part of the order subsystem.

Pricing has many new features for V5.1:

- Trading positions are used for dynamic pricing based on contracts for individual users or user groups.
- Discounts have been enhanced to allow many calculations based on groups of products, contracts, or offers along with other attributes.
- Currency enhancements allow for multiple currencies to be displayed, selectable by the customer or defined for a store or store group. Conversion is done automatically for the supported currencies.
- Units of measure allow for metric and imperial (pounds, inches) values and partial or fractional quantities.

A store typically collects two types of taxes, a sales or value add tax and a shipping tax. WCS allows for jurisdiction taxes, such as state and federal taxes (or provincial and municipal taxes), in combination with these.

Shipping enhancements bring in the concept of fulfillment centers. These centers are separate from the stores themselves. They work through the details of inventory control and shipment processing. The shipping mode indicates the shipping carrier and the method of shipping that was specified by the customer. Some stores may use a fixed charge for shipping their items.

9.4.11 Negotiation subsystem

Commerce Suite provides tools to help you create and manage auctions for your site via the negotiation subsystem. Sample auction files are also provided to help you learn about auctions and to demonstrate the auction component.

Using the Commerce Suite Accelerator, the merchant selects products to add to an auction and the date and time the auction should start. Several auction bidding techniques are available including:

- **Open cry**: The bidder names and bids are all publicly seen and the bid values increase.

- **Sealed bid**: The bids are confidential and viewed only by the seller.
- **Dutch**: The administrator announces a price and asks if there are any participants who are willing to conduct a trade at that price. The bidder names and bids are all publicly seen, and the bid value decreases until there are sufficient bidders to clear the inventory.

Note: Many auctions can be conducted simultaneously. Enhancements include an auction creation wizard.

9.4.12 Common runtime

WCS has an extendable system framework so that if the supplied commands and logic do not do everything that you want them to do, you can customize and create your own commands and logic to do what you require. WCS also boasts the following runtime attributes:

- Process model

  Java threads are used in place of system processes. Threads are lighter weight objects and, therefore, can start up and come down quicker for performance gains.

- Scalability

  Java Virtual Machine cloning can be used to expand the scalability of your store. The JVM handles the Java servlet requests and the JSP invocations for a store.

- Server topology

  Enhancements for multi-tier configurations allow for multiple firewalls and further protection of access to user data.

- Persistence model

  Moves away from Net.Data and ODBC to the EJB component architecture. The data integrity is managed by WebSphere. This involves entity beans that represent data to the end user and session beans that are used as JDBC helper classes rather than as business logic. Direct data manipulation, via SQL, is not recommended.

- Display model

  JavaServer Pages use templates (servlets) to work with databeans to access and then display dynamic data to the end user. The beans represent the data to the Web designer who does not need to know any more details about the data to use it.

9.5 WebSphere Payment Manager V2.2 (5733-PY2)

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 Manager 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.

Packaging: IBM WebSphere Payment Manager is a separate product that is shipped with WCS. It is part of the package when you buy WCS. You can also purchase it separately and use it as the payment manager for any other e-commerce or e-business solution on your iSeries server.

With IBM WebSphere Payment Manager, 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 Manager offers payment hosting capabilities for Internet Service Providers (ISPs), Commerce Service Providers (CSPs), Application Service Providers (ASPs), banks, and financial institutions.

Figure 9-3 on page 213 shows how the Payment Manager fits in the e-commerce architecture on the iSeries server. The Payment Manager provides payment services on the Internet by taking credit card payments from consumers. The Payment Manager runs for 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. In addition to the SET protocol, a cassette (a software plug-in to an architected interface used to expand the number of payment types) for CyberCash is also available.

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**: The customer who holds the payment card.
- **Merchant**: This is the company or person supplying goods to the customer.
- **Issuer**: The customer's financial institution, which provides the payment card to the customer and the payment to the merchant.
- **Acquirer**: The merchant 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. Therefore, it does not need a secure Internet implementation.

SET has four components:

- **Cardholder Wallet**: A 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 the SET Merchant, Payment Gateway, and Certificate Authority components.
- **Merchant Server (Payment Server)**: A 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**: A 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**: A 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 Web site at: http://www.setco.org

9.6 WebSphere Commerce Suite integration with back-end systems

One important component of WCS is back-end business systems integration. This component is also referred to as *back-end 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 benefits when you successfully “Webulate” or Web enable.

9.6.1 Connect for iSeries

Connect for iSeries is an important product in the B2B arena for WebSphere integration. Chapter 11, “B2B: Connectors” on page 245, discusses B2B and Connect for iSeries for WebSphere integration (includes WCS).

9.6.2 WebSphere Commerce Suite messaging

Due to the distributed nature of the Internet, some communications need to be performed asynchronously because a reasonable response time cannot be guaranteed. Message brokers have perfected this kind of service over the last few years but are not widely used for sending messages across the Internet. A tight integration between message brokers and object brokers, such as the WebSphere Application Servers, adds significant capabilities to both technologies.

Note: The integration of messaging into the managed environment of an object-based application server is technically challenging since it involves receiver activation on message arrival, data format translation, some degree of transaction coordination, and the definition of a security context for the incoming request.

9.6.3 MQSeries Adapter

IBM addresses the messaging field by integrating the MQSeries product family with the WebSphere Application Servers. IBM MQSeries, already an important part of the WebSphere software platform for e-business, has an even tighter association with WebSphere. MQSeries, responsible for dynamic integration, will soon become *WebSphere MQ* to reflect the fundamental part that it plays in dynamic e-business. The integration of messaging with objects is a major focus of IBM's current development activities.

Refer to 11.2.3, “MQSeries” on page 256, for more information on using MQSeries for B2B integration.

9.6.4 Customer Relationship Management and WCS

Kana and IBM announced the integration of IBM's WebSphere Commerce Suite with Kana's Web-based Customer Relationship Management (CRM) products. The companies will enable users to link WebSphere Commerce Suite to Kana products ranging from Kana Response, which processes incoming e-mails, to Kana Service, a contact center product.

Source: For more information, go to: http://iwsun4.infoworld.com/articles/hn/xml/01/07/13/010713hnkana.xml

9.6.5 References

For more information about WebSphere Commerce Suite integration with back-end systems, consult these resources:

- Ferguson, D. F. and Kerth, R. “WebSphere as an e-business server”. *IBM Systems Journal*, Volume 40, Number 1, 2001: http://www.research.ibm.com/journal/sj/401/ferguson.html
- *Mobile Commerce Solutions Guide using WebSphere Commerce Suite V5.1*, SG24-6171
- *Integrating WebSphere Commerce Suite with Domino Back-End Application: iSeries 400 Edition*, REDP0141
- *Integrating WebSphere Commerce Suite With a Back-End Order Management Application*, REDP0514
- *Connect for iSeries with WebSphere Commerce Suite: BtoB Enabling a WebSphere Commerce Suite Web Site*, REDP0127

9.7 Transition to the new version

To assist with the transition to the new version, WCS will assist with:

- For the customer data:
  - Scripts to migrate standard tables of all WCS components via Catalog Manager and Mass loader
  - Tools and customized scripts for custom tables

- Documentation for further customizing of the scripts (for example, for tables with complex relationships)

- Customer display logic migration:
  - V5 object model and databean access replacing SQL access using JSPs
  - Possible reuse of HTML elements in Net.Data macros; hand copy into JSP source.
  - Internal conversion helper tool to recommend a data bean to use in place of SQL

    Note: The helper tool is now available on Alpha Works for use “as is”.

  - Documentation on JSP and V5 object model.
- For customers Override Functions (OFs) and Commands (Cmds) migration, the code needs to be rewritten. The V5.1 object model and framework allows easier customizing of data entities and V5.1 includes more base commands and OF, which may reduce the need for customizing.

9.8 References

This section lists any relevant Web sites, publications, any relevant PTFs that might be required. It outlines any future directions for this product and lists any service offerings.

9.8.1 Future directions

The Store Archive Manager (SAR) will be used in the future to back up an existing store.

9.8.2 Program temporary fixes

Recommended individual PTFs and PTFs for WebSphere Commerce Suite V5.1 and WebSphere Payment Manager V2.2 are referenced at:
`http://www-4.ibm.com/software/webservers/commerce/servers/downloads/as400/v5.1/ptf.html`

Note: For more information, see Informational APAR II12902 - *WCS V5.1 Information on Missing DB2 CD*.

9.8.3 Web sites and publications

This section lists any relevant Web sites and publications to this product:

- Readme installation guide and PTFs:
  http://www-4.ibm.com/software/webservers/commerce/wcs_pro/lit-tech-os400.html
- WebSphere Commerce Suite: http://www-1.ibm.com/servers/eserver/iseries/ebusiness/wcs51.html

This section provides various references for WebSphere Commerce Suite V5.1 for iSeries.

Online manuals

Most of the manuals for WebSphere Commerce Suite V5.1 for iSeries are delivered as online documentation installed on the iSeries server. Once you have installed WebSphere Commerce Suite V5.1 for iSeries look in IFS directory */QIBM/ProdData/CommerceSuite5/docs/en_US*.

Web sites

- IBM WebSphere Commerce SuiteHome Page:
  http://www.ibm.com/software/webservers/commerce
- AS/400 and IBM iSeries WebSphere Commerce:
  http://www.iseries.ibm.com/ebusiness/wscommerce.htm
- IBM WebSphere Commerce Community:
  http://www.ibm.com/software/websphere/commerce/community
- IBM WebSphere Application Server:
  http://www.iseries.ibm.com/products/websphere
- PartnerWorld for Developers, iSeries:
  http://www.iseries.ibm.com/developer
- IBM Payment Server Home Page:
  http://www.ibm.com/software/webservers/commerce/payment
- IBM Redbooks: http://www.redbooks.ibm.com
- IBM AS/400 and iSeries reference information:
  http://www.ibm.com/servers/eserver/iseries
- IBM Information Center: http://www.ibm.com/iseries/infocenter
- Service offerings at IBM Support: http://www.ibm.com/servers/support
- “New IBM e-Commerce Software Offers Broad Support for Multicultural Trade, Improved Customer Loyalty Features (IBM press release)”:
  http://www-4.ibm.com/software/webservers/commerce/wcs5_press.html

Publications

- *IBM WebSphere Commerce Suite Fundamentals, Version 4.1*, GC09-2994
- *WebSphere Commerce Suite Handbook V5.1*, SG24-6167
- *Mobile Commerce Solutions Guide using WebSphere Commerce Suite V5.1,* SG24-6171
- *Demo CD-ROM (based on Net.Commerce V3)*, GK3T-2318
- *Secure Electronic Transactions: Credit Card Payment on the Web in Theory and Practice*, SG24-4978
- *Payment Server V1.2 for AS/400: Secure Transactions in e-commerce*, SG24-5199
- *Building AS/400 Client/Server Applications with Java*, SG24-2152
- *Building AS/400 Applications with Java*, SG24-2163
- *Building AS/400 Applications for WebSphere Standard Edition 2.0*, SG24-5635
- *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

9.8.4 Services

For more information on SmoothStart Services, see:
`http://www-1.ibm.com/services/its/us/smoothstart.html`

Or refer to the Global services Web sites (the latter allows you to choose your geography) at:

- `http://www.ibm.com/services`
- `http://www.ibm.com/services/worldwide/index.html`

For country-specific service offerings, please talk to your IBM Sales Representative or IBM Business Partner.

Part 4

B2B: Business transform through applications

This part discusses B2B, in general, and how you can use the iSeries to transform your business way through transforming its existing core applications. It written for both business decision makers and technical people. It will help you understand the transformations you must make to your business processes for e-business. To that end, this part examines B2B connectors, those key technologies and actual products that help you to establish the connections between your core applications and your customer-facing solutions.

Many companies have already “solved” such integration problems. This part surveys some of the pre-packaged applications suites that are meant to save time and effort over building your own application suites using connectors.

This part also reviews the service offerings that are available for you with a focus on this B2B transformation.

Note: Summit Strategies has released a well-written report that is entitled “IBM’s iSeries 400: AS/400's B2B Transformation” from January 2001. It introduces the concept of B2B and the role of the iSeries. For a copy of this report, go to http://www.summitstrat.com/

10

B2B: Transforming business processes for e-business

What is B2B? The title of this chapter says it all. Business-to-business. It transforms your business processes – the way you do business to achieve your business goal better – to thrive in your business area, to lead the pack of the industry, and in many cases, to simply survive. You achieve this transformation by transforming your existing *core* applications into *Web-enabled applications*. This chapter sets the foundation for the rest of the chapters in this part.

10.1 B2B overview

The theme of this section is “business transformation”, that is, transforming the way you do business and the flow in which the processes interact with each other. This is not something you do alone. You need to transform business processes and workflow of your business partners, suppliers, and customers alike, along with you. You want and need this transformation to take place together and toward the same direction. The changes have to be almost revolutionary rather than evolutionary.

At the same time you are moving forward, you also want to ensure that you are not losing your “feet-on-the-ground” perspective and understanding of the value your company delivers to its industry and the relationships you have built with your trading partners and customers. Often, B2B can be defined as “Back to Basics”, or in other words, preserving your core-business value and logic while extending your reach. This is the ultimate business goal.

Many perceive this transformation as a business financial improvement strategy. Some perceive it as a survival strategy. Both of these strategies are correct.

The following sections look at what B2B is and explain how you can participate in this trend in a reliable fashion ahead of your competitors and with your business partners.

10.1.1 B2B and e-business definitions

What is B2B? What is e-business? Are they related or even the same thing? What do they have to do with business transformation? Let’s start the argument by attempting to define e-business appropriately.

Some have defined e-business as “every sort of business you conduct over the Web.” Maybe others focus on the “e” portion of e-business. We focus on the “business” portion of e-business. Most likely this is due to the solid “feet-on-the-ground” placement of the iSeries in the world of business servers.

Figure 10-1 shows, in the middle of the picture, the “Core Business Solution”. Another name for this is an ERP system, line of business (LOB), back-end application, or even a legacy system. For the majority of iSeries customers, this is an RPG application. No matter what you call it, this is your existing core business engine, and that’s where the real power is.

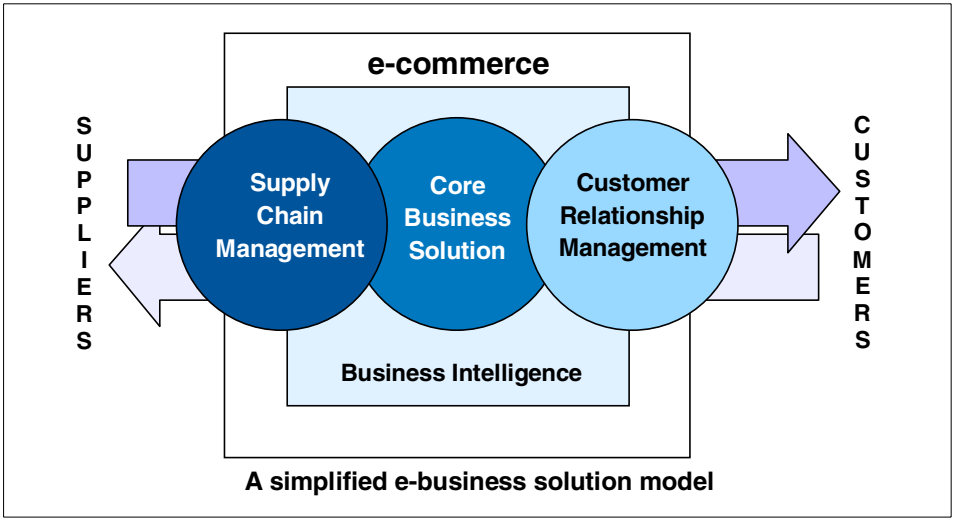


Figure 10-1 e-business definition

Business transformation is the process of extending the power of the existing applications set to your Internet, intranet, and extranet audience so that they can access the core applications set, basically at their finger tips, through a Web browser.

This introduces new layers of application processes such as:

- **Supply Chain Management (SCM)**: For your suppliers' audience to access your core business applications
- **Customer Relationship Management (CRM)**: For your customers' audience to access your core business applications
- **Business Intelligence (BI)**: For your internal staff such as sales, planning, marketing, and business executives, and e-commerce, which allows your customers and business partners to purchase your goods and track orders over the Internet

We define e-business as conducting business using Internet technologies. As such, it encompasses things like e-mail and e-commerce (including the underlying technologies that support them). E-commerce is further subdivided by B2C e-commerce and B2B e-commerce.

Before we continue, let's summarize some of the terminology:

- Synonyms referring to existing business applications are:
  - Core business solution
  - Line of business (LOB)

  - Back-end application
  - ERP system
  - Transactional system
- Extending the existing business application to an Internet audience includes the terms:
  - e-business
  - B2B
  - Business transform

Of course, each of these names carries its own meaning. Maybe it is not fair to generalize these names and group them together as if they are really all identical. But remember, we are talking at a conceptual level, and at that level, they make sense.

iSeries e-business strategy

IBM is very focussed on delivering e-business references for the iSeries server. iSeries customers can evolve from “brick and mortar” business models to “brick and click”, B2B and B2C models. This means that you can continue to leverage your existing IT infrastructure, while at the same time, taking advantage of the exploding opportunities that are available by extending your business-critical applications to the Web.

iSeries customers can take advantage of the iSeries server’s optimized infrastructure (Java, Domino, Web serving, and so on) to migrate applications to the Web. This includes existing LOB applications, such as Billing, A/R, Inventory, as well as front-office applications, such as SCM, CRM, and e-commerce applications.

10.2 Comparison of B2B and B2C

We all understand what B2C is, which is the business of buying and selling over the Web. It is online shopping. It is Amazon.com, Cabelas.com, and Nordstrom.com. This is already part of our society and is rapidly becoming one of the key staples of it. In the U.S. alone, the volume of online Christmas shopping in the year 2000 was expected to reach $12 billion. We all know what B2C is. It’s big and keeps growing rapidly. So how is B2B different from B2C?

Look at the upper left corner of Figure 10-2, where a little boy is drinking milk. When he has finished his milk, his family buys more milk via a transaction that could take place at a local food store *or* via the Web. This is marked as 1 in the picture and this is where the B2C action takes place. This simple B2C transaction spawns numerous transactions between so many different business organizations. As you can easily see in the picture, all the transactions from 2 through 10 are B2B transactions.

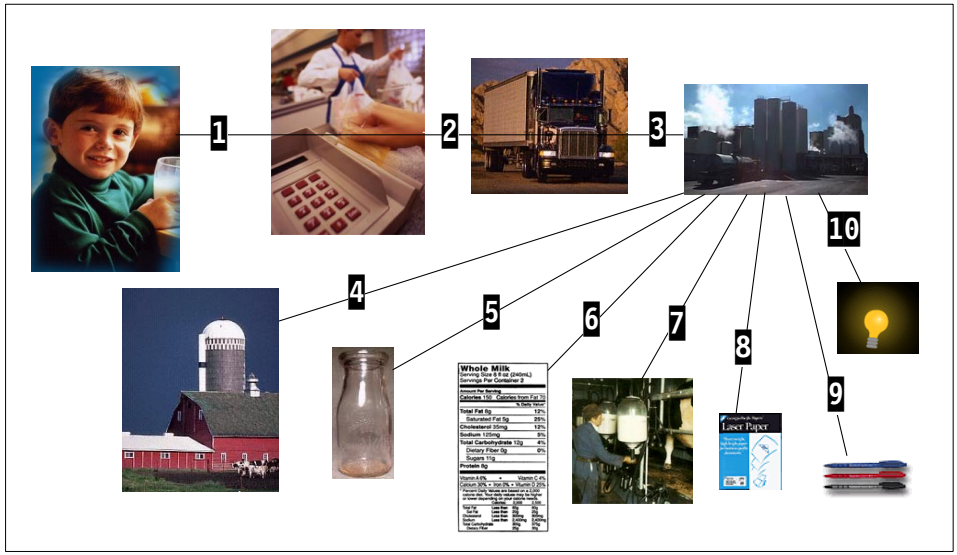


Figure 10-2 B2C to B2B relationships

Year 2003 projections put this into a business figure perspective. It is expected that some $300 billion work transactions will take place in B2C, while this figure in B2B, would be some $3.2 trillion.

10.2.1 Summary of B2B and B2C differences

At this point, it is beneficial for us to summarize the differences between B2C and B2B.

Different connection topology

You may want to put your B2B server deep in your trusted intranet loop and give tight access control. You will want to open the access authorities only to those trusted business partners or internal staff.

In the case of B2C, you may not want to enforce the same level of access control rules simply because it will not make much business sense. Therefore, you may consider putting your B2C server within the demilitarized zone (DMZ; describes a place in your network between the public Internet and your internal intranet). Let each business process go through the security control mechanism whenever they need to come to the core part of your business engine, which resides beyond your bastion firewall.

Different system capacity requirements

The B2C server should be optimized from the performance perspective to handle a large number of concurrent requests at the expected peak time. Literally you have no control over this type of workload, and you need to be prepared for the worst (but the best for your business). At any rate, the most important requirement here is to provide the acceptable response time to each online shopper.

In case of a B2B server, however, what's more important here is reliability and the availability of the services. It's common in this setting that a single unit of work will involve multiple transactions with multiple data updates in multiple database files so secured commitment control is a feature that must be implemented.

Different types of purchases and authorization

Compared to B2C, B2B has these characteristics from a purchase and authorization perspective:

- Scheduled, repetitive
- Larger quantities and dollar value
- Open Requisitions (POs)
- Different authorizations within business customers
- Maintenance, Repair and Operation (MRO) purchases
- Direct purchases (supply chain)
- Often by SKU
- Unique contracts and terms and conditions for different business customers

Different personalization

In the case of B2C, the most common personalization technique is analyzing the favorite goods that the online shopper has and trying to provide the best candidates for their additional purchases. For example, let's say you run a book store on the Web. If you have a customer who has a pattern of buying thriller novels, you can personalize their site to introduce new thriller novels in the market on their next visit.

In the case of B2B, the customer may be a procurement officer for a company. For this customer from their business perspective, a volume purchase discount rate table, for example, may be more important than the preference of the color of fabric on a sofa.

10.3 What's driving the adoption of B2B

There are a number of factors that drive B2B, but the three most important driving forces of this trend are:

- Businesses exerting their buying power
- Businesses expanding their market reach
- Businesses reducing the cost of transacting business

10.3.1 Businesses exerting their buying power

B2C buying power and its consequences – the risk of lost business – can be quite significant. In the case of B2B, this can be enormous. In many cases, an unfortunate incident of consecutive mistakes can drive a company out of business. For example, suppose you are an auto-parts supplier. Let's assume that your customers, who are major auto makers, standardized their parts procurement processes and demanded all suppliers adopt this new B2B way. What if your order-taking application has not been B2B enabled? Even if it has been B2B enabled, what if there have been a couple of serious incidents of not being able to meet your customers delivery schedule due to the errors in your workflow?

10.3.2 Businesses expanding their market reach

You can expand your market reach through proper and efficient management of an electronic catalog or electronic configurator that provides:

- Integrated enabling infrastructure
- Can integrate with existing back-end systems
- Improved service to buyers or distributors

10.3.3 Businesses reducing the cost of transacting business

When you think of every business organizations' primary goal of increasing profit, there are always two ways to achieve that goal. The first way is to increase the revenue. The second way is to reduce the costs. Many view B2B as a way to increase revenue, but B2B has a larger much larger potential of increasing profit by decreasing the operations costs of a business organization. This can be achieved by reducing the following costs:

- Search costs or information costs
- Bargaining costs or decision costs
- Policing costs or enforcement costs

Table 10-1 shows the case of IBM procurement cost savings by implementing B2B.

Table 10-1 Benefits of B2B adoption: IBM results in e-procurement

Procurement step	Before	Now
Purchase order processing time	30 days	1 day
Contract cycle time	6 to 12 months	30 days
Average length of contract	40+ pages	6 pages
Rate of “Maverick Buying”	30%	Less than 2%
Internal satisfaction with procurement	40%	More than 85%

The original objective of the IBM e-procurement system was to leverage IBM’s global purchasing power by installing common processes and applications across the corporation and Web-enabling critical functions. IBM now has a leadership position in exploiting IT for the procurement of non-production goods and services. Since 1993, IBM has saved $9 billion.

10.4 B2B commerce model

Players in today's new B2B commerce usually focus on one of three solution areas:

- Buy-side solutions
- Sell-Side Solutions
- e-Marketplace solutions

These solution models are illustrated in Figure 10-3.

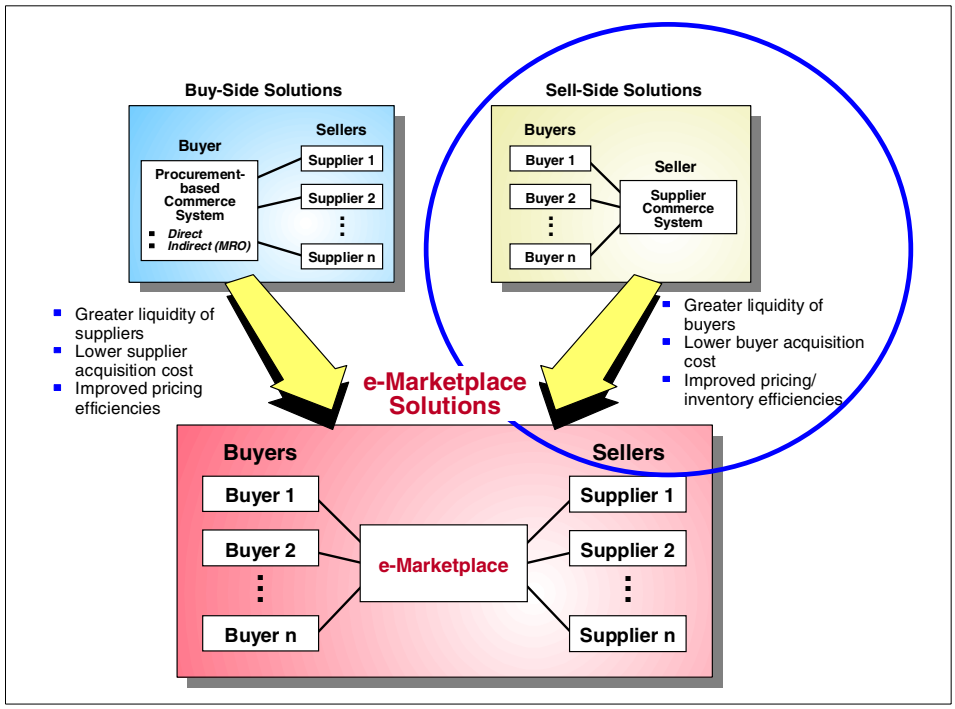


Figure 10-3 The new B2B commerce

The following sections examine all three of these B2B commerce solutions.

10.4.1 Buy-side solution

Buy-side solutions consist of procurement software that is being purchased primarily by large customers to streamline their purchasing process and significantly reduce their overall costs. With this new software from companies like Ariba, Metiom, Commerce One and others, companies can streamline their purchase of Maintenance, Repair, and Operation (MRO) goods, like light bulbs and office supplies, as well as direct goods that are needed for manufacturing of their products. The procurement software allows them to interface with the catalogs of multiple suppliers simultaneously and get the best price available at the time. Many of these procurement packages use some form of XML to describe their orders and send the information over HTTP.

10.4.2 Sell-side solution

Sell-side solutions are for the manufacturers or distributors of the goods and services being purchased by the new procurement software. A seller needs to make their goods available to a variety of buyers using a variety of protocols to place the orders. Sellers who cannot “speak” about these new protocols run the risk of being passed up by those more nimble companies that can. An example of a sell side solution is Connect for iSeries, which is discussed in Chapter 11, “B2B: Connectors” on page 245.

10.4.3 e-Marketplace solution

e-Marketplace solutions are being developed and used by larger companies who want to provide a service (usually on a per transaction fee base) of bringing together buyers and sellers. Not only does an e-Marketplace keep track of available buyers and sellers, it can provide value add services, such as catalog aggregation, auctions, and reverse auctions, that take some of the burden off of the buyers and sellers to provide these types of services on their own. e-Marketplaces also often provide catalog and order processing services that handle the translation of one message type to another for those buyers and sellers who cannot support all available protocols. This, of course, is done for a fee.

There are few e-Marketplaces today as they have yet to demonstrate their true value to both buyers and sellers. This demonstration will come and their numbers will increase. Meanwhile, the trend seems to be toward private exchanges sponsored by individual buyers wishing to communicate to multiple sellers, as well as direct buyer to supplier communication. Connect for iSeries Version 1.1 can accommodate these new private protocols (see Chapter 11, “B2B: Connectors” on page 245).

10.5 B2B: Not writing new applications but transforming existing ones

B2B (or e-business) is not about writing a whole new set of applications to replace existing ones. Although this is could be an option, it is a questionable alternative in terms of feasibility and justifiability.

Instead, you should extend your existing applications to both the Internet and your intranet. To do this, you need *connectors*, which are defined in Chapter 11, “B2B: Connectors” on page 245.

11

B2B: Connectors

B2B connectors are the technology used to integrate your business to your suppliers' and buyers' business to avoid manual processing of business-to-business transactions. This, in turn, reduces processing time and transaction costs.

11.1 Connectors: Overview

Connect for iSeries is an example of a B2B supplier-enablement solution developed specifically for iSeries customers and business partners. It is implemented as a software integration framework that allows you to integrate your new and existing back-end business applications with those of your trading partners (for example, buyers). The framework supports plug-ins for multiple trading partner protocols. Currently Ariba's cXML and Metiom's mXML protocols are supported. Protocols such as Commerce One's xCBL are in the works. Custom protocols can be added by customers and business partners to support private exchanges and point-to-point connections. Connect also provides pluggable connectors that make it easy to communicate to various back-end applications through a variety of access mechanisms.

Connect for iSeries was written with small to mid-market customers in mind. As such, it has been priced reasonably and requires minimal investment with a service provider to be installed and configured (use of a trained service provider is strongly recommended). Connect also comes with an integrated tool set that provides various wizards to help the service provider quickly configure a customized installation for the customer and for the customer to manage and maintain the product later.

Connect for iSeries is targeted for the sell side of e-business. It helps suppliers with numerous tasks such as registering supplier information, keeping track of information about each of the buyers (including authentication information), and building and maintaining catalogs for the buyers to shop from. Plus, if the seller chooses to host the catalog on their own system, Connect helps with the integration with WebSphere Commerce Suite.

Connectors do not give you a ready-to-run application (for this, you need to consider Chapter 12, “B2B: Application solutions” on page 289). Rather, they provide universal access from your Web application to your existing data, applications, and transactions. They help you transform your business to an e-business without making major changes to your existing applications.

11.1.1 Connect for iSeries: What it can do for you

So, what can Connect for iSeries do for you? As stated earlier, Connect for iSeries is a B2B supplier-enablement tool that can help the supplier connect to multiple trading partners and keep track of all of the information needed to do so.

Connect keeps a database of information about buyers, suppliers, and marketplaces. This information is used when processing transactions and building catalogs. Connect also maintains the relationships between these buyers, suppliers, and marketplaces. This way we know which buyers are allowed to do business with a particular supplier through a particular marketplace.

In addition to supporting multiple trading partner protocols (including Ariba's cXML and Metiom's mXML), Connect also handles catalog management tasks such as building a catalog from scratch or from an existing database. It then helps you augment your database information with additional information that marketplaces like to see in catalogs such as classification codes and manufacturing IDs. Connect can then export the catalog in various formats including cXML and Catalog Interchange Format (CIF).

One of the most important things Connect does is integrate with your existing back-end applications. Incoming trading partner requests are usually received in XML format. Most existing back-end applications do not understand these requests. Connect can be configured to convert these XML requests into database calls, program calls, MQ messages, or data queue messages. You use the connect mapping tools to describe how the XML messages are to be converted to these formats and Connect handles the runtime mapping operations.

Out of the box, Connect is configured to interface with WebSphere Commerce Suite (WCS) as a back-end application. Connect helps you import WCS supplier information into Connect databases. You can then associate buyers with WCS shoppers. WCS can be used as a remote catalog for those buyers/marketplaces that support remote catalog shopping.

11.1.2 Connect for iSeries features

The Connect for iSeries features are summarized here:

- Maintains a customizable database of information about:
  - Suppliers
  - Marketplaces
  - Buyer organizations
- Handles various trading partner protocols
  - Ariba cXML
  - Metiom mXML
  - Commerce One (future)
  - Custom protocols

- Handles catalog management
  - Build catalog data from existing sources or from scratch
  - Augment catalog with unique data required by trading partners
  - Publish catalog in various formats (cXML, CIF 3.0)
- Handles integration with back-end applications
  - Maps trading partner requests to a format acceptable by an application
  - Accesses applications through program calls, Java calls, queues, or JDBC
- Handles integration with WebSphere Commerce Suite
  - Associates marketplaces and buyers with merchants and shoppers
  - Allows B2B catalogs to be hosted at the supplier site (“Punchout” support)
  - Augment's WCS catalog with unique data required by trading partners
- Runs in a multi-tier environment
  - Delivery gateway can run on a different system than the Flow Manager
  - Single point of administration
  - Good for installations that require a DMZ

11.1.3 Connect for iSeries architecture

The architecture of Connect for iSeries is shown in Figure 11-1.

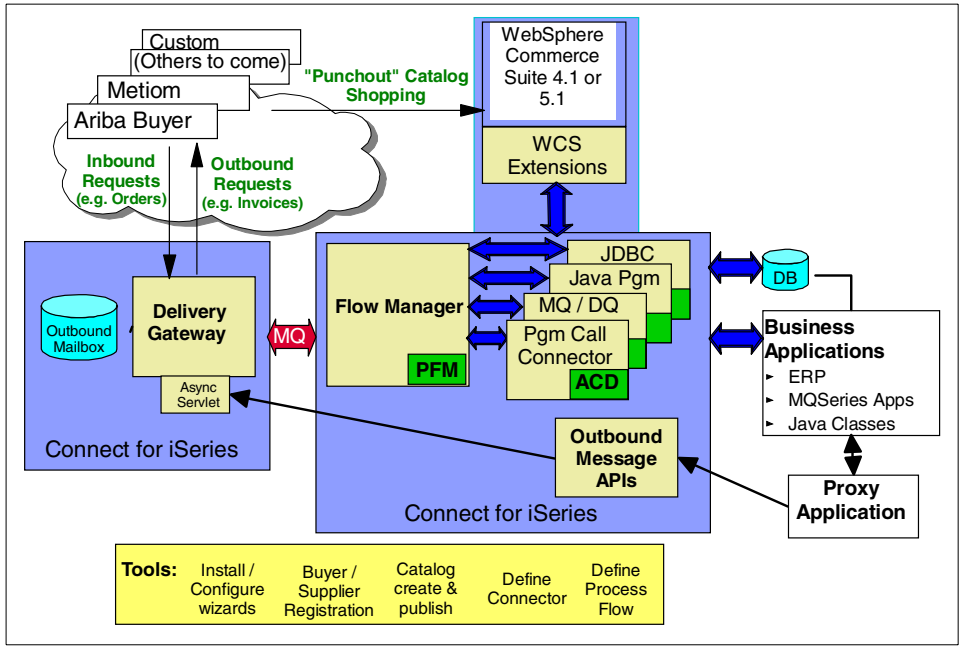


Figure 11-1 Connect for iSeries architecture

Connect for iSeries is primarily made up of three runtime components and a series of tools.

Runtime components

The runtime components include:

- The Delivery Gateway is responsible for communicating with the different trading partners via various protocols including custom protocols. It does authentication of the requests and passes them on to the Flow Manager.
- The Flow Manager accepts requests from the Delivery Gateway and determines which back-end applications should handle the requests and what mechanism to use to communicate to that application. The Flow Manager maps the received information from XML format to the format required by the back-end application.
- Connectors are used to do the actual communication to the back-end application. A program call connector is used to call procedural programs (with parameters) written in C, C++, COBOL, RPG, CL, etc. A Java connector is used to call Java programs. A queue connector is used to place messages on MQSeries Queues or iSeries Data Queues. A JDBC connector is used to access the database.

Tools

The tools for Connect for iSeries include:

- Installation and configuration tools to mask the complexity of getting the product and its prerequisites up and running.
- Buyer/Supplier/Marketplace registration tools to keep track of information about your trading partners.
- Catalog creation and export tools to help you build and maintain catalogs for your partners.
- Tools to help define a connector instance to communicate to a back-end application.
- Process Flow tools to help define how to handle a particular incoming request and how to map that request appropriately for the back-end connector.

11.1.4 Connect for iSeries concept

The main concept behind Connect for iSeries is relatively simple. A customer or, more likely, a business partner, uses the Connect toolset to create and distribute catalogs to buyers or to local catalog hosting tools. The tools are also used to define the mapping required on incoming messages in order for them to be understood by back-end applications. This mapping information is then deployed in the form of runtime mapping rules that are used by Connect for iSeries to handle incoming transactions. This is shown in Figure 11-2.

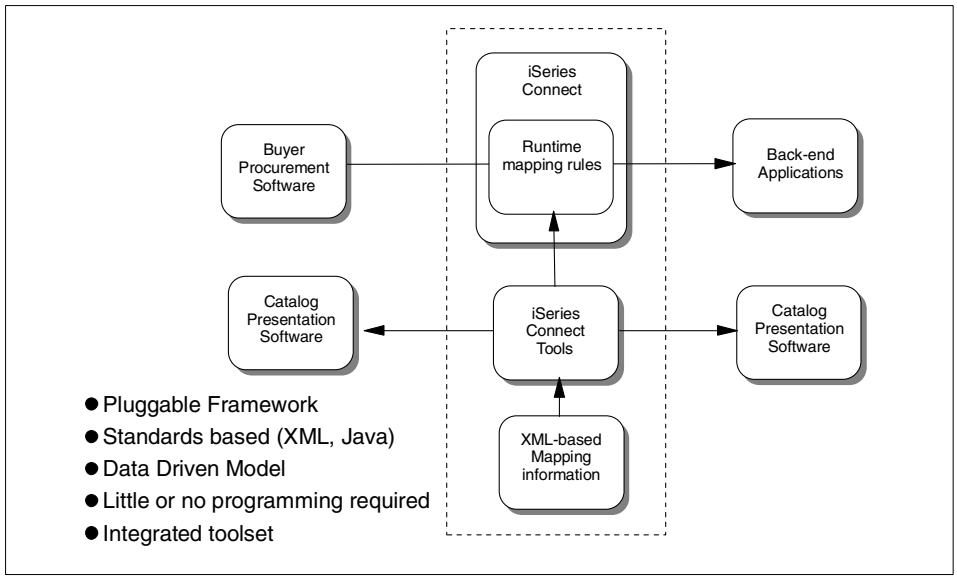


Figure 11-2 Connect for iSeries concept

11.1.5 Connect for iSeries benefits

The primary reasons for purchasing Connect for iSeries over competitive products are speed of deployment and flexibility. Connect for iSeries is a data-driven model, which makes it much faster and easier to map trading partner requests to back-end applications. And with the framework structure, you have the flexibility to define additional supported protocols and applications with little additional effort. Here are some further benefits:

- Speed of deployment:
  - Built-in connectors to back-end applications and marketplaces reduce the amount of custom programming required
  - User friendly tools to configure BtoB transaction environment

  - Automatic configuration of a Web server, WebSphere Application Server, MQSeries, and Security (user profiles, certificate registration)
- Flexibility:
  - Built on widely used industry standards like Java and XML
  - Designed to work with different e-business infrastructures like WebSphere or Domino
  - Designed for plug-in connections with different marketplaces, for example Ariba, Metiom, and Commerce One
- Key design points:
  - Complete supplier enablement solution
  - Easy, low cost
  - Data-driven architecture
  - Protocol independent application integration
  - Customer/business partner extendible

11.1.6 Connect for iSeries V1.1 enhancements

Connect for iSeries has been greatly enhanced at V1.1 to align with the new B2B motivations to allow incoming and outgoing requests and to support and customize different protocols:

- Support for new trading partner protocols (cXML 1.2 and mXML 5.1; OCI and xCBL support planned)
- Support for private and custom protocols (user-defined gateway flows)
- More complex Flow Manager flows (multiple steps, decision steps, asynchronous responses)
- Support for outbound messages (supplier initiated invoices, advanced shipping notices, and so on)
- JDBC Database Connector
- Visual toolset for ACD and flow creation (later in 2001)
- Catalog export enhancements (product classification, buyer specific pricing)
- Support new topologies (DMZ versus private network)
- Support for WCS V5.1 and MQSeries V5.2

11.1.7 References

For more information on Connect for iSeries and Connectors, see:

- Connect for iSeries Web Site: http://www.iseries.ibm.com/btob/connect
- "IBM Connect for iSeries Overview" white paper: http://www-1.ibm.com/servers/eserver/iseries/btob/connect/whtpaper/iconovr1.htm
- Connect for iSeries Classroom Education: http://www.iseries.ibm.com/service/itc/ebiz-educ.htm
- WebSphere Commerce Suite for iSeries: http://www.iseries.ibm.com/ebusiness/wscommerce.htm
- Partner World for Developers, iSeries: http://www.iseries.ibm.com/developer/
- Ariba: http://www.ariba.com
- Ariba Supplier Network: http://supplier.ariba.com
- Ariba cXML: http://www.cxml.org
- Metiom: http://www.metiom.com

11.2 Connector technologies and products

B2B is the art and science of connecting your business logic and processes to other business logic and processes, whether they are on your same iSeries server or on another system. Connectors, such as WebSphere Application Server, IBM Toolbox for Java (which contains many iSeries data access connector objects), MQSeries, Domino for iSeries, eXtensible Markup Language (XML), Net.Data, Common Gateway Interface (CGI), and CORBA, all provide you with the mechanism to make these connections.

If you are looking for a program product to help you integrate many of these connectors from a single place, go to 11.3, "Connect for iSeries: Pulling them all together" on page 280.

11.2.1 WebSphere Application Server

You can use WebSphere Application Server (WAS), along with the HTTP server, to run the front-end process of the third-party request. WAS can provide the services for the application servlet engine to run your servlets, with the HTTP server providing the HTTP protocol handling.

WAS supports XML document structures and can generate, validate, parse, and serve XML documents.

Using CCF connectors with IBM VisualAge for Java

The task of connecting an application to a back-end data store is relatively standard. It follows the same basic pattern whether you are considering the interactions between applications, servlets, EJBs, message queueing systems, relational databases, transactional systems, or some other pieces of enterprise infrastructure.

The IBM Common Connector Framework (CCF) recognizes that most interactions follow a standard pattern. It provides a standard Java-based infrastructure for integrating various system components together.

The CCF solves problems by providing:

- A common client programming model for connectors that greatly reduces the learning curve for an application developer
- A common infrastructure programming model for connectors
- A plug-in interface for higher-level tools, making them independent of a particular connector

The CCF is easily applied within a feature-rich component environment such as the environment provided by WebSphere Application Server to support servlets or Enterprise JavaBeans.

The MQSeries connector

VisualAge for Java's MQSeries Common Connector Framework (CCF) Connector classes provide a higher-level Java interface, which conforms to the IBM CCF. This interface simplifies some of the programming tasks associated with the MQSeries Client Classes for Java native programming interface. It is consistent with the CCF interfaces implemented by other IBM connectors.

Programs written using the MQSeries CCF Connector classes can communicate with programs that use the standard MQSeries programming interface (the MQI) or with programs that use the MQSeries Client Classes for Java interface. The other applications can be running on any of the systems to which MQSeries has been ported.

IBM DB2 JDBC drivers

The Java Database Connectivity (JDBC) driver consists of the JDBC client and the JDBC server. The JDBC client driver is loaded along with an applet or servlet.

Figure 11-3 shows the most common scenario with a Web server and servlet. The servlet uses an application driver and can connect to the DB2 server located on the same machine or on a different machine. The best way to access the DB2 database is to install the DB2 client on the same machine as the Web server.

Calls to JDBC are translated to DB2 CLI calls through Java native methods. This requires the DB2 Client Application Enabler (CAE) component to be installed at the client. A JDBC request flows through the DB2 CLI to the DB2 server through the normal CAE communication flow.

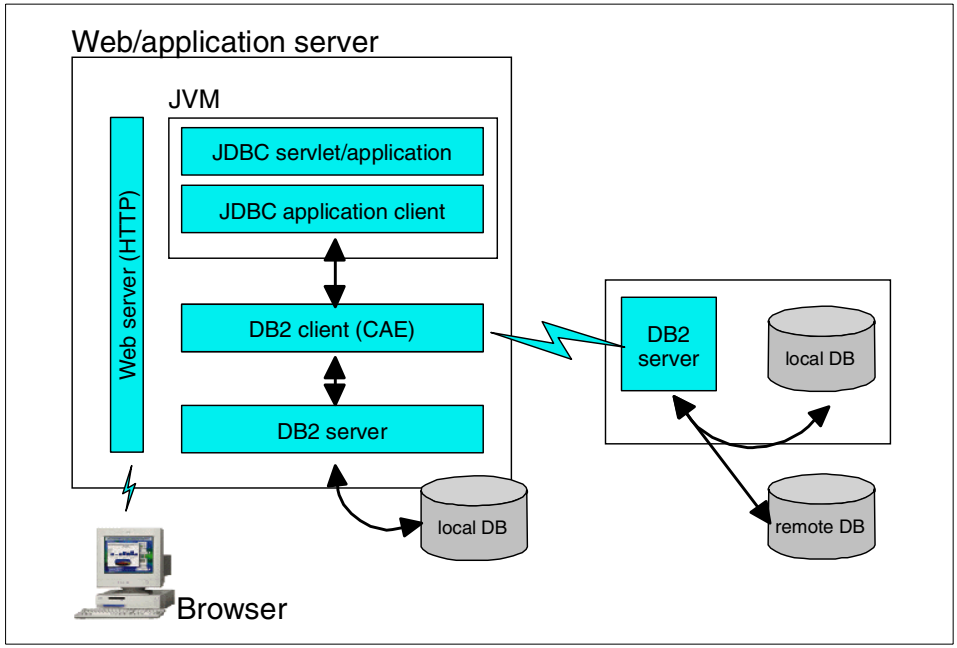


Figure 11-3 DB2 JDBC application driver architecture in a servlet

11.2.2 IBM Toolbox for Java

The IBM Toolbox for Java is a library of Java classes that give Java programs easy access to iSeries data and resources. These classes allow you to access legacy or ERP application data through Java programming. In other words, the IBM Toolbox for Java delivers a ProgramCall class, which provides a means of calling any iSeries program from a Java program. More specifically, the ProgramCall class uses the iSeries Host server ProgramCall driver to call any iSeries program object.

The IBM Toolbox for Java includes the XML4J parser (IBM XML Parser), Program Call Markup Language (PCML) (an XML dialect to support Java programs calling iSeries applications programs), and Panel Definition Markup Language (PDML) (an XML dialect to support GUI panel definition).

IBM Toolbox for Java access classes

IBM Toolbox for Java access classes represent iSeries data and resources. The classes work with iSeries servers to provide an Internet-enabled interface to access and update iSeries data and resources. That is, the `com.ibm.as400.access` package has interfaces, classes, and exceptions to access various iSeries resources.

The servlet classes that are provided with IBM Toolbox for Java with the access classes, which are located on the Web server, give you access to information located on your iSeries. Figure 11-4 shows how the servlet classes work between the browser, Web server, your Web application, and iSeries data.

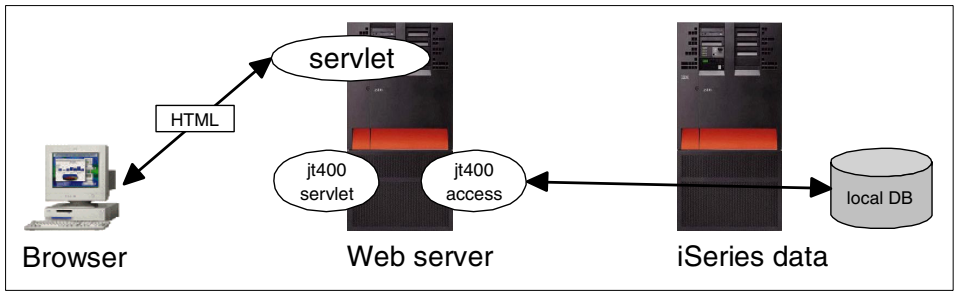


Figure 11-4 How servlet classes work between the browser, Web server, Web application

A browser connects to the Web server that is running your Web application servlet. The jt400Servlet.jar and jt400Access.jar files reside on the Web server because the servlet classes use some of the access classes to retrieve data and use the HTML classes to present the data.

Notice that the name of the toolbox is the IBM Toolbox for Java, not the IBM Toolbox for Java. You should be aware that the IBM Toolbox for Java not only runs on the iSeries (at the Web server in Figure 11-4), but it runs on most any other server that provides a Java Virtual Machine (JVM) that fully supports JDK 1.1.8 or any later JDK, including Java 2. That is, the IBM Toolbox for Java has been tested and runs on IBM OS/400 V4R4 or later, IBM AIX 4.3.3.1, Sun Solaris 5.7, Red Hat Linux 5.2, Microsoft Windows 95, Microsoft Windows 98, Microsoft Windows NT Workstation 4.0, and Microsoft Windows 2000. Is your business's data on an iSeries? If so, you can use the IBM Toolbox for Java to provide connectors from most any popular server today to your iSeries server.

For more information about the IBM Toolbox for Java, see:
http://www.ibm.com/servers/eserver/iseries/toolbox/

11.2.3 MQSeries

MQSeries enables Web applications to use message queuing to communicate with your back-end legacy or ERP applications. Programs within a Web application communicate with a back-end legacy or ERP application by writing and retrieving application-specific data (messages) to and from queues without having a private, dedicated, or logical connection to link them. Therefore, the Web application is shielded from the mechanics of the underlying communications.

MQSeries is used in a client/server or distributed environment. Web and legacy programs can run on one workstation or on different machines on different platforms.

MQSeries Queue Manager ensures that messages reach the target queues. It can also provide a confirmation of delivery option that is unlike the OS/400 built-in data queue function.

Figure 11-5 shows how MQSeries can be used in the Web application environment to communicate with back-end applications.

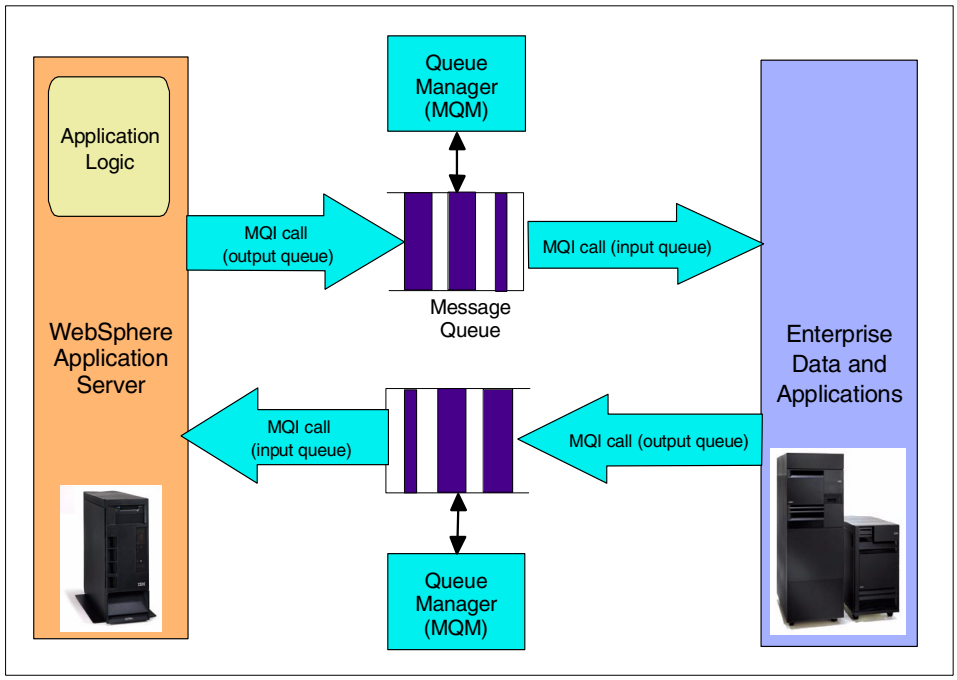


Figure 11-5 MQSeries with back-end applications

Application programs invoke functions of the queue manager by issuing API calls. For example, the MQPUT API places a message on a queue to be read by another program using the MQGET API.

A program may send messages to another program that runs in the same machine as the queue manager. Or it may send messages to a program that runs in a remote system, such as a server or a host. The remote system has its own queue manager with its own queues. Application programmers do not need to know where the program to which they are sending messages runs. They place their message in a queue and let Message Queue Manager (MQM) worry about the destination machine and how to get it there.

The functions of Message Queue Manager include:

- Manages queues of messages for application programs.
- Provides an application programming interface – the Message Queue Interface (MQI).
- Uses networking facilities to transfer messages to another queue manager when necessary.

Note: TCP/IP is often the first protocol that you think of when you start designing your e-business network. But, in Figure 11-5, the network between the WebSphere Application Server on the left and the Enterprise Data and Applications server on the right could either be SNA or TCP/IP. MQSeries supports both. The advantages of SNA in this environment are that it is extremely stable, performs well, and is relatively secure as compared to most intranet implementations of TCP/IP. In any case, you decide which to use.

- Provides additional functions that allow administrators to create and delete queues, alter the properties of existing queues, and control the operation of the queue manager. These functions are invoked through the Run MQSeries Commands (RUNMQSC) utility.

For more information about MQSeries and the MQSeries family of products, see:
http://www.ibm.com/software/ts/mqseries/

MQSeries Client for Java

MQSeries Client for Java provides a set of Java class libraries that permit Java applets on a Web browser, or stand-alone Java applets, to access MQSeries applications over the Internet without needing any other MQSeries code on the client machine.

MQSeries Java Message Service fully supported on iSeries

MQSeries classes for Java Message Service (JMS) are a set of Java classes that implement Sun Microsystem's Java Message Service specification. A JMS application can use the classes to send messages to either existing MQSeries or new JMS applications.

Using MQSeries classes for Java Message Service offers benefits associated with using an open standard to write MQ applications, such as the protection of investment both in skills and application code. In addition, the JMS classes provide some additional features not present in the MQSeries classes for Java, such as explicit support for Publish and Subscribe and now support for XA transactions via the JTA/XA interface. This interface allows transaction coordination between messaging and other resource (usually database) updates.

In addition, this level of MQ JMS provides JMS Application Server Facilities, and Connection Pooling which can provide performance enhancements when re-using connections.

You can download the MQSeries JMS V5.2 for iSeries now for no charge from:
http://www-4.ibm.com/software/ts/mqseries/txppacs/

MQSeries Application Messaging Interface (AMI) on iSeries

The AMI improves programmer productivity by providing a simple API that supports point-to-point and publish/subscribe messaging.

The MQSeries AMI is available in C, C++, and Java. It simplifies application development by moving function from the application program into the messaging infrastructure. This reduces the need for much of the in-depth MQSeries knowledge required by application programmers by moving this responsibility to a small number of specialist administrators within an organization.

These administrators create policy and service definitions in the AMI repository file, which is then referenced by AMI programs. The MQSeries AMI repository can be created using the MQSeries AMI Administration Tool for use with Windows NT and Windows 2000.

AMI V1.2, now available on iSeries, provides the following new functions:

- Added support for policy handlers. Policy handlers extend the function of the AMI to suit the needs of a particular user, for example, to add auditing of messages or compression of message data.
- Added support for LDAP (IBM Tivoli and Active Directory) for the AMI repository. This reduces the management of the repository and ensures consistent definitions are used throughout the network.
- New application calls that allow the setting of message types and report codes, and access to additional AMI object properties.
- Extended file transfer support for logical file splitting on a specified byte boundary.
- Enabling additional MQSeries functions such as generation of a new correlation identifier and support for MQSeries client channel name and TCP/IP address.
- Improving performance in application server environments by repository caching.

You can download the MQSeries AMI 1.2 for iSeries now for no charge from:
http://www-4.ibm.com/software/ts/mqseries/txppacs/

MQSeries Integrator Version 1.1

MQSeries Integrator is a powerful message-brokering software that automatically distributes information to those who need it. When you use MQSeries to transport messages across different computing platforms, it routes information according to enterprise-defined rules, transforming and reformatting it to suit the

receiving application. Dynamic reformatting performs conversions, transformations, and message enrichment to meet the needs of the enterprise. MQSeries Integrator seamlessly integrates applications, databases, and networks.

Usability features for those defining broker actions include graphical user interfaces, editable definition files, and a visual tester.

Predefined templates mean MQSeries Integrator can exchange information with major packaged applications such as those from PeopleSoft GL and SAP. They enable new systems to be productive immediately.

The highlights of MQSeries Integrator include:

- Forms the message brokering layer of the IBM business integration framework
- Makes adding, extending, or replacing applications in an MQSeries network simple and easy
- Applies intelligent routing to seamlessly integrate applications and networks
- Enables application-to-application message transformation
- Supports custom-built and predefined application libraries
- Supports PeopleSoft GL, SAP R/3, and S.W.I.F.T. templates from New Era of Networks Inc. (NEON)
- New usability features and improved graphical user interfaces

For more information about MQSeries Integrator Version 1.1 (Version 2.0 is not yet available for the iSeries server), see:
http://www.ibm.com/software/ts/mqseries/integrator/

11.2.4 Domino for iSeries

There are several ways to integrate Lotus Domino and iSeries applications. Lotus Domino applications can interact directly with enterprise data and business logic, and they can use a messaging/queuing layer to post work to an iSeries transaction monitor. iSeries applications can use APIs to update or retrieve Lotus Domino data.

Domino.Connect is an Enterprise Integration solution that integrates Notes and Domino applications with a broad range of relational database management systems (RDBMSs), transactions, and enterprise application systems.

Domino.Connect supports these features:

- Is a complete environment for developing and deploying Internet and intranet business applications.
- Enables Notes clients and Web browsers to access enterprise data and applications.
- Allows developers to incorporate database capabilities into Domino-based Web sites and applications.
- Allows secure distributed access and database integration, along with complete messaging, calendaring and scheduling, and replication.
- Allows Domino applications to interact with users to update or create complex transactions with back-end systems.

Domino.Connect consists of a number of components that are the plug-ins, drivers, applications, and tools that integrate the enterprise. They can be classified into the following categories:

- **Relational database connectivity**: Power through integration – NotesPump, NotesSQL, LotusScript Data Object, DB2 Plug-In, and ODBC
- **Transaction connectivity**: MQSeries Plug-In
- **Application system integration**: SAP R/3 Plug-In, Lawson, SSA, and J.D. Edwards
- **Developer's interface**: LotusScript Plug-In toolkit

Connectors provide the strategic "plumbing" for enterprise integration. They provide native connectivity, via a consistent object model, to external data sources. They allow Lotus Domino applications to connect, authenticate, and translate data with RDBMS, ERP, and transaction processing systems.

Connectors can be accessed through visual data mapping tools, such as Lotus Domino Enterprise Connection Services (DECS) or Language Enterprise Integrator (LEI). Alternatively connectors can be programmatically accessed via the Lotus Software Extension (LSX) for Lotus Domino Connectors or Lotus Connectors Java classes. Connectors are "open" so the design specifications are published, and anyone can write a connector using the Lotus Connector Toolkit. Connectors can interact directly with the enterprise data, or they can interact with the business logic.

Java, IBM Toolbox for Java, and Lotus Domino

The iSeries Java environment interacts with the Lotus Domino environment in the same manner as on the other platforms. Agents can be written in Java to run on the iSeries server. Lotus Domino agents using the Lotus Domino Object classes can run on either the server or the Lotus Notes client. Server Java agents use the built-in JVM that is shipped with OS/400. Client agents use the JVM of the client operating system.

Agents on either the client or the server may then use Java constructs, such as Remote Method Invocation (RMI), to interact with other enterprise Java applications. Or they may use the IBM Toolbox for Java to invoke an iSeries program object or post a transaction to an iSeries application's data queue.

- **Java classes**: Internally, Java Lotus Domino classes execute the same C++ code as the LotusScript Lotus Domino back-end objects. The only difference is the language syntax.
- **Java agents**: Java classes can also be created as agents in a Lotus Domino database that are executed like any other Lotus Domino agent. They have full agent scheduling and triggering abilities from the client and the server. Java agents can be run in the foreground or the background and can be replicated.

  Java agents complement the LotusScript agents and, to a large degree, can be used interchangeably when dealing with back-end operations.
- **Java applets**: Java applets allow a Lotus Domino developer to create a richer GUI environment for the end user. Applets are dynamically downloaded from the server, executed on the client's machine, and work with either Web browsers or Lotus Notes clients.

  Java applications differ from applets in that they are not dynamically loaded from the server. They are similar to traditional executables in this respect.
- **Java servlets**: Java servlets only run on the server. A servlet is invoked by a client request and responds directly to the client. Typically, a servlet is used to provide a high performance link to a back-end system and display the results on the client in HTML format. However, servlets are not restricted to serving only HTTP requests and may, in fact, converse directly with any suitable client application (usually an applet). A servlet can access both local and remote Lotus Domino databases.
- **Lotus Connector Java Classes**: The Lotus Connector (LC) classes are available to use through Java classes. Developers must import these classes.
- **Java Database Connectivity (JDBC)**: Developers can access enterprise data using Sun Microsystem's Java Database Connectivity (JDBC) API. JDBC provides access to DB2 UDB for iSeries data whenever Java is used with a TCP/IP connection to the iSeries server. It permits developers to send SQL statements to DB2 databases and retrieve the results.

- **Application programming interfaces (APIs)**: The Lotus Domino for iSeries product includes low-level C and C++ APIs. These APIs allow the programmer to operate on Lotus Domino objects programmatically, without having to use the Lotus Domino interface. Programs using these APIs can open, create, or delete Lotus Domino databases and manipulate Lotus Domino database elements.

11.2.5 Extensible Markup Language (XML)

XML is often used to exchange business data between enterprises or within an enterprise's own business unit. XML adds value to these relationships because it provides a common and consistent means of data definition.

XML is a standard and specification for describing data with markup tags. A user defines the set of tags and tag rules to meet their needs. Tags can describe a data or a structure. XML provides additional flexibility because documents are self describing.

Tags allow the creation of such XML dialects as:

- Wireless Markup Language (WML)
- Commerce XML (cXML)
- Electronic Business XML (ebXML)

Each XML document consists of an element that is specific to that document. Figure 11-6 shows the structure of an XML document. An element with content has a start tag and an end tag, with the content in between the two tags. Elements can be organized into a structure, much like files are organized. The nesting is reflected by the position of the start and end tags. Any element can have an attribute that is used to further define the element.

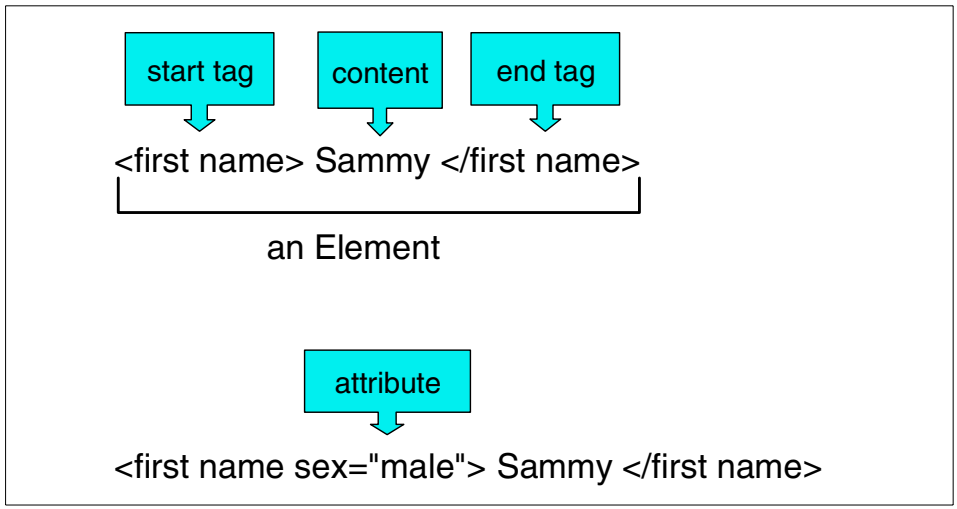


Figure 11-6 Structure of an XML tag (element)

The following example shows an XML document used for a catalog. The elements have been indented to easily show the hierarchy of the document:

```
<?xml version='1.0'?>
<catalog season='fall'>
  <name>Wally's Fall Outdoors Apparel</name>
  <item>
       <itemname>Wool Jacket></itemname>
       <type>
          <typename>Male</typename>
          <cost>$50.00</cost>
          <description>Lite weight Wool Jacket</description>
          <number>4901195M</number>
          <weight unit='pound'>1.5</weight>
          <shippingcost/>
       </type>
       <type>
          <typename>Female</typename>
          <cost>$57.50</cost>
          <description>United Lite weight Wool Jacket</description>
          <number>490394W</number>
          <weight unit=’pound’>1.2</weight>
          <shippingcost/>
       </type>
   </item>
</catalog>
```

The XML document contains information about two wool jackets: a male version and a female version. Within each <type> </type> tag set is the information for each item (jacket). The <shippingcost/> tag does not have an end tag, but rather a back slash (/) after the term shippingcost within the start tag. This is known as an *empty tag*, which has no content and can be used as a place holder for later use.

Document Type Definition (DTD)

The XML document has an associated Document Type Definition that defines the valid content of the XML document and the relationship between the elements within the document. The DTD defines the structure of the XML document, any rules about the relationship between elements, and any rules that are particular to a specific element. The DTD expresses the hierarchy and the nesting of elements within the document structure.

The following example shows the DTD for the XML document example on page 264:

```
<!ELEMENT catalog (name, item*)><ELEMENT name (#PCDATA)>
   <!ATTLIST catalog season (winter|soring|summer|fall) #REQUIRED>
<!ELEMENT item (itemname, type*)>
   <!ELEMENT itemname (#PCDATA)>
   <!ELEMENT type (typename,cost,description,number,weight,shippingcost)>
      <!ELEMENT typename (#PCDATA)>
      <!ELEMENT cost (#PCDATA)>
      <!ELEMENT description (#PCDATA)>
      <!ELEMENT number (#PCDATA)>
      <!ELEMENT weight (#PCDATA)>
         <!ATTLIST weight unit (pound|kilogram|gram|ton) #REQUIRED>
      <!ELEMENT shippingcost (#PCDATA)>
```

An element is defined in this form as <!ELEMENT element name>. An element may contain other sub-elements, which are enclosed in parentheses () and listed after the element name. For example, an element type in the above example has the sub-elements typename, cost, description, number, weight, and shippingcost.

Some elements contain attributes defined in an attribute list <!ATTLIST> statement. For example, element weight has the attributes pound, kilogram, gram, and ton. An attribute is used to add meaning to a particular tag and must be defined within the DTD.

Each element of the document is defined separately for its data type. The #PCDATA (meaning Parsed Character Data) indicates the character (text) data. Currently XML documents only consist of character data.

eXtensible Stylesheet Language (XSL)

XML documents can be viewed in XML-enabled browsers by using XSL stylesheets to format the document. Using XML in a business-to-business transaction, and as the common communication vehicle between disparate applications, requires a mechanism that will read and interpret the XML document into computer friendly form.

XSL consists of two parts:

- **XSL Transformations (XSLT)**: A language to transform XML documents
- **XML vocabulary**: To specify formatting semantics (XSL Formatting Objects)

Figure 11-7 shows how the XML document catalog.xml looks in the Internet Explorer browser.

```
<?xml version="1.0" ?>
- <catalog season="fall">
    <name>Wally's Fall Outdoors Apparel</name>
  - <item>
      <itemname>Wool Jacket></itemname>
    - <type>
        <typename>Male</typename>
        <cost>$50.00</cost>
        <description>Lite weight Wool Jacket</description>
        <number>4901195M</number>
        <weight unit="pound">1.5</weight>
        <shippingcost />
      </type>
    - <type>
        <typename>Female</typename>
        <cost>$57.50</cost>
        <description>United Lite weight Wool Jacket</description>
        <number>490394W</number>
        <weight unit="pound">1.2</weight>
        <shippingcost />
      </type>
    </item>
  </catalog>
```

Figure 11-7 Example: catalog.xml in Internet Explorer

Figure 11-8 shows an example of cXML order request message from the Ariba SupplierLive procurement application.

cXML OrderRequest Message

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE cXML SYSTEM
"http://xml.cXML.org/schemas/cXML/1.1.009/cXML.dtd">
<cXML payloadID="3223232@ariba.acme.com"
    timestamp="1999-03-12T18:39:09-08:00" xml:lang="en-US">
  <Header>
    <From>
      <Credential domain="AribaNetworkUserId">
        <Identity>admin@acme.com</Identity>
      </Credential>
      <Credential domain="AribaNetworkUserId" type="marketplace">
        <Identity>bigadmin@marketplace.org</Identity>
      </Credential>
      <Credential domain="BT">
        <Identity>2323</Identity>
      </Credential>
    </From>
    <To>
      <Credential domain="DUNS">
        <Identity>942888711</Identity>
      </Credential>
    </To>
    <Sender>
      <Credential domain="AribaNetworkUserId">
        <Identity>admin@acme.com</Identity>
        <SharedSecret>abracadabra</SharedSecret>
      </Credential>
      <UserAgent>Ariba.com Network V1.0</UserAgent>
    </Sender>
  </Header>
    <Request deploymentMode="test">
      <OrderRequest>
        <OrderRequestHeader orderID="DO1234" orderDate="1999-03-12"
type="new">
          <Total>
            <Money currency="USD">12.34</Money>
          </Total>
          <ShipTo>
            <Address>
              <Name xml:lang="en">Acme</Name>
              <PostalAddress name="foo">
                <DeliverTo>Joe Smith</DeliverTo>
                <DeliverTo>Mailstop M-543</DeliverTo>
                <Street>123 Anystreet</Street>
                <City>Sunnyvale</City>
                <State>CA</State>
                <PostalCode>90489</PostalCode>
                <Country isoCountryCode="US">United States</Country>
              </PostalAddress>
            </Address>
          </ShipTo>
          <BillTo>
            <Address>
              <Name xml:lang="en">Acme</Name>
              <PostalAddress name="foo">
                <Street>123 Anystreet</Street>
                <City>Sunnyvale</City>
                <State>CA</State>
                <PostalCode>90489</PostalCode>
                <Country isoCountryCode="US">United States</Country>
              </PostalAddress>
            </Address>
          </BillTo>
          <Shipping trackingDomain="FedEx" trackingId="1234567890">
            <Money currency="USD">12.34</Money>
            <Description xml:lang="en-us">FedEx 2-day</Description>
          </Shipping>
          <Tax>
            <Money currency="USD">12.34</Money>
            <Description xml:lang="en">foo</Description>
          </Tax>
          <Payment>
            <PCard number="1234567890123456" expiration="1999-03-12"/>
          </Payment>
          <Comments xml:lang="en-US">Anything well formed in XML can go
here.</Comments>
        </OrderRequestHeader>
```

Figure 11-8 Example: cXML document from Ariba SupplierLive

XML parser

Application programs require a means to access the individual pieces of information (elements) contained within each XML document. This is accomplished by using an XML parser to render the document in a structured form (hierarchical tree structure), which allows each element of the document to be accessed and manipulated.

The XML parser uses the DTD to validate the document, which involves ensuring the XML document follows all the rules specified in the DTD. For example, the DTD rules can specify the valid set of tags, the valid element nesting rules, and the attributes that are associated with a particular element.

Document Object Model (DOM) tree

An XML parser uses both the DTD and the XML document to create a Document Object Model (DOM) tree, which presents the document hierarchically. The DOM is a representation of the document used by applications at run time to query and update information within an XML document. The DOM provides a group of APIs that allows access to the elements within the tree. When you use DOM APIs, you can access, change, delete, or add any element within the XML document.

Figure 11-9 shows an example of the DOM tree for the document from XML document example on page 264 (catalog.xml). It does not represent the content within the tree structure. The tree must be visualized as a grove or forest of trees representing that content rather than this single structure. Each rectangle in following diagram represents a node in the tree, and each oval represents an attribute. To keep Figure 11-9 simple, only the element and attribute names are included.

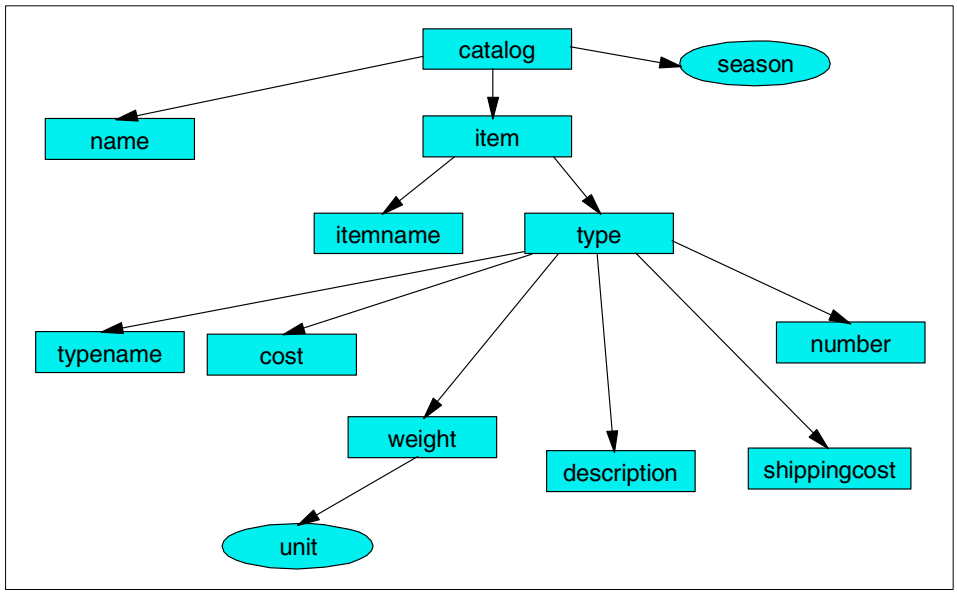


Figure 11-9 Example: Document Object Model tree for catalog.xml

By following the tree (hierarchical) structure, the methods allow traversing the tree using method calls for the parents and children. The DOM provides methods to traverse the tree created by the parser. The method accesses the elements within the tree using the parent-child relationship.

Java XML parser (XML4J)

IBM provides the XML4J parser in various products including the IBM Toolbox for Java and on the IBM Alpha Works site (http://www.alphaworks.ibm.com/). Because this parser is written in Java, it is portable to operating systems with a JVM.

The XML4J parser allows you to access the information contained within an XML document.

IBM XML parser for C++ (XML4C)

XML4C is based on Apache's Xerces-C XML parser, which is a validating XML parser written is a portable subset of C++. XML4C integrates the Xerces-C parser with IBM International Components for Unicode (ICU) and extends the number of encoding supported to over 150.

It consists of three shared libraries (two code libraries and one data library) that provide classes for parsing, generating, manipulating, and validating XML documents.

SAX parser

Often iSeries applications are not equipped to process XML documents. There are two solutions to this problem:

- Change the application. This method is cumbersome, time consuming and, in many cases, simply not a viable alternative.
- Transform the XML data into an acceptable format that can be read by the application.

Data queues are often used by conventional iSeries applications for business transactional data. Therefore, converting XML data into a data queue format is a logical method of causing a traditional iSeries program to interface with and use an XML document.

The SAX specification was put together by numbers of `xml-dev` mailing lists. SAX is a de facto standard for interfacing with the XML parser, even though it is not a World Wide Web Consortium (W3C) recommendation. The SAX parser implements event-driven APIs for parsing XML documents, which means SAX provides access to the XML document structure and contents via events.

The following example contains a portion of the AddressBook.xml document for the entry "James Edward Washerton". The example includes the XML tags that show both the structure of an address entry and the address content.

Document	Events
<?xml version="1.0" encoding="UTF-8"?>	startDocument
<AddressBook>	startElement
<AddressEntry>	startElement
<Name title="Mr.">	startElement
<FirstName>James</FirstName>	startElement characters endElement
<MiddleName>Edward</MiddleName>	startElement characters endElement
<LastName>Washerton</LastName>	startElement characters endElement
</Name>	endElement
<Address>	startElement
<PostalAddress type="home">	startElement
<Street>123 Main Street</Street>	startElement characters endElement
<City>Our Town</City>	startElement characters endElement
<State>MN</State>	startElement characters endElement
<PostalCode>55489</PostalCode>	startElement characters endElement
<Country>US</Country>	startElement characters endElement
</PostalAddress>	endElement
<eMailAddress jewash@aol.com</eMailAddress>	startElement characters endElement
<Phone type="home"> 507-334-6565</Phone>	startElement characters endElement
<Phone type="work"> 507-334-6688</Phone>	startElement characters endElement
</Address>	endElement
</AddressEntry>	endElement
</AddressBook>	endElement endDocument

While parsing this document, the SAX parser generates an event for each node that is encountered (shown in the above example in the right-hand column). Each event can be captured by the application program invoking the parser. The application program implements event handlers to process these parsing events. Conveniently, these event handler methods can be extended to perform actions appropriate to a particular parsing event.

The application implements the DocumentHandler and ErrorHandler. The DocumentHandler, the primary event handler interface, “listens” for the various events created by the parser. The ErrorHandler handles the errors generated during the parsing process.

The important difference between SAX and DOM parsers is that each of these parsers supports the two major types of XMI APIs:

- SAX for event-based APIs
- DOM for hierarchical or tree-based APIs

The SAX parser does not build an internal tree. While processing the XML document, it reports parsing events to the application through callbacks. When using the SAX parser, the application must be written (or modified) to implement handlers that deal with the different parsing events.

The DOM parsers represent the XML document in an internal tree (hierarchical) structure. The DOM APIs are used by the application to navigate within the tree. These APIs allow all forms of manipulation of the tree content, including additions, deletions, and updates.

Figure 11-10 shows input to and output from the XMLtoDQSAX class. It shows the transformation of an XML document into messages on a data queue that can be processed by an iSeries program. It does not show the iSeries program that would process the data queue messages.

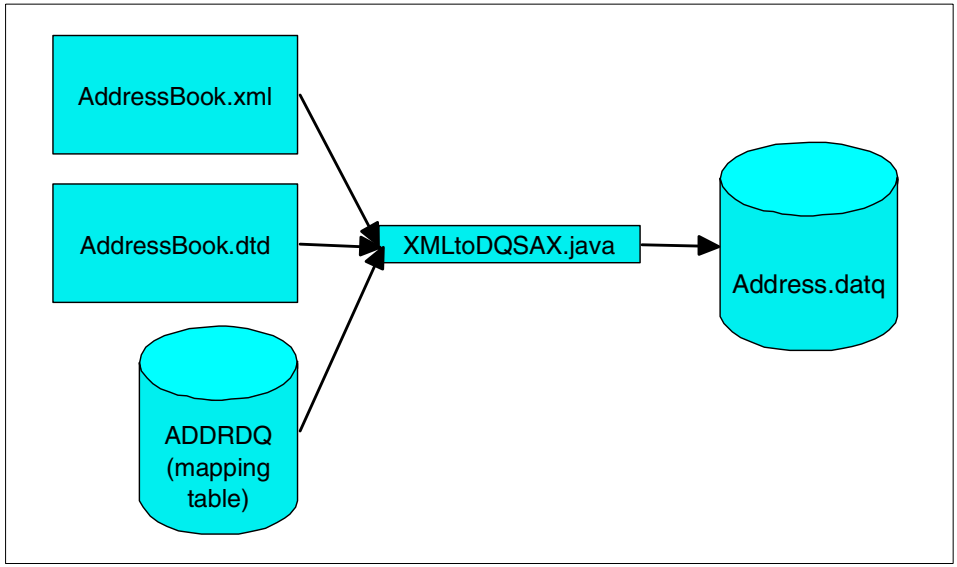


Figure 11-10 Input and outputs to the XMLtoDQSAX class

The XMLtoDQSAX class processes AddressBook.xml using these steps:

1. It validates the input XML document using the AddressBook.dtd DTD.
2. It maps the XML document contents by element name to the data queue field names using the ADDRDQ DB2 table. The ADDRDQ table defines the cross reference (mapping) between the elements and attributes in the XML document and the fields within the data queue message format.
3. It creates complete messages on Address.datq.

DB2 XML Extenders

In the future with DB2 XML Extenders, the iSeries developer will be able to map XML document details directly into DB2 UDB for iSeries tables. Meanwhile, the currently provided Java class (insertXMLintoDB2.java class) can be used. This is accomplished by using the XML4J parser and key Document Object Model (DOM) APIs that are incorporated into the insertXMLintoDB2.java class.

Figure 11-11 shows the input to and results from insertXMLintoDB2.java. It shows both the catalog.xml document and the catalog.dtd document as input. It also shows access to a DB2 UDB for iSeries table named MAPCATALOG. Each catalog is processed to create an insert statement. A complete insert statement is used to update the table CATALOG.

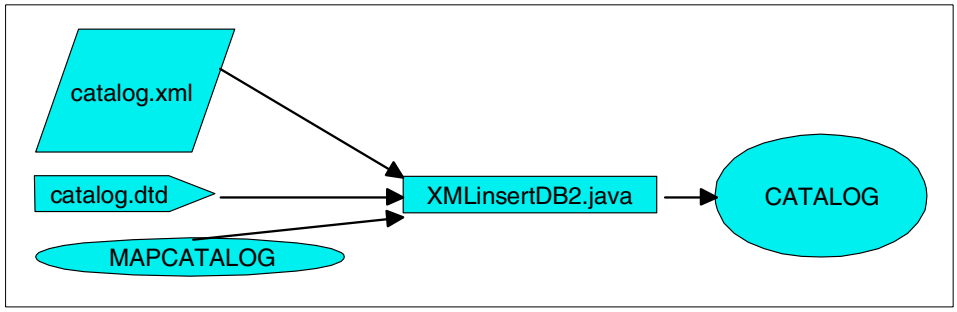


Figure 11-11 Input and results used in insertXMLintoDB2.java

The MAPCATALOG table provides the cross reference between the insert statement and the XML document. It determines whether an element from the XML document is included in the insert statement and which field (by position) that content is to replace.

Lotus XSL Transformer

Lotus provides an XSL transformer, which can be used to translate an XML document into HTML. There are several ways XML can be included in a designer application and serve the data to an XML parser.

You can enter XML tags that describe data on a form or a page. By treating the contents of the form or a page as HTML, you can serve XML to an XML parser that can interpret the tags. XML describes the data being presented. To format and style the data on the form or page, a stylesheet is used that is created with XSL to transform the data into HTML.

tpaML

This specification defines the language for creating electronic Trading Partner Agreements (TPAs) between two business partners (parties to the TPA). Like the Trading Partner Agreements used in electronic data interchange (EDI), these TPAs define the “information technology terms and conditions” that enable business documents to be electronically interchanged between partners. However, these TPAs are not paper documents. Rather, they are electronic documents, written in XML, which can be processed by computers at the partners' sites to set up and then execute the desired business information exchanges.

A TPA describes all the valid visible, and therefore enforceable, interactions between the parties. It is independent of the internal business processes of each party. Each party builds its own internal business process to satisfy these external TPAs and interface them to the rest of its business processes. However, the internal business processes are, in general, not visible to other parties (unless desired by the service providers themselves). The intent is to provide a high-level specification that can be easily comprehended by humans and yet is precise enough for enforcement by computers.

Information in the TPA includes:

- **Identification**: Identifies uniquely the TPA document and the parties involved.
- **Communication**: Specifies the transport protocol or protocols and electronic addresses of the parties.
- **Security**: Defines the certificates used for authentication, non-repudiation, digital envelope, and other security parameters.
- **Invocation-independent properties**: Specify overall properties of the TPA, for example, the valid duration of the TPA.
- **Data definition**: Describes the formats of the data being passed around.
- **Role definition**: Describes each of the roles specified in the TPA that can be filled by specific parties.
- **Action list**: Describes the requests each party can issue to the other. These actions are the independent units of work. The action definitions define the associated message flows between the invoker and the service provider, responsiveness, failure handling, and other attributes.
- **Sequencing rules**: Describe the valid action invocation sequences in each party.
- **Global properties**: Describe the default properties of various fields in the TPA, for example, responsiveness.
- **Comments**: Describe the handling of disputes, termination of the TPA as a whole, and other exceptional conditions.

PCML

Program Call Markup Language (PCML) is a tag language that helps you call iSeries programs, with less Java code. PCML is based on XML, which is a tag syntax you use to describe the input and output parameters for iSeries programs. PCML uses a program-call-document framework designed to make it easier for the programmer to call an iSeries program from a Java program. PCML enables you to defined tags that fully describe iSeries programs called by a Java application.

PCML allows you to write less code. Ordinarily, extra code is needed to connect, retrieve, and translate data between an iSeries server and Java Toolbox objects. However, by using PCML, your calls to the iSeries with the IBM Toolbox for Java classes are automatically handled. PCML class objects are generated from PCML tags and help minimize the amount of code you need to write to call iSeries programs from your Web application.

When used in conjunction with the ProgramCallDocument class delivered in the IBM ToolBox for Java, PCML fully describes all parameters, structures, and field relationships for a given iSeries program call. The IBM Toolbox for Java support interprets the PCML, calls the iSeries program, and allows the programmer to use any data returned from the called iSeries program.

Although, PCML was designed to support distributed program calls to iSeries program objects from a Java platform, you can also use it to make calls to an iSeries program from within an iSeries environment. Figure 11-12 shows how to make program calls to the iSeries using PCML.

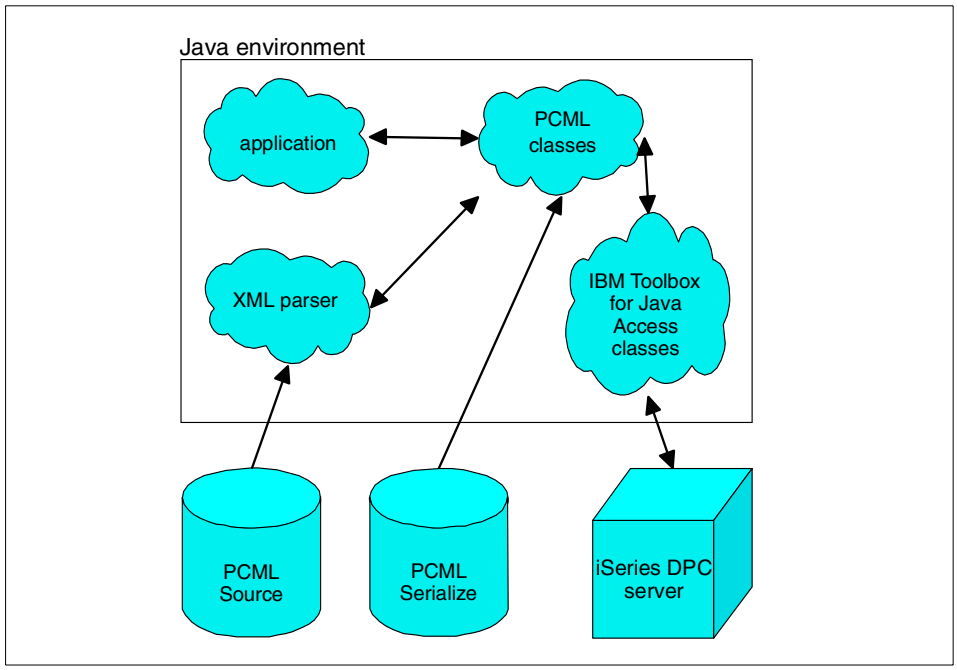


Figure 11-12 Making program calls to an iSeries program using PCML

When your Web application constructs the ProgramCallDocument object, the IBM XML parser reads and parses the PCML source file. After the ProgramCallDocument class is created, the application program uses the ProgramCallDocument class methods to retrieve the necessary information from the iSeries through the iSeries distributed program call (DPC) server.

To increase run-time performance, the ProgramCallDocument class can be serialized during your product build time. The ProgramCallDocument is then constructed using the serialized file. In this case, the IBM XML parser is not used at run time.

PDML

Panel Definition Markup Language (PDML) is a new user interface (UI) data representation language that is based on XML to define a platform independent language for describing the layout of GUI elements. Panels can be defined by using the Graphical Toolbox, which is included in the IBM Toolbox for Java Modification 2. The Graphical Toolbox also provides a run-time API to display the panels. The API displays panels by interpreting the PDML tags and rendering the user interface as Java Foundation Classes.

Here are some examples of PDML tags:

<panel>	Defines a panel
<title>	Specifies the title of the panel or field
<size>	Specifies the size of the panel or field
<label>	Defines a label on the panel (static text field)
<location>	Specifies the location of the field on the panel
<button>	Defines a button on the panel
<textfield>	Defines a text field on the panel

Some of the tags used in PDML are:

- **<pdml></pdml>**
  Used to identify the start and end of a PDML definition.
- **<panel name=mypanel1> and </panel>**
  Used to identify the start and end of a panel called mypanel1.
- **<title>xxx</title>**
  Sets the title used when displaying a panel. If the panel is the only content of a window, then this is the window title.
- **<label name=label_1>Name</label>**
  Defines a text label (output only) to show on the display.

Graphical Toolbox

The Graphical Toolbox, a set of UI tools, makes it easy to create custom user interface panels in Java. You can incorporate the panels into your Java applications, applets, or Operations Navigator plug-ins. The panels may contain data obtained from the iSeries server or data obtained from another source, such as a file in the local file system or a program on the network.

The GUI Builder is a what you see is what you get (WYSIWYG) visual editor for creating Java dialogs, property sheets, and wizards. With the GUI Builder, you can add, arrange, or edit user interface controls on a panel, and then preview the panel to verify that the layout behaves the way you expected. The panel definitions you create can be used in dialogs, inserted within property sheets and wizards, or arranged into splitter, deck, and tabbed panes. The GUI Builder also allows you to build menu bars, toolbars, and context menu definitions.

The Resource Script Converter converts Windows resource scripts into an XML representation that is usable by Java programs. With the Resource Script Converter, you can process Windows resource scripts (RC files) from your existing Windows dialogs and menus. These converted files can then be edited with the GUI Builder. Property sheets and wizards can be made from RC files using the resource script converter along with the GUI Builder.

Both the Resource Script Converter and the GUI Builder rely on PDML as the means to represent the user interface layout. Once your panels are defined in PDML, you can use the run-time API provided by the Graphical Toolbox to display them. The API displays your panels by interpreting the PDML and rendering your user interface using the Java Foundation Classes.

Pervasive computing (PvC)

Pervasive Computing (PvC) devices are one of the latest types of devices to emerge on the scene. These devices, ranging from cell phones to WebTV, can be used to conduct business by connecting via the Internet or a private network to business applications running on an iSeries server.

XML plays an important role in this new mobile environment. XML, which is used to define portable data, provides both the basis for the various XML dialects used by these devices and the tagged business data displayed on these devices. The transformation of the business data (represented by a dialect) into a form tuned to the device is accomplished by using XSL and a stylesheet transformer, like LotusXSL from IBM.

The viewing space dictates the amount of information that can sensibly be presented on these devices. For example, cell phones have under two square inches of viewing space, and a palm device has under four square inches of viewing space. The different input mechanisms affect the dialogue structure and limit the way responses are made. Many of these devices support a subset of HTML with their owns tags mixed in. Cell phone manufacturers use Wireless Markup Language (WML) as the standard markup language. WML is a dialect that contains some HTML and some unique tags. A WML document is composed of one or more cards to carry out the dialog with the cell phone user. A card would equate to an application display screen.

Some Wireless Application Protocol (WAP) gateway vendor products can dynamically format existing Web page content (HTML and graphics) into WML, which is then compiled into a compressed byte stream that is sent from the WAP gateway to the phone device's micro browser. Similarly, these products enable user input from a WML browser by translating from the compiled WML sent to the gateway to WML and sending it to the Web server resources. In addition, such products as IBM WebSphere Transcoding Publisher cannot only do this for WML devices. However, they can customize HTML and graphics content for devices such as Palm Pilots.

11.2.6 Common Gateway Interface (CGI)

The Common Gateway Interface (CGI) specification defines how the server is expected to call external programs and how those programs should return the document that they produce back to the HTTP server. CGI is a standard for interfacing external applications with information servers, such as HTTP servers or Web servers. The current version of CGI is 1.1.

CGI support allows you to build interactive forms for use on the Web. You can write a program in C, RPG, COBOL, or Java that can accept and interpret input from the form, perform an action, and return the resultant output to the client in HTML.

A programmer creates a gateway program that is specifically coded to handle the parameters (usually sent as name-value pairs). The fields used to query and send data back to the iSeries CGI application are hidden to the user as part of the HTML of a Web page link's FORM or ISINDEX query box. In response to the user request, the gateway program executes and returns the results to the client in the form of more HTML.

11.2.7 Net.Data

Net.Data simplifies the writing of interactive Web applications through macros. Using Net.Data macros, you can execute programming logic, access and manipulate variables, call functions, and use report-generating tools. Net.Data processes the macro to produce output that is displayed by a Web browser. Macros combine the simplicity of HTML with the dynamic functionality of Web server programs, making it easy to add live data to static Web pages.

The Web server invokes Net.Data as a CGI application when it receives a URL that requests Net.Data services. The URL includes Net.Data-specific information, including the macro that is to be processed. When Net.Data finishes processing the request, it sends the resulting Web page to the Web server. The server passes it on to the Web client, where it is displayed by the browser.

Net.Data supplies language environments that can be used to access data sources and to execute your legacy or ERP application containing business logic. For example, you can use the SQL language environment to both read from and update information in your DB2 database.

With Net.Data, you can add a user-written language environment in a pluggable fashion. Each user-written language environment must support a standard set of interfaces that are defined by Net.Data and must be implemented as a service program.

11.2.8 CORBA

Common Object Request Broker Architecture (CORBA) encompasses a series of standards and protocols for interprocess communication in a heterogeneous environment. Using CORBA, developers can easily write applications for many different operating systems at once, in any number of languages. It has become a standard inclusion along the Apache Web server in software packages such as IBM WebSphere.

CORBA is an architectural standard proposed by the Object Management Group (OMG). This is an industry standard organization. This standard allows you to create object descriptions that are portable among programming languages and execution platforms.

CORBA encompasses a series of standards and protocols for interprocess communication in a heterogeneous environment. With CORBA, developers can easily connect processes running on different machines, with different operating systems, and with code written in different languages. The CORBA specification has quickly caught on as a standard method for interprocess communication.

The CORBA specification only defines a set of conventions and protocols that must be followed by CORBA implementations. It is left to vendors and developers to translate this specification into a working implementation. CORBA does not make any restrictions on language or on the underlying operating system. Because of this, implementations of the CORBA specification have been created for a wide variety of operating systems including UNIX, Windows, and OS/400, and for many languages, including C, C++, Java, Ada, LISP, Python, and even COBOL. Any CORBA implementation that matches the defined interfaces and adheres to the defined protocols is allowed to communicate with other CORBA implementations.

Objects, ORBs, POAs, BOAs, and IORs

Objects are at the heart of every CORBA application. Objects reside on various machines throughout the distributed environment and are tasked with performing duties defined by their implementation. In the standard two-tier architecture, the objects are often thought of as the servers in the system. However, unlike standard servers, objects have the ability to move around if needed. A client communicates to an object through an object reference. This is a pointer to the object that allows requests for operations and data access to be sent from the client to the server via an Object Request Broker (ORB).

An ORB is best thought of as the traffic cop in the system. It knows whether requests should be routed to implementations contained within itself or to another ORB running on another machine.

Every object on the ORB must have an implementation. This implementation is code written to perform tasks on the server machine. In other words, the implementation is what does the actual work of the object. An implementation can be in any language. It is allowed to perform tasks supported by the language, operating system, and underlying hardware. Examples of such implementations are database adapters and code designed to interface with a legacy library.

When a request reaches the ORB for which it is intended, the request is passed to an object adapter. The portable object adapter (POA) and its predecessor, the basic object adapter (BOA), form a link between an object's implementation and its presence on the ORB. During the creation of an object on the ORB, the developer must specifically link a newly created object reference and its implementation. The object adapter then informs the ORB that it wants any requests for the new object reference to be routed to it. With object adapters, the ORB is no longer burdened with the task of keeping track of object implementations.

Every object on the ORB has an Interoperable Object Reference (IOR). An IOR is a global identifier string that identifies the machine on which its associated object is located and the interface that the object supports. If given the IOR for an object, a client can use standard function calls on the ORB to turn it into an object reference. With the information contained in the IOR, the ORB knows what type of object is being referenced and the machine to which all requests should be routed. The simplest way for a client to access the IOR of a server object on the ORB would be for the server object to write its IOR to a file. The client could then read the IOR from this file and have the ORB resolve it into an object reference.

11.3 Connect for iSeries: Pulling them all together

Connect for iSeries (5733-B2B) is targeted for sellers of goods and services that suddenly realize that their buyers are now in control of what trading protocols will be used for the exchange of goods. Buyers, in an attempt to streamline their purchasing process and reduce their expenses, purchase new procurement software from companies like Ariba or Metiom. This software has the ability to communicate to multiple seller organizations using XML-based protocols such as Commerce XML (cXML). The buyer is motivated to do business with any sellers that support this new protocol because it helps the buyer to further reduce their expenses.

The seller must support these new protocols or be at a competitive disadvantage to those sellers who support the protocols. These protocols represent new ways of receiving and responding to orders from their buyers. For maximum efficiency, the seller must be able to tie these new orders into existing order processing software.

11.3.1 The Connect for iSeries solution

One of the goals of the Connect for iSeries solution is to provide a highly configurable or pluggable architecture that is extremely easy to use, yet easy to extend. This extensible framework is supported by a series of graphical tools that allow the product to be installed and configured, and then customized solutions to be developed, deployed, and managed. Figure 11-13 shows a very high level overview of the Connect for iSeries product.

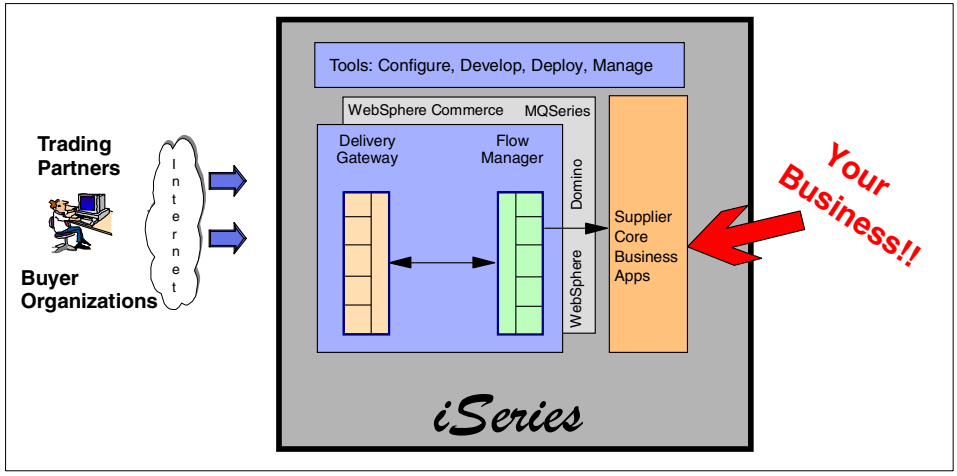


Figure 11-13 Connect for iSeries: The big picture

A front-end B2B enablement framework handles the interfacing with the various trading partners over a variety of connectivity mechanisms and protocols. A collection of plug-ins is provided or can be downloaded from the Web that supports a multitude of mechanisms used by buyers and e-marketplaces to submit B2B requests such as order placement, order status checks, and catalog maintenance.

A back-end integration framework deals primarily with the processing of the B2B requests by tying them into existing ERP, supply chain, and other core business applications. A collection of connector types is provided or can be downloaded from the Web that supports three popular interfacing mechanisms: program calls, queues, and Java methods. For each connector type, one or more connector

instances can be created. A connector instance is described by an Application Connector Document (ACD), which describes the interface and the data to be passed to the application. This ACD is unique for each application being accessed.

Building an ACD does not involve writing code. However, adequate knowledge of the interface to the application being accessed is required. ACDs may be provided for popular core business applications either by IBM or its business partners. Custom ACDs can be built for other applications using tools provided with the product.

Connect for iSeries uses other middleware, including WebSphere Application Server, WebSphere Commerce Suite, MQSeries, and Domino, to process some of the B2B transactions. Usage of these middleware tools depends on the types of transactions being processed and their availability in the customer's environment. The configuration tool is used to install the appropriate plug-ins and connectors that enable these products.

Connect for iSeries is built using industry standard Java and XML. It is written in 100% Java for ease of development and portability. A messaging interface is used to transfer XML documents between components of Connect for iSeries. Enterprise JavaBeans are not currently used in this product.

11.3.2 Application Connector Document (ACD)

An Application Connector Document is an XML document that defines the properties and input and output parameters supported by a given connector instance. The customer must create an ACD to describe the interface to the back-end application that will be accessed. You can use PCML or XML to describe this interface. The ACD defines all the information that the back-end application expects. And in the case of the program call connector, it describes the name and location of the program to be called. Only one ACD needs to be defined for a particular application.

ACDs are created and updated using the Business Process Editor tool. They are referenced by one or more Process Flow Models, which define a business process that will handle one or more types of B2B requests. ACDs also serve as a means to describe the interface to customer or ISV-written business solutions that want to integrate with the Connect for iSeries product.

11.3.3 Process Flow Model (PFM)

A Process Flow Model (PFM) is an XML document that defines the business process that will be used to handle a particular B2B request. In Version 1.0, business processes are restricted to a single connector instance invocation. In future releases of Connect for iSeries, PFMs will be extended to allow multiple connectors to be invoked in response to a B2B request and will provide support for more advanced control flow constructs (for example: if-then-else, case, iteration, and so forth). In addition to defining the particular connector instance used to handle a B2B request, PFMs also define field mappings between:

- The request message provided with the B2B request and the input parameters supported by the connector instance
- The output parameters returned by the connector instance and the response message defined for the particular B2B request

PFMs are created and updated using the Business Process Editor tool. PFMs can be used to describe how a given customer or ISV solution can be used to handle a particular type of B2B request and can serve as the vehicle for integrating these solutions with the Connect for iSeries product.

11.3.4 Request/Response Message Format (RMF)

Request/Response Message Format are provided with Connect for iSeries for each supported protocol (cXML and mXML). The RMF is an XML document that describes all the elements and attributes of a trading partner request and associated response.

Each type of B2B request supported by Connect for iSeries has a corresponding RMF that defines the request and response messages associated with the B2B request that can be mapped to or from a connector instance by a PFM (see 11.3.3, “Process Flow Model (PFM)” on page 283). For XML-based message formats, the RMF identifies the XML DTD or schema associated with the request type and the subset of fields defined by the DTD or schema that are applicable for B2B requests of this type. The RMF also allows alias names to be associated with elements in the request or response message for the B2B request. This enables more meaningful and intuitive names to be used when mapping the B2B request fields to a connector instance.

Note: Request/Response Message Format (RMF) was previously known as PFM.

11.3.5 Business Process Editor tool

With the RMF and the ACD available, you can now use the Connect for iSeries Business Process Editor (BPE) to create a Process Flow Model. The PFM defines the connector type to be used and the mapping of the RMF data fields to the ACD data fields. A unique PFM is created for each RMF/ACD combination.

The Business Process Editor tool is a Java GUI tool used to create and update information associated with connector instances (for example, ACDs) and to create and update business process flow information designed to handle particular B2B requests (for example, PFMs). The Business Process Editor runs on either a Windows NT or Windows 2000 client and can be used while connected via a TCP/IP network to the iSeries host that supports a B2B instance or in standalone mode where no connection exists to the host containing the Connect for iSeries run-time environment. A publish operation is supported by the Business Process Editor to transfer complete ACD or PFM definitions to an iSeries host where it can be deployed to a B2B instance running on that host.

Figure 11-14 shows the Application Connector tab of the Business Process Editor Tool. The ACD points to an external PCML document and shows the mappable fields that are contained in that PCML document.

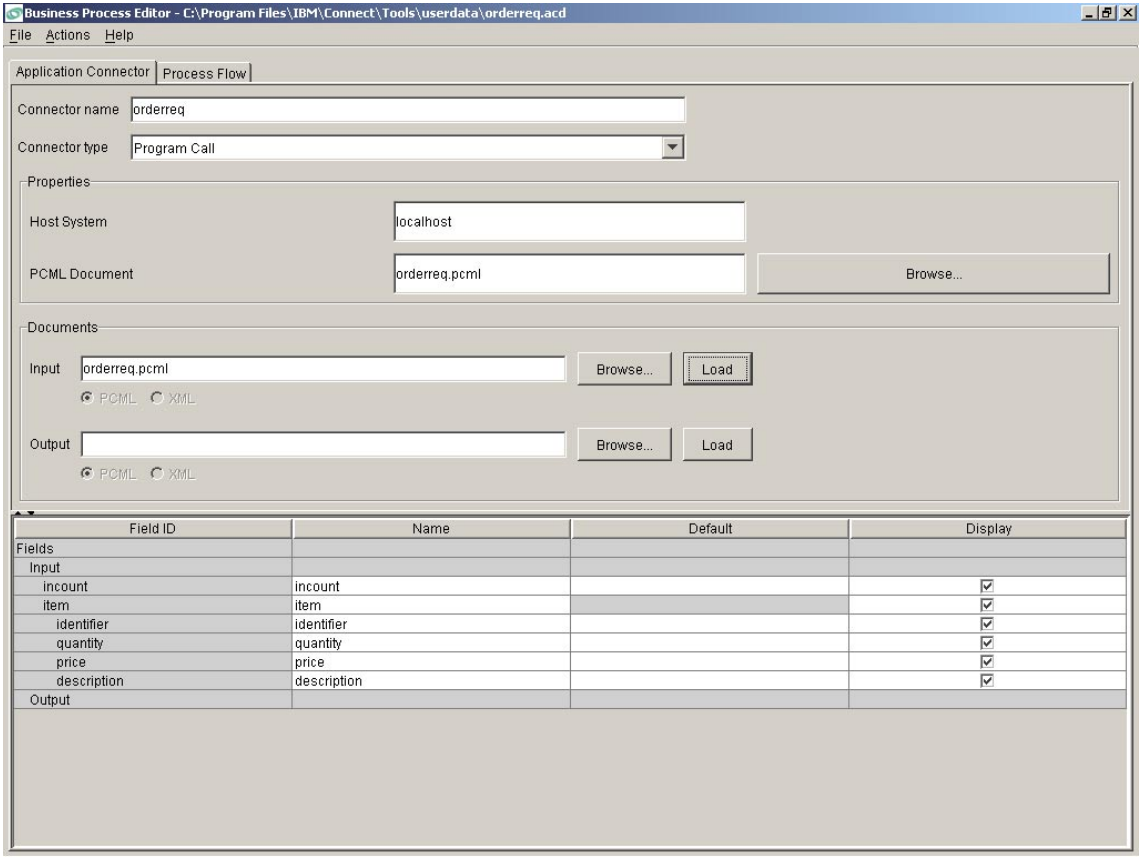


Figure 11-14 Business Process Editor: Application Connector

The Application Connector tab is used to capture information required to define a connector instance, including the properties and input/output fields supported by the connector instance.

Figure 11-15 shows the Process Flow tab of the Business Process Editor. This shows the target fields defined by the ACD and the list of possible source fields from the selected RMF. For each ACD field, you select which RMF field will be used to populate that field.

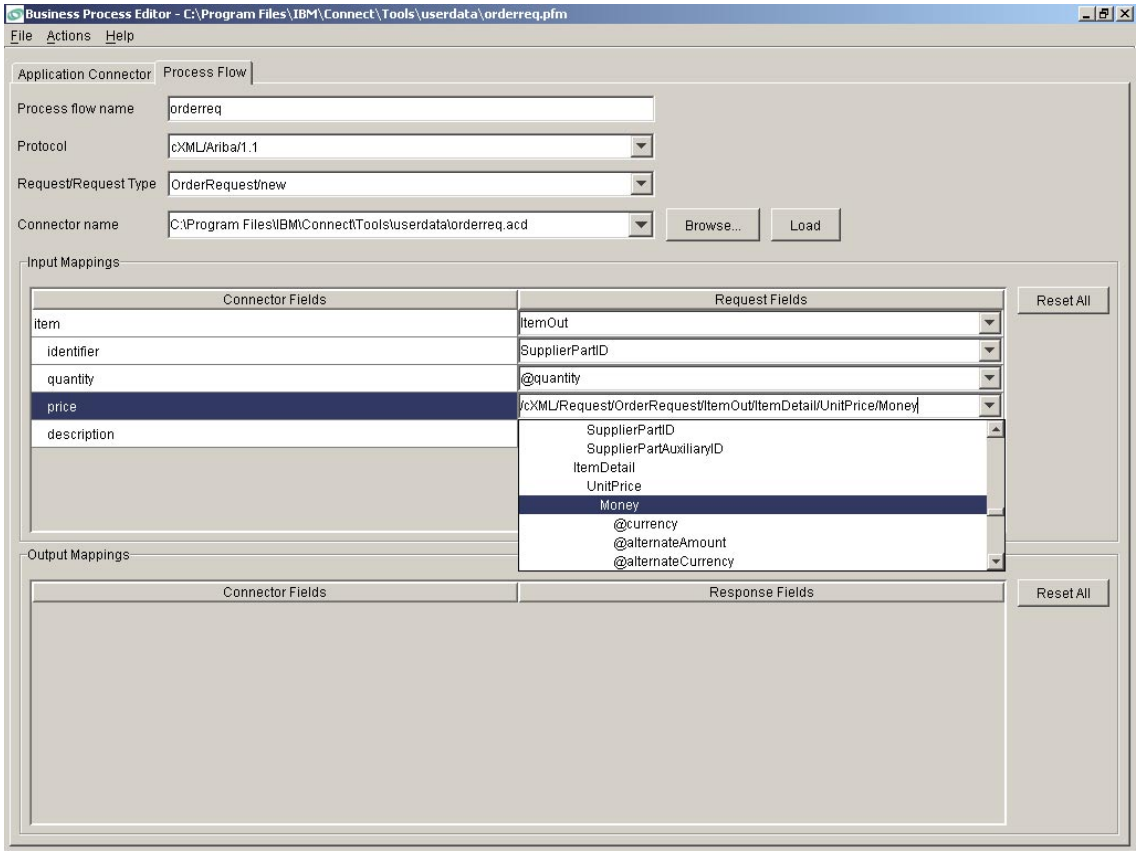


Figure 11-15 Business Process Editor: Process Flow

11.3.6 Browser-based user interface

Connect for iSeries V1.1 has a browser-based user interface for:

- Creating/managing an instance
- Registering supplier information and associating with marketplaces
- Defining buyers and buyer organizations
- Building and managing catalog information
- Deploying runtime mapping flows

Note: Developing flows is done with the PC-based Business Process Editor.

Figure 11-16 shows the Connect for iSeries browser based administration and configuration tool. Most all of Connect's configuration is done using this tool.

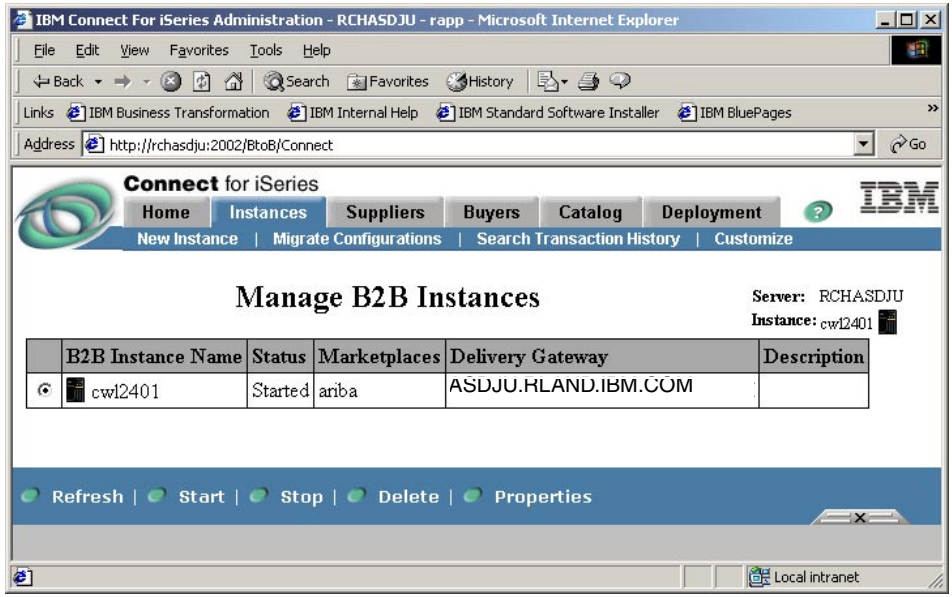


Figure 11-16 Browser-based UI

11.3.7 Process Deployment Tool

The Process Deployment Tool is a Web-based interface used to deploy a complete business process flow (PFM) and associated connector instance definition (ACD) into the run-time environment supporting a particular Connect for iSeries instance. The Process Deployment Tool runs within the context of a given Connect for iSeries instance. It allows the business process flows defined for that instance to be updated or extended. In essence, the Process Deployment Tool converts one or more PFM/ACD pairs into the run-time meta data format required by the Flow Manager run time responsible for handling incoming B2B requests within a given Connect for iSeries instance.

The process of deployment includes associating a particular business process flow to the type of B2B request the flow is to handle. B2B requests can be qualified by B2B marketplace, B2B protocol, transaction type and subtype, buying organization, and supplier. Therefore, the act of deployment involves:

- User selection of values for all of B2B request qualifiers
- User identification of the business process flow that will handle these requests
- Generation of run-time meta data representing these selections

- Storage of this information in the run-time environment associated with the B2B instance

The features of this process are supported by the Process Deployment Tool provided with Connect for iSeries.

The Process Deployment Tool is a Web-based interface (Figure 11-17) used to deploy a defined business process flow and associated connector instance definition into the run-time environment associated with a particular B2B instance where it will be used by the Connect for iSeries Flow Manager run time to service B2B requests. A key task in the deployment process involves the association of a particular business process flow with the B2B request that the flow is designed to service. Since B2B requests are identified by B2B protocol, marketplace, transaction type/subtype, buying organization and supplier, all of these qualifiers can be specified when deploying a business process flow.

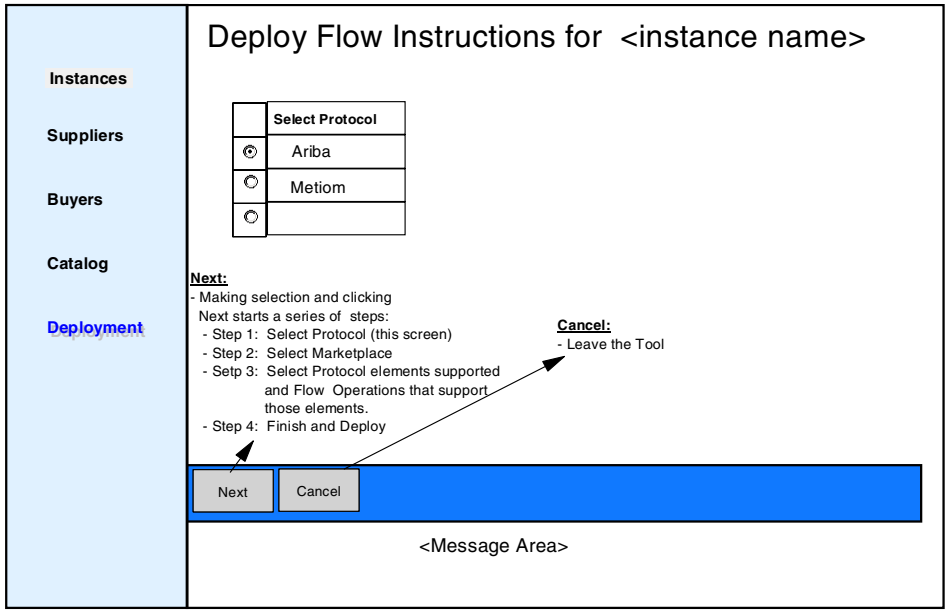


Figure 11-17 Process Deployment Tool

The Process Deployment Tool provides a wizard-like interface to walk the user through the set of selections required to deploy a new business process flow or to view the set of current business process flows that are currently defined to a B2B instance.

12

B2B: Application solutions

B2B computing has become a major force in the industry. From core business to e-business, it doesn't mean changing everything. It means linking the core transaction processing applications, that are the heart of your business today, directly with your distributors and manufacturers to better support and serve your customers and strategic business partners through new interfaces.

IBM and its Business Partners understand the demands of integrating a computing relationship. For that, with the iSeries technology and tools, we offer a set of ready applications. This IBM and Business Partner worldwide solutions Web site is a key place to start your search and understanding:
http://www.ibm.com/solutions/

12.1 Solutions by industry index

Once you reach the IBM Solutions Web site (http://www.ibm.com/solutions/), you see an index to solutions by industry (Figure 12-1).

Figure 12-1 IBM and non-IBM solutions by industry

Another way to search and find a specific solution is through the PartnerWorld for Developers Web site: http://www.developer.ibm.com/

On the PartnerWorld for Developers site, under Features on the right-hand side, click the **Global Solutions Directory**. On the Global Solutions Directory page, select your language and then click the link **Search for solutions now!**. Figure 12-2 shows the page that appears, which offers a powerful solution search tool. You can search by keyword against the solution provider name, the solution name and description, and even a business problem description. Notice on the right-hand side that you can refine your search by operating system.

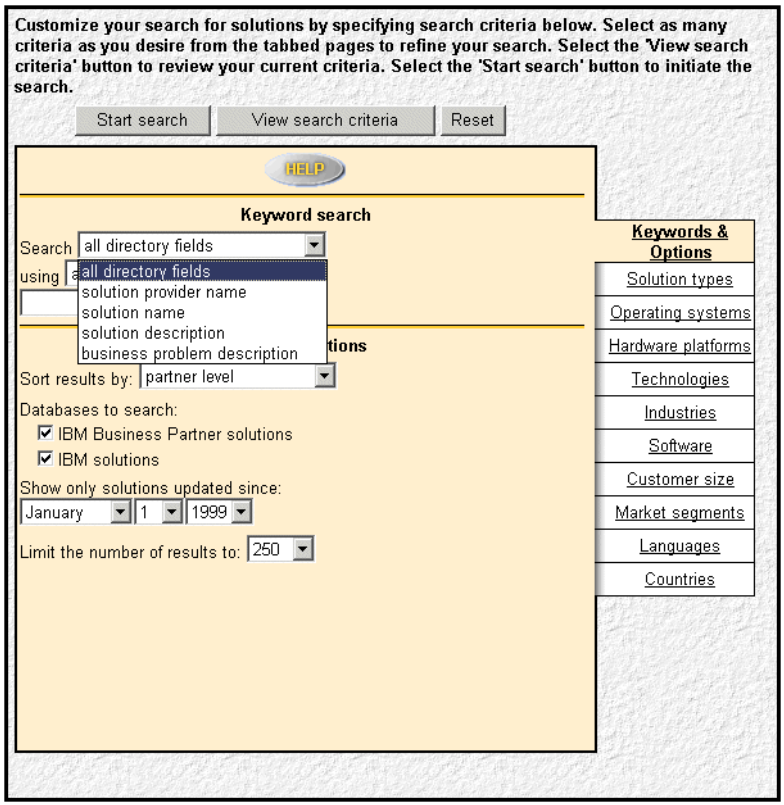


Figure 12-2 PartnerWorld for Developers: Global Solutions Directory

12.2 IBM solutions

For an e-commerce solution that is right for both B2C and B2B, see Chapter 9, “WebSphere Commerce Suite for iSeries V5R1 (5798-WC5)” on page 203. For a payment engine to handle the integral part of e-business success (money!), see 9.5, “WebSphere Payment Manager V2.2 (5733-PY2)” on page 225.

While products like Domino itself are not “solutions”, many companies provide Domino-based portals and solutions that might fit your needs. For this and other solutions, one of the best places to start is IBM PartnerWorld for Developers. PartnerWorld is a world wide program that supports developers who build solutions using IBM technologies. For more information about Domino, see Chapter 7, “Domino Application Server for AS/400 (5769-LNT)” on page 153.

13

B2B: Services

"Nobody will go it alone – not in a business this complex." – Lou Gerstner, IBM chairman and CEO

This chapter provides a couple of places where you can start your research for good and reliable services resources from IBM and IBM Business Partners.

13.1 IBM iSeries Services Network

You can visit this valuable Web site at:
http://www.ibm.com/eserver/iseries/services

The main page is shown in Figure 13-1.

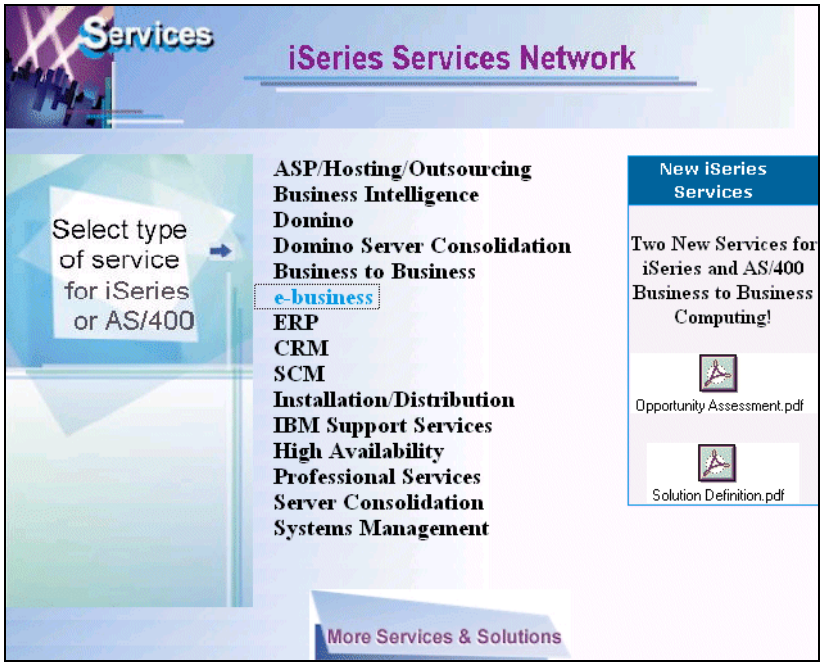


Figure 13-1 iSeries Services Network

From the main page, you can select either the “e-business” category or the “Business to Business” category to find the list of the services available in your geographical region. Notice that the sidebar on the right in Figure 13-1 mentions two new services offerings for the iSeries B2B computing. They are:

- iSeries B2B Opportunity Assessment
- Defining an iSeries B2B Solution

These services are offered to iSeries customers to assist in integrating B2B technologies and solutions into your business.

13.1.1 iSeries B2B Opportunity Assessment

Start your B2B journey here. Move from B2B awareness to the solutions and technologies to unharness the potential of B2B in your business.

Audience

This service targets businesses that need assistance in taking the first step to leverage B2B technologies in their business. This session helps to assess B2B opportunities and associated requirements and to identify potential projects. You will learn about available solution offerings and resources to create a business advantage.

Description

Three services are available to iSeries customers and are performed by IBM iSeries e-business consultants or a qualified service provider. They provide up to 16 hours of an e-business consultant's time and knowledge transfer in one or more B2B areas:

- Reviewing and analyzing your e-business and IT strategy as it relates to B2B
- Identifying potential B2B projects to create a business advantage
- Investigating and knowledge transfer in one or more B2B areas:
  - Sell-side commerce
  - Catalogs
  - Marketplace
  - Connection to market place
  - Procurement systems
  - Connectors to ERP systems
  - Business process integration
  - Supply chain
- Analyzing and positioning iSeries solutions and enablers within the context of your e-business and IT strategy and requirements
- Identifying services providers with the skills capable of further defining, implementing, and deploying the customized solution you select
- A summary report provided by e-mail of any reviews, investigations, and analysis performed

Contact point

For information and scheduling, contact the Rochester iSeries Technology Center via a-mail at: `itcebiz@us.ibm.com`

13.1.2 Defining an iSeries B2B solution

If the existing portfolio of iSeries B2B solutions does not match your current requirements, you have found the right place. Skilled technical resources are available to build the customized iSeries solution you need to compete.

Audience

This service targets businesses that clearly understand B2B opportunities, but need assistance in taking the next steps to further develop project details and architect a solution. Participants receive help in selecting a technology base for implementation that is consistent with your IT strategy and skill and in developing a specific implementation proposal and cost estimate.

Description

These customized solutions are developed by IBM iSeries e-business technical consultants within the Customer Technology Center (CTC), part of the IBM Rochester iSeries Laboratory, or qualified services provider.

This offering provides for:

- Getting started with a B2B project requiring a customized solution
- Developing a high level architecture and a design with considerations for:
  - Existing IT infrastructure
  - Integration with existing business applications
  - Technologies available
- iSeries and IBM software technical experts in:
  - Internet and intranet applications including WebSphere
  - Native Java, Domino, and XML solutions
  - TCP/IP and sockets application development
  - XML programming
- Mapping project requirements into a high level technical specification
- Developing an initial project management outline with cost projections for subsequent customization and deployment stages

For more information, please contact:

Mark Even
AS/400 Custom Technology Center
3605 Hwy 52 North
Rochester, MN 55901
Phone: 1-507-253-1313
e-mail: even@us.ibm.com

13.2 eLance for iSeries

eLance is a service site where you can buy and sell services. In a way, it is analogous to eBay. At eBay, you exchange goods, while at eLance, you exchange (or buy and sell) services.

IBM has worked with eLance to provide access to the eLance global marketplace, which connects iSeries buyers and sellers. Buyers can use eLance to access global pricing, talent, and experience by posting project descriptions and opening them up for competitive bidding. For standard services, buyers browse the descriptions of fixed price services and place orders for service. Service providers can use eLance to access buyers from around the globe without expensive marketing efforts.

You can access eLance for iSeries at:
http://www.ibm.com/eserver/iseries/services

Under Related Links on the left bottom panel, click the link to **eLance iSeries Marketplace**. The main page of the Marketplace is shown in Figure 13-2.

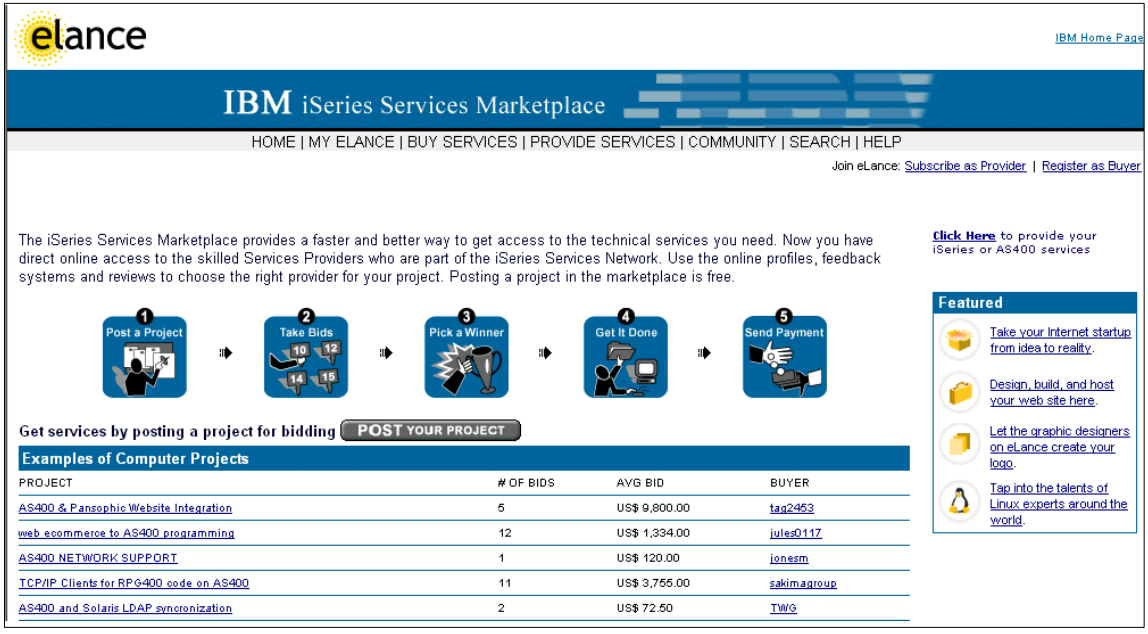


Figure 13-2 IBM iSeries Services Marketplace

Part 5

Appendixes

This part includes three appendices that provide other helpful information. These appendices include:

- Appendix A, “Sizing and performance” on page 301
- Appendix B, “NLS considerations” on page 315
- Appendix C, “Related iSeries e-business products” on page 323

A

Sizing and performance

This appendix discusses the performance and sizing related issues for e-business on the iSeries server.

iSeries performance components

When you evaluate 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 that affect performance in Web environments. The components include the:

- **Client**: The client component typically contributes up to 25% of the response time if you use 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.

iSeries server components

There are three major components within the iSeries server component itself. To understand how your iSeries server acts as a Web server, you need to understand these components. 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, WCS, JSP, EJBs
- Database functions:
  - Get key
  - Get method
  - R/O and R/W
  - JDBC, SQL

Figure A-1 illustrates the components and their sub-components from a performance perspective. The pie chart at the center represents the server-side subcomponents.

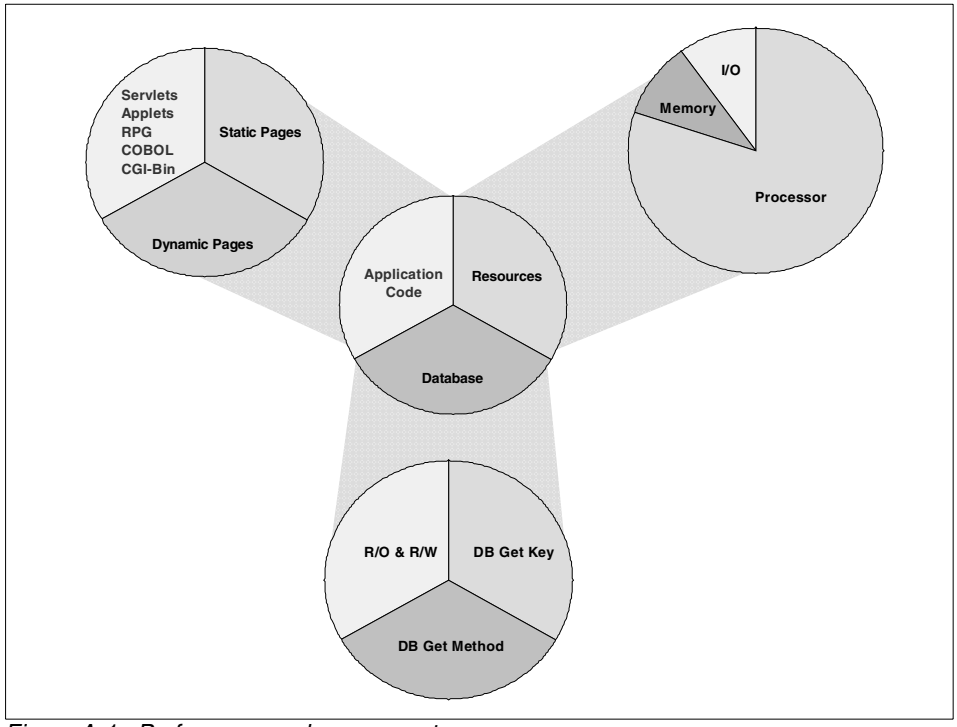


Figure A-1 Performance subcomponents

The subcomponents shown in Figure A-1 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 pie chart areas of each subcomponent do not necessarily represent the portions or contribution of the subcomponents for performance.

Announced in April 2001 was a refreshed iSeries product line (new SStar processors for Models 820, 840, and 270) and the development of a new performance metric, Compute Intensive Workload (CIW). This performance metric is representative of the new breed of workloads running on the iSeries. More and more, the type of applications that are being used on the iSeries are less dependant on overall balanced server resources, measured and reported today as Commercial Processing Workload (CPW).

We are introducing this new performance metric on the Base Processor Features to establish a capability reference point for CPU-intensive workload processing. As we move forward, this new metric will become the one we rely on to plan for growth and determine year-to-year performance improvements. The Processor CPW metric will become less important over time.

With SStar processors and V5R1, iSeries now delivers its seventh generation of 64-bit processors. The SStar processor is an important consideration for those companies who want to move into or further develop e-business.

News: “iSeries Performance Breaks the Bank”

Proving once again that it's one of the fastest servers in the business, the iSeries topped the Midas-Kapiti International (MKI) benchmark for server performance in the high-volume, fast-paced banking industry. MKI, an international banking and financing software vendor, matched a 24-way iSeries 840 with its Equation DBA banking application and concluded that the iSeries can handle loads typically associated with mainframes, according to Koen Van den Brande, MKI's Universal Banking Product Centre director. The iSeries and Equation combo managed a database with more than 30 million accounts while maintaining a response time of less than three seconds and a transaction rate of 1,000 transactions per second.

For more information, see (login and password required):
http://www.as400network.com/nwn/story.cfm?ID=10832

V5R1 sizing considerations

When making performance decisions or tackling capacity planning issues, the first place to look is *iSeries Performance Capabilities Reference Version 5, Release 1*, SC41-0607, which is available from the Web at:
http://publib.boulder.ibm.com/pubs/html/as400/online/chgfrm.htm

OS/400 V5R1 provides an unprecedented amount of new function to the iSeries. It provides one of the most flexible application environments in the industry with support for Linux, Lotus Domino, Java, Microsoft Windows, UNIX, and iSeries applications, combining availability with superior workload management and logical partitioning.

To take advantage of what V5R1 OS/400 has to offer and successfully install it on either an existing system (upgrade) or a new system, effective planning is important.

Here are considerations to help you with planning for a successful installation.

- The minimum amount of memory required is 128 MB.
- The minimum amount of disk space recommended is 8 GB.
  - The load source requires a minimum disk unit of 2 GB.
  - V5R1 requires:
    - An additional 90 MB disk space (as compared to V4R5)
    - An additional 270 MB disk space (as compared to V4R4)

The total V5R1 disk space required ranges from 350 MB to 1 GB (depending on what you install).

Important additional items to review when planning for the size of V5R1 OS/400 are located at the following Web sites:

- **V5R1 Memo to Users**: A link to the V5R1 Memo to Users is on the first page of the iSeries Information Center (one of the small red diamonds near the bottom of the content page). The iSeries Information Center is your starting point for looking up iSeries and AS/400 technical information. The link to the V5R1 iSeries Information Center is:
  http://www.ibm.com/servers/eserver/iseries/infocenter
- **Preinstallation Tasks**: These tasks are in the iSeries Information Center (see link above). A CD-ROM version of the Information Center (iSeries Information Center, SK3T-4091-00) comes with your OS/400 order. On the left navigation bar, select **System planning and installation** -> **Hardware and software** -> **Software and licensed programs** -> **Prepare for software installation**. The first topics in *Prepare for software installation* have links to the Memo to Users. About half-way down the Prepare for software installation tasks is the topic *Estimating your installation time* (with a link to *Software Installation*, SC41-5120-05, and also the Licensed Program (LP) size information in the iSeries Tech Studio).
- **Preventive Service Planning (PSP) Information**:
  http://as400service.ibm.com
- **Licensed Program Size Information**:
  http://www.iseries.ibm.com/tstudio/tech_ref/Indexfr.htm

  Appendix D in *Software Installation*, SC41-5120, also shows a way to estimate your total installation time, similar to this link.
- ***Software Installation* manual**: This book contains task-oriented instructions for installing the OS/400 operating system and licensed programs. A printed copy of *Software Installation*, SC41-5120, is available with every new OS/400 software order or upgrade and is shipped with the backup media. The PDF version is in the iSeries Information Center (http://www.ibm.com/servers/eserver/iseries/infocenter). Select **System planning and installation** -> **Hardware and software** -> **Software and licensed programs** -> **Install software (or Manuals and Redbooks)**.

Links to the PDF are also in several of the Prepare for software installation topics.

Workload Estimator for iSeries

BEST/1 is a consideration when deciding which tool to use to perform system capacity planning. However, BEST/1 does not model threads, and the majority of the e-business applications are Java-based, which is fully thread-enabled. V5R1 is also the last release at which BEST/1 will be supported. Therefore, we recommend you use the Workload Estimator.

To obtain an estimate of the size iSeries server that is recommended to run one or more workloads associated with e-business and or collaboration, such as Domino, Java, Web Commerce, HTTP server, or WebSphere Application Server, use the IBM Workload Estimator for iSeries (Estimator). Use the Estimator to size a brand new iSeries, with all new workloads, to size new workloads, or to size the upgrade of an existing server with the original workload set.

IBMers, Business Partners, and customers can use the Estimator to size a single new workload (such as Domino or WebSphere) or to size several workloads running on the same server. 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 processor utilization, the amount of disk, and memory. The interactive features 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 customizing, the Estimator recalculates to determine the best iSeries server options to fit your needs.

The recommended access method for obtaining the IBM Workload Estimator for iSeries is to log on to the Web site at:
http://www.as400service.ibm.com/estimator

Note: There is also a download form available for IBM Sales and IBM Business Partners. You can find it on the Web at:
http://www.as400service.ibm.com/supporthome.nsf/document/16533356

We highly recommend you involve IBM Sales or IBM Business Partners before you make any purchasing decisions based on the results obtained from the Estimator. All Estimator results need to be refined by IBM Marketing or a Business Partner.

V5R1 enhancements for Workload Estimator

The enhancements to V5R1 of the Workload Estimator include:

- iNotes Outlook Mail Client added to the Domino Workload

  The Domino workload has been enhanced to include the iNotes Outlook Mail client as an option. If you are familiar with previous versions of the Workload Estimator, it is strongly suggested to see the Domino workload help text for a more complete explanation of the Domino workload enhancements.

- Lotus QuickPlace

  The help text for the Domino workload has been updated to include the instructions needed to size a QuickPlace installation. Visit the Domino workload help text for a more complete explanation.

- Version Checking

  The Estimator has been enhanced to provide a capability for the download version of the tool to determine if an updated version is available. Visit the help text for a more complete explanation.

- Old Save and Restore

  In the next release of Workload Estimator, the development team plans to drop support for the old style of Save and Restore (from versions of the Estimator prior to version 2000.3). If you have any of these old versions of saved estimations, you should restore them and resave them in the new format. Please note that the ability of performing a save and re-use with estimations saved in versions 2000.3 and later will not be affected.

WebSphere Application Server (WAS) and Java

When it comes to performance tuning, the most obvious prerequisite is to ensure adequate system resources. For WAS and Java CPU, MHz and L2 cache sizes are more important than CPW. There are the other obvious prerequisites like having sufficient memory, ensuring no I/O bottlenecks, and using the Workload Estimator (see “Workload Estimator for iSeries” on page 306).

Optimizing OS/400 for Java and WebSphere

To achieve optimal performance and stability, you need to:

1. Understand the Java environment on iSeries
2. Optimize OS/400 for Java and WebSphere

   Load the latest cumulative and/or Group PTFs for OS/400, Java, WebSphere, Toolbox and DB2 UDB for iSeries fixpack. To check the latest packages, speak with your local IBM Support Center for advice, or go to the IBM @server iSeries Support site at: http://www.as400service.ibm.com/
3. Optimize Java environment
   a. Set the Java heap size. When you are trying to track down specific problems like memory leaks, it is useful to see what is happening within the JVM.
   b. Use the **DMPJVM** command.
   c. Consider executing the JVM in verbose mode for class and garbage (check the Web sites at the end of this list for further information).
   d. Use Resource Analyzer.
4. Tune WebSphere queues
   a. Identify the WebSphere System Queues used in your production environment:
      - Network
      - Web server
      - Servlet engine
      - EJB server
      - Data source
   b. Adjust queue settings using the Max. Application Concurrency value as a reference point.
   c. Queue upstream, preferably in the network.
   d. Re-adjust queues for access patterns.
   e. Re-adjust queues after adding additional servers in a cluster.
5. Analyze and tune application code

   There are several application analysis tools such as DMPJVM and PEX.

   Here are some guidelines to optimizing your code:

   a. Avoid string manipulation and multiple instantiations
   b. Use the native JDBC driver
   c. Avoid synchronization

6. Consider cloning

   To enable cloning, you need to create a regular application server and “promote” it to be a “model”. Once the model is created, you can create a number of clones and locate them in any of the particular nodes. Cloning has two objectives: workload management and failover support.

   Note: Cloning should only be considered once all other tuning options have been exhausted.

7. Load or stress test to prove the expected benefit.

References

For more information, refer to these sites:

- WebSphere Application Server – Performance considerations: http://www-1.ibm.com/servers/eserver/iseries/software/websphere/wsappserver/product/PerformanceConsiderations.html
- WebSphere Application Server – Performance considerations for Advanced Edition V3.5: http://www-1.ibm.com/servers/eserver/iseries/software/websphere/wsappserver/product/performanceAE35.html

WebSphere Commerce Suite (WCS) V5.1

WCS V5.1 is built on a new framework based on IBM WebSphere Application Server. One of the main subjects discussed in this book is studying the effects of the newly introduced Java technology.

The redbook *WCS V5.1 Performance Tuning*, SG24-6258, describes tuning techniques for WebSphere Commerce Suite V5.1. It covers the implications of WCS V5.1 in terms of performance, and covers the tuning techniques you will need for use with the new environment. E-commerce administrators and developers will find it a useful addition to their technical library.

The contents of this redbook have been broken down by individual components of WebSphere Commerce Suite to allow quick access to the information you need. WCS V5.1 Performance Tuning provides a single source of the information you need to tune your e-commerce site. It is enhanced with examples, easy-to-follow instructions, and ample illustrations.

Lotus Domino for iSeries

In sizing or evaluating a system for Domino, the workload and function mix must be considered relative to the hardware specifications. For example, applications with highly CPU intensive functions, such as complex database queries 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 processor-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.

Dedicated Server for Domino (DSD)

Domino workloads can use 100% of the DSD, which is why it is designed to be a totally “dedicated” server. The recommendation for a DSD is to keep non-domino workload CPU utilization to less than 15% of the CPU and to use a single 5250 job for system administration functions only. The DSDs provide sufficient capacity for non-Domino workloads in support of a Domino environment (that is, remote DB2 access, file serving, Integrated xSeries Server, TCP/IP, and so on).

Lotus Domino Workloads are defined as out-of-the-box functions such as:

- E-mail
- Calendaring and scheduling
- Web serving
- Standard Lotus Domino template applications (discussion database, workflow) and custom-developed applications written with Domino Designer that perform no external program calls, local relational database access, or Java integration.

System administration

iSeries and AS/400e Dedicated Server for Domino can be effectively managed when there is no interactive CPW available for application workloads. System administration activities performed in any of the following ways can leverage all of the capacity of the AS/400e Dedicated Server represented by the Processor CPW value:

- Any job started from a green-screen console to perform system administration function is not considered interactive work if it is the *only* interactive job running (single interactive job exception).
- Any system administration job submitted to batch is not considered interactive work.

- Any use of Operations Navigator (GUI administration functions) is not considered interactive work.

Interactive application workloads (CPW=0)

Any task started through a 5250 session (5250 device or 5250 emulation), where the user waits for a response, is considered OS/400 interactive work. Interactive (CPW=0) represents the maximum amount of 5250 processing capability available for customer applications:

- Application processing that uses 5250 interfaces has no available capacity on the Dedicated Server for Domino.
- 5250 print has no available capacity on the Dedicated Server for Domino.

The new DSDs require OS/400 V5R1 and Lotus Domino for iSeries server release 5.0.6a or later. Increased capacity for Domino applications using Java Servlets and WebSphere Application Server became available 28 September 2001.

For recommendations on evaluating workloads on DSDs, refer to: http://www-1.ibm.com/servers/eserver/iseries/domino/pdf/dsdworkloads.pdf

For more detailed planning, go to the IBM Workload Estimator for iSeries, which is available on the Web at: http://www.as400service.ibm.com/estimator

New Lotus Domino for iSeries record: The iSeries server Model 840 powered by Silicon-on-Insulator (SOI) and copper wiring technologies has set a new world record for Lotus Domino scalability and performance. It successfully handles 75,000 concurrent NotesBench R5 Mail Users with an average response time of 276 milliseconds.

iSeries server recommendations

Lotus Domino for iSeries requires an iSeries or AS/400 based on PowerPC (RISC) technology. Although Domino will run on all RISC-based iSeries or AS/400 servers with supported operating system software and available capacity to support it, there are price/performance and response time advantages to using the newest technology iSeries models.

For specific details regarding memory and disk requirements and administration workstation requirements, refer to the Domino for iSeries Release Notes and the Domino for iSeries Help database for the applicable release. These can be found online at: http://notes.net/notesua.nsf

Administration workstation

The workstation you use to administer a Domino server on the iSeries server 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)

Software requirements

Notes:

- OS/400 V4R4 is the last release that supports Domino for iSeries R4.6.x. To use Domino for iSeries on OS/400 V4R5, existing Domino for iSeries R4.6 users need to upgrade their server to Domino for iSeries R5.
- The new DSDs require OS/400 V5R1 and Lotus Domino for iSeries server Release 5.0.6a or later.

The base supported software requirements for Domino for iSeries are OS/400 V4R3 or higher and TCP/IP Connectivity Utilities for AS/400 (5769-TC1 or 5722-TC1).

Prerequisite PTFs are listed at:

- http://www.ibm.com/servers/eserver/iseries/domino/support
- http://www.iseries.ibm.com/domino

The TCP/IP Connectivity Utilities is a no-additional-charge product that comes with OS/400, but needs to be configured. Additional software requirements to take advantage of optional services are documented in the Domino for iSeries Release Notes and the Domino for iSeries Help database for the applicable release. These can be found at: http://notes.net/notesua.nsf

Networking requirements

Domino for iSeries runs with the TCP/IP network protocol. TCP/IP is delivered with OS/400 but must be configured. TCP/IP knowledge on the iSeries platform is a necessary prerequisite for successful implementation of Domino for iSeries.

Other miscellaneous considerations

An add-in called DB2 for AS/400 Notes Import Program (also called the DB2 Client Import Library), which enables the iSeries query embed using the Notes client, is available at no charge for optional use with Domino for iSeries from Notes client machines running Windows 3.1, Windows 95, Windows NT, or OS/2. It requires a client ODBC connection to the AS/400e server using TCP/IP, such as the ODBC driver that ships with iSeries Client Access. You can find more information about the DB2 Client Import Library and a link to download it under the Related Products link at: http://www.iseries.ibm.com/domino

For more information about iSeries Client Access, go to the site at: http://www.iseries.ibm.com/clientaccess

If the optional product Lotus Enterprise Integrator is used, it needs to be installed on the same AS/400e server as Domino for iSeries. The journaling setting in LEI (or DECS) must match whether the file is journaled.

Directory synchronization requires the installation of Domino software iSeries Integration (option 1) and HiTest C API (option 6).

Domino tuning

Here are some useful bits of information learned from customer experiences:

- If you are having performance issues with Lotus Enterprise Integrator batch transfer, take a close look at how your replication is set up. The recommendation is to do selective replication based on timestamp. This requires making sure you have a timestamp field in your DB2 UDB for iSeries database(s) and using that field to determine how much data is replicated. Without the timestamp replication, you will replicate the entire database every time, which can be very time and CPU consuming.
- If you are using an Ethernet line adapter, set the mode to “half duplex” unless you have a switching hub. In the absence of a switching hub, whenever an adapter defined as full duplex-capable transmits, it does so without first testing the line for possible collisions (the standard Ethernet collision detection protocol). If another station was in the midst of a transmission, this new injection of activity can cause immediate collisions. Then both the original sender and the iSeries adapter go into standard Ethernet recovery, displaying symptoms of performance problems.

References

For more information, consult these sources:

- iSeries (V5R1) Information Center:
  http://publib.boulder.ibm.com/html/as400/v5r1/ic2924/index.htm
- For performance topics related to e-business, go to WebSphere Application Server V3.5 Performance Considerations, in HTML and PDF format:
  http://www-1.ibm.com/servers/eserver/iseries/software/websphere/wsappserver/product/PerformanceConsiderations.html
- *V5R1 Performance Capabilities Reference Guide*, SC41-0607:
  http://publib.boulder.ibm.com/pubs/html/as400/online/chgfrm.htm
- System Performance Management Web site (includes performance white papers): http://www-1.ibm.com/servers/eserver/iseries/perfmgmt/
- White papers offering performance tuning tips are available at:
  http://www.iseries.ibm.com/developer/domino/perform/
- *Lotus Domino for AS/400: Performance, Tuning, and Capacity Planning,* SG24-5162
- Sizing considerations for V5R1 OS/400:
  http://www-1.ibm.com/servers/eserver/iseries/software/os400sizing.htm

B

NLS considerations

This appendix provides general information about national language support (NLS) on iSeries. It also offers considerations for using and managing e-business Web sites on iSeries in a multilingual environment.

National language support

The iSeries server is a worldwide product that addresses many country-unique requirements. For different countries/languages, specific support is provided, either with translated machine-readable information (MRI), such as screens and messages, or with keyboards and displays on the local or remote workstation twinaxial controller.

Multilingual support allows multiple users on the same system to operate in different languages. This means that system messages, displays, help information, and user applications can be presented to the end user in their national language.

The iSeries server also supports the Universal coded Character Set (UCS). Many customers do business in a worldwide environment. It is too costly and time consuming to redesign and rewrite an application to support users in another national language or culture. These applications require the ability to store and process character data from more than one national language.

For example, a database file may need to contain customer names in English, German, Greek, Arabic, Japanese, and Thai characters. This capability must be available in a client/server environment and in a network of heterogeneous systems that exchanges character data via customer applications.

The UCS is an emerging global character encoding method, developed jointly by the industry (UNICODE 1.1) and the International Organization for Standardization (ISO). ISO/IEC 10646-1 defines a code page (UCS-2) encompassing the characters used by all currently significant languages, a rich set of scientific and publishing symbols, and a variety of script languages. This common code page spans the character sets of many languages. It can ease application development and management issues historically found in multiple code page system environments and networks. This capability is provided in OS/400 with the UCS2 Level 1 support for database to permit characters of any national language to “coexist” in database files.

General considerations

The iSeries server uses EBCDIC encoding (CCSID) to store data in its DB2 UDB for iSeries databases and ASCII encoding for the integrated file system (IFS). And all browsers use ASCII encoding (CCSID). When data is transferred to the browsers, data needs to be converted between the two encoding (CCSID). Figure B-1 shows an overview of how the code conversion takes place for the HTTP server.

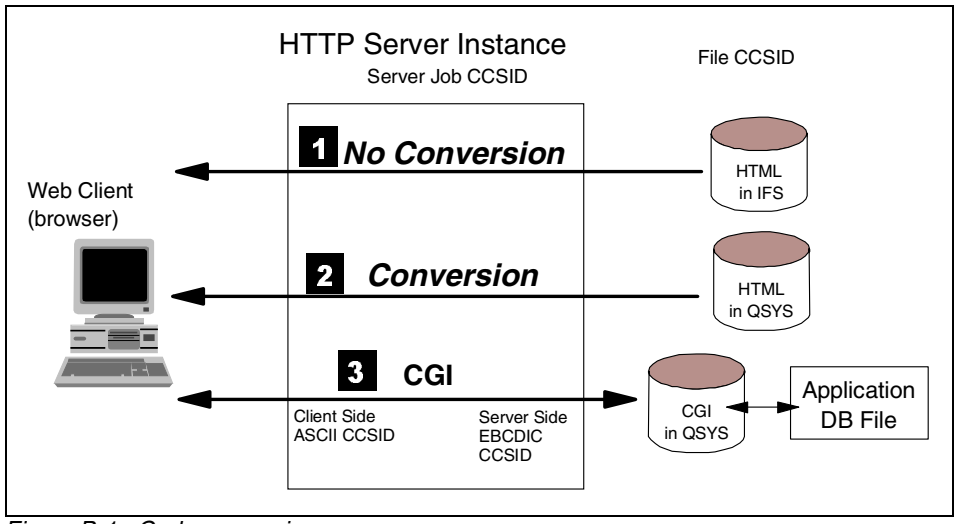


Figure B-1 Code conversion

Consider the following points:

- If the page (HTML in Figure B-1) is from an IFS file system, it is not converted.
- If the page is from qsys.lib, it is converted to the CCSID associated with the 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 the page do not change.
- **Dynamic data**: Some contents of the pages change, depending on time, user requested data, and so on. The contents may come from database files.

Static page

As discussed in Chapter 5, “The Web server: The core to your e-business” on page 105, the static page is the first phase for evolving e-business. This is also the easiest scenario in terms of multilingual services. Your focus is on the Web pages to be published and on translating them or creating 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 IFS 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 multiple server instances, you need IBM HTTP Server for iSeries. Domino HTTP Server does not support multiple instances. In this scenario, the pages can be stored in both the qsys.lib file system and IFS. You can configure each server instance to convert data residing in qsys.lib to an appropriate ASCII encoding.

- Synchronizing 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.

Dynamic data

When data is retrieved from other resources and stored in 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.

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 “Static page” on page 317, 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

that the browser user is using. After retrieving the data, the HTTP server converts the data to ASCII CCSID.

- **Domino server**: The Domino server is the NLS capable product. It uses UNICODE for internal character representation, which can 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 a Domino server, or use the iSeries LPAR capability to have multiple independent versions of Domino loaded on the same physical iSeries server.
- **WebSphere Application Server**: Since WebSphere Application Server runs on top of the HTTP server, the same can be applied as in the HTTP server considerations. Using WebSphere Application Server, you can control a multilingual environment more effectively. For detailed information, refer to “Using WebSphere Application Server” on page 320.

Client (browser) considerations

When you browse 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. But two major browsers you usually use provide solutions to the problem:

- Microsoft Internet Explorer (IE)

  Offers the ability 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.

- Netscape Version 6

  Offers a function called “Language Region Packs”. Using this function, you can read many languages through browser on the other language operating systems. Now provides English, French, German, and Japanese.

Using WebSphere Application Server

Using WebSphere Application Server, you can run a multilingual environment more efficiently. You can configure individual application servers to run with different globalization settings to support different language environments. There are two considerations:

- iSeries user profiles

  The user profile settings are the basis for the application server's job attributes, and the job attributes determine the properties for the Java Virtual Machine environment. By default, each application server runs under the QEJBSVR user profile. The language environment settings for the QEJBSVR profile default to the system settings. You can change these profile settings suitable for your language environments.

- WebSphere Application Server national language version (NLV) settings

  If the language version is a secondary language, configure the application server by setting the QIBM_EJB_NLV environment variable. It can be configured from the administrative console.

The WebSphere Application Server can also control the character encodings. WebSphere Application Server has an ability to designate character encodings clearly. Using this function is very easy. You can designate character encodings from the Administrative Console, and you can use sample servlets called "show Cfg" to check the result of the settings. Figure B-2 shows an example of the result (CP943C is used for Japanese).

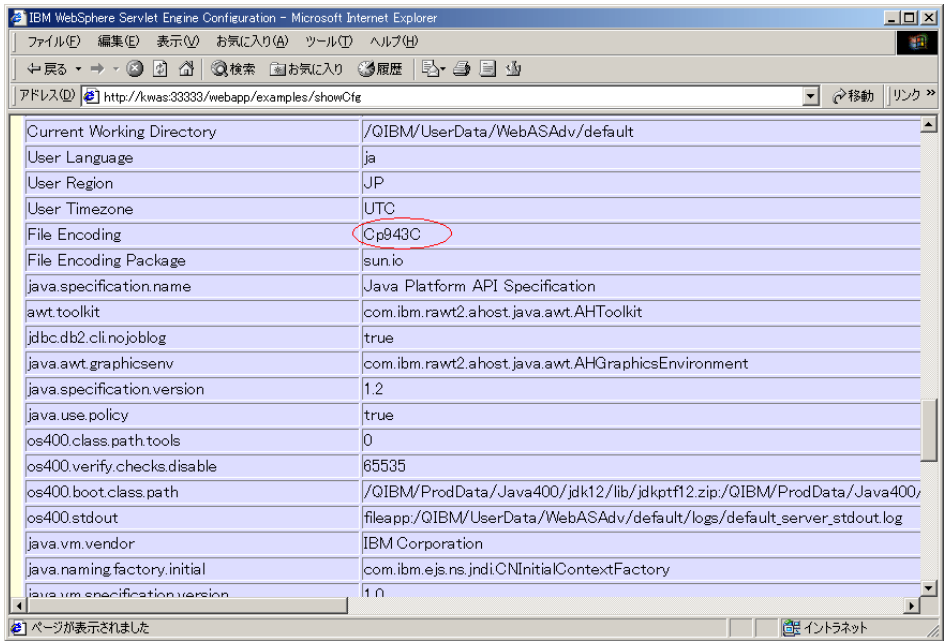


Figure B-2 The result of setting character encoding in WebSphere Application Server

To show this screen, type the following URL from a Web browser:

`http://hostname/webapp/examples/showCfg`

On this screen, you can also check the JDK versions.

The WebSphere Application Server can also designate parameters on JSP and servlets. On JSP, the designated encodings are used when reading JSP source files. On servlets, you can change encodings that the servlet compiler uses.

C

Related iSeries e-business products

This appendix provides information and pointers relating to additional e-business products and tools that may also be important to provide your business for a complete e-solution. It covers Tivoli, Backup Recover Media Services for AS/400 (BRMS/400), MQSeries, e-print, Management Central, and ESP.

Tivoli Management Agent

Tivoli Management Agent (TMA) is the enabling component of the Tivoli Enterprise product set. It resides on the iSeries as of V4R5. When the TMA is started on your iSeries, it can report to your Tivoli Management Framework environment as an end point. TMA enables the iSeries server to be managed by the Tivoli Enterprise product set, like any other platform in a Tivoli-based, centrally managed, heterogeneous IT environment.

Tivoli Management integrates its IT management processes across the board, creating a powerful combination that delivers superior, business-relevant services to your customers within and outside of your organization. Tivoli Enterprise-based solutions are platform-independent.

Note: There are several other Tivoli products, including Tivoli Storage Manager (TSM) (5698-TSM), based on the ADSM product. You can read more about this product at the Web site mentioned below.

For more information, see:

- Tivoli Web site: http://www.tivoli.com/
- Tivoli systems management on iSeries: http://www.ibm.com/servers/eserver/iseries/sftsol/tivoli1.htm

Backup Recovery and Media Services (5722-BR1)

Backup Recovery and Media Services (BRMS/400) helps you implement a disciplined approach to managing your backups. It also provides you with an orderly way to retrieve lost or damaged data. Using BRMS, you can manage your most critical and complex backups, including online backups of Lotus servers, simply and easily. You can also recover your system fully in the event of a disaster or failure.

In addition to these backup and recovery features, BRMS enables you to track all of your backup media from creation to expiration. You no longer have to keep track of which backup items are on which volumes, and worry that you will accidentally write over active data. BRMS also performs some daily maintenance activities that are related to your backup routine.

Note: Backup Recovery and Media Services is not a replacement for a backup, recovery, and media management strategy. It is a tool that you use to implement your strategy. Before you start doing backups using BRMS or any other product, you should plan your backup and recovery strategy.

New in V5R1

V5R1 enhancement

With the new release of OS/400 V5R1 came several enhancements to BRMS/400.

Graphical User Interface (GUI)

BRMS now supports graphical operations by providing an optional plug-in to Operations Navigator. You can install the BRMS plug-in on any workstation that has been upgraded with IBM Client Access Express for Windows (5722-XW1) connected to any iSeries server upgraded with IBM Backup Recovery and Media Services for iSeries (5722-BR1).

When installed, a Backup Recovery and Media Services folder is added to the Operations Navigator hierarchy. The BRMS Operations Navigator plug-in simplifies backup planning by providing wizards for creating backup policies and adding media to the BRMS managed inventory. Context menu functions on the backup policies allow you to easily run and schedule backups. The BRMS restore wizard guides you through the steps to locate and restore saved objects. In addition, the BRMS Operations Navigator plug-in integrates a Backup and Restore function into many of the object context menus in the hierarchy. This allows you to easily back up and restore these objects directly to tape media.

Extended parallel support

*The save library support, either through the Save Library using BRM (SAVLIBBRM) command or Backup Control Groups, using parallel devices has been enhanced to now include: *ALLUSR, *IBM, *ALLPROD, *ALLTEST, *ASPnn, and a generic library name.*

*SYSTEM control group

*A new Backup Control Group named *SYSTEM is shipped with the BRMS product. This control group can be used to backup the entire system including all user data. Prior to V5R1, you had to either use both the *SYSGRP and *BKUGRP control groups to complete this save or create your own customized policy. This *SYSTEM control group uses a new media policy named SYSTEM, which has a default retention of 90 days.*

Command overrides

The Start Backup using BRM (STRBKUBRM) command has been enhanced with two new parameters that helps you minimize the number of backup control groups you need to create and use.

*The ACTIVITY parameter allows you to override the weekly activity of the control group entries and can be used to force either a full or incremental backup. The RETENTION parameter allows you to override the retention settings of the media policies used by the control group. If your media polices have a retention of 30 days, you can use the RETENTION parameter to override this for a single backup to a new retention of *PERM or a number of days. This may be useful if you want to keep a copy of your normal saves at year end for 365 days or longer. These new control group attribute overrides are resolved at the time the command is run and do not change the stored attributes of the backup control group or media policy.*

Target release

The target release parameters on the Save Library using BRMS (SAVLIBBRM) and Save Object using BRMS (SAVOBJBRM) commands, and the target release attribute of Backup Control Groups, have been updated to support the VxRxMx format for specifying a target release, where Vx is the version, Rx is the release, and Mx is the modification level. This allows you to save objects that you intend to restore on previous release systems. Previously, BRMS restricted you to N-1 from the release of the save. Now you can save objects through BRMS and restore on systems that are N-2 from the release of the save.

Improved recovery report

The BRMS System Recovery Report (QP1ARCY) has been improved. Some recovery actions that had previously included multiple tasks were moved into separate steps to minimize the likelihood of the actions being missed during recovery. Potential problems that might affect system recovery are highlighted better to minimize recovery exposures. More steps were added to the report reducing some of the cross references to the OS/400 Backup and Recovery*, SC41-5304.*

Expanded pass phrases

The BRMS Console Monitor has been updated to support pass phrases of up to 128 characters.

Increased ASP support

BRMS has increased the support for traditional user ASPs from 16 to 32.

Tivoli Storage Manager Application Client

The BRMS Application Client to TSM allows BRMS users to perform save and restore operations using Tivoli Storage Manager servers as the storage medium. For more information, see:
http://www-1.ibm.com/servers/eserver/iseries/service/brms/adsmclnt.htm

References

For more information, go to these sites:

- iSeries Information Center (V5R1):
  http://publib.boulder.ibm.com/pubs/html/as400/v5r1/ic2924/index.htm
- Backup Recovery and Media Services site:
  http://www-1.ibm.com/servers/eserver/iseries/service/brms/
- Backup Recovery and Media Services site – What's new in V5R1:
  http://www-1.ibm.com/servers/eserver/iseries/service/brms/new.htm

Extreme Support Personalized (ESP)

In our increasingly Web-based world, you need easier access to total solutions. An important aspect of technology is technical support that helps make that technology work for us as people. IBM has expanded its Extreme Support through Personalization initiative to include more easy-to-use, proactive, and personalized tools.

ESP features and functions for the iSeries and AS/400 include:

- Management Central-Pervasive for remote management of servers
- Access to IBM @server Technical Support Web sites
- IBM Electronic Services for AS/400
- Universal Connection - ECS over TCP/IP
- PM400e Integrated with Work Load Estimator
- Physical Device Placement Assistant (PDPA)
- Software Inventory Utility (SIU)
- iSeries and AS/400 University
- Personalized Web Pages

ESP is a new technical support initiative from IBM designed to help you get the most out of your iSeries and AS/400 technology. ESP consolidates a wealth of knowledge and expertise into a single, concise program that makes it easier than ever to set up or upgrade your server and keep it running at peak performance. ESP offers a full suite of online tools integrated into the product that enable full service and support over the Web. It gives you the ability to collaborate with thousands of service and support personnel around the globe. ESP provides automated predictive support that can anticipate failures and even your business growth needs. It's almost as though the system can read your mind and provide exactly the support you need when you need it. One of the many facets of ESP is

the ESP pop-up window, shown in Figure C-1. It is designed to guide you through the robust resources that center around the most sought after topics and offerings for iSeries. You can find additional information about IBM support offerings at: http://www.as400service.ibm.com/

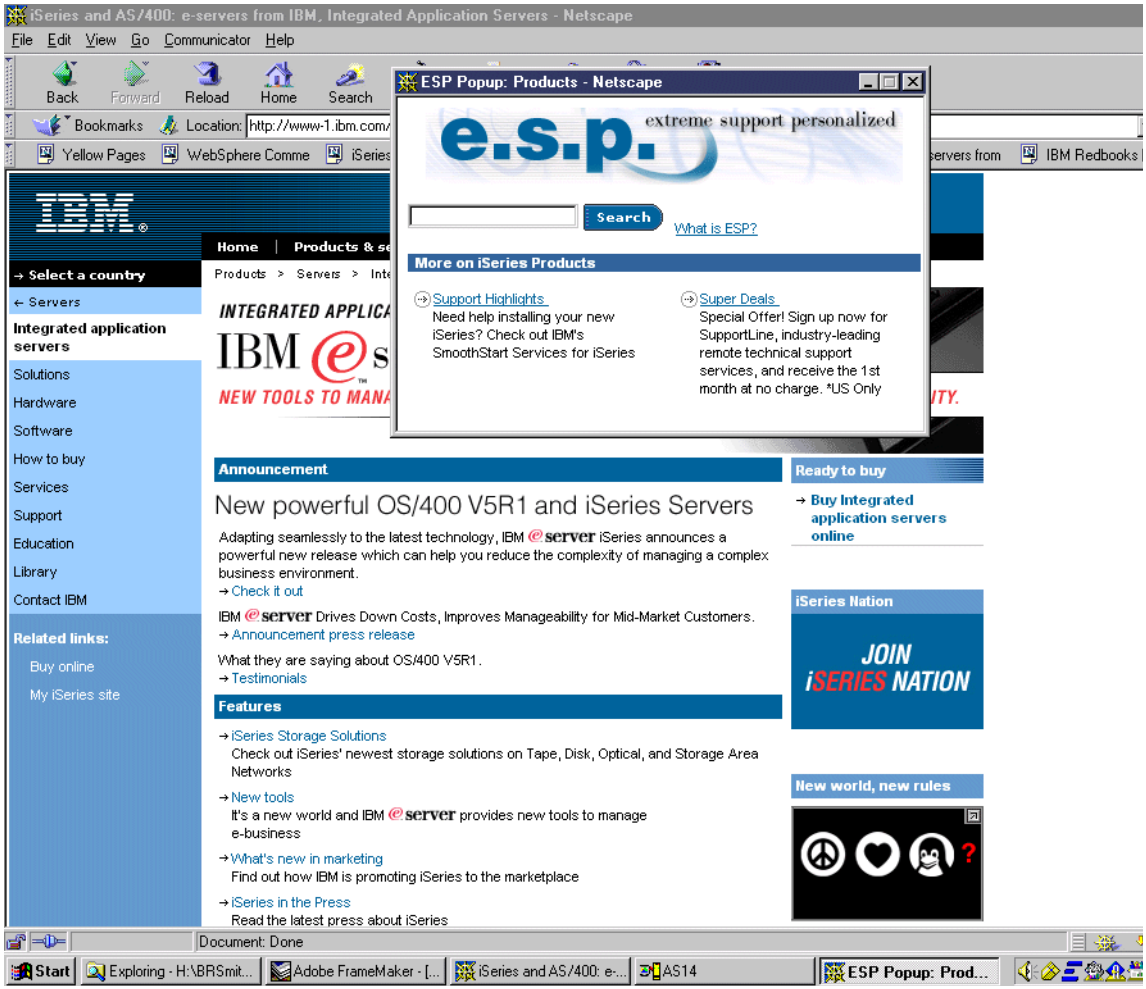


Figure C-1 ESP pop-up window

Extreme Support Personalized (ESP) is IBM's comprehensive technical service and support initiative exclusively for the AS/400 and iSeries. ESP supports the new iSeries as part of the IBM Customer Care Advantage initiative. Customer Care Advantage focuses on support across the new IBM product line. ESP is total solutions support for iSeries and AS/400, personalized for you in the form you need it. ESP involves support over the Internet, voice and on-site support, and support that is integrated right into the product.

One of the offerings includes support that uses TCP/IP with Performance Management/400, Service Agent, and inventory consolidation with Management Central. Figure C-2 shows what ESP provides.

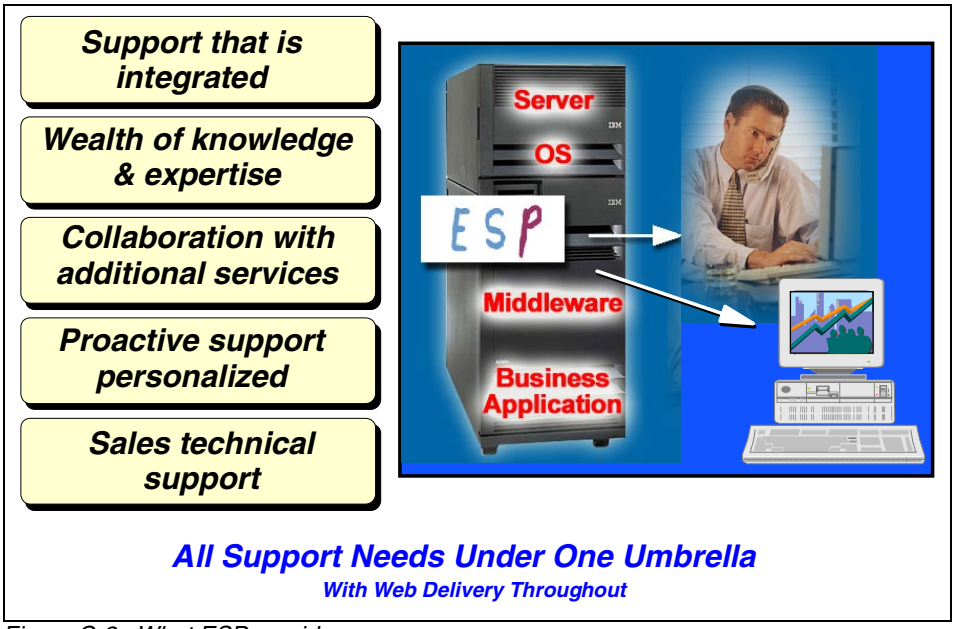


Figure C-2 What ESP provides

ESP: New with V5R1

V5R1 enhancement

OS/400 V5R1 introduces several changes to simplify and improve PTF notification and delivery of PTF management, such as:

- *The ability to electronically download Group PTFs from IBM Service.*
- *Two new commands to manage cover letters on the system: Copy PTF Cover Letter (CPYPTFCVR) and Display PTF Cover Letter (DSPPTFCVR). These commands allow users to copy cover letters from media without having to load the PTFs. They provide the capability to filter the list of cover letters based on a set of attributes and status, for example, to view all the cover letters with special in instructions.*
- *Progress indicators during PTF load and apply processing. This includes progress indicators when PTFs are being applied or removed during the IPL.*
- *A new attribute called preconditions for PTFs. A precondition identifies a job, subsystem, or object that cannot be active when the PTF is applied or removed immediately. The system detects this condition and prevents processing of the PTF when the precondition is active.*

- *Internet support gives you more flexibility for Universal Connection. IBM gives you more options for Electronic Customer Support (ECS) and Electronic Service Agent connectivity through Universal Connection. In addition to dial-up support over TCP/IP via ATT Global Network Services, with V5R1 the Universal Connection also supports Internet connections using a virtual private network (VPN). This can be used for Direct Internet connection through the integrated modem with an Internet Service Provider (ISP) of your own choosing or through higher speed connections (T1, T2, Ethernet-attached cable or DSL, and so on.)*
- *Simplification of select software upgrades using the Software Upgrade Assistant (SUA), a Web-based utility. This allows eligible customers and business partners to order version or release upgrades directly based on software subscription.*

Note: Software Upgrade Assistant is English only. The availability of this service may vary by geography.

References

For more information, consult these sources:

- IBM @server iSeries Support:
  http://as400service.ibm.com/supporthome.nsf/document/20965550
- iSeries Information Center (V5R1):
  http://publib.boulder.ibm.com/html/as400/v5r1/ic2924/index.htm
- *IBM @server iSeries Universal Connection for Electronic Support and Electronic Services*, SG24-6224

iSeries print and e-print

The iSeries server provides a robust printing solution that works well in the e-business environment. When you make the choice as to where the print server resides (either on the iSeries server or a remote location), you have the following solutions for printing.

Print server resides on the iSeries server

Handling the print server function on the iSeries server can give you greater control over the printing process and, therefore, the quality of the final printout. This kind of solution fits well in the following potential e-business environments:

- The enterprise-out solution where your application is largely based on a traditional ILE language solution. In this case, you most likely already have

solutions for generating printed reports and now simply must be concerned about how to transport the printer data stream across either an intranet or the Internet.

- The enterprise-out solution, but using solutions such as Host-on-Demand as a tool to convert the SNA character string (SCS) or Advanced Function Printer (AFP) data stream generated by your ASP application into an ASCII data stream. The ASCII data stream is then formatted and sent to an ASCII printer through a Host On-Demand 5250 printer session. The conversion is done on the iSeries via the Host Print Transform (HPT) function.
- Pre-printed forms can cause an additional level of complexity because the output generated must match the form in the printer. By handling the print server function from the iSeries, you will have greater control over the actual position of the text on the paper.
- Keeping the printer data stream or document on the iSeries provides increased protection to the loss of data. If the print documents are moved to the client's environment to be stored, they are at risk to being destroyed or lost, all depending on the quality of each and every client's backup and recovery plan (that is, if they have one, of course).
- An enterprise-out solution that is now front-ended (faced) with a WebSphere Application Server servlet or some other Web-based application development environment. In this case, the "print" servlet makes calls to your existing enterprise-out print program to create the output.
- A Java servlet can use native iSeries server calls to generate printer data streams on the iSeries that will now have to be sent from a print server running on the iSeries to the remote client location. The list of tools available in Java to manage this situation are increasing all the time.

  The easiest way to accomplish this is to use the print classes as part of the Java Toolbox to put data into iSeries spooled files.

  Another way is to use the 2D Graphics APIs with the remote Abstract Window Toolkit (AWT). To learn more about how to do this, search for AWT on the iSeries Information Center at:
  http://publib.boulder.ibm.com/pubs/html/as400/v5r1/ic2924/index.htm

Let's take a quick look at the types of printer data streams that can be created on the iSeries and how you can transport these data streams to remote clients.

Note: A good source of reference for printing is *AS/400 Printing V*, SG24-2160. Further study of printing solutions on the iSeries should be directed to this IBM Redbook.

Data streams supported on the iSeries server

Printed output is the result of the interaction between your iSeries application and the printer file (see Figure C-3). The output of this interaction can be controlled by the printer device type selected in the printer file as shown in Figure C-4.

Back to Figure C-3, this printer data stream or document is created as a spooled file in an output queue. Later, this printer data stream or document may need some kind of transformation into the actual data stream of the printer, via a print writer.

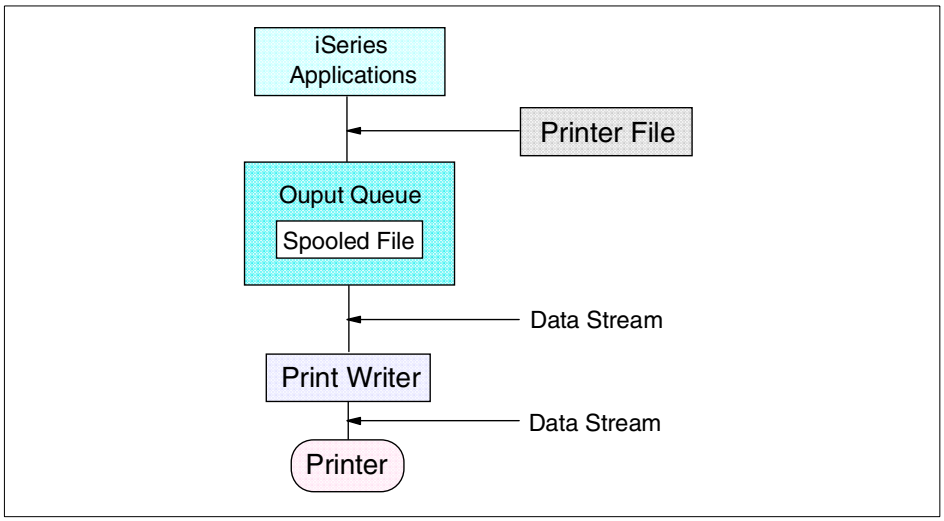


Figure C-3 Data stream: iSeries server

The iSeries server supports different data streams and can automatically create the majority of them. The Printer device type parameter (Figure C-4) in the printer file determines the type of data stream or document to be created.

```
                        Create Printer File (CRTPRTF)
 Type choices, press Enter.

 File . . . . . > MYPRTF        Name
   Library  . . . . . >   MYLIB       Name, *CURLIB
 Source file  . . . . . .   *NONE        Name, *NONE
   Library  . . . . . .                  Name, *LIBL, *CURLIB
 Source member  . . . . . .   *FILE        Name, *FILE
 Generation severity level  . . .   20            0-30
 Flagging severity level  . . . .   0             0-30
 Device:
   Printer  . . . . . .   *JOB         Name, *JOB, *SYSVAL
 Printer device type  . . . . . .   *SCS         *SCS, *IPDS, *LINE...
 Text 'description' . . . . . .   *SRCMBRTXT


Bottom
 F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
 F13=How to use this display        F24=More keys
```

Figure C-4 Create Printer File: Printer device type parameter

The Printer device type parameter can be set to one of the following values:

- *SCS (SNA Character String):

  Used to control line mode printers and has a relatively simple structure. The Data Description Specifications (DDS) FONT keyword is not supported. The font specified in the printer file or the printer default font is used.

  An extension of SCS, Final-Form Text Document Architecture (FFT-DCA) is used within the iSeries Office environment.

- *IPDS (Intelligent Printer Data Stream):

  A host-to-printer data stream used for AFP subsystems. It provides an attachment-independent interface for controlling and managing all-point-addressable (APA) printers. It supports an interactive, two-way dialog between the print driver and the printer (printer information, cooperative recovery, and resources management).

  Note: The iSeries-generated IPDS is a subset of the full IPDS.

- *AFPDS (Advanced Function Printing Data Stream):

A data stream for advanced function printers (independent of operating systems, independent of page printers, and portable across environments). AFPDS is a structured data stream divided into components called *objects*. AFPDS includes text, images, graphics, and barcodes, and references AFP resources (for example, overlays, page segments, and fonts).

- *LINE (Line data stream):

  A LINE data stream referencing a page definition and a form definition with the spooled file. The Printer device type parameter was enhanced in V3R2 and V3R7 (and later) with a new value *LINE.

- *AFPDSLINE: AFPDS line (also called Mixed) data stream:

  AFPDSLINE data stream is a mixture of AFP structured fields and LINE data. Only certain AFP structured fields can be mixed with the line data. Programmers must specify AFP structured fields in applications. The Printer device type parameter was enhanced in V3R2 and V3R7 (and later) with the new value *AFPDSLINE.

- *USERASCII: ASCII data stream:

  There is no formal structure that controls the use of the American National Standard Code for Information Interchange (ASCII) data stream to control printers attached to systems providing ASCII support. There is no architectural data stream standard to which ASCII printers can conform in the interest of uniformity.

  To create a spooled file in *USERASCII on the iSeries server, programmers must specify ASCII escape sequences in applications that use the transparency mode. We do not recommend this approach because the escape sequences required in the application depend on the type of printer.

  A *USERASCII spooled file can contain any form of ASCII printer data stream (for example, PCL5, PPDS, or PostScript).

Spooled files can also be received from other systems:

- From another iSeries server, you can receive spooled files in SCS, IPDS, LINE, AFPDSLINE, AFPDS, or USERASCII data streams.
- If the spooled file is from a System/390, LINE, AFPDSLINE, and AFPDS are supported. By using object distribution (SNADS), the spooled file is placed directly in an iSeries output queue.
- From a PC running Client Access for AS/400 network printing, you can receive spooled files in SCS, AFPDS, or USERASCII.
- From a RISC system (IBM @server pSeries), you may receive spooled files in AFPDS or USERASCII.

- From an Other Equipment Manufacturer (OEM) system, spooled files are normally received in USERASCII.

A spooled file stored in an iSeries output queue can be in different data streams. On the other end, many printers support only one data stream (for example SCS, IPDS, or ASCII PCL5). Some others (for example, the IBM Infoprint 20, 21, 32, and 40) support IPDS, PCL, and Postscript. Figure C-5 shows data streams and printer devices.

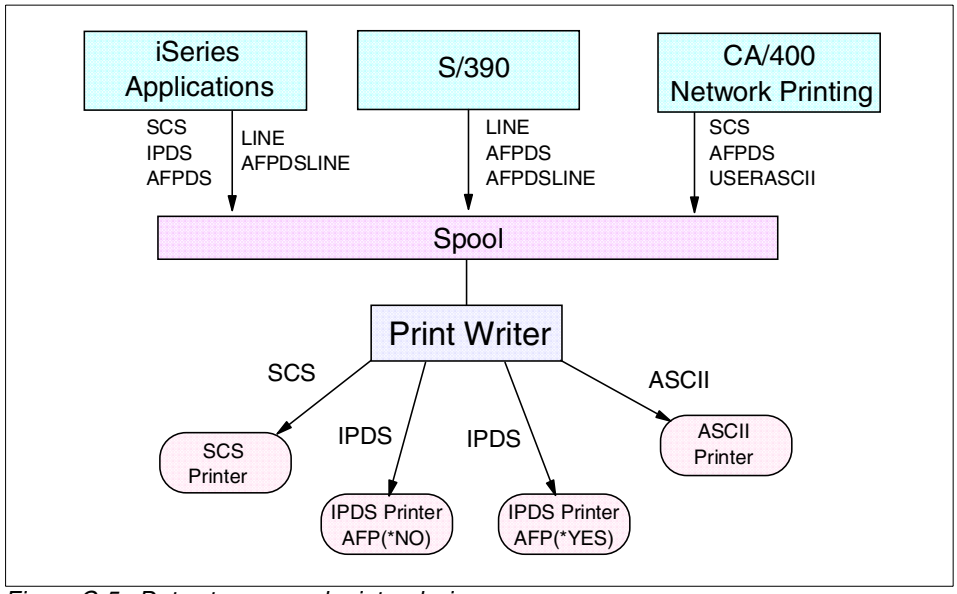


Figure C-5 Data streams and printer devices

On the iSeries server, the print writer can convert some of the data streams to others. The following section explains the possible conversions.

The job of the printer writer

The printer writer program is a system-supplied program. This program takes the spooled file from an output queue and sends it to a printer. The printer writer handles spooled files by using one of the following options:

- Print Writer
- Print Services Facility/400 (PSF/400)
- Host Print Transform

Each of these writer options supports different data streams and printer types. They can also perform certain data stream conversions.

V5R1 of OS/400 has been the biggest printing and presentation release so far. The focus is very much on e-output to keep up with the ever expanding e-business environment. It addresses two key areas: page composition on the front-end and providing e-output capabilities at the back end.

Traditional information methodology has been “print and distribute”. However, e-business is changing the face of business communications in such a way that the “e-output” requirement is the ability to create fully electronic pages of information and deliver them to the desired destination in the desired format.

V5R1 enhancement

The V5R1 enhancements include the ability to:

- *Produce PDF from any iSeries output*
- *E-mail automatically any iSeries output*
- *Publish iSeries output in either PDF or AFP format for Web and client access*
- *Design iSeries output applications with a new, integrated, fully graphical system*
- *Archive iSeries output to a new, strategic, fully Web-enabled archival system*
- *Develop server print applications in Java*
- *Print directly to iSeries-attached printers using Internet Print Protocol (IPP)*
- *Segment iSeries output electronically for presentation or e-mail*
- *Manage printing with the iSeries from any ERP software*
- *Separate page formatting from applications without giving up anything*
- *Integrate a Web image into iSeries output applications*
- *Print directly to PDF printers*
- *Produce up to 999,999 spooled files from a single application*

Figure C-6 shows the iSeries print and e-print structure. It also introduces the new V5R1 printing products that are discussed in “Infoprint Server for iSeries (5722-IP1)” on page 337 and “Infoprint Designer for iSeries (5722-ID1)” on page 338.

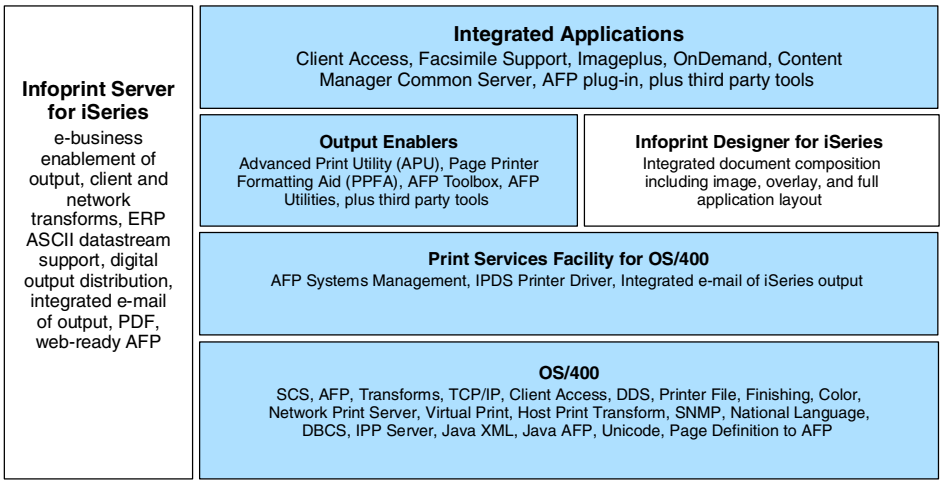


Figure C-6 iSeries print and e-print structure

Print Services Facility (PSF/400)

PSF/400 is discussed in 3.3.20, “Print Services Facility/400 (5722-SS1 options 36, 37, 38)” on page 77.

Infoprint Server for iSeries (5722-IP1)

The focus of Infoprint Server is the electronic distribution of output and iSeries management of network printing with the following features:

- **iSeries support for PDF**: Transform services for any iSeries standard output (AFP, IPDS, SCS, and even OV/400), PDF output to e-mail, IFS, or PDF printer, high-function PDF server and segmentation – “electronic burst and bind”
- **Integrated e-mail of output**: PDF output can be automatically e-mailed; multiple e-mails based on segmentation and exits for customization
- **iSeries as a network print server**: PCL, PostScript and PDF to AFP, PostScript and PDF transform is IBM-Adobe full-function Level 3
- **Web-ready AFP**: Add external resources to AFP data for portability; add indexing for navigation
- **Image transforms**: GIF, TIF, and JPEG transforms to IOCA; Windows-based

Infoprint Designer for iSeries (5722-ID1)

Infoprint Designer is a state of the art design front-end to the robust, integrated AFP and IPDS print/presentation subsystem on the iSeries server.

The key features are:

- Integrated for design operations, integrated for print operations.
- Overlay Design Editor for designing electronic forms.
- Image Design Editor for designing images.
- Layout Design Editor for designing the complete application.
- Creates standard iSeries print resources.
- Windows design functions integrated with upload/download for ease of design and production.
- Professional, high-precision system geared to the demands of business communications.
- Existing applications can be redesigned without application changes.
- Entire AFP Font Collection integrated into Infoprint Designer.
- Design platform for new Java print architecture.

MQSeries (5733-A38 V5R1 and V5R2)

Note: IBM MQSeries, already an important part of the WebSphere software platform for e-business, has an even tighter association with WebSphere. MQSeries, responsible for dynamic integration, is now known as WebSphere MQ, to reflect the fundamental part that it plays in dynamic e-business.

MQSeries is middleware that provides application to application communications. It has its roots in the CICS transaction management software. Customers requested an asynchronous messaging facility for cross platform, assured message delivery – and then the product was born.

MQSeries is basically a messaging mechanism, it enables message exchange between applications. Messaging generally requires a queuing mechanism as well so MQSeries also focusses on queues. The queueing is not a difficult concept. However, the messaging component is difficult and the two are intricately linked. MQSeries enables message delivery between applications regardless of the underlying communications infrastructure or programming language.

It is very important in commercial and enterprise environments that you can be sure that the message we are sending actually arrives at its destination. There are many potential points of failure when two systems are connected across a network. The message can be lost in any of the following places:

- During transit
- Flowing through the source system
- Flowing through the target system
- Being moved up the various application layers of software to its final destination on the target system

e-business and the need to more closely integrate with your suppliers and customers pushes application and enterprise integration. MQSeries helps enable business to business integration, without requiring major rewrites of your applications.

You can learn more about MQSeries on the Web at:
http://www-4.ibm.com/software/ts/mqseries/

MQSeries V5.1 highlights

V5.1 enhancement

The highlights for V5.1 of MQSeries include:

- *Multiple Queue Managers*
- *Increased maximum message size (100 MB)*
- *Increased maximum queue size (2 GB)*
- *MQSeriesQueue Manager Clusters*
- *Enhanced transactional support*
- *Support for threaded applications*
- *Enhanced MQSeries classes for Java*
- *Enhanced bindings for COBOL*
- *Enhanced exploitation of OS/400 Work Management*

Note: MQ V5.1 refers to the release of MQSeries. MQ V5.1 is applicable to OS/400 V4R4 and later. MQSeries was last updated to V5.2 in December 2000 with greatly improved performance over V5.1.

Java Messaging Services (JMS)

MQSeries Java Messaging Services for iSeries became generally available (GA) on 29 June 2001, marking the initial offering of “JMS for iSeries”. MQSeries Product Extension Support Pac (MA88 - MQSeries Classes for Java and Java Message Service) now includes non-transactional support for JMS on the iSeries and provides support for developing MQSeries applications in Java through the following Java-based APIs:

- MQSeries classes for Java V5.2
- MQSeries classes for Java Message Service (JMS) V5.2

Special notices

References in this publication to IBM products, programs or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM product, program, or service is not intended to state or imply that only IBM's product, program, or service may be used. Any functionally equivalent program that does not infringe any of IBM's intellectual property rights may be used instead of the IBM product, program or service.

Information in this book was developed in conjunction with use of the equipment specified, and is limited in application to those specific hardware and software products and levels.

IBM may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to the IBM Director of Licensing, IBM Corporation, North Castle Drive, Armonk, NY 10504-1785.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the exchange of information between independently created programs and other programs (including this one) and (ii) the mutual use of the information which has been exchanged, should contact IBM Corporation, Dept. 600A, Mail Drop 1329, Somers, NY 10589 USA.

Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

The information contained in this document has not been submitted to any formal IBM test and is distributed AS IS. The use of this information or the implementation of any of these techniques is a customer responsibility and depends on the customer's ability to evaluate and integrate them into the customer's operational environment. While each item may have been reviewed by IBM for accuracy in a specific situation, there is no guarantee that the same or similar results will be obtained elsewhere. Customers attempting to adapt these techniques to their own environments do so at their own risk.

Any pointers in this publication to external Web sites are provided for convenience only and do not in any manner serve as an endorsement of these Web sites.

The following terms are trademarks of other companies:

Tivoli, Manage. Anything. Anywhere.,The Power To Manage., Anything. Anywhere.,TME, NetView, Cross-Site, Tivoli Ready, Tivoli Certified, Planet Tivoli, and Tivoli Enterprise are trademarks or registered trademarks of Tivoli Systems Inc., an IBM company, in the United States, other countries, or both. In Denmark, Tivoli is a trademark licensed from Kjøbenhavns Sommer - Tivoli A/S.

C-bus is a trademark of Corollary, Inc. in the United States and/or other countries.

Java and all Java-based trademarks and logos are trademarks or registered trademarks of Sun Microsystems, Inc. in the United States and/or other countries.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States and/or other countries.

PC Direct is a trademark of Ziff Communications Company in the United States and/or other countries and is used by IBM Corporation under license.

ActionMedia, LANDesk, MMX, Pentium and ProShare are trademarks of Intel Corporation in the United States and/or other countries.

UNIX is a registered trademark in the United States and other countries licensed exclusively through The Open Group.

SET, SET Secure Electronic Transaction, and the SET Logo are trademarks owned by SET Secure Electronic Transaction LLC.

Other company, product, and service names may be trademarks or service marks of others

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

IBM Redbooks

For information on ordering these publications, see “How to get IBM Redbooks” on page 347.

- *TCP/IP Tutorial and Technical Overview*, GG24-3376
- *Moving to Integrated Language Environment for RPG IV*, GG24-4358
- *Building AS/400 Client/Server Applications with Java*, SG24-2152
- *AS/400 Printing V*, SG24-2160
- *Building AS/400 Applications with Java*, SG24-2163
- *AS/400 Programming with VisualAge for RPG*, SG24-2222
- *Secure Electronic Transactions: Credit Card Payment on the Web in Theory and Practice*, SG24-4978
- *Lotus Domino for AS/400: Performance, Tuning, and Capacity Planning,* SG24-5162
- *V4 TCP/IP for AS/400: More Cool Things Than Ever*, SG24-5190
- *Net.Commerce V3.2 for AS/400: A Case Study for Doing Business in the New Millennium*, SG24-5198
- *Payment Server V1.2 for AS/400: Secure Transactions in e-commerce*, SG24-5199
- *Lotus Domino for AS/400: Integration with Enterprise Applications*, SG24-5345
- *Who Knew You Could Do That with RPG IV? A Sorcerer's Guide to System Access and More*, SG24-5402
- *AS/400 Internet Security: Implementing AS/400 Virtual Private Networks,* SG24-5404
- *Building e-commerce Solutions with Net.Commerce: A Project Guidebook*, SG24-5417
- *Lotus Domino for AS/400 R5: Implementation*, SG24-5592

- *Building AS/400 Applications for WebSphere Standard Edition 2.0*, SG24-5635
- *AS/400 HTTP Server Performance and Capacity Planning*, SG24-5645
- *Building iSeries Applications for WebSphere Advanced Edition 3.5*, SG24-5691
- *Design and Implement Servlets, JSPs, and EJBs for IBM WebSphere Application Server*, SG24-5754
- *AS/400 Internet Security Scenarios: A Practical Approach*, SG24-5954
- *Domino and WebSphere Together: Second Edition,* SG24-5955
- *Porting UNIX Applications using AS/400 PASE*, SG24-5970
- *IBM WebSphere Host On-Demand: Version 5 Enhancements,* SG24-5989
- *User-to-Business Patterns for e-business: Developing AS/400e e-business Applications,* SG24-5999
- *Developing an e-business Application Using Lotus Domino for AS/400*, SG24-6052
- *Application Service Provider Business Model: Implementation on the iSeries Server*, SG24-6053
- *WebSphere V3.5 Handbook*, SG24-6161
- *WebSphere Scalability: WLM and Clustering Using WebSphere Application Server Advanced Edition*, SG24-6153
- *WebSphere Commerce Suite Handbook V5.1*, SG24-6167
- *IBM @server iSeries Wired Network Security: OS/400 V5R1 DCM and Cryptographic Enhancements*, SG24-6168
- *Mobile Commerce Solutions Guide using WebSphere Commerce Suite V5.1*, SG24-6171
- *New Enterprise Integration Functions for Lotus Domino for AS/400*, SG24-6203
- *WebSphere Personalization Solutions Guide*, SG24-6214
- *IBM @server iSeries Universal Connection for Electronic Support and Electronic Services*, SG24-6224
- *WCS V5.1 Performance Tuning*, SG24-6258
- *Connect for iSeries with WebSphere Commerce Suite: BtoB Enabling a WebSphere Commerce Suite Web Site*, REDP0127
- *Integrating WebSphere Commerce Suite with Domino Back-End Application: iSeries 400 Edition*, REDP0141
- *IBM WebSphere Development Tools for AS/400: An Introduction*, REDP0503

- *Integrating WebSphere Commerce Suite With a Back-End Order Management Application*, REDP0514

You can find more information on Operations Navigator for V5R1 in the following Redbooks, which will be available in first quarter 2002:

- *Managing Your iSeries V5R1 with Operations Navigator- Volume 1*, SG24-6226
- *Managing Your iSeries V5R1 with Operations Navigator - Volume 2: Advanced Topics*, SG24-6227

Other resources

These publications are also relevant as further information sources:

- *IBM WebSphere Commerce Suite Fundamentals, Version 4.1*, GC09-2994
- *V5R1 Performance Capabilities Reference Guide*, SC41-0607: http://publib.boulder.ibm.com/pubs/html/as400/online/chgfrm.htm
- *Software Installation*, SC41-5120
- *Up and Running with Domino for AS/400*, SC41-5334
- *Demo CD-ROM (based on Net.Commerce V3)*, GK3T-2318
- The announcement information for V5R1 of OS/400 can best be found at http://www.ibmlink.ibm.com First select your geography, and then click **Announcements**. Next, select **Announcements search** and search for all announcements for April 23, 2001.

Referenced Web sites

These Web sites are also relevant as further information sources:

- Jupiter Communications: http://www.jup.com
- IDC Research: http://www.idcresearch.com/Press/default.htm
- IBM @server iSeries home page: http://www.ibm.com/servers/eserver/iseries/
- IBM iSeries e-business solutions: http://www.ibm.com/servers/eserver/iseries/ebusiness/
- OS/400 V5R1 home page: http://www-1.ibm.com/servers/eserver/iseries/announce/
- DB2 UDB for iSeries: http://www.ibm.com/servers/eserver/iseries/db2

- iSeries integration with Windows:
  http://www.ibm.com/eserver/iseries/windowsintegration/
- Linux and the iSeries:
  http://www.ibm.com/servers/eserver/iseries/linux/
- Portable Application Solutions Environment (OS/400 PASE):
  http://www.iseries.ibm.com/developer/factory/pase/
- Logical partitioning (LPAR):
  http://www.ibm.com/servers/eserver/iseries/lpar/
- Client Access information:
  http://www.ibm.com/servers/eserver/iseries/clientaccess
- V5R1 information:
  http://publib.boulder.ibm.com/pubs/html/as400/infocenter.html
- TCP/IP for OS/400: http://www.ibm.com/servers/eserver/iseries/tcpip/
- Technical Studio: http://www.iseries.ibm.com/tstudio/
- IBM HTTP Server for iSeries:
  http://www.ibm.com/eserver/iseries/software/http
- Client Access Express for Windows:
  http://www.ibm.com/eservers/iseries/clientaccess
- IBM Personal Communications:
  http://www.ibm.com/software/enetwork/pcomm
- WebSphere Host On-Demand (HOD):
  http://www.ibm.com/software/webservers/hostondemand
- iSeries Access for Web:
  http://www.ibm.com/eservers/iseries/clientaccess/beta/webaccess.htm
- WebSphere Host Publisher:
  http://www.ibm.com/software/webservers/hostpublisher
- WebFacing Tool: http://www.ibm.com/software/ad/wdt400
- WebSphere Transcoding Publisher:
  http://www.ibm.com/software/websphere/transcoding
- Screen Customizer:
  http://www.ibm.com/software/network/screencustomizer
- WebSphere Development Tools for iSeries:
  http://www.ibm.com/software/ad/wdt400/
- Lotus Domino for iSeries: http://www.iseries.ibm.com/domino/
- WebSphere Application Server for iSeries:
  http://www.ibm.com/servers/eserver/iseries/software/websphere/wsappserver/

- Connect for iSeries Web site: http://www.iseries.ibm.com/btob/connect
- Tivoli systems management on iSeries: http://www.ibm.com/servers/eserver/iseries/sftsol/tivoli1.htm
- iSeries Technical Support: http://www.as400service.ibm.com/
- Workload Estimator for iSeries: http://as400service.ibm.com/estimator/index.html

How to get IBM Redbooks

Search for additional Redbooks or Redpieces, view, download, or order hardcopy from the Redbooks Web site:

ibm.com/redbooks

Also download additional materials (code samples or diskette/CD-ROM images) from this Redbooks site.

Redpieces are Redbooks in progress; not all Redbooks become Redpieces and sometimes just a few chapters will be published this way. The intent is to get the information out much quicker than the formal publishing process allows.

IBM Redbooks collections

Redbooks are also available on CD-ROMs. Click the CD-ROMs button on the Redbooks Web site for information about all the CD-ROMs offered, as well as updates and formats.

Index

D

E

J

L

M

N

O

P

Q

R

S

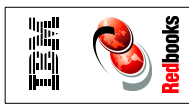
T

U

V

W

X



IBM @server iSeries e-business Handbook

(0.5” spine)
0.475”<->0.875”
250 <-> 459 pages

IBM @server iSeries e-business Handbook

A V5R1 Technology and Product Reference

Redbooks

Discover iSeries for extreme B2B and B2C e-business solutions

Extend your business critical OS/400 applications to the Web

Explore the new features for OS/400 V5R1

This IBM Redbook targets IBM marketing personnel, Business Partners, and AS/400e and iSeries customers who are looking to extend and expand their information server into e-business. It provides a bottom-up approach to learning about base OS/400 features and functions that provide a rock-solid foundation for e-business. Next, it adds details about the networking aspects of e-business that are based primarily on the TCP/IP protocol suite. Then it describes the built-in Web serving features of both the original and powered by Apache HTTP servers.

The implementation of e-business today is the evolutionary movement of your presence on the Web from static Web pages, to dynamic data, and finally to a transactional site – a business-to-business (B2B) or business-to-consumer (B2C) marketplace.

To this end, this redbook provides information to help organize your understanding of some of the major e-business application environments available on your iSeries with V5R1 of OS/400. This includes the WebSphere Application Server, WebSphere Commerce Suite, Lotus Domino for iSeries, and Host Integration programming information. Finally, this redbook rounds out the study of e-business on the iSeries by looking at sizing and performance, national language support, and systems management.

INTERNATIONAL TECHNICAL SUPPORT ORGANIZATION

BUILDING TECHNICAL INFORMATION BASED ON PRACTICAL EXPERIENCE

IBM Redbooks are developed by the IBM International Technical Support Organization. Experts from IBM, Customers and Partners from around the world create timely technical information based on realistic scenarios. Specific recommendations are provided to help you implement IT solutions more effectively in your environment.

For more information:
ibm.com/redbooks

SG24-6711-00 ISBN 0738424013