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IBM WebSphere Application Server V5 Web Services Deployment Environment

IBM's Web Services Support Gets Richer and Easier for Programmers

By Susan E. Aldrich

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By Susan E. Aldrich   *June 13, 2002*

NETTING IT OUT

Web Services is the newest technology on the scene to ease the shift to adaptive and inter-twined business processes, and companies are moving rapidly to take advantage of the opportunities Web Services enable.

IBM is a leader in encouraging, enabling and employing Web Services. IBM WebSphere Application Server (AS) V5, a J2EE application server in the mid- to high-end server market, is IBM's primary Web Services deployment environment. WebSphere AS also provides Web Services Infrastructure Services and choreography and workflow support for Adaptive Business Process Environments.

The strengths of WebSphere AS are its reliability, manageability, scalability, and performance; its leading market share (34 percent); the impressive set of Web Services infrastructure services enriched in V5; the commitment of partners; and the availability of IBM Global Services. On the downside, WebSphere AS is complicated to install, which puts the cost of WebSphere AS Web Services out of range for small companies. Also, although the story is improving, the WebSphere product line is not yet integrated into a seamless collection.

Nevertheless, we're betting that, through 2004, WebSphere AS will be the enterprise's first choice for J2EE Web Services development and deployment in environments of any complexity. IBM's Web Services-based integration capabilities for linking a variety of application architectures, middleware implementations, and database platforms, along with its highly-scalable runtime environment, make it the high-end J2EE leader.

LINKING PROCESSES TO DEEPEN RELATIONSHIPS

The Business Appeal of Web Services

Businesses are deploying existing application functions as Web Services, using Web Services to more effectively link business processes. These companies are planning their services architectures to ultimately create more adaptive business processes to better serve customers and seize opportunities.

Much of the Web Services attention to date has been focused on development environments. However, in the long run, we don't believe that development tools will be the battle ground for Web Services leadership. Leading development tools will expand to incorporate Web Services, and Web Services capabilities alone are unlikely to drive the IDE decision. Ultimately, Web Services budgets will flow to the vendors with the best combination of development, deployment, and Web Services infrastructure services. The best deployment environments will offer and support the most valuable Web Services infrastructure services and the best tools for creating and managing adaptive business processes.

For this reason, we are currently focusing our attention on Web Services deployment environments and the Web Services Infrastructure Services embedded in them.

Web Services Technology Landscape

Adaptive Business Process Environment

Adaptive Business Process Environment

Service Infrastructure Services

Billing

Identity

Authentication

Authorization

Auditing

Provisioning

Description

User Session Management

Transaction Management

State Management

Discovery

J2EE

.NET

Application Server

.NET Server

Web Services Deployment

Runtime	Security
Component Deployment	
SOAP	Description

UDDI Services

Directory Services

Directory Services

Web Services Deployment

Runtime	Security
Component Deployment	
SOAP	Description

Development and Assembly Environment

Development and Assembly Environment
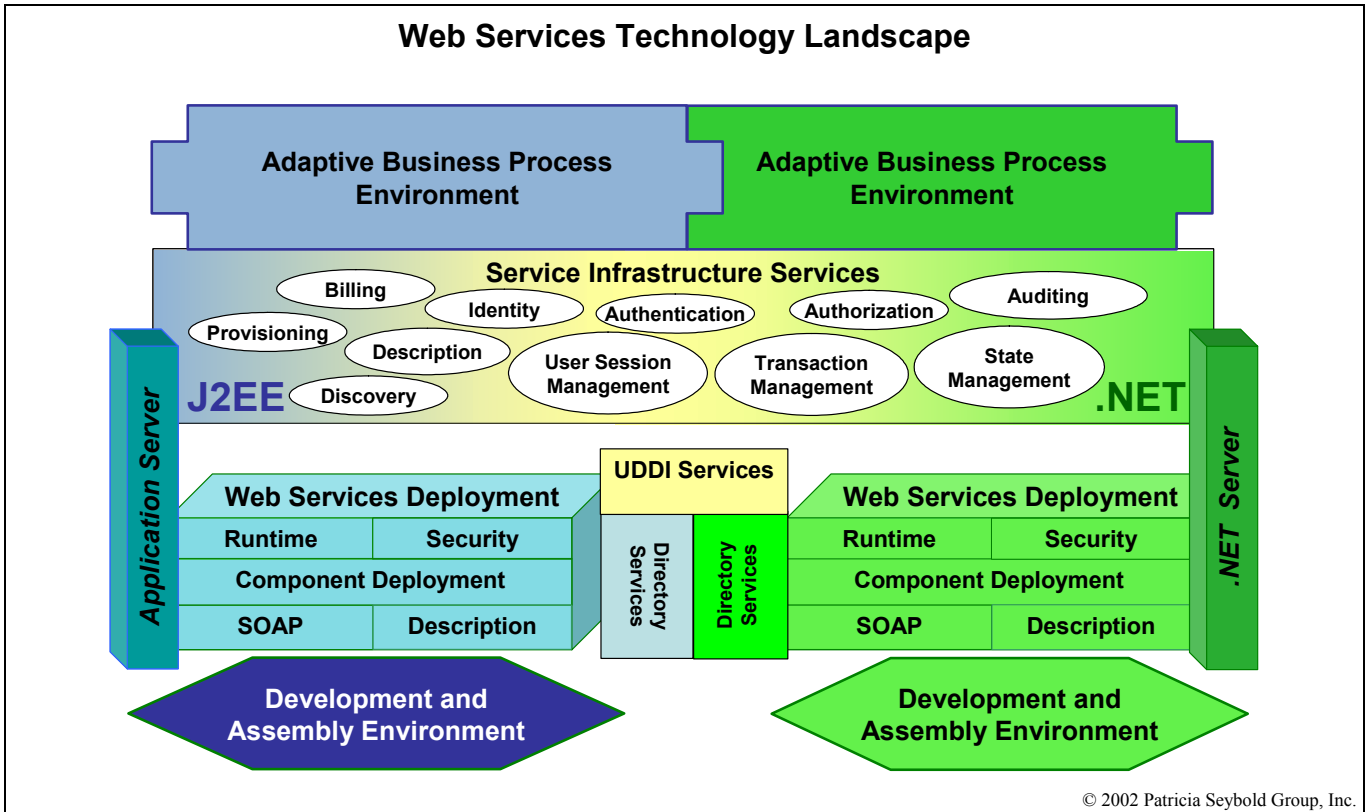
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Illustration 1. The landscape for Web Services includes a range of technologies, spanning both the service requestor's environment and the service provider's environment. In this diagram, the requestor application runs in a .NET environment, and the provider's application runs in a Java environment.

WEB SERVICES DEPLOYMENT ENVIRONMENTS

Web-Services Technology Categories

Generally speaking, the Web-Services technologies you'll be considering include development and assembly environments, deployment environments, directories, Web Service Infrastructure Services, and adaptive business process environments. Service Infrastructure Services are common services that support secure and reliable Web Services and may be provided as separate products, separate services, embedded in application servers, embedded in platforms, or provided by adaptive business process solutions.

Our landscape of the Web-Services space is presented in Illustration 1.

These aren't exactly product categories yet, but are more of a continuum. In other words, the Web-Services market has not yet agreed upon what should be expected from a deployment environment product, orchestration product, or business process management product.

What Is a Web-Services Deployment Environment?

In our view, a Web-Services deployment environment has the following responsibilities:

- **Component Deployment.** Provide tools that will expose existing application parts (components, programs, and objects) as Web Services. This includes creating WSDL, the wrapper, and the SOAP interface for each Web service as well as listing the service on a UDDI registry or other directory.

- **WSDL and XML Schema Support.** Provide descriptions of all deployed Web Services for potential clients and support the XML data typing system.

- **SOAP Support.** Provide, or integrate with, a SOAP service that manages the sending, routing, and receiving of SOAP messages; XML-to-language type mapping; application invocation; and propagation of error messages.

- **Runtime.** Provide an application runtime environment for Web Services with configuration and lifecycle management, provide fault tolerance and recovery, and log, trace, and enable performance tuning of active environment.

- **Security.** Provide runtime services for providers and requestors to verify authentication, proof of origin, message integrity, and message privacy.

IBM AND WEB SERVICES

IBM

IBM, founded in 1911, is the largest IT supplier in the world with 2001 revenues of $85.9 billion. Of that total, services comprised $35 billion, hardware $33 billion, and software $13 billion. First quarter IBM 2002 revenues were $18.1 billion, a decrease of 9 percent from same period 2001, satisfactory results in a painful year for high tech.

Goals for Web Services

IBM aims to provide enterprise quality Web Services through its WebSphere family of products. IBM WebSphere Application Server (AS), the leading J2EE application server, is IBM's primary Web Services deployment environment. WebSphere AS provides Web Services runtime; security; SOAP server and client services; UDDI, WSDL, and XML support, and enables component deployment. WebSphere AS also provides Web Services Infrastructure Services and choreography and workflow support for Adaptive Business Process Environments. See Illustration 2.

IBM expects Web Services to be a key contributor to IBM's current and future software technology leadership. Web Services already permeate IBM's four software brands, WebSphere, Lotus, Tivoli, and DB2.

Opportunities in Web Services

Web Services also round out IBM's portfolio of integration technology offerings, which cover messaging and publish/subscribe middleware and EAI. Even more importantly, they provide an open standardized mechanism IBM can employ to evolve its software collection into an open, standardized, integrated platform. Moreover, being an unfamiliar, hot, and valuable new technology, Web Services are likely to drive considerable demand for IBM Global Services.

Customers see Web Services as providing simpler and more flexible access to the capabilities of these IBM products as well as of corporate and trading partner application portfolios.

Scope of Web Services Contributions

Supporting Web Services so early, and so well, places IBM in a leadership position in the Web Services arena. IBM has been a significant contributor to the specification and reference implementations of the Web Services technologies.

IBM's investments in and contributions to Web Services development include:

- Chair of XML Protocol working group in W3C

- Chair of the Web Services Coordination Group in W3C

- Co-author of SOAP and WSDL specifications

- Co-author of WS-Security and a Web Services security roadmap

- Contributed SOAP4J to Apache open source project, now known as the Axis project

- Contributed reference implementations of UDDI, WSDL and SOAP to Apache

- Leader in creating UDDI project

- Hosts UDDI Business Registry beta

- Founded Web Services Interoperability Organization (WS-I.org), an open industry organization chartered to promote Web Services interopera-
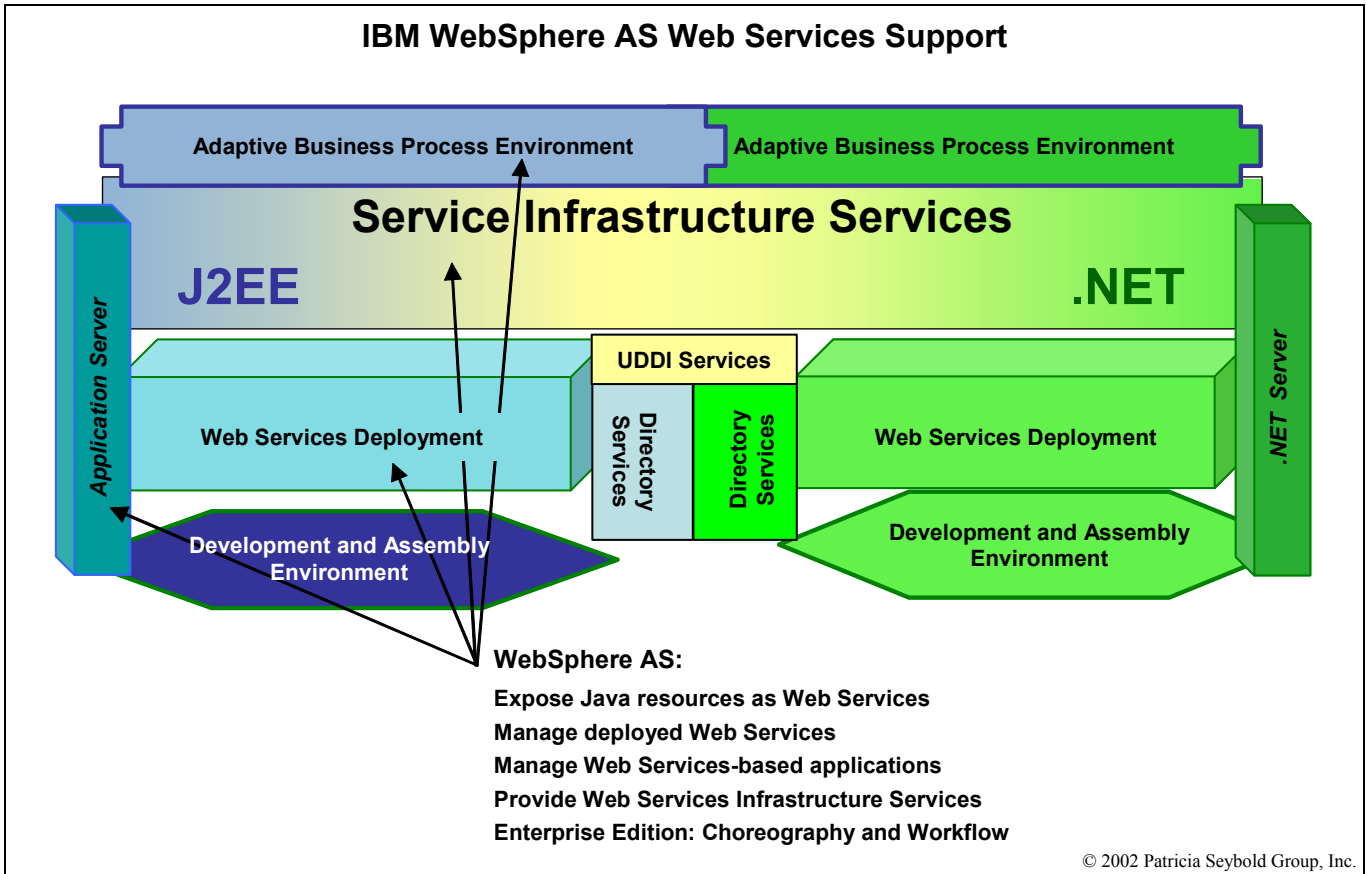
IBM WebSphere AS Web Services Support

Adaptive Business Process Environment

Adaptive Business Process Environment

Service Infrastructure Services

J2EE

.NET

Application Server

.NET Server

Web Services Deployment

UDDI Services

Directory Services

Directory Services

Web Services Deployment

Development and Assembly Environment

Development and Assembly Environment

WebSphere AS:

Expose Java resources as Web Services

Manage deployed Web Services

Manage Web Services-based applications

Provide Web Services Infrastructure Services

Enterprise Edition: Choreography and Workflow

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Illustration 2. WebSphere AS provides Web Services runtime, security, SOAP server and client services, UDDI, WSDL and XML support, and enables component deployment. WebSphere AS also provides Web Services Infrastructure Services, and choreography and workflow support for Adaptive Business Process Environments.

bility across platforms, operating systems, and programming languages

WEBSPHERE APPLICATION SERVER

WebSphere AS was first released in 1999, and has, so far, clocked 12 consecutive quarters of revenue growth. Currently, the WebSphere product family has 50,000 customers. IBM has certified more than 6,000 partner personnel for selling and implementing WebSphere products. WebSphere AS has integration hooks to key IBM products including DB2, Tivoli, and WebSphere MQ, as well as hundreds of ISV solutions.

WebSphere Product Family

Given the success of the WebSphere brand, it's not surprising that IBM now faces the task of reducing the six dozen named products in the WebSphere family to a simpler collection. IBM's strategic goals for the WebSphere product family are to achieve leadership in business integration, establish WebSphere as the heart of world-class open services infrastructure, and support deployment of secure, manageable Web Services that reuse existing applications and data. These products are more integrated with V5 than with V4.

In 2001, IBM committed $1 billion worldwide to WebSphere, its integrated electronic commerce (e-commerce) software, and associated development, marketing, and partners.

WebSphere Studio is a development environment with tools for Web Services development, assembly, and publishing.

WebSphere Editions

WebSphere Edge Server
z/OS
Enterprise Edition
Advanced Edition
Single Server Option

V4 Editions

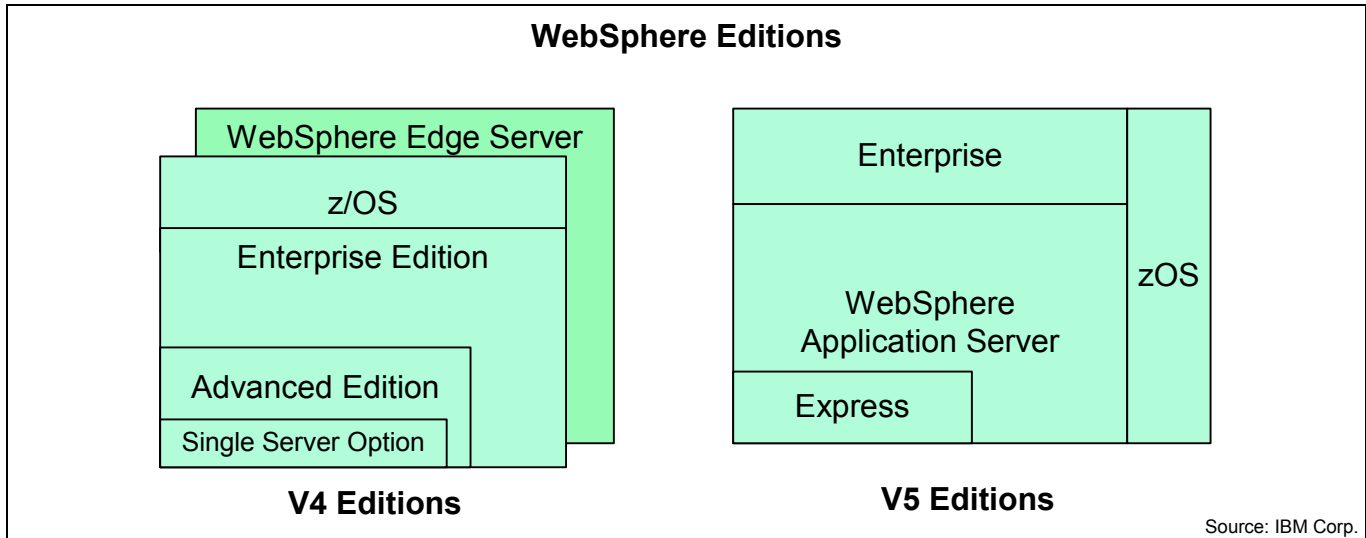| Enterprise	
WebSphere Application Server	zOS
Express	

V5 Editions

Source: IBM Corp.

Illustration 3. WebSphere Application Server editions have been redefined in V5. WebSphere Advanced Edition now corresponds to WebSphere Application Server (AS). In V5, Edge Server functions are now in Application Server. WebSphere Application Server—Express is the new entry-level server. All WebSphere editions support Web Services.

WebSphere Editions

All WebSphere application server editions support Web Services. Like V4, WebSphere AS V5.0 is offered in four editions, but the editions have been redefined. WebSphere editions are depicted in Illustration 3. The four new editions are as follows:

- **WebSphere Application Server—Express.** Simplified application server for dynamic Web site development and deployment.

- **WebSphere Application Server.** The core Web Services and J2EE certified application server, corresponds to V4's Advanced Edition; includes Edge Server functions in the Network Deployment and Extended Deployment configurations.

- **WebSphere Application Server Enterprise.** For creating, composing, and choreographing dynamic, cross-enterprise applications.

- **WebSphere Application Server for z/OS.** J2EE application server for enterprise customers using zSeries hardware and z/OS software.

WEBSPHERE APPLICATION SERVER FEATURES AND FUNCTIONS

The focus of this report on the WebSphere Web Services deployment environment is WebSphere AS V5, announced May 8 for delivery in 3Q 2002. V5 solidifies WebSphere's functional leadership. The differentiating attributes of IBM's WebSphere Web Services deployment environment are as follows:

- Inclusion of key Web Service Infrastructure Services, including authentication, internationalization, and transaction compensation

- WebSphere reliability, manageability, scalability, and performance

- Improved WebSphere integration with IBM infrastructure and platform solutions

- IBM's leadership in Web Services technology and architecture definition

- Commitment of partners

- IBM Global Services

The key features of V5 are summarized in Table A.

Key Web Services Deployment Features in WebSphere V5

Web Services Deployment Environment Function	V5 New Features
Development Tools	• Macromedia ColdFusion MX
Component Deployment	• Web Services Gateway • Web Services Invocation Framework • Workflow choreography as a Web Services • Business rules and internationalization frameworks • Dynamic EJB query • J2C+ adapters as Web Services
Description	• WSDL Version 1.1 processor and generator added to v5.0. • UDDI Registry • Private UDDI registry • UDDDI for Java toolkit and parser runtime—to talk to registry • Improved XML parser runtime
SOAP	• SOAP for Java toolkit and parser runtime • Asynchronous SOAP messages supported
Runtime Engine	• WSIF • QoS management • JMX management support • Advanced transactional support • Rules-based caching and routing of messages • Content distribution framework: • All WebSphere services can be accessed via Web Services
Security	• Java encryption • LDAP Directory support • Plug and play framework; SPIs • Embedded Tivoli Access Manager • Web Services Gateway
Performance	• Boost from content distribution and rules based routing and caching • QoS management
Environment/Configuration	• Configurations—Three: base, Network Deployment ND, Extended Deployment XD, and single server • Distributed, cross-platform topologies
Packaging	• WebSphere Application Server—Express • WebSphere Application Server • WebSphere Application Server • Enterprise • WebSphere for z/OS

Table A. This table summarizes key WebSphere AS features in each of the requirements areas.

WebSphere Provides Key Service Infrastructure Services

Web Service Infrastructure Services are a key differentiator of the WebSphere platform.

We define Service Infrastructure Services as a common set of services required by all Web Services, such as security, management, billing, state management, transaction management, and auditing, among many many others. From the standpoint of reliability, flexibility, adaptability, and productivity, it is critical that common services be isolated from business logic rather then coded into each application, or worse, each application function. They need to be consistent and are best built by specialists. These common functions should be provided as separate Web Services.

Web Services Infrastructure Services are depicted in Illustration 1 as a layer that spans the Web Services environment because these services will come from a variety of sources. Some of these Infrastructure Services will be offered as pay-as-you-go services, much like credit card authorizations are today. More commonly, these services will be built by in-house developers, provided with other technology such as application servers and Web Services frameworks, or sold by software vendors as functional suites to be tailored by IT developers.

IBM offers a rich set of these Web Service infrastructure services with WebSphere AS. Here are some examples of the Service Infrastructure Services provided by WebSphere:

- Web Services Gateway, which enables decoupling of deployment and invocation

- Authentication and authorization services, provided by Tivoli Access Manager, which are embedded in WebSphere

- Activity Session Service, which provides the ability to extend the scope of and group multiple local transactions—group commit for unit of work

- Business rules services, which allow you to define, execute, manage, and schedule rules

IBM offers a rich set of these Web Service infrastructure services with WebSphere AS.

- Dynamic query services, which dynamically define a SQL query statement at runtime

- Application profiling, which checks the application profile at runtime for decisions about resource utilization and runtime calls

- Internationalization service, which automatically adjusts applications to handle time, language, currency and cultural constraints

- Work-area service: scratch pad to share data used by distributed application

- Compensation service, which completes or negates a list of transactions making up a unit of work

Component Deployment

With WebSphere AS, any resource can be exposed as a Web Service. Chief among the component deployment features new to WebSphere AS V5 are the Web Services Gateway, the UDDI registry, and deployment support for additional resources.

WEB SERVICES GATEWAY. The most exciting of these is the Web Services Gateway, an example of a Web Services Infrastructure Service. The gateway provides a level of abstraction that insulates the Web Services you are building from two key environmental issues: firewalls and messaging infrastructures.

Developers should not be building Web Services that are dependent on a particular message protocol, since these Web Services may ultimately interact with many trading partners who have implemented a variety of message protocols. For the same reasons, developers should not be building Web Services that are tailored to specific firewall configurations.

The Web Services Gateway assesses assets and automatically exposes them as Web Services; performs service mapping acting as a proxy for inbound and outbound requests; transforms protocols, for example, from SOAP over JMS to SOAP over HTTP; automates UDDI publication and lookup; and provide a single point of control, access, and validation of Web-Services requests.

UDDI REGISTRY. UDDI specifies an API and data model for directory access, but it also refers to the collection of directory entries, or registry. WebSphere AS provides a UDDI registry.

ADDITIONAL RESOURCE DEPLOYMENTS. V5 adds support for new resources including workflow choreography and J2C+ adapters, which can thus be exposed as Web Services.

SOAP, WSDL, XML, and UDDI

IBM leverages its Apache contributions by incorporating Apache technologies for SOAP and XML. IBM has also invested in improving XML parser performance and in providing tools for connecting Java to XML and UDDI. Standards support is summarized in Table B.

SOAP. WebSphere AS incorporates Apache Soap V2.2, a Java-based implementation of the SOAP 1.1 specification, including support for attachments. No other versions of SOAP are supported. V5 includes the IBM SOAP for Java toolkit and parser runtime.

XML. WebSphere AS includes Apache XML4J, a JAXP-compatible name-space aware parser for Version 3.1 XML, which is required for Apache SOAP. WebSphere AS also incorporates XML-based transformation tools. V5 incorporates XML parser runtime improvements for better performance of XML and XSL processing.

WSDL. WebSphere AS 4.0 supports WSDL Version 1.1. V5 adds a WSDL processor and generator.

UDDI. WebSphere supports UDDI Version 1.0. WebSphere AS provides UDDI4J, a Java API for the UDDI registry. WebSphere AS V4.0 does not include a private UDDI registry. This is available as a free download from the WebSphere Developer Domain.

V5.0 adds the private UDDI registry, a UDDI Version 3.0 interface, and the UDDDI for Java toolkit and parser runtime for interaction with the UDDI registry.

Runtime Engine

A Web Services runtime engine is a Web-Service container responsible for processing SOAP messages and converting them into application invocations and vice versa. In the process, the runtime engine maps language types to XML types and XML types to language types, dispatches requests, processes and propagates exceptions, and manages the applications under its control.

RELIABILITY, MANAGEABILITY, SCALABILITY. IBM WebSphere AS runtime strengths are its reliability, scalability, and manageability. IBM's decades of experience in building highly-reliable and -manageable operating systems have clearly been applied to WebSphere AS.

WebSphere AS has several features that make it possible to manage collections of servers, control the number of configuration variations the operations staff has to deal with, and make it easier to deploy or redeploy servers, which provide the management functions designed to operate on collections of resources and make reproducing a set of configuration attributes fool proof.

Standards and Extensibility

Protocol Stack	Support	API / Plug-In
Web Services Transport	HTTP, HTTPS, JMS, SMTP, IMAP, POP3, IBM WebSphere MQ messaging	Yes
	Protocol independence via WebSphere Gateway	
XML Messaging	SOAP 1.1 compliant stack	Yes
	XML Schema 1999/2000/2001	
Web Services Description	WSDL 1.1	No
Web Services Discovery	UDDI 1.0	No

Table B. WebSphere AS supports Web Services standards.

New with WebSphere AS V5.0 is support for JMX, a standard way of managing J2EE environments that exposes administrative data to management products such as IBM's Tivoli among myriad others. V5 also provides an XML-based administrative client.

To improve quality of service management (QoS), V5 provides rules-based routing and caching. This feature improves responsiveness for customers and throughput for processes. The WebSphere AS runtime analyzes requests at the edge of the network and prioritizes them based on who is making the request and what the request is for.

A related effect is provided by the Content Distribution Framework, which moves content closer to user to optimize performance.

A related feature, application profiling, enables QoS decisions by providing a stream of application execution information, such as resources required.

MESSAGING FEATURES. Another WebSphere AS Web Services runtime differentiator is integration with the WebSphere MQ messaging infrastructure, enabling WebSphere deployed applications to send, transform, and route messages via the highly reliable MQ messaging.

WEB SERVICES ENVIRONMENT. V5 allows all functions in WebSphere AS to be accessed via Web Services interfaces. This makes it easier for programmers to leverage WebSphere's Service Infrastructure Services in building reliable, manageable Web Services-based applications.

PROGRAMMER FEATURES. Beyond the arena of manageability, WebSphere AS V5 provides very attractive Web Service runtime features for programmers. Here are the key features for Web Services deployments:

- **Web Services Invocation Framework.** A key new feature available in V5.0 is the Web Services Invocation Framework (WSIF), which is another of WebSphere AS's Service Infrastructure Services. WSIF provides a layer of abstraction that insulates developers (and their code) from succeeding versions of SOAP and, in fact,

AS V5 provides very attractive Web Service runtime features for programmers.

from any protocol dependence. It also relieves developers of a performance optimization headache, because WSIF automatically connects Web Services on the most efficient mechanism available. SOAP is currently considered to add noticeable amount of processing overhead to message handling. If Web Services requestors and clients are running in the same environment, WSIF can choose a SOAP-less binding.

- **Advanced Transactional Support.** V5 provides last participant support, which eases the effort of coordinating updates in a unit of work comprised of two-phase commits and one-phase commit resources. Activity Session Service simplifies coordination of multiple local transactions.

- **V5 Compensation.** V5 provides services that reduce the complexity of defining and executing roll-back for a unit of work.

- **Internationalization Framework.** This framework organizes locale-based specifications, such as currency, taxes, regulations, and user interface differences, to ease the programming task of internationalization.

- **Work-Area Service.** Programmers can now use a shared scratch pad to coordinate activities of distributed applications.

- **Dynamic Query Services.** WebSphere applications can now receive dynamic SQL query statements; EJB query statements and parameters can be passed at runtime.
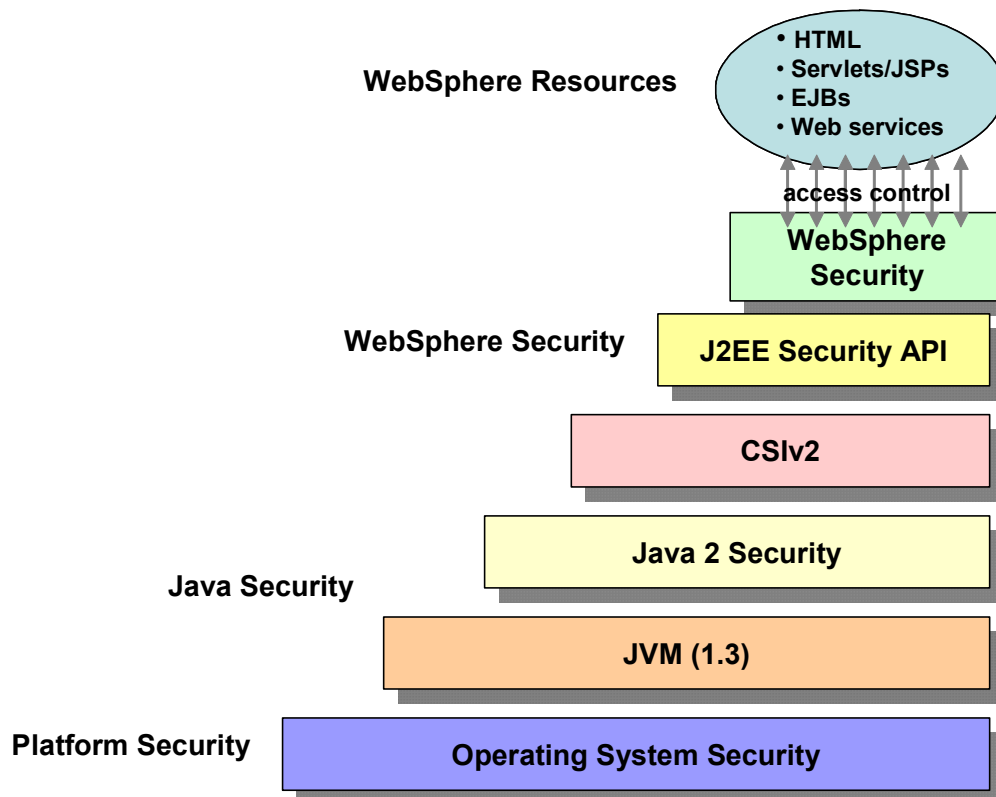
Security

Customers are confused and concerned about Web Services security, and understandably so. Adding new entry points to your business systems is never without risk.

There are a number of issues to consider in this area. These are the executive-level concerns:

1. Are the Web Services messages safe?

Security Layers from Platform to Web Services

WebSphere Resources
- HTML
- Servlets/JSPs
- EJBs
- Web services

access control

WebSphere Security

WebSphere Security

J2EE Security API

CSIv2

Java Security

Java 2 Security

JVM (1.3)

Platform Security

Operating System Security

Source: IBM Corp.

Illustration 4. Resources, and the functions that secure them, occur on several levels. Web Services represent another application technology that must be supported by existing security infrastructure.

2. Is use of the Web Service adequately controlled?

3. Does the Web Service enable access to resources I thought were controlled but aren't?

4. Am I comfortable that the users (programs and people) of the Web Services have been correctly identified (by my systems or by my trading partners' systems)?

Questions 2 and 3 are the responsibility of your programming and operations staff. The most difficult question is #4 because of its impact on business relationships and business opportunities.

Question 1 is the only question that is addressed by Web Services standards and implementations. Security is provided at several levels in the technology stack before WebSphere and Web Services se-

curity come into play. WebSphere AS supports a cascade of security standards and services, including operating system, Java, and J2EE. See Illustration 4.

It is WebSphere's challenge to support the existing standards, reducing overall risk, without unduly complicating the security issues. WebSphere AS supports existing standards and provides tools and capabilities to mesh with existing security infrastructures. This simplifies security implementation somewhat and also reduces overall risk. Making security less complicated in the J2EE environment isn't a reasonable goal for a single vendor—certainly not for IBM.

In the Web-Services arena, WebSphere provides basic SOAP security support, which includes authentication, asymmetric secure sockets layers, SOAP digital signature, and symmetric HTTPS. These features have the effect of protecting message

integrity and enabling Web Service clients and servers to exchange credentials.

WebSphere AS itself provides broader security features which include authentication policies and services, authorization policies and services, delegation policies, trust policies single sign-on support, and password encoding in configuration files. Authorization control is at the application or Web-Services levels, for methods within a Web service. This high degree of granularity makes it more feasible to use existing resources as Web Services because you control which methods are exposed.

WebSphere AS V5 improves security and security management for Web Services. The following features are key features of WebSphere security:

• **Java Encryption.**

• **VJAAS Support.** Java Authentication and Authorization Service secures J2EE applications.

• **LDAP Directory Support.**

• **Security Framework.** Security implementations vary widely. The V5 security framework provides security program interfaces (SPI) which enable companies to plug in preferred authorization and roles engines.

• **Embedded Tivoli Access Manager.** V5 ships with embedded Tivoli Access Manager (formerly known as Policy Director) which provides a single repository, authentication and access control for Web Services. Access Manager is not a single sign-on solution, but interacts with such solutions. If you haven't yet standardized your security services, consider using Access Manager.

• **Web Services Gateway.** We've mentioned the gateway already. The gateway provides a set of interceptors, or proxies, that enable Web Services to work through the existing firewalls in your trading network. The gateway spares your programmers the task of building their own, which they would surely be forced to do otherwise.

WebSphere AS does not support GSS-API, a standard for end-to-end authentication and authorization services.

WS-SPECIFICATION. Web Services security (all security, for that matter) needs to be simpler and more standard, to make it easier for corporations—and departments—to work together and to share resources. The world is thirsty for frameworks and standards in this arena. IBM and Microsoft are working with other standards bodies, customers and partners to evolve the Web Services security model, and WS-Security Specification is the first step on this path. It defines the core facilities for protecting the integrity and confidentiality of a message, and associating security claims. We hope that within a few years, this set of specifications, assuming it continues to develop, will have the effect of simplifying the security mess.

ARCHITECTURE

Organization

The key components of WebSphere AS include the Administrative Domain, an embedded HTTP server, Application Server JVM, and Web and EJB containers. See Illustration 5.

Structure

With V4, WebSphere AS shifted to a single J2EE-compatible code base supporting all editions. The V4 architecture was not modular; modularity is introduced in V5. With V5, customers can deploy sets of features as needed. Editions become a pricing matter rather than a packaging matter. Features themselves are constructed, as much as possible, as services within WebSphere.

WebSphere's internal features are now exposed as services, accessible to Web Services.

Performance

WebSphere is built to support large- and very-large-volume processing. Visa, a WebSphere customer, processes tens of thousands of transactions per second on WebSphere platforms. Those are not Web Services transactions, but they are an indicator of WebSphere's scalability.
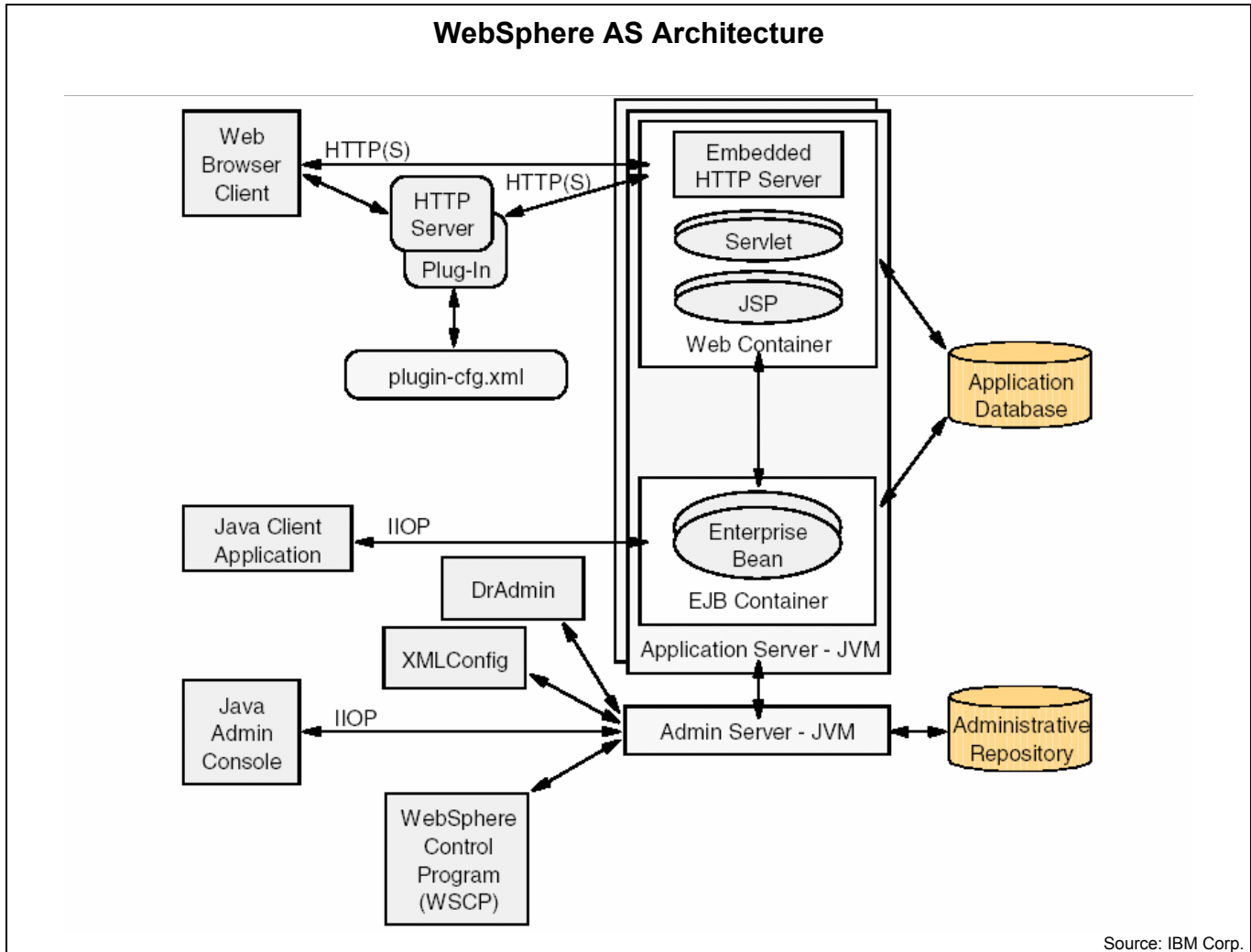
WebSphere AS Architecture

Illustration 5. This diagram depicts the major components of WebSphere AS.

We've already discussed the critical contribution WebSphere management capabilities make to scalability. Another dimension of WebSphere scalability is provided by features such as workload balancing through a single-system image across clusters. V5 enhances workload management by increasing the intelligence of application-level load balancing, through automated advisors, weighted round-robin, and exposing workload information to management programs.

Another key contributor to scalability is a tunable and performance-balanced environment. Industry benchmarks serve as a measure of not only raw power, but the tenability of the deployment environment. Although Web Services-specific benchmarks have not yet been developed, WebSphere's excellent performance in J2EE benchmarks, as well as customer environments processing tens of thousands of transactions per second, put WebSphere at the high and very high end of the processing range, at very good price-performance ratios.

Environment and Configuration

WebSphere AS supports distributed, cross-platform topologies that incorporate Unix, Linux, OS/400, Windows, and S/390. As we've mentioned, clustering, failover, and management features are provided to support complex and reliable WebSphere configurations.

WebSphere V5 editions are available in three configurations: single server, Network Deployment (ND), and Extended Deployment (XD).

Standard deployment is optimized for simpler administration and provides dynamic caching, browser-based administration, and database support.

Network deployment is optimized for distributed multi-server configurations. This deployment option provides workload management, clustering and failover, distributed administration, dynamic network caching, the UDDI registry, and the Web Services Gateway.

Extended deployment option is optimized for edge of network and decentralized deployments. This option provides multi-domain work load management and failover, content distribution framework, service caching, rules-based routing, dynamic edge-of-network caching, and advanced security services.

MARKET

Positioning

IBM is today's leader in encouraging, enabling, and employing Web-Services technologies. Web Services adds the final chapter to IBM's integration story. IBM identifies five types of integration required by customers: user interaction, process integration, application connectivity, information integration, and a category IBM calls *build to integrate*, the slot filled by Web Services.

IBM is set on strengthening WebSphere's position, and its Web Services mindshare, by continuing its strong investment in developing Web Services specifications and standards, in particular in the realm of security and complex transaction support.

IBM is differentiating WebSphere on its classic strengths of reliability, manageability, and scale. It is differentiating WebSphere's Web-Services support by adding key Web-Services infrastructure services, which help guide customer Web-Services architecture-decision, and provide a real boost to Web Service development projects. Once these Web Services infrastructure services are employed, of course, the application is dependent on IBM WebSphere AS.

Web Services adds the final chapter to IBM's integration story.

Target Customers and Industries

IBM sells WebSphere into every industry. The WebSphere decision is generally made at an executive level, typically a director involved in e-business, a director or VP within IT, or the CIO. The decision is heavily influenced by assessments and requirements from IT architecture, development, and operations.

Pricing and Platforms

WebSphere is available on 35 platforms, including Microsoft Windows NT, Windows 2000, Linux, HP-UX, Sun Solaris, IBM AIX, Red Hat Linux, TurboLinux, SuSE Linux, Novell Netware, IBM OS/400, IBM z/OS, and Linux for IBM e-server zSeries.

WebSphere AS V5 pricing has not yet been finalized; IBM states that the pricing will be consistent with V4 pricing. (WebSphere AS V4 pricing ranges from $795 per CPU for Standard Edition to $35,000 per CPU for Enterprise Edition.)

Company and Product Viability

IBM and WebSphere are strong brands. Have no fears that either will be disappearing from the scene.

Vendor's Technical Support

There are two support programs to consider: support for IBM customers and support for IBM business partners.

IBM's customer support provides online self-support, online training, classroom training, downloadable patches for all severity 1 and most severity 2 problems that have been reported, and phone support for a customer's technical support team.

IBM business partners have access to the same support services through IBM PartnerWorld for Developers. In addition, IBM has established development centers called Solution Partnership Centers and WebSphere Innovation Centers where partners can learn WebSphere while working on their WebSphere-related products.

IBM Global Services has 1,000 consultants trained for Web Services implementation work.

Competition

Enterprises commonly have both Java and .NET technologies. It's not a question of which environment to use to extend existing applications into the Web Services arena; developers and architects will apply their current tools, whether Visual Studio and .NET, Macromedia and JRun, or WebSphere. But there is an open question on which platform will attract the development and deployment budget where there is a choice. One such choice, addressed daily, is which environment will be used to build the additional business process glue in Web-Services projects. Part of the answer is in deployment and runtime, and IBM has a good story with WebSphere AS. Another evaluation point is in links to software and databases, and IBM has another strong story with hooks to DB2, MQ, and WebSphere Business Integrator, as well as 170+ partner solutions.

IBM's WebSphere family has evolved to a highly reliable, scalable and manageable integrated platform. WebSphere AS has been steadily gaining mindshare and market share for the past 12 months.

Two tough rivals have moved to change the application server game. Both Sun and Microsoft have strategies to undercut the importance and value of an application server by combining the application server functions in the base operating system. If Sun and Microsoft succeed in defining the operating system as the source for application server functions, IBM could have a tough time justifying the $8,000 to $35,000 per CPU price tag for WebSphere AS. Sun is currently taking Unix market share away from IBM, and, given the move to fold application server function into Solaris, this can't be happy news for IBM.

There are other Web Services and J2EE application servers out there that are, price-wise, way out of IBM's league. Macromedia's JRun, for example, is likely to satisfy customer requirements for all but the highest end, and its price tag is 10 percent of WebSphere's. And you can install it yourself, sparing you the cost of IBM or partner professional services.

> *Sun and Microsoft have strategies to undercut the importance and value of an application server by combining the application server functions in the base operating system.*

CONCLUSION

Weaknesses

A J2EE application environment is complicated, and WebSphere AS doesn't tend to simplify it. If IBM wrote the book on manageability, they included several chapters on complexity. When you've finished making WebSphere bullet proof, what hair you have left will have curled.

The intricacies of WebSphere AS deployment deter IBM from delivering a low-end WebSphere AS version for small companies, unless it can be packaged as part of an industry-specific solution from IBM's application software partners.

An issue with all J2EE environments, including IBM WebSphere AS, is that vendor extensions are almost unavoidable. It's difficult to retain architectural standardization or application portability when IBM offers so many enticing, WebSphere-only services.

Strengths

IBM has emerged as the Web Services leader. There are four reasons that IBM has such a strong Web Services position: WebSphere's market leadership, IBM's early investments and early leadership in Web Services, IBM's partners, and IBM's integration technology and services portfolio.

WebSphere AS is a rock-solid J2EE deployment environment and the leading J2EE application server. There is little doubt that WebSphere will hold the same position in the Web Services arena.

IBM's early contributions to Web Services standards and specifications have given IBM development a head start, with Web Services technologies now incorporated in Lotus, Tivoli, and DB2 families as well. The early involvement has also served to capture Web Services mind share.

IBM has a strong development tools story in WebSphere Studio AD and the open source Eclipse environment, plus a developer community and Web site that rivals Microsoft's. IBM's partner programs have been honed over decades of experience, and IBM is coordinating all partner Web Services sup-

port through the Web Services on WebSphere (WoW) program. Although they don't use our terminology, IBM provides very valuable Service Infrastructure Services in WebSphere V5. These Service Infrastructure Services reflect IBM's embrace-and-extend strategy. The services are extremely valuable for programmer productivity as well as reliability and manageability.

Bottom Line

We're betting IBM dominates the J2EE Web Services arena for the next year. WebSphere's market position is very strong, and IBM has gotten an early enough start that the careful pace of IBM product development won't put WebSphere at the back of the pack in the feature race. The result will be that partners and customers will continue to place their chips on the IBM pile at an accelerating rate.

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