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WebSphere Application Server, Version 5

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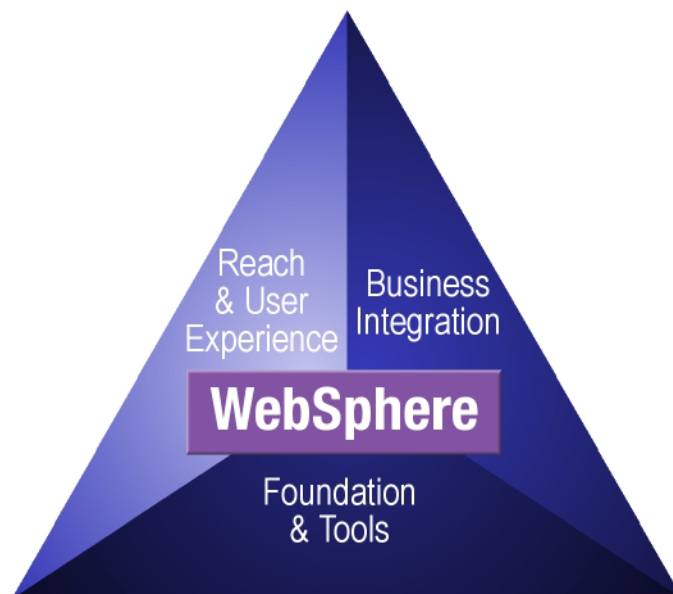
Executive Overview

WebSphere Application Server, Version 5 is a proven, agile e-business platform designed to support today's business imperatives. *WebSphere Application Server, V5* facilitates reducing overall costs, improving customer loyalty, and adapting quickly to exploit new business opportunities.

Serving as an OS for the Internet, *WebSphere Application Server, V5* provides:

1. *A comprehensive open standards-based integration platform*
2. *A highly integrated application development environment*
3. *Agile application deployment and administration*
4. *Intelligent end-to-end application optimization*

Overall, Version 5 provides new features in support of dynamic applications, improved ease of management, and support for the latest J2EE and Web services standards. Version 5 also builds on WebSphere's history of scalability and performance with new automated performance tuning and load-balancing services. Version 5 is available in several configurations across a wide range of platforms eliminating the need to over-investment today yet maintaining growth options for the future.

WebSphere Application Server fully integrates with the WebSphere Studio application development platform, which based on the Eclipse open source project. This combined development and deployment environment supports rapid time to market of new applications and dramatic improvements in asset reuse across the organization and over time.

WebSphere Application Server and Studio provide a common foundation for IBM software including the rest of the WebSphere family, Tivoli management, Lotus collaboration, and DB2 data management products. As a result, WebSphere Application Server and Studio provide not only immediate impact with today's projects but also a highly extensible platform that will continue to deliver efficient returns as you employ new portal, commerce or business process integration projects in the future.

The paper begins with an overview of the changing role of the application server within an e-business solution. This is followed by a discussion of four primary areas of function provided by *WebSphere Application Server, V5*. Each functional overview includes a description of customer requirements, the specific technologies WebSphere Application Server and Studio provide and examples of how these technologies can be applied to achieve the desired benefits.

Evolving Role of Application Servers

From Point Product to Internet "OS"

The In the early stages of e-business, application servers, integration servers and customer relationship management servers all had their own technology stacks. Over time, it became clear that the core "engine" required to build, deploy and manage any application containing new business logic could be defined as a single set of core application server functions. And, if this common engine could be standards-based, it could more quickly and easily become the foundation for any number of specialized software packages.

This evolution to a common underlying infrastructure for e-business is taking place rapidly because "an OS for the Internet" directly addresses acute problems faced by many enterprises, independent software vendors and solution providers. These organizations grapple with improving their asset efficiency, improving control over decentralized operations and increasing infrastructure flexibility to rapidly respond to business changes.

These plain goals are very difficult to achieve when faced with the realities of today's computing environment. Some major characteristics of this environment are:

- The world is heterogeneous. Almost every organization uses a variety of hardware and operating systems and programming languages. Anytime an organization needs to connect with another business, yet another assortment of technology platforms must be negotiated.

- Packaged and custom-build applications have sprung up, disconnected, throughout the organization. These applications need to be managed, secured and sometimes even integrated.

- Developer productivity is a question mark. Existing skills have to be leveraged. New skills have to be learned. Assets need to be integrated by the people on staff today.

- The available resources are constantly changing. Vendors are going out of business. Budgets are shifting. New assets cannot be readily acquired.

This challenging environment means an OS for the Internet must meet several robust requirements in order to deliver an efficient and flexible infrastructure. It must provide:

1. Comprehensive build-to-integrate platform
2. Highly integrated development and deployment environment
3. Agile deployment and ease of management
4. End-to-end intelligent application optimization

The features in *WebSphere Application Server, V5* are designed to work together to deliver on these core requirements.

Comprehensive "Build-to-Integrate" Platform

Almost all new applications require integration with other applications and existing enterprise systems. Specific integration requirements include:

❖ Integrating and reusing existing IT assets within a dynamic e-business infrastructure

❖ Increasing developer productivity while composing integrated application

❖ Creating flexible applications that allow easy updates in the future

❖ Combining synchronous application server services with asynchronous messaging

Services Oriented Architecture

Version 5 of WebSphere Application Server and Studio fully implement and leverage a services oriented architecture based on Web services and J2EE standards. Because *WebSphere Application Server, V5* features an open approach to transforming any application asset into a modular service, these services are then accessible for reuse by other developers throughout the organization. WebSphere provides visual tools for developing business objects, business logic, and integration logic which are all compatible, using one repository for metadata and a single approach for defining data handling and transformation.

A services oriented architecture not only aids internal development and integration but also provides a standardized method for publishing encapsulated business services in order to drive B2B collaboration and new revenue streams. Examples Web services include stock quotes and charting, credit card verification and payment processing, integrated travel planning, and auctions.

WebSphere Application Server, V5 provides leading Web services capabilities including:

❖ Support for the latest Web services standards including SOAP 1.1[1], and access and security updates, all natively integrated with the J2EE programming model. SOAP is widely viewed as the backbone to a new generation of cross-platform; cross-language distributed computing applications, or Web services. The Apache SOAP architecture, which is incorporated in *WebSphere Application Server, Version 5*, defines a set of stable, published interfaces for component-oriented deployment.

❖ Intuitive interfaces for utilizing the latest Web services standards like SOAP (Simple Object Access Protocol) and WSDL (Web Services Description Language).

❖ Information connectivity via pre-built and tailored application adapters using the latest Web services standards for generation and service composition.

❖ Web services-based invocation framework providing protocol flexibility and easy-to-use tools that generate Web services applications.

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[1] SOAP allows for easy, standardized access to public and private registries and other Web services applications. SOAP is the Web services version of RPC (Remote Procedure Call), an XML-based protocol and encoding format for inter-application communications

❖ UDDI (Universal Description, Discovery, and Integration) registry for use within the enterprise or between trusted parties. The UDDI registry provides a secure dynamic mechanism by which services can be published and consumed. WebSphere also supports use of the Public UDDI registries.[2]

❖ Support for Web services gateways. These gateways offer more security and protection by filtering Web services access to registries and other applications as suitable for B2B solutions.

WebSphere's services oriented architecture provides critical flexibility. Specific features in the application server products build on this foundation to meet customers' demanding integration requirements.

Integrated Connector Architecture

New Java-based applications frequently need to integrate existing legacy assets with new business logic written in Java. The ability to create new applications which incorporate a variety of enterprise resources quickly and easily is a key requirement across a variety of industries. Businesses are looking for new ways to reduce the amount of complex underlying coding required to create these dynamic applications without sacrificing transactional integrity. For example, what if an insurance or telecommunications company which stores a multitude of customer data utilizing IBM CICS now needs to integrate this information within their J2EE environment. How does it efficiently accomplish this task?

WebSphere Application Server, V5 delivers a productive environment for visually creating dynamic application adapters that can be easily integrated with others within complex, multi-mode transactional schemes. WebSphere Application Server leverages the J2EE Connector Architecture (JCA) which provides a consistent way of connecting to and communicating with a wide range of enterprise systems and applications, and extends it to provide advanced transaction coordination..

The J2EE Connector Architecture defines function that *WebSphere Application Server* provides and which back-end system vendors (e.g., IBM CrossWorlds, SAP, PeopleSoft, Siebel, Oracle, and/or third-party connector developers) can use to plug into J2EE.

JCA defines a set of service contracts that a connector developer can expect will be available to the adapter at application runtime. The three services defined in 1.0 and implemented in WebSphere *WebSphere Application Server, V5* include:

❖ **Connection management** enables *WebSphere Application Server* to create and manage connections to back-end systems. *WebSphere Application Server* also implements connection pooling, since connections to back-end systems are expensive.

❖ **Transaction management** supports transactional access to underlying resource managers. This service enables the transaction manager provided within the EJB server to manage transactions across multiple back-end systems.

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[2] Public registries enable anyone to publish their services and for other, effectively anonymous users to locate them and understand how to use them. Normal access restrictions will still apply from a technical and business perspective. These are operated currently by IBM and Microsoft®, and will be shortly joined by HP and SAP.

❖ **Security management** enables the developer to define security between the EJB server and the back-end system. The specific security mechanism that is used is dependent on the security mechanism provided by the back-end system.

Becuause *WebSphere Application Server,* V5 implements a services oriented architecture and sufaces that architecture to developers through a visual tool, connectors can be easily accessed and integrated into workflows via the visual WebSphere Studio integration perspective.

Compose long-running workflows

WebSphere Application Server, V5 provides the ability to integrate Web services into long- running workflows which leverage new and existing applications. Being able to easily choreograph application interactions allows for real-time adjustments in the future. With new *WebSphere Application Server, V5* features, applications can be generated with adaptable intra-application flows and behaviors that can be changed dynamically via human interactions or rules engines. The figure below outlines an example of how a multitude of services could be combined and choreographed within an integrated workflow.
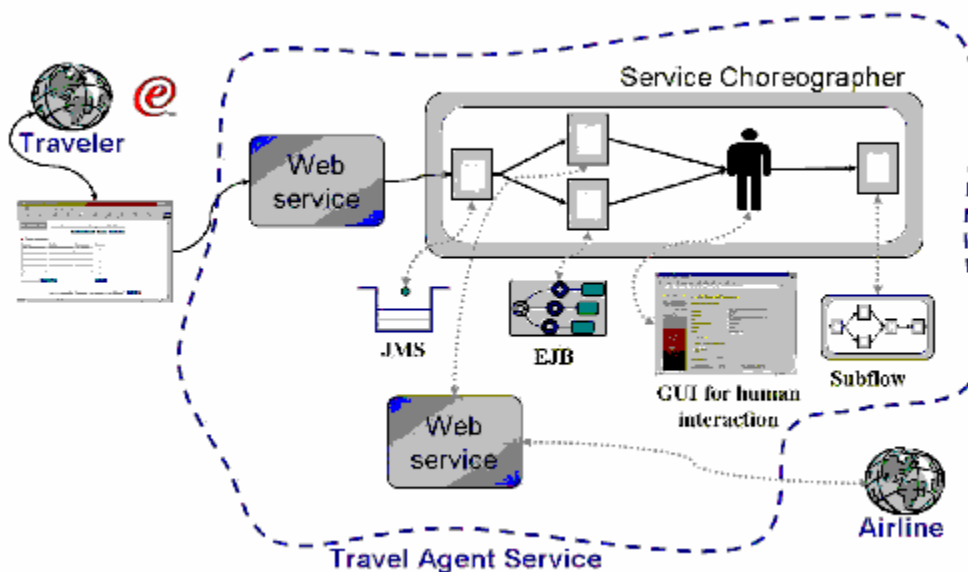
The diagram above outlines WebSphere Application Server workflow capabilities. Long running business processes (macroflows) encompass shorter running, synchronous "activities" (microflows). These long running flows can be exposed as services which process a series of activities which can be reversed if one or more activities fail. For example, a service called BookTravel could combine a series of activities called Bookcar, Bookflight, and Bookhotel. If one of these activities fails, the entire service is "rolled back" and undone. These services could also support human interaction as an activity. Multiple services could be combined into a single service. This flexible programming model promotes the future reuse of existing services.

WebSphere Studio provides a visual services choreography tool to create and assemble services into workflows. WebSphere Studio also provides application usage profiling and a business rules engine that can be populated dynamically for controlling a Web services-oriented architecture--as well as EJB transactions.

The following figure displays WebSphere Studio Application Developer with visual workflow composition capabilities.
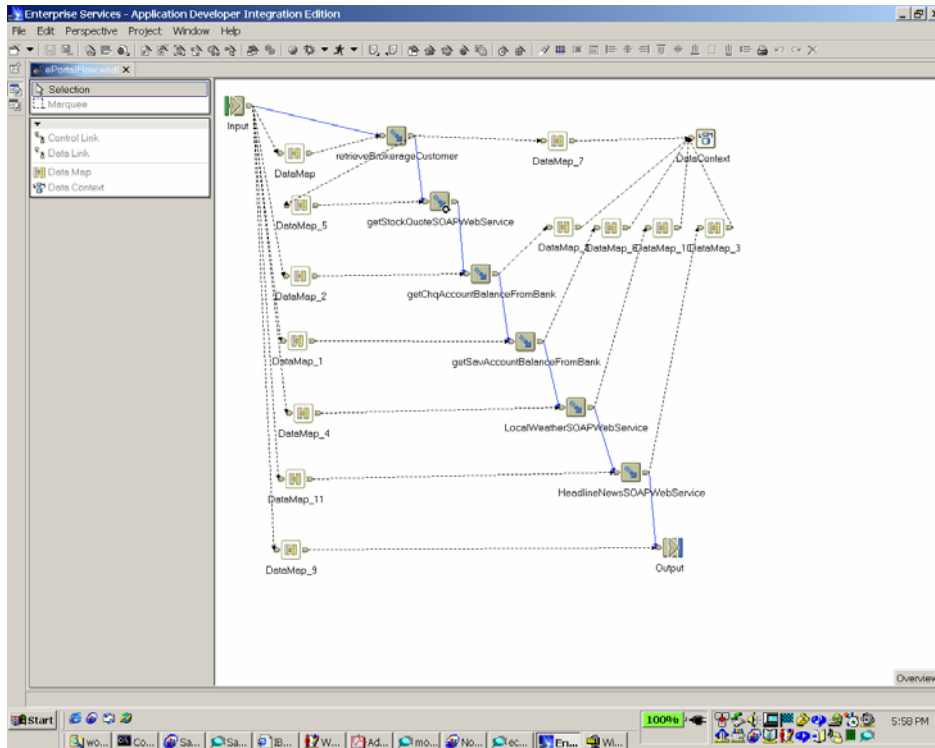
Application Flexibility

By implementing a services oriented architecture, *WebSphere Application Server and WebSphere Studi0, V5* facilitate the creation and maintenance of flexible applications. The products provide specific tools to help customers and solution providers exploit this capability and make changes to applications on the fly without re-coding.

Many businesses today across different industries rely on various business policies and rules as part of their business processes. For example, the insurance industry relies heavily on regulations – both government and self imposed -- which determine insurability. Meanwhile, the telecommunications industry constantly faces regulatory policy changes. Businesses need to be responsive to these changes. *WebSphere Application Server, V5* provides a business rules framework and an internationalization framework to help with these types of scenarios.

Business Rules Framework

The WebSphere business rules framework provides the ability to define, execute, manage, and schedule the rules that encapsulate variable business policy. Any discrete unit of business logic can be

expressed as an externally managed rule. Developers initially create or select a rule that will be triggered from an application. Business analysts or administrators can maintain the rule thereafter without programmer involvement. This framework decreases maintenance and testing costs, increases the consistency of business practices, allows for reuse of policies across business processes, and provides the ability to identify and correct conflicting rules across the business.

The following figure displays the WebSphere Application Server business rules console. Business analysts can define when rules should take effect as well as end dates and rule classification.
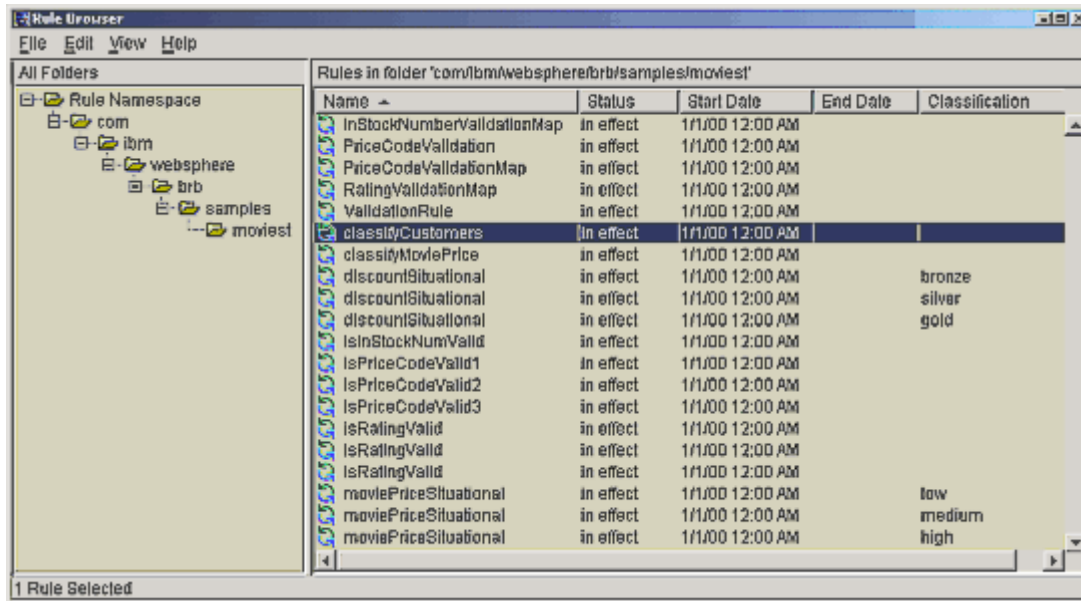
Businesses can use this rules framework to enact changes to risk classification policies dynamically and respond to a myriad of state and regional regulatory changes in real time. It can also be used to proactively create and manage service levels. For example, businesses can dynamically classify their best customers and then offer these customers the highest levels of service. Overall, the business rule framework provides the ability to gain control over where and how business rules are defined, and exactly when critical business rule changes should take effect.

Internationalization Framework

WebSphere's internationalization framework provides the ability to extend applications to global constituencies with ease. It provides the framework to display content using appropriate local language conventions and currencies and to account for client time zones as time-sensitive transactions are processed. The WebSphere internationalization framework eliminates months of programming costs and significant maintenance IT costs typically associated with expanding into international markets.

Businesses trying to take advantage of global opportunities now have the ability to deliver intelligent applications that account for customer's language, geography, formatting rules, sorting algorithms, and time zone.

The internationalization and business rules frameworks in WebSphere Application Server, V5 improves the end-user customer experience through increased personalization while improving IT resource utilization through decreasing programming costs and increased application flexibility. Both of these frameworks have been submitted to industry standards bodies for consideration as future standards. Both address outstanding customer problems today.

Integration of asynchronous messaging services

A powerful part of "build-to-integrate" is building new applications that initiate and respond to asynchronous invocations, conversations, and broadcasts. *WebSphere Application Server V5* delivers extended services for mixed synchronous and asynchronous transactional environments as part of the native J2EE 1.3 and Web services environment. A comprehensive, self-contained Java Message Service (JMS) implementation that encompasses queue management and publish/subscribe components is included in the product.

Java™ Messaging Service relies on concepts established in the application messaging market for a number of years. JMS is based on the concept of a JMS "consumer" application (for example an Enterprise JavaBean™ or EJB™) listening for the arrival of a message on a queue, and then executing some business logic based on the message (for example updates to an online catalog), and possibly put a response (such as an acknowledgement) on a response queue. A new specification in J2EE 1.3, EJB 2.0 Message-Driven Beans includes the concept of a "listener" interface with the EJB container which monitors the appropriate queues.

The following figure depicts a publish/subscribe process through a JMS framework.
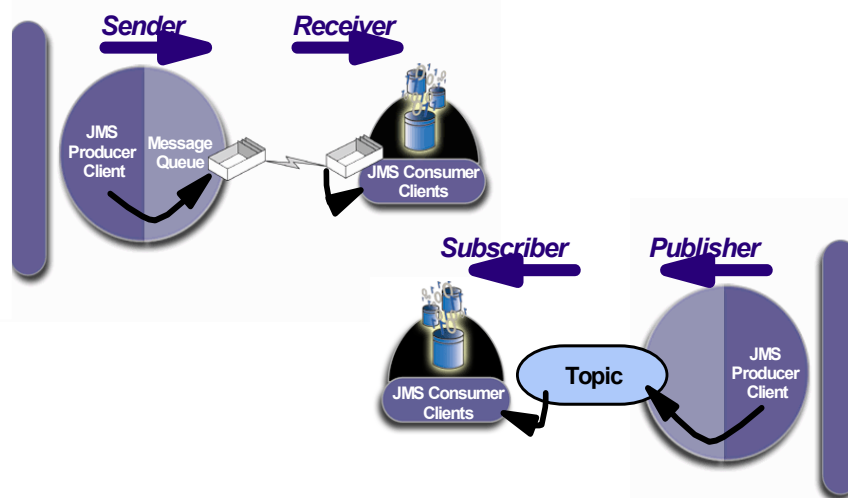
 WebSphere Application Server, V5 also implements a publish/subscribe message broker, where messages are published to a broker against an identifying topic. The messages are then distributed to subscribers whose registered subscriptions match the published messages. All of this is done within an environment that provides fault-tolerant clustering and load balancing, as well as full support for distributed transactions for a more robust implementation of JMS--offering high-performance publish/subscribe technology.

WebSphere Application Server, V5 adds value on top of the core EJB 2.0 specification by delivering container-managed messaging as a way of simplifying the development of these asynchronous applications. Container-managed messaging shifts responsibility for interacting with the messaging services to the EJB container, allowing EJBs to exploit messaging facilities without making explicit JMS calls. Container-managed messaging is analogous to container-managed persistence, where data in entity EJBs can be persisted to the database tables without developers having to implement any database calls.

Finally, *WebSphere Application Server, V5* minimizes costs by maximizing utilization of existing computing resources in supporting line of business applications. WebSphere provides the ability to process workloads through parallel processing. These capabilities allow for scheduling of high priority work processing adding speed and productivity. Background tasks can be automated and scheduled to process during low traffic off hours.

In summary, *WebSphere Application Server, V5* provides a comprehensive "build-to-integrate" platform. WebSphere Application Server and Studio provide integrated visual development tools and dynamic frameworks to leverage existing skills and assets as well as build new agile applications. Based on an open services oriented architecture, integration of existing and new assets is greatly simplified. Applications built with WebSphere Application Server and Studio provide excellent user experience, increased business flexibility and efficient use of IT resources.

Highly Integrated Application Development

The workflow capability is one example that demonstrates the power of the WebSphere integrated development and deployment environments. WebSphere Studio provides a visual tool for composing new applications out of a set of enterprise services – whether they are Web services, EJBs or legacy resources – enabling this new application to be tested immediately, and subsequent changes to be implemented, without disruption to the running production applications.

An integrated application development and deployment platform provides direct positive impact on ROI by:

- Enabling rapid time to market for new applications, from concept through debug and test into production – regardless of the deployment server platform or operating system

- Making it easy to expand and adapt applications as business needs changes

- Facilitating re-use of existing assets and skills when creating new applications

- Driving productivity for both the individual developer -- --through wizards and templates – and across the development team by supporting different developer roles across the organization.

Build Quickly, Expand Easily

WebSphere Studio, V5 integrates development of Web sites (HTML, CSS); dynamic Web applications (JSP, XML, JDBC); and J2EE applications with a WebSphere Application Server unit test environment. The integrated tools and server enable a tight develop, test, debug cycle for both functional and performance testing by each developer.

In addition, by utilizing Eclipse Technolgy -- an open, industry supported software platform for application development -- IBM *WebSphere® Studio, V5* provides an integrated environment for the many different developer roles throughout the application life cycle. The result is higher quality, lower cost, more flexibility and faster time to value.

By leveraging a services oriented architecture, *WebSphere Application Server, V5* simplifies the development and ongoing adaptation of dynamic applications.

Increase Productivity

The time required to roll out new applications is a key concern across all industries, and improved developer productivity is clearly a way to address this. One way to vastly improve productivity is to reduce the need for handcrafted programming. This can be accomplished through powerful frameworks that absorb much of the work involved in development, or through tools that generate code used by the runtime.

WebSphere delivers a combination of frameworks and tools that work together to provide best practice implementations, a realization of the industry's best architectures. With *WebSphere Studio, V5*, developing and maintaining applications is largely facilitated through *visual programming*. As discussed in the "Build-to-integrate" section of this paper, the WebSphere Studio services choreography feature enables a developer to create and combine basic services into workflows or applications. Wiring these interactions together in a visual fashion makes it easier for developers to create applications, and to preserve the flow structure of the application when underlying service implementations change over time. *WebSphere Studio, V5* also provides Web site developers with the ability to visually map a series of actions in order to generate a dynamic Web page.

Still other productivity gains come from the inclusion of wizards, automated project task lists and sample application templates.

Maximize Development Assets

Integral to information and data connectivity is building new applications that integrate multiple back-end systems requiring data transformation and transactional integrity. *WebSphere Application Server, V5* delivers productivity through an open approach to transforming any application asset into a modular network-accessible service, which can be easily identified and reused by other.

WebSphere Studio Assets Analyzer is a powerful member of the WebSphere Studio family that can be used to analyze existing application assets – from Web pages, to Java components, to host assets such as COBOL, PL/1 and JCL. Using the knowledge store built from the analysis of your assets, WebSphere Studio Asset Analyzer helps you identify reusable components; understand the impacts to changing them; and helps you prepare them for broader use as services accessible by new and existing business applications. The result: you maximize the value of exiting assets that have been running your business for years (if not decades) and continue to leverage the skill and experience of all of your developers.

Agile Deployment and Administration

Deployment and administration of e-business infrastructure have been challenging. Point products have provided a variety of administration systems and because many of the e-business platform products were first or second generation, their ease-of-use capabilities were limited. As the application server platform becomes the new OS for the Internet, it must provide a simpler, more unified deployment and administration model.

An infrastructure must provide a stable base for the services and applications built on top. And it must provide for the ability to grow over time with minimum disruption to the existing infrastructure and applications.

WebSphere Application Server system management has been significantly enhanced in version 5. It is now easier to update and manage both middleware and applications within 7x24 operations, utilizing an improved administrative client. The overall result is improved integrity, and scalability; reduced administrator training time and operations costs; and improved application service and uptime.

In addition, migration tools and documentation enable simplified migration of infrastructure from previous versions or different configurations of WebSphere Application Server -- or even from other Web application servers.

Efficient Deployment

WebSphere Application Server, V 5 delivers a centralized web-based user interface to remotely manage multiple applications and/or middleware. The updated administrative client with an intuitive user interface provides a comprehensive look at applications, servers, and resources within the Web Application Server environment. The administrative client interface has a consistent implementation across WebSphere Application Server configurations – reducing training and experience-level required to implement or migrate to multiple configurations.

Installation of WebSphere Application Server has been improved via a single consistent installation across platforms and configurations -- and even more simple, WebSphere Application Server – Express offers a true one-touch installation suitable for mid-sized companies and departments. Typical set-uptime for *WebSphere Application Server, V5* ranges from 5 to 30 minutes depending on the configuration.

Application server configuration information is stored and managed as an XML file and can be used to rapidly and conveniently configure new servers that have similar requirements. In addition, each application server is started from that local configuration file, avoiding dependency on a central repository and eliminating a single point of failure.

WebSphere Application Server, V5 can be installed and interoperate with previous versions of the server within the same network and even the same machine. Additional nodes of the server can be dynamically added and managed in the network asynchronously regardless of individual or overall network status.

To efficiently reuse XML and the new Java™ applications and components, *WebSphere Application Server, V5* implements a service-oriented architecture to achieve reusability of critical business processes. A service-oriented architecture allows virtually any software resource to be seen through the lens of a business service interface. This generalized notion of services builds upon the Web

services value proposition to provide a consistent and inclusive programming model that easily incorporates existing assets into new solutions. The result is faster assembly and deployment of new applications with re-use of existing investments.

New capabilities for installing, deploying and updating applications and components within 7x24 operations available in *WebSphere Application Server, V5* include the graphical Application Assembly Tool; an expanded command line interface, now based on the *Bean Scripting Framework*, offering support for JACL; and executable ANT tasks for common administration functions. Application components can be installed and uninstalled on-the-fly enabling updates to be implemented without impacting other application components operation. In addition, applications can be started and stopped manually or via application logic individually without impacting overall application server availability.

The administrator at a large global enterprise can take advantage of these capabilities to easily manage updates to Intranet applications that are accessed by employees around the world, around the clock, requiring 7x24 operation. For example, the administrator can update pricing methodology within an application component at the time a new sales tax law becomes effective without impacting the rest of the product pricing application operation by first uninstalling and then installing the new component on-the-fly. Via the remote administrative client the administrator can update the component on both the primary and back-up servers located anywhere in the world with no impact to the 7x24 operation.

Automated Management

WebSphere Application Server, Version 5 delivers automation across many application server management functions, enhancing productivity and reducing the cost of administration.

Administration of the server(s) is easy with an expanded XML-based administration console that works over HTTP. This console gives the WebSphere administrator more capabilities than ever through a simpler interface that renders the tasks associated with administering a WebSphere Application Server environment more efficient. With the enhanced administration capabilities, WebSphere Application Server clusters can be created and managed, and new components, applications, and services can be deployed quickly and easily. The administrative client is a J2EE application itself and can remotely manage all networked application servers from a single client. The admin client can run on any installed application server or even separately on its own "admin server" as it can be installed and run with its own application server.

A DB2 database is included in the WebSphere Application Server Network Deployment for session persistence and container-managed persistence — providing a database right in the box to take advantage of these application server features.

Basic administration functions such as error messages now provide more intuitive help giving administrators and developers better insight into application or server issues. In addition, the IBM WebSphere InfoCenter on-line has been improved to offer additional guidance to help more quickly resolve issues and improve WebSphere Application Server implementations.

Performance Monitoring

From an application and server management perspective, *WebSphere Application Server, V5* supports JMX (Java Management eXtensions), recording and logging statistics on usage and resources which can in turn be picked up and used by more extensive performance monitoring and management products from Tivoli and others that also support the JMX standard. *WebSphere Application Server, V5* supports JMX in a distributed, quality of service context with operating environments involving:

- Multiple processes

- Multiple Web application server nodes

- Distributed events

- Performance Monitoring Interfaces through JMX

The Java Management Extensions standard (JMX) provides a simple, lightweight method of assigning Java objects. Throughout the WebSphere platform, manageable objects are being exposed through JMX so that compliant management systems will be able to manage WebSphere resources in a standard way. A resource that has been instrumented with JMX can expose its read only and read/write attributes, expose methods that can be invoked to perform operations on the objects within the managed resource, and enforce event notification registration to allow management systems to be notified when a particular event occurs within the managed resource.

A central and open management interface helps customers administer multiple applications and components from the same environment, thus reducing the complexity inherent in application and systems management. Open interfaces to other management and monitoring products from Tivoli as well as third-party partners and software vendors. (See "End-to-end application optimization" section for more information on this topic.)

Performance Tuning

There are several tools available to ease common administrative tasks for verifying implementations and tuning the application server for improved performance. For example, Autotuning simplifies the administrator's job by automatically tuning the most critical WebSphere parameters to maximize performance. This leverages live data collected from a running system to refine the specific application and environment. These capabilities are critical in a scenario where the administrator is responsible for successful operation, performance and management of a high volume application running on networked servers. As website volume grows, say due to an advertised holiday sale at a commerce-oriented website, overall application performance will obviously be affected. With *WebSphere Application Server, V5* the administrator can monitor critical performance indicators using an integrated Tivoli or third-party tool. The administrator can then take action to adjust workload for any application server on the network via the remote administrative client or using the Autotuning capability – all easily accomplished with *WebSphere Application Server, V5*.

Grow From Any Starting Point

As needs change -- whether in terms of workload type, volume or new business efficiency objectives -- the e-business infrastructure won't have to. WebSphere provides a range of choices for getting started today and for growing over time.

WebSphere Application Server V5 supported growth scenarios include:

❖ Extending or migrating onto new hardware and operating system platforms

❖ Upgrading to more sophisticated configurations of WebSphere

❖ Consolidating operations from other application servers onto WebSphere

WebSphere Application Server V5 provides several configurations to help a business seamlessly grow from basic to sophisticated as business needs require. Upward compatibility and migration paths are clear. WebSphere Application Server – Express provides an easy on-ramp to e-business. For a distributed environment with diverse platforms and multiple enterprise systems on the "back-end", one can start with the fully J2EE™ 1.3-compliant flagship WebSphere Application Server product, with the Network Deployment option for clustering and workload management. Additional integration, application framework and deployment services designed to simply complex mixed enterprise environments are provided by WebSphere Application Server Enterprise.

WebSphere Application Server supports the industry's broadest range of platforms. Customers routinely run WebSphere across a variety of hardware and software platforms. Companies can develop and pilot the application on Windows and later deploy on a Unix or Linux-based system.

With the introduction of Version 5, new competitive migration help is available. The Migration Zone on WebSphere Developer Domain (accessible via www.ibm.com/websphere) provides current information on this rapidly growing set of tools, documentation and services.

Intelligent End-to-End Application Optimization

In today's ever-changing business environment, the ability to optimize your network for enhanced performance, scalability and availability on an ongoing basis has a direct impact on the top and bottom lines of a business. High-volume, dynamic Web sites place significant demands on e-business infrastructure. Attracting and keeping customers who have the choice to go elsewhere requires reliable and secure access to business-critical applications. And, refreshing frequently-requested data must happen dynamically and transparently so the Web sites are available without interruption. All these functions must happen while continuing to drive efficient operations and keep costs down.

WebSphere® Application Server, V5 leverages the proven experience of IBM to deliver the most scalable, available and secure e-business platform. Through added performance and availability features together with edge-of-network technology and advanced security capabilities, *WebSphere Application Server, Version 5* can dynamically and securely react to network pressures. WebSphere provides an intelligent, optimized application platform that benefits business today and lays the foundation for e-business grid services capabilities.

For the highest qualities of service, *WebSphere Application Server, V5* includes capabilities to exploit the powerful z/OS™ operating system platform. *WebSphere® Application Server, V5* is the only application server software natively exploiting key facilities like Workload Manager (WLM), Parallel Sysplex and Intelligent Resource Director for true optimizations in that environment.

Always On, Always Available

To improve network performance and system availability and to reduce unplanned outages, *WebSphere® Application Server, V5* provides an improved and more advanced implementation of workload management, offering more intelligent application-level load balancing across WebSphere clusters.

The new load-balancing component in *WebSphere® Application Server, V5* provides a scalable solution for distributing and routing HTTP, servlet, and Enterprise JavaBean™ (EJB) requests. As the load on one server or a cluster of servers with similar content increases, the load balancer can redirect this incoming traffic to underused servers to help maintain optimal response times for each site visitor. Incoming user requests are routed to back-end servers depending on their availability, performance and on the relevance of the application or components they host.

Additionally, custom advisors can be used to load-balance requests based on unique application and platform criteria. To ensure ever-changing, accurate traffic allocation to back-end servers, an advisor can be deployed to be as high level as periodically determining the overall status of the servers, or as granular as checking specific application response times on the servers. Once the server health is determined, the advisor informs the load balancer "manager" function, which then sets weights for the servers to determine which server should receive new session or application requests. Through advisor code, traffic is appropriately routed to the optimal back-end server.

To extend the load balancing capabilities beyond purely a WebSphere Application Server environment, consultant code can be used to optimize server performance within a Cisco or Nortel infrastructure. Consultants generate server weighting metrics and distributes them to Cisco CSS 11000 switches or Nortel Alteon 180 series of switches for optimal server selection, load balancing and fault tolerance.

Of course, no system is 100% free from failure risk. If a failure does happen, WebSphere helps capture the root cause of the failure and quickly diagnose the necessary corrections. If remote support is

needed to fix a problem, then everything the remote support team needs for diagnosis is automatically captured for further investigation.

Enhanced User Experience

For improved system response times and enhanced user experiences, WebSphere's caching technology can be deployed to reduce network congestion by storing frequently accessed content so information is retrieved only once. Information can be cached depending on when it will expire, how large the cache should be, and when the information should be updated. Faster download times for cache hits mean better quality of service for customers and reduced load on back-end servers.

The new edge-of-network caching capability in *WebSphere Application Server, Version 5*, improves response time by offloading back-end servers and peering links. And, in contrast to other caching proxies that can cache *static* content, the edge proxy server can also cache - and invalidate – *dynamically-generated* content from the WebSphere Application Server, such as JSP and servlet results to create a virtual extension of the application server cache into network-based caches – or to caches in the Akamai network through the implementation of Edge Side Includes (ESI) technology.

Edge Side Includes (ESI) is a simple mark-up language and proposed standard for the dynamic assembly of Web page fragments, such as stock quotes and individual catalog prices. By leveraging ESI technology, dynamic content caching is extended by moving fragments from the Application Server to a proxy server that resides in the network - such as Akamai's. This enables caching to occur at a more granular level, as well as allowing companies to position page composition at the most optimal location, closer to the end user. As a result, companies can improve user experiences through expedited, personalized page composition, and reduce workload on the network servers due to fragment offload to the edge. In addition, *WebSphere Application Server, Version 5,* maintains control over the externally cached fragments through the ESI Invalidation Gateway.

To further enhance network performance, WebSphere exposes performance monitoring interfaces to allow Tivoli and third-party performance monitors to better integrate with WebSphere and provide services to help you fine-tune your WebSphere systems for the best possible overall performance regardless of the typical peaks and valleys of transactional application needs.

Instill Confidence with Security

WebSphere Application Server, Version 5, offers the best security in the industry through its sophisticated security infrastructure, single sign-on capabilities and through its extensive support of open, standards-based java specifications. WebSphere Application Server's secure infrastructure prevents unauthorized access to the J2EE and Web resources it protects, through strong WAS authentication capabilities that consist of basic (UserID/Password), forms-based, and certificate options to validate that a user is who the user says he/she is, and roles-based authorization to allow the user to only access those resource(s) that he/she has been given the rights to access through the designation of the administrator.

From a single sign-on (SSO) perspective, WebSphere Application Server includes SSO capability across Domino, WebSphere and Tivoli resources to allow web users to move between different applications, located on the same or different physical machines, without being promoted for a username and password (or certificate) every time.

Additionally, *WebSphere Application Server, V5,* will support Java Authentication and Authorization Services (JAAS) for authenticating new principals and managing privilege information for a principal, Java 2 Standard Edition (J2SE) for securing system resources, Java Secure Socket Extension (JSSE) for securing communication channels based on transport level security (TLS/SSL), Java Cryptographic Extension (JCE) and Java Cryptographic Architecture (JCA) for java cryptographic extensibility such as for PKI integration, and Common Secure Interoperability V2 (CSIv2) for secure interoperability between application servers. Together, these implementations enable customers and partners to implement standards-based security capabilities within their enterprise applications.

Sophisticated enterprise topologies and infrastructure can also be implemented by leveraging WebSphere's pluggable security architecture. This includes pluggable user registries to enable customers to exploit LDAP or custom registries, web single sign-on exclusively provided by WebSphere or through integration with front-end authentication end-points through Trust Association Interceptor (TAI) technology.

And, if you require a centralized approach to security, tighter integration has been developed between the *WebSphere Application Server, Version 5* and the Tivoli Access Manager. This will enable you to build centralized identity management solutions with global sign-on capabilities and enforceable policies to secure cached and non-cached J2EE, Portal, Web and legacy resources. In addition, companies who implement this integrated solution will benefit from the ease of working with a single object namespace, representing the full set of security policies for the resources you want to protect. When T. Rowe Price needed to create secure Web-based access with single sign-on across 120 applications for over 1 million users, they chose an integrated WebSphere Application Server and Tivoli Access Manager solution. The result was a secure enterprise environment that greatly simplified administration and enhanced user experiences.

In the Web Services Security space, *WebSphere Application Server, Version 5,* will provide support for the WS-Security specification, that was jointly developed by IBM, Microsoft and Verisign and recently submitted to the OASIS standards body. The WS-Security specification defines the propagation of security credentials, including identity assertions, digital signature support and XML-based encryption.

Harness the Power of z/OS

WebSphere® Application Server for z/OS allows you to deploy your J2EE applications and Web Services to the platform that was specifically designed to respond to the demanding Quality of Service requirements for large-scale enterprise e-business: zSeries™ servers running the z/OS operating system. *WebSphere Application Server for z/OS* utilizes zSeries™ and z/OS unique features that translate into real, tangible business benefits in a variety of key areas, including:

Availability: the z(ero downtime)/OS brand promise. z/OS is capable of consistently delivering expected service regardless of capacity-constrained environments, unanticipated workload spikes, or failures in applications, system software or hardware. *WebSphere Application Server for z/OS* is designed for availability through its focus on workload isolation; exploitation of z/OS Parallel Sysplex clustering; integration with z/OS Automatic Restart Management (ARM); and utilization of the self-managing behavior of the z/OS Workload Manager (WLM).

Selectivity: managing resources towards achievement of business goals. z/OS enables the ability to guarantee service levels (response time, throughput, etc) for specific types of customers and high priority workloads as defined by business needs. *WebSphere Application Server for z/OS* is designed to rely on the z/OS WLM to provide goal-oriented workload balancing, management and reporting both within a system and across a Parallel Sysplex cluster.

Integration: enabling reuse of existing assets. Composition and integration with multiple z/OS resource managers is a key requirement for any application that needs to reuse existing assets. *WebSphere Application Server for z/OS* is designed to provide optimized, heterogeneous two-phase commit concurrency control with IMS, CICS and DB2. Using *WebSphere Application Server for z/OS* as your integration engine will provide optimal performance (through closer data proximity and a reduced duration of held locks), better availability (through reduced points of failure), and faster recovery in rollback situations.

Efficiency: maximizing people and system resources. z/OS was designed for efficiency, and can provide a lower total cost of ownership through reduction in trained system programmers to configure, monitor, and adjust multiple systems, and fuller utilization of existing capacity.   z/OS is able to automatically handle unpredictable spikes in mission critical workload without wasting spare cycles during periods of low and average utilization. As a well-behaved z/OS subsystem, *WebSphere Application Server for z/OS* easily fits into the heterogeneous nature of z/OS workloads running simultaneously in either a single z/OS image or across multiple images configured in a Parallel Sysplex cluster.

Security: providing a trusted environment. z/OS is a proven security leader, maintaining the integrity and availability of systems, applications and data in the face of threats. *WebSphere Application Server for z/OS* was designed to fully integrate with the IBM SecureWay Security Server for z/OS or equivalent z/OS security products.

WebSphere Application Server for z/OS is the only application server that has been designed with the special optimizations and fine-tuning required to fully exploit and leverage the exceptional scalability capabilities of the z/OS operating system environment.

For the existing z/OS customer, *WebSphere Application Server for z/OS* lets you fully leverage your existing investment in zSeries in unparalleled ways. The skills and the procedures already in place for use in your data center can be utilized with *WebSphere Application Server for z/OS* in taking these battle tested, proven assets to the web environment.

WebSphere Application Server for z/OS provides the best of both worlds for your environment - the deep exploitation of the zSeries hardware and z/OS software, with the application portability of the J2EE standards. As business needs demand, a J2EE application or Web Service deployed to any other platform can be re-deployed without code changes to z/OS. With *WebSphere Application Server for z/OS* , you can leverage your existing assets and investments without new skills or hardware purchases, and well-established operational procedures for the zSeries can be re-used for your Web environment.

Summary – The Right Choice

As demonstrated by the case study, *WebSphere Application Server, V5* delivers new capabilities that are designed to help you gain sustained competitive advantage. These benefits can be summarized as:

1. Comprehensive build-to-integrate platform
2. Highly integrated development and deployment environment
3. Agile deployment and ease of management
4. End-to-end intelligent application optimization

While *WebSphere Application Server, V5* has a lot to offer, IBM understands the selection of a software platform isn't just about one product; it is about selecting a strategic partner. IBM has the experience

to successfully tackle immediate problems as well as help a business respond to new challenges over time. To this end, IBM provides:

Complete software platform. The value proposition for WebSphere Application Server starts with support for complete solutions. WebSphere Application Server and Studio provide the foundation for a complete e-business infrastructure that spans everything from "reach and end-user experience" to deep "business integration". When WebSphere won the *Network Computing* Editor's Choice award, the magazine stated that *"WebSphere Application Server is part of IBM's larger suite of complementary products that sits on top of this world-class solution."*

Unparalleled sustained investments. WebSphere Application Server is backed by IBM's year-over-year multi-billion dollar investments and many thousands of IBM employees, with industry-leading developer programs that promote widespread WebSphere adoption. Web Sphere has been one of IBM's "must-win" initiatives with top-level executive commitment and extensive focus across the company. Web Sphere has also benefited from IBM's enormous investments in research and development (some $5.6 billion dollars in 2001 alone). There were 524 patents attributed to IBM software this past year – more than any other software company in the world. Of these 524 patents, 222 were specifically related to Web Sphere[3].

Core strengths and competencies. WebSphere Application Server incorporates IBM's core capabilities in building system software. These capabilities include transactional and security leadership; an ongoing focus on interoperability; IBM's heritage in delivering messaging and persistence capability as well as component technology; strengths related to Web services and XML; industry-best support for manageability (including synergies with Tivoli); and significant experience in the area of application integration and connectivity.

Clear industry leadership. WebSphere Application Server 's strong industry momentum that is second to none (as measured by both analyst and press opinions, market share numbers and trends, and growing developer momentum). WebSphere has won key competitive battles in accounts like eBay and Abbey National, and more than 50,000 customers are now using WebSphere worldwide. Business partners are also increasingly selecting WebSphere as their application server of choice. WebSphere delivers first-rate support 24 hours a day, seven days a week. WebSphere Application Server and Java solutions from IBM have together won more than 30 industry awards. Beyond garnering an impressive number of industry awards, WebSphere has allowed customers such as Bekins Van Lines to receive first-place industry awards of their own.

Excellent return on investment. WebSphere Application Server helps businesses improve customer loyalty, respond more quickly to change, and reduce overall costs. WebSphere provides advantages related to overall cost of ownership measured in terms of truly excellent price/performance, as well as the provision for customers to leverage their existing investments. In terms of price/performance, according to Evan Quinn, chief analyst with the Hurwitz group, the 2002 eBay win suggests that WebSphere is *"reliable enough to handle the huge transaction volume served up by even the busiest Internet sites"*. WebSphere customers are able to achieve many tens of millions of page views per day in production on the Web. Kana recently set an eCRM Solution industry benchmark by running on WebSphere. And IBM has demonstrated more than 12,500 EJB-based transactions per second – serving 800,000 users – with approximately one quarter of a second average response time. WebSphere is supported by a High Volume Web Site team, and by a High Volume Web Site Performance Simulator used in capacity planning.

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[3] Patentable code specific to the WebSphere Application Server includes performance optimizations such as application profiling; advanced caching and in-memory data replication; flexibility extensions provided by shared work areas and the internationalization service; and business integration extensions that include support for process automation services and advanced transactional models. Patentable innovations also include things like Java class loading and application isolation, HTTP session affinity and profiling, inventions related to threading and scenario-based testing, numerous security inventions, and – specific to IBM's tooling – advanced techniques related to code generation and object modeling.

Support for industry standards. WebSphere Application Server is J2EE-certified on more platforms than any other vendor. WebSphere is the first and only major application server brand to become J2EE 1.3-certified last year (through the Technology for Developers release). WebSphere engineers have contributed to more than eighty percent of the J2EE specification, and these engineers continue to define the next wave of standards through participation in the Java Community Process. WebSphere was first in line to deliver an integrated Web services solution with a complete set of associated tooling. WebSphere engineers have defined, co-authored, or significantly contributed towards all of the relevant standards in the Web services and XML space.

Best practices and industry expertise. WebSphere is about delivery of *expertise* and not just software. WebSphere solutions include the services of a talented and experienced team of engineers and consultants who stand ready to work with you on your most pressing business needs. WebSphere Developer Domain provides a wealth of free online information, community resources and access to publications such as detailed implementation guides (called Redbooks). We invite you to contact your local IBM representative *today* for more information about how you can achieve business results well ahead of your competition. IBM's WebSphere team is at your service.

Note that online information about WebSphere Application Server software and solutions can be found at ibm.com/websphere .

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