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OS/390 Web-Enablement Overview

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Goal: *This paper is intended to discuss the major options available to OS/390® customers for providing Web access to business critical applications and data, and some selection considerations to assist customers in making the right choices to meet their e-business objectives.*
Audience: *This paper is intended for IT managers, line of business managers, and other personnel who are looking for a high level understanding of Web-enablement on OS/390.*

Overview

There is no longer any debate on whether the Web provides opportunities for developing new business. The only question is "when should companies start doing this?" For many companies seeking to create or respond to competitive threats, the answer is TODAY - so Time-To-Market is a critical factor. Another important consideration is the need to connect these new e-business applications to existing applications and data such as customer data, inventory and mission-critical transactions. Fortunately for S/390 customers there are easy solutions that can be deployed quickly and safely by web-enabling these existing applications and data while maintaining the necessary qualities of service. According to Gartner Group "More than 60 percent of enterprises enhancing Web applications will maintain, and enhance, existing investments in legacy server (hardware and OS) and core layered software (e.g., database) through 2002 (0.8 probability)" (from Choosing Server Platforms - October 99). The reason enterprises are evolving, rather than replacing, these existing investments is simple - the Return On Investment is much higher (as confirmed by Meta Group research commissioned by IBM - July 1998). ROI is maximized because the Time-To-Market is short, the cost of development and testing is significantly reduced and risks are low. Existing assets are battle-proven, fully functional and have fast response times. In parallel the S/390 has evolved to become a highly available, secure and scalable platform well suited for the modern demands of e-transaction processing.

Although becoming an e-business will be necessary for improved operations, increased revenues and greater market share, it will not guarantee success. The distinction between winners and losers will depend on how a company becomes an e-business -- the soundness of the plan, the speed of the transition, and the ability to continually improve. A winning company needs to capitalize on its current computing resources as well as Internet technologies to establish a complete Web-based

service structure that improves conditions for customers, employees, Business Partners, and stakeholders.

While being new and nimble can be a great asset to starting an e-business, established companies have the opportunity to activate long-standing host investments in a Web environment. They can take advantage of the breadth and depth of their host application portfolio and data, the same resources they have been using to successfully run their business for years. Accessing information on IBM System/390®, databases, and other corporate servers from the Web can improve a company's competitive position. But the degree of success correlates directly with how fast, how securely and how flexibly an organization can accomplish this.

Organizations need a way to quickly and efficiently extend, integrate and publish host information to meet the unique needs of all their Web users. Typically the various user needs call for a combination of technologies. In some instances where the required information is available through existing host applications, only a delivery method is needed. On the other hand, if the existing host data needs additional business logic, a new application must be developed.

While it is important to move quickly, it is just as important to have a long range plan on how your company will build Web applications in the future. IBM has a strategy and solutions to help organizations start simply and build for the future to meet their e-business objectives.

As companies strategize and plan for the future, it becomes apparent that new development techniques will be required to respond quickly to new requirements and meet competition. Component-based development is IBM's strategic direction to enable fast and efficient application development. The move to component-based development will be an evolution starting with Web-enabling existing applications today. It will continue with componentization of applications that perform tasks such as data mining and using Java to wrap around existing applications, and finally moving to complete reengineering of basic business processes and supporting applications.

As companies move towards component-based development, we expect there will be an evolution.

First Generation (API) connectors - Web-enable existing applications quickly using existing skills, no new business logic

Second Generation (Java) connectors - Web-enable existing applications including using the power of Java and tooling to provide new business logic

Third Generation (Enterprise Java) connectors - Reengineering and use of component technology to transform business processes through total business integration

Whether the choice is to create new Web-based applications or Web-enable existing applications, it will still be necessary to access existing applications and data. These applications provide mission critical functions and are proven to be rock solid. Processing is efficient, applications well tuned, and are often highly integrated with other business processes. There are few surprises with existing applications and it is possible to leverage it effectively.

Web Integration Design Overview

One of the first things to consider when selecting a Web-enabling solution is what business process or processes are trying to be moved to the Web. This will help to determine the required data sources and the preferred Web solution architecture.

If the requirement is simply to make existing 3270 applications available to Web users, then a simple Java emulator may be the quickest and best solution. If the requirement is to enhance the user interface, then one of several solutions described in this paper should be assessed to determine if they meet the user's needs.

If an entirely new application is required in order to reengineer existing business processes, the WebSphere development environment would be the best choice, including VisualAge® for Java and the various Connectors for access to applications and data.

Enterprises should consider the end user's usage characteristics and requirements. Such things as whether the user accesses the application occasionally and for short periods of time, or whether they access it every day

and for long periods of time. Whether the end user is already familiar with the application or requires an improved graphical user interface. Do they require fast, transaction oriented response time or whether typical Web page response is sufficient. With many Internet users, one cannot assume they will have the required level of Java on their system. These considerations must be included in the solution selection process. Most enterprises will require more than one solution to meet all of the requirements of their target users.

The available options generally fall into two categories. One is to implement a separate solution from the host application system without requiring changes to the database or applications. This solution can be done with Web server-side or client-side programming. The second is to modify the existing application to allow direct Web access. This second option may have benefits in efficiency or performance, but will generally take more time and be more costly. Some of the solutions described in this paper are examples of IBM providing direct access to applications such as the CICS Web Support with 3270 Bridge. Either way, you can start with what you are familiar with today and use the solution that best meets your needs to Web-enable your existing applications.

Web Server-Side Programs

Web server-side programs include techniques such as CGI programs, Web server plug-ins, or servlets, acting as gateways between a Web server and the existing system. A client Web browser communicates with a Web server, which in turn invokes the server-side program that in turn invokes the existing system. Examples include Net.Data®, MQSeries®, CICS® Transaction Gateway, VisualAge Interspace, IMS™ Connectors, Host On-Demand Connector, Host Publisher, and Host On-Demand beans for Java.

Web Client-Side Programs

This is implemented by using Java, where the Java client runs as an applet in the browser and communicates directly with the existing target system or through a gateway. Usually, the Web browser contacts the Web server, which downloads the Java applet to the browser. In the case of Host On-Demand, the client can keep a copy of the Java applet on the browser and only have it refreshed when there is a change to the applet on the server. Examples of this technique include JDBC (similar to ODBC but for Java), SQLJ (similar to SQL but for Java), the Java Applet supplied with the CICS Transaction Gateway, IMS Client for Java, the MQSeries client for Java, VisualAge Interspace, and Host On-Demand. An alternative to running a Java

applet is to run a Java stand-alone client application independently of a browser.

Direct Access to Application Servers

In this technique, the existing system is modified to respond directly to the Web protocol, enabling direct browser access without intermediate application code on the client or server. An example of this is the CICS Web Support (CWS) in CICS for OS/390.

Application Framework for e-business

Some customers require developing brand new business applications to transform their business processes for e-business. IBM's answer is the Application Framework for e-business, a comprehensive, scalable platform that can support the services enterprises need to develop and deploy e-business solutions. The benefits of developing applications using the Framework are illustrated by the key principles that have guided the Framework's development: Maximize ease and speed of development and deployment, accommodate any client device, ensure portability across a diverse server environment, and leverage and extend existing assets.

IBM's Web-enablement solutions support the Application Framework for e-business and provide the application development capability known as the e-business Connectors. Many of the connectors are based on the IBM developed Common Connector Framework (CCF). CCF provides a consistent means of connecting to, and interacting with, enterprise resources from any Java execution environment. IBM has worked closely with JavaSoft™ and the industry to define a "Common Connector Framework." This Framework is supported by the Java application development tools of WebSphere, specifically VisualAge for Java. Connectors can greatly reduce the complexity and cost of developing mission critical Web applications because in many cases the hard transactional business logic is complete and already running in a robust, managed environment. Connectors are Java libraries and supporting tools that support access from the Framework's programming environment to various external data and application servers. They shield the programmer from the usually application specific protocols needed to access these servers. e-business Connectors from IBM provide a comprehensive set of connectors to a wide range of existing application and data servers including CICS, Encina, IMS, DB2® and other relational databases, 3270, 5250, VT and MQSeries. The most common connectors used for

Web-enabling OS/390 applications include both first and second generation connectors.
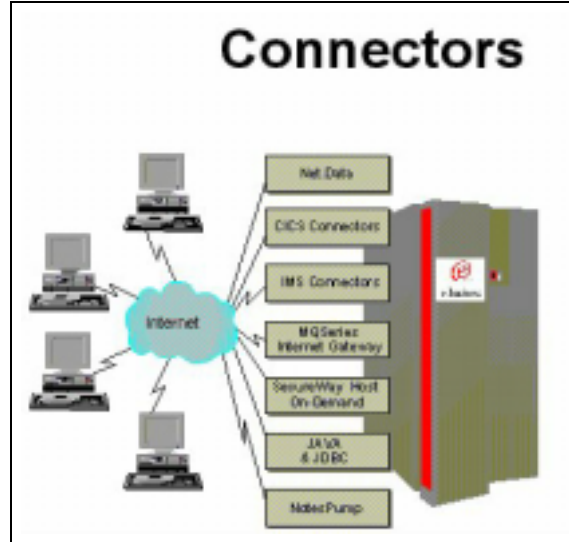
First Generation Connectors

- CICS Web Support (CAWS)
- IMS TCP/IP OTMA Connection (IMS TOC)
- Net.Data

Second Generation Connectors

- CICS Transaction Gateway (CTG)
- IMS TCP/IP OTMA Connection (TOC) Connector for Java (IMS Connector for Java)
- JDBC
- SQLJ
- Host On-Demand

Third Generation Connectors

- JDBC
- SQLJ
- Servlets
- Java Server Pages
- Java Transaction Services
- Java Transaction API
- Java Naming and Directory
- Java Messaging Services

Refer to the OS/390 Guide to e-business Connectors: Second Edition for a detailed description of these e-business connectors

Selection Considerations

Other key considerations that may influence the solution selection include performance requirements, scalability, security requirements, existing software levels, and available programming skills.

A Web-based tool OS/390 Planning Assistant for e-business, has been developed to guide you through the decision process for picking the right Web-enablement solution, and is available at *http://www.s390.ibm.com/os390/wizards/ebiz*

Web-enablement Solutions

Business opportunity is the primary driver behind IS investment in Web-enabling existing applications. Web-enablement solutions move IS out of the back room and into the front office, out to Business Partners and customers. In addition, utilizing existing applications and extending the reach of those applications provides an extremely high return on IS investment. Enterprises get the advantage of a new application portfolio without the high investment needed to design, develop, test and roll out new applications. Web-enablement solutions can also be implemented much faster than new application development. As long as the information required by an end-user is available in a back-end system, usually that a Web-enablement solution will be the quickest and least expensive solution available. Once implemented, enhancements are often desirable and IBM provides the robust set of tools that enable Web application evolution.

In order to assist customers in extending existing applications and data to the Web, most major IBM products such as CICS and IMS have introduced solutions to provide Web enablement. These solutions allow customers to start where they are, utilizing existing resources and skills, while they prepare for the future of component-based development. Some solutions are general solutions for making multiple data sources accessible to the Web. Other solutions are specific to products, allowing easy access to the data.

Types of Solutions for Web-Enablement

Solutions for Multiple Sources: For enterprises that have more than one data or application source to be made available to the Web, products offering a variety of integration options may be the answer. Instead of modifying each type of host application or data system for Web access, they can install one product with an interface to each.

Host On-Demand is most often used as a client-side solution that gives fast and easy access to 3270, 5250, or VT applications by emulating a terminal. Web users have access to applications using the old and familiar "green screen" interface. By using the default GUI functions included with Host On-Demand or with the addition of Screen Customizer for Host On-Demand, the "green screen" can be presented as a graphical interface. For server-side connections to existing applications, Host On-Demand provides a rich set of reusable beans for Java to provide a high level of connection and application navigation support. The reusable components provide the quickest and easiest way to program host access applications from many prevailing IDE's, Java and non-Java. No changes are required to the existing applications. Host On-Demand is targeted primarily at the intranet and extranet.

Host Publisher provides one of the quickest and easiest ways to implement e-business by extending the reach of mission-critical applications to users across the Internet, no changes are required to the existing applications. IBM Host Publisher provides the capability to integrate data and services from multiple existing applications into a single Web page, giving end users the appearance of a single new application. Support for HTML delivery to end users ensures the broadest possible reach of existing applications across the Internet. Host Publisher provides access to a wide range of existing application types, including 3270, 5250, VT, JDBC databases, and Java applications. Host Publisher uses Host On-Demand's reusable components to access host application data. Host Publisher integrates with WebSphere to provide the runtime environment, and Integration Objects created with Host Publisher can be used in other Java applications such as those developed with VisualAge for Java, providing a high level of navigation and connection management support without any additional Java programming. Host Publisher is targeted primarily to the Internet and extranet, but customers are finding it is very suitable for the intranet as well.

Net.Data provides dynamic Web page creation and interaction with relational and non-relational database management systems (DBMS), such as DB2, ODBC, and IMS databases, and applications written in programming languages such as Java, Perl, C++, and REXX.

DB2 DataJoiner enables an enterprise to view all their data -- IBM, multi-vendor, relational, nonrelational, local, remote, and now geographic data -- as if it were local data. With a single SQL statement, one can access and join tables located across multiple data sources without needing to know the source location.

VisualAge Interspace provides an easy way to access CICS (3270 Datastream or CICS COMMAREA) applications, MQSeries applications or Encina applications from web-based servers as well as client workstations. Using any GUI tool (e.g VisualAge for Java, WebSphere Developer, Visual Basic, Power Builder, ActiveX and more) one can easily connect to CICS resources using the CICS Universal Client or CICS Transaction Gateway as well as MQSeries and Encina with the same tools. VisualAge Interspace gives your WebSphere developers a rapid development environment for capturing the essence of existing or new CICS and MQSeries applications in servlets.

Specific Solutions: Many existing application servers have designed specific client interfaces to provide Web access to their data. For enterprises that are accustomed to this type of individual data access, specific Web access interfaces may be preferred.

CICS provides several alternatives for Web access, including CICS Transaction Gateway, CICS 3270 Bridge, and CICS Web Support (CWS).

CICS Transaction Gateway provides a comprehensive set of Java-based Web server facilities for access to CICS applications from a Web browser. These include Java classes and Java beans for writing application-specific server programs (servlets) and browser programs (applets) and IBM-supplied code for common functions. There are classes for access to both traditional and object-oriented CICS applications. However, the classes required for access to 3270-interface transactions are available only on non-S/390 servers.

CICS Web Support with 3270 Bridge is suitable for intranet solutions, due to the direct connection between Web Browser and the enterprise server. Internet solutions could be implemented using the Web server security features. Enables Web browsers to communicate directly with mainframe CICS application

programs without an intermediate gateway or separate Web server, making this a very efficient solution. It requires CICS programming skills. The 3270 Bridge allows customers to run existing 3270-based transactions without change. It is especially useful for applications where 3270 instructions are distributed throughout the code and the knowledge and the documentation of the application is very limited. It eliminates the overhead and effort of emulating a 3270. The bridge is implemented through the use of an exit and may need to be modified or rewritten to handle specific CICS applications.

(Refer to the paper titled Web-Enabling CICS Applications: A Selection Guide for assistance in tool selection)

IMS also provides several alternatives for Web-enablement, including the IMS TCP/IP Open Transaction Manager Access (OTMA) Connection (IMS TOC),and the IMS Connector for Java.

IMS TCP /IP OTMA Connection (IMS TOC) provides high performance access from TCP/IP clients directly into IMS. IMS TOC is currently downloadable from the IMS home page at *www.ibm.com/ims*, and is being repackaged/enhanced as the IMS Connect feature of IMS V7.

IMS Connector for Java provides CCF classes for interfacing to IMS from Java servlets and applications in any VA for Java or WebSphere Advanced or Enterprise Edition environment. The IMS Connector for Java is currently delivered with the VA for Java EE V2 for Windows NT and downloadable from the VADeveloper Domain to registered owners of VA for Java, EE, V2.0).

WebSphere

For enterprises considering an extensive Web environment, IBM WebSphere Application Server products provides an excellent solution for managing a comprehensive Web environment. Application Server is a complete Java-based solution for Web application development, providing the servlet Java runtime environment for the major commercial Web servers and a set of servlet management tools. In addition, it provides features such as session management and data server connection management that make servlets a powerful means for developing complex Web applications. WebSphere Application Server includes WebSphere Studio, for project management, and WebSphere Performance Pack, for managing Web sites with strong performance requirements.

Summary

The move to total business integration and transforming your business processes is not an overnight process. Enterprises should develop a long-range plan and position themselves for the evolution to component-based development. Component-based development allows organizations to be more responsive to new requirements, establish a competitive advantage, and lower the cost of development.

In parallel with the evolution to component-based development you must take advantage of the power of the Web today. In order to remain competitive, improve service to customers, and build new sources of revenue, companies must extend their existing applications and provide new Web-based applications now. IBM has the robust set of tools and solutions to enable a successful Web presence today. Start quickly now, while the evolution to total business integration builds for the future.

Where to go for additional information:

White papers:

OS/390 Guide to e-business Connectors: Second Edition
http://www.ibm.com/s390/nc/connectors/

Web-Enabling CICS Applications: A Selection Guide
Http://www.software.ibm.com/ts/cics/library/#whitepapers

Host Publisher
http://www.ibm.com/software/network/hostpublisher/library/

SecureWay Software Host Integration: A Fast, Flexible and
Uncompromising Web-to-host Solution
http://www.ibm.com/software/network/library/whitepapers/

An Introduction to IMS e-business solutions
http://www.ibm.com/ims

Redbooks:

Web-to-Host Integration Solutions
http://www.redbooks.ibm.com/ (search for SG24-5237)

Host On-Demand 4.0 (SG24-2149-01)
http://www.redbooks.ibm.com/ (search for SG24-2149)

An Introduction to Component Broker on OS/390
(SG24-5601)
http://www.redbooks.ibm.com/ (search for SG24-5601)

CICS Transaction Server for OS/390: Web Interface and 3270
Bridge (SG24-5243)
http://www.redbooks.ibm.com/ (search for SG24-5243)

IMS e-business Connect Using the IMS Connectors
(SG24-5427)
http://www.redbooks.ibm.com/ (search for SG24-5427)

Revealed! CICS Transaction Gateway and More CICS Clients
Unmasked (SG24-5277)
http://www.redbooks.ibm.com/ (search for SG24-5277)

Revealed ! Architecting Web Access to CICS (SG24-5466)
http://www.redbooks.ibm.com/ (search for SG24-5466)

CICS Web Interface the 3270 Bridge (SG24-5243)
http://www.redbooks.ibm.com/ (search for SG24-5243)

Web pages:

Application Framework for e-business
*http://www.ibm.com/developer/features/framework/framework
.html*

Host Publisher
http://www.ibm.com/software/network/hostpublisher

Host On-Demand
http://www.ibm.com/software/network/hostondemand

CICS for Java
*http://www.ibm.com/software/ts/cics/about/modern/cicsjava.ht
ml*

Net.Data
http://www.ibm.com/software/data/net.data/

IMS TOC and IMS Connector for Java
http://www.ibm.com/ims

WebSphere
http://www-4.ibm.com/software/webservers

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