



WebSphere. software

Robust Infrastructure for SOA



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Executive Overview

IBM WebSphere® Application Server, Version 6.0 is the foundation of the IBM WebSphere software platform and is a key building block for a Service Oriented Architecture (SOA). As the leading Java™ 2 Enterprise Edition (J2EE) 1.4 and Web services application platform, WebSphere Application Server delivers a high performance transaction engine and extremely scalable, highly available, and secure foundation for SOA.

With the same programming model and core application server functionality across configurations¹, WebSphere Application Server, Version 6.0 accelerates business flexibility. By enabling enterprises to standardize, automate, and integrate services, clients can maximize return on investments while responding, on demand, to changing business opportunities.

With WebSphere Application Server, you can grow seamlessly from basic single server implementations to more sophisticated distributed topologies that leverage multi-server clustering for on demand scalability and high availability, all on a common server foundation. WebSphere Extended Deployment extends this foundation, enabling a business-grid through a dynamic, goals-directed, high performance application environment for running mixed application types and workload patterns in WebSphere. IBM WebSphere Application Server, Version 6.0 is a proven, agile platform designed to support today's urgent business imperatives. WebSphere Application Server can help you reduce overall costs, improve customer loyalty and respond quickly to new business opportunities. WebSphere Application Server delivers the following advantages:

- **Service Oriented Architecture building block** – WebSphere Application Server, Version 6.0 delivers the foundation for an SOA today. In addition to providing a reliable, secure deployment environment in which to run services, WebSphere Application Server enables reuse of existing assets with standards-based messaging and comprehensive support for Web services. The result? Increase in Return On Investment (ROI) and lower Total Cost of Ownership (TCO).
- **Rapid development and deployment** - WebSphere Application Server, Version 6.0 enables rapid time to market, and increased productivity for the individual developer with support for rapid development frameworks and extensive automation.
- **Agile deployment and administration** – Simplified and unified administration across all configurations¹ of WebSphere Application Server, Version 6.0, minimizes training costs and makes it much easier to migrate across the WebSphere Application Server configurations. Streamlined packaging, simplified installation, and the rapid deployment framework speed time to deployment.
- **Secure, optimum resource utilization supporting on demand operations** – WebSphere Application Server, Version 6.0 can provide a secure, scalable, and highly available platform for enterprises, with support for advanced workload management, dynamic caching, dynamic clusters and high availability management. WebSphere Application Server Network Deployment and WebSphere Application Server for z/OS provide near continuous uptime for mission critical applications, helping to eliminate lost business opportunities.

As the robust, secure foundation of a Service Oriented Architecture, WebSphere Application Server provides a comprehensive platform for connecting and integrating people, processes, and applications. It provides a reliable SOA infrastructure that can deliver real business flexibility. With WebSphere Application Server you can:

- Standardize, automate and integrate services and the underlying infrastructure to improve time to market.
- Extend and reuse existing assets including legacy systems to maximize value.
- Scale quickly and cost-effectively to meet dynamic business demands.
- Optimize resource utilization in a secure, highly available environment to reduce TCO and eliminate lost business opportunities.

WebSphere Application Server provides features to support dynamic applications, improved ease of management and the latest J2EE technology and Web services standards. WebSphere Application Server now builds on its proven scalability and performance with new automated performance tuning and load balancing and workload management services. With IBM and the award-winning family of WebSphere products, you can fully address the challenges of a rapidly changing business world.

The Evolving Role of Application Servers

Application servers have evolved rapidly from their early days as products that provided relatively simple component runtimes (and often as simply an extension to web servers providing dynamic content to web applications). Today they are comprehensive platforms for connecting people, processes, and applications, providing the underlying services for portal, business integration, and commerce solutions.

With IBM WebSphere Application Server, Version 6.0, the application server has become the foundation building block for SOA applications that are easy to use, interoperable, secure and transactional. The application server thus has become the core enabler of a standards-based approach to SOA for building business flexibility. As the application server has matured into the foundation of an SOA application and integration platform, it is increasingly called upon to fulfill a variety of roles within organizations, at a variety of scales, and with customers at different stages of SOA adoption. To truly enable business flexibility, it is important that the application server addresses all these roles with a common programming model that allows you to respond on demand by scaling up (with broad platform support) and scaling out (across heterogeneous environments) quickly and easily. Support for clustering and high availability management ensures this can be done with near continuous uptime for mission critical applications.

While many customers require the robust application infrastructure features found in WebSphere Application Server V6.0 others are deploying applications on lighter weight open source application servers. With the addition of WebSphere Application Server Community Edition V1 (a J2EE application server built on open source technology from the Apache Software Foundation) to the WebSphere Application Server family customers can deploy to the application server of their choice.

WebSphere Application Server Community Edition V1 introduces a new business model to IBM's market-leading WebSphere Application Server family. Providing code that is free to download and use along with a

range of for-fee technical support options brings increased choice and flexibility. Customers can begin development, testing and deployment at no cost; and because WebSphere Application Server Community Edition V1 is based on the J2EE programming model, customers can evolve to the more advanced WebSphere Application Server products with minimal disruption.

Whether the requirement is for a simple single server deployment or for massively distributed grid computing, the application server platform must provide consistently, an infrastructure that maximizes flexibility and reduces the complexity of building, deploying, and managing services. It must also provide the ability to achieve near continuous availability and near linear scalability on demand. WebSphere Application Server, Version 6.0 addresses these needs by delivering:

- Service Oriented Architecture Building Block
- Rapid Development and Deployment
- Secure, Optimum Resource Utilization
- On Demand Infrastructure

This paper outlines these requirements in more detail and describes how WebSphere Application Server V6 addresses them to deliver a highly scalable, highly available platform for SOA that delivers benefits in terms of reduced costs, reduced time to value, and increased business flexibility.

WebSphere Application Server Family Overview

WebSphere Application Server, Version 6.0 is the foundation of the IBM WebSphere software platform and is a key building block for a Service Oriented Architecture (SOA). As the leading J2EE 1.4 and Web services application platform, WebSphere Application Server, Version 6.0 delivers a high performance transaction engine and extremely scalable foundation for traditional or SOA development

WebSphere Application Server, Version 6.0 is available in multiple configurations (Figure 1) across a wide variety of hardware and operating systems. Importantly, WebSphere Application Server, Version 6.0 delivers the same full J2EE 1.4 programming model and core application server functionality across all configurations¹. With WebSphere Application Server, you can grow from basic single server implementations to more sophisticated distributed topologies that leverage multi-server clustering for on demand scalability and high availability, all on a common server foundation. This provides customers with the flexibility to:

- Choose the level of capability best suited to current needs
- Expand, scale and grow as business needs evolve
- Respond on demand to the changing marketplace without the cost of re-architecting, reprogramming, and migrating to different technology bases

With the broadest platform support WebSphere Application Server, Version 6.0 delivers the greatest flexibility in deployment choices, including support for: Windows®, Linux® on many platforms from IA-32 to z/Series®, IBM AIX®, Sun Solaris®, HP/UX®, IBM OS/400® and i5/OS™, z/OS®, and selected 64-bit platform support. Customers routinely run WebSphere software across a variety of hardware and operating system platforms. Companies can pilot the application on Microsoft Windows and later deploy and scale to their platform of choice as business needs dictate.

WebSphere Application Server, Version 6.0 provides a strong migration path for existing customers with the ability to run older J2EE 1.3 and 1.2 applications as well as the new J2EE 1.4 Java and SOA applications. In addition, support in WebSphere Application Server, Version 6.0 (Network Deployment and z/OS configurations) for mixed V5 and V6 server environments, provides for co-existence and a more flexible and staged migration to Version 6.0.

WebSphere Application Server, Version 6.0 offers multiple entry points with the right value to most closely match your needs today—while maintaining the flexibility to grow and migrate by scaling up and scaling out. WebSphere Application Server supported growth scenarios include:

- Extending or migrating to new hardware and operating system platforms
- Upgrading to more sophisticated configurations of WebSphere software
- Consolidating operations from other application servers or consolidation of physical servers

The IBM WebSphere Application Server Family

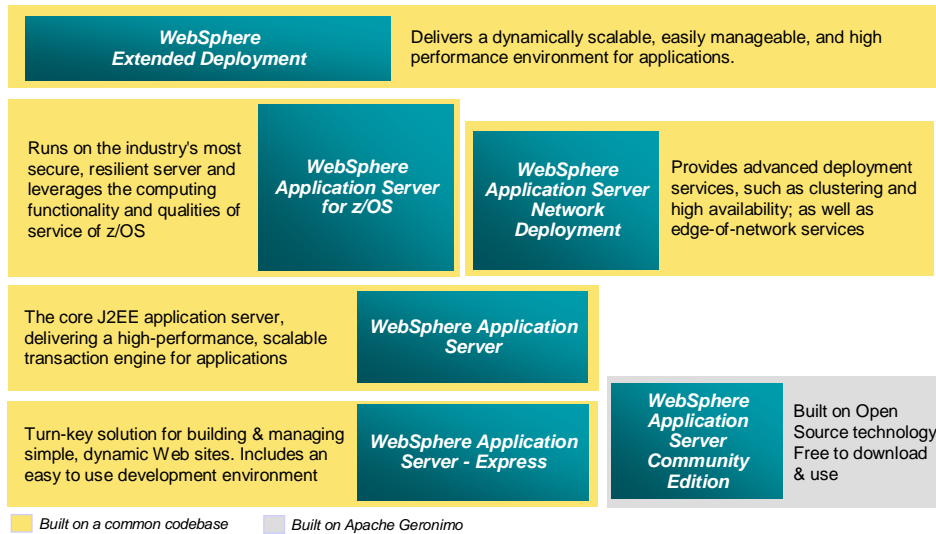


Figure 1 - WebSphere Application Server Configurations

The WebSphere Application Server configurations provide customers with clear entry points and migration paths from one configuration to another as business needs grow. All configurations deliver a solid foundation building block for SOA that integrates enterprise data, transactions, and Web services.

WebSphere Application Server Community Edition V1² is a lightweight J2EE application server, built on Apache Geronimo technology, designed to help you accelerate your development and deployment efforts. It harnesses the latest innovation from the open source community to provide a readily accessible and flexible foundation for building Java applications. WebSphere Application Server Community Edition is backed by world-class support from IBM (purchased separately), assuring you of reliable assistance and timely problem resolution from IBM's team of expert support professionals and developers.

WebSphere Application Server - Express is the entry point for customers that require a rapid and affordable solution for easily developing, deploying, and managing applications on a single server with up to two processors. The Express configuration delivers an out-of-the-box solution for managing simple yet dynamic Web sites with an easy-to-use application server and development environment. In Version 6.0, the Express configuration now supports the entire J2EE 1.4 programming model, in common with all other WebSphere Application Server V6 configurations, including Enterprise Java Beans (EJB) and the Java Connector Architecture (JCA). The Express configuration includes the IBM Rational Web Developer application development tool. Geared to web developers, this tool includes support for most J2EE 1.4 features, with the exception of EJB and JCA development.

WebSphere Application Server is the industry's leading J2EE and Web Services application server, delivering a high-performance and extremely scalable transaction engine for dynamic applications. This

base configuration is the entry point for departmental-scale single server solutions, adding unlimited processor support, simple HTTP failover / load distribution, and additional platform support, such as Linux on z/Series.

WebSphere Application Server Network Deployment is the primary entry point for enterprises that need higher scalability and quality of service built in. It extends the WebSphere Application Server base package to include clustering capabilities, edge-of-network components, extended web services support, and high availability for distributed configurations. This is the configuration for distributed, clustered, highly available, high volume environments. In addition to the base capabilities of the WebSphere Application Server, WebSphere Application Server Network Deployment delivers enterprise scalability and availability through intelligent workload management (WLM), extended Web services support through the Web services Gateway, edge-of-network caching services, high availability management, and central management across multiple clustered application servers. WebSphere Application Server Network Deployment, Version 6.0 provides significantly enhanced high availability features out of the box, which help ensure 24x7 availability with WLM-mediated failover at the HTTP, web container, and EJB container levels. New in Version 6.0, WebSphere Application Server Network Deployment delivers an autonomic High Availability Manager (HAManager), Backup Cluster support, and support for Network Attached Storage shared file system technologies. The IBM Tivoli Access Manager and Tivoli Directory Server for WebSphere Application Server (an LDAP server) are included in all WebSphere Application Server configurations¹ for centralized identity management and security in enterprise distributed environments.

WebSphere Application Server for z/OS is the leading core J2EE application server optimized to leverage the z/OS qualities of service in a mainframe environment. It is the entry point for customers that need to leverage the unique resilience and quality of services of the z/Series platform, or leverage the TCO benefits of server consolidation on z/Series. With the same full J2EE 1.4 programming model as WebSphere Application Server Network Deployment, WebSphere Application Server for z/OS brings the qualities of service of the z/OS platform to Java and web services applications, including close proximity to enterprise data, intense scalability, high availability, and rich security. New with WebSphere Application Server for z/OS, Version 6.0 is the ability to achieve higher performance and dramatically lower TCO by exploiting the new z/Series Application Assist Processor (zAAP). Available on the z/890 and z/990 (and follow on models), the zAAP is a dedicated processor for Java workloads running under the IBM JVM and is free from processor cycle charges. This allows you to offload processing cycles from the general purpose processor, improving overall performance while reducing TCO.

WebSphere Extended Deployment is an add on to existing WebSphere Application Server Network Deployment and WebSphere Application Server for z/OS environments that extends them to provide on demand dynamic responsiveness, high performance computing enhancements, simplified administration and management of complex distributed environments and a flexible approach to support both transactional and long running workloads. As a simple delta to these existing WebSphere Application Server installations, WebSphere Extended Deployment does not require migration or restructuring of the existing environment and is integrated into the WebSphere administration environment. WebSphere Extended Deployment extends capabilities to dynamically accommodate variable business demands, support mixed (transactional and long running) workloads and mixed server environments, and reduce the complexity and cost of

managing complex distributed environments. WebSphere Extended Deployment delivers extended capabilities in four key areas:

- *Flexible* - Provides support for mixed application types and workload patterns in WebSphere, enabling you to better leverage your existing application infrastructure resources.
- *Reliable, scalable, high performance* - Enhances quality of service of business critical applications to support near linear scalability for high-end transaction processing, helping you improve customer service levels while also leveraging existing Java skills and resources.
- *Dynamic* - Allows your application environment to scale on demand with virtualization of WebSphere resources and use of a goals-directed infrastructure, helping you increase the speed at which your company can adapt to business change.
- *Easily managed* - Offers simpler and improved management of complex system operations with a real-time operational health monitoring tools, helping you reduce the cost of managing IT resources.

Together, these extended features of WebSphere Extended Deployment allow your application environment to scale on demand with improved resource utilization, lower TCO, autonomic management and continuous high availability.

The WebSphere Application Server family provides a consistent foundation for SOA across all configurations¹, from Express to Network Deployment and z/OS. These configurations provide consistent support for the full J2EE 1.4 programming model and latest Web services standards, core WebSphere programming model extensions, and feature broad platform support. This consistency and coordination among WebSphere Application Server configurations enables application portability across platforms¹. As well, it enables the flexibility to migrate and scale easily to other configurations when more advanced capabilities are needed, such as higher availability and advanced workload management, or the unique qualities of services provided by the z/OS platform.

Services Oriented Architecture Building Block

More and more, customers are searching for ways to increase the flexibility of their business processes, streamline their IT infrastructures, and retain and reuse their existing assets. These customers are looking to standardize, automate, and integrate their business processes to allow greater flexibility in adapting to dynamic business conditions. A Service Oriented Architecture (SOA) is the key enabler of this business flexibility. SOA is an architectural pattern not a technology in itself. In order to achieve the benefits of a SOA, customers need implementation technologies that are standardized, interoperable, and support the composition of applications from loosely coupled, often asynchronous, and reusable services. At the same time, most customers have existing IT assets and investments in enterprise information systems that they need to extend and reuse within their new SOA environment. IBM WebSphere software provides a strategic foundation for on demand solutions through a comprehensive platform that is implemented as a SOA. IBM WebSphere Application Server, Version 6.0 is the key building block for SOA applications, with leading support for standardized implementation technologies that allow you to build SOA applications, including support for the latest J2EE 1.4 and Web services standards, and a unified communications infrastructure that allows loosely coupled, reliable, asynchronous interactions among J2EE components, Web services and legacy systems.

Implement SOA with Web Services

Web services are self-contained, modular applications that can be described, published, located, and invoked over a network. They are the key standardized technology for implementing application functionality as reusable services. They implement a service oriented architecture, which supports the connecting or sharing of resources and data in a very flexible and standardized manner. As such, Web services provide a standardized way of encapsulating business processes in new and existing applications, and exposing them for reuse and integration within a SOA. Because WebSphere Application Server features an open approach to transforming any application asset into a modular service, you can have these services accessible for reuse by other developers throughout your organization. Web services-based software aids internal development and integration, and it provides a standardized method for publishing encapsulated business services to drive business-to-business (B2B) collaboration and, in time, new revenue streams. Examples of these services include stock quotes and charting, credit card verification and payment processing, integrated travel planning and auctioning.

WebSphere Application Server, Version 6.0 provides leading Web services capabilities, for implementing SOA applications using standards-based, interoperable, secure, and transactional XML-SOAP message based Web services. Web services standards support includes:

- J2EE 1.4 programming model, including Web Services for J2EE, Version 1.1
- Web Services Interoperability (WS-I) Basic Profile 1.1
- WS-Transaction, for coordination of distributed Web services transactions
- WS-Security 2004
- UDDI V3 support, with its improved security features, including digital signing of UDDI entries
- SOAP with Attachments API for Java (SAAJ) 1.2
- Java API for XML-based RPC (JAX-RPC) 1.1

- Java API for XML Registries (JAXR) 1.0
- Enterprise application connectivity through prebuilt and tailored application adapters using JCA 1.5 and the latest Web services standards
- Web services-based invocation framework (WSIF), providing protocol flexibility, efficient communication with local services, and easy-to-use tools that generate Web services applications
- Web services Gateway, which offers a single point of control, access and validation of Web service requests (WebSphere Application Server Network Deployment configuration only)
- Web services enabled Service Integration Bus (SiBus), which integrates the former standalone Web services Gateway functions into a broader facility upon which inbound and outbound services (including but not limited to web services) can be defined and exposed to new destinations in a unified manner. The SiBus supports both synchronous and asynchronous messaging with extended messaging mediations including content transformation (mediation plug-in required) and content based routing (plug-in required).

Integration of Asynchronous Messaging Services

In a SOA, application functions (business processes) are modular and inherently loosely coupled. SOA applications need to initiate and respond to asynchronous invocations, conversations and broadcasts. Because of this, SOA applications and integrations require a standardized communications infrastructure that allows loosely coupled, reliable, asynchronous interactions among J2EE components, Web services, and legacy systems capable of messaging. WebSphere Application Server, Version 6.0 delivers significantly enhanced services for mixed synchronous and asynchronous transactional environments as part of the native J2EE 1.4 and Web services environment. WebSphere Application Server, Version 6.0 has a pure JMS 1.1 messaging engine, fully integrated within the application server, and can exchange data up to five times faster than previous releases. The messaging engine provides advanced queue management, supports the publish and subscribe model and provides a full range of messaging Quality of Service options from best-effort to assured-persistent messages. In assured delivery mode, messages are persisted to the embedded IBM Cloudscape™ Java database or an external database resource provider (such as IBM DB2 or other vendor's database). Being fully integrated, the JMS messaging engine can now scale with the application server (clustering) and take advantage of the high availability features of the platform (e.g. failover and HAManager protection for the JMS engine).

WebSphere Application Server, Version 6.0 provides comprehensive support for messaging with its internal (default) JMS provider, support for generic JMS providers, and also for IBM WebSphere MQ for customers with enterprise messaging topologies based on WebSphere MQ technologies. To facilitate migration to WebSphere Application Server, Version 6.0, communication across mixed cells of WebSphere Application Server V5 and V6 is supported. This robust and scalable JMS messaging engine is a key element of the Service Integration Bus architecture of WebSphere Application Server, Version 6.0.

Service Integration Bus Architecture

A unified communications infrastructure for connecting services is a key element of SOA initiatives. A service integration bus (SiBus) is a logical concept that provides an intelligent infrastructure for integration and connection of services in a SOA. Composed on the messaging engines and related services of the

WebSphere Application Servers collaborating together along with integrated Web services functionality (Figure 2), the SiBus provides a common infrastructure for secure communications between application services through synchronous and asynchronous messaging. As such, the SiBus provides a highly available and scalable, unified communications pipeline that enables application services to participate transparently in message exchanges, whether the services end points are: Web services providers and requestors, JCA resource adapters and application servers JCA containers, and JMS messages. The SiBus provides additional features needed to connect the components of a SOA architecture including message mediations (message transformation, replication, content based routing) and protocol translation between HTTP Web services and JMS Web services. The SiBus can also connect to WebSphere MQ, participating in an extended bus infrastructure, or with the Enterprise Service Bus, for enterprise wide SOA applications and integrations.

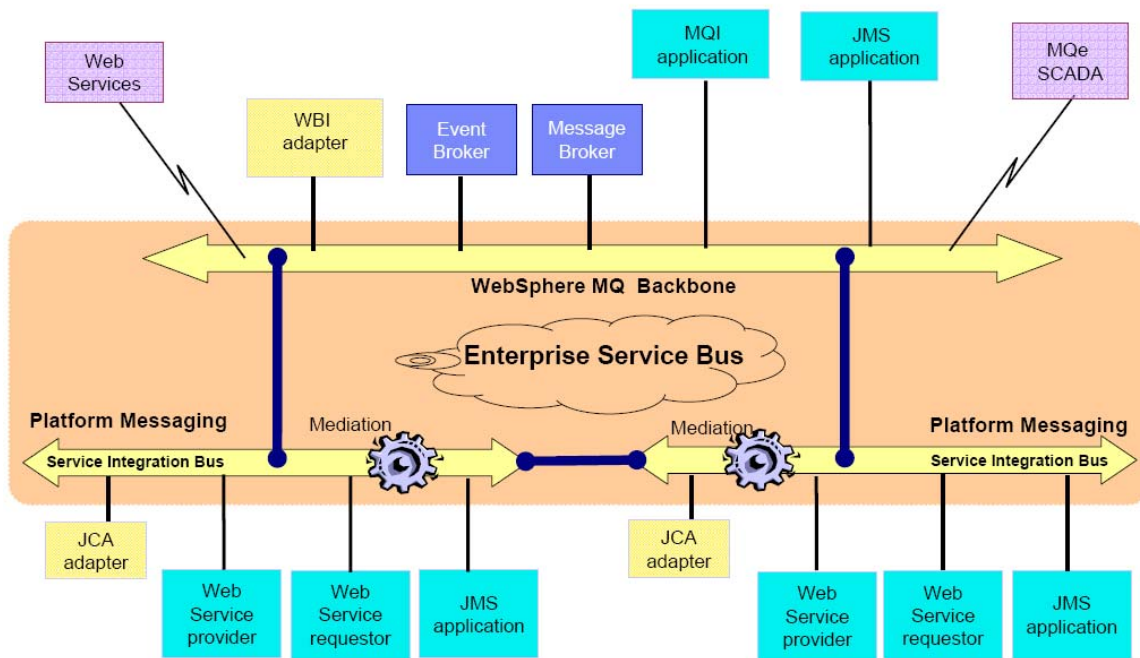


Figure 2 - Service Integration as part of the Enterprise Services Bus

With WebSphere Application Server, Version 6.0, you have a comprehensive platform for enterprise SOA. With an open service-oriented architecture and a unified communications bus infrastructure, you can easily integrate new and existing assets, increase your business flexibility and facilitate the efficient use of your IT resources.

Integrate and Reuse Existing IT Assets

Many customers have significant investments in legacy systems and enterprise applications. Customers need to extend and reuse these existing assets in conjunction with new business logic written in Java to maximize value and achieve secure, optimum resource utilization. The ability to create new applications that incorporate a variety of enterprise resources quickly and easily is a key requirement in a variety of industries. Businesses are looking for new ways to reduce the complex underlying coding required to create these

dynamic applications without sacrificing transactional integrity. For example, an insurance or telecommunications company that stores a multitude of customer data utilizing IBM CICS® now needs to integrate this information within its J2EE environment.

WebSphere Application Server helps reduce the risk, complexity and cost of extending enterprise applications through its advanced support for J2EE Connector Architecture (JCA) 1.5. The JCA specification defines a standard architecture for integration between heterogeneous enterprise information systems (EIS) and application servers such as WebSphere. This gives you a consistent way to connect to and communicate with a wide range of enterprise systems and applications as well as advanced transaction coordination, without the need for advanced programming skills or extensive coding. Based on the JCA specification, an EIS vendor (e.g. SAP, Oracle / PeopleSoft, Siebel, etc.) or third party connector developer can develop a standard resource adapter for its EIS to plug into any application sever that supports JCA. JCA 1.5 supports both synchronous and bi-directional, asynchronous interactions between a J2EE server and resource adapters as well as JMS provider support. Via JCA support, WebSphere provides client applications all system services regarding connection, transaction, and security management on behalf of the resource managers. Comprehensive J2EE Connector Architecture support is also provided at development time (in Rational Application Developer), with tools that let a developer easily integrate existing EIS such as CICS or IMS™ into their SOA solution. Using these tools, developers can quickly create a Web service from an existing EIS transaction.

JCA has two basic components:

- A common client interface (CCI) that manages the flow of data between the application and the back-end system and has no visibility into how the container and application server perform
- A set of system-specific services implemented as part of its base J2EE platform

CCI is a programming interface that application developers and client programs can use to connect and access back-end systems. It is a low-level application programmer interface (API) and is similar to Java Database Connectivity (JDBC). Unlike JDBC, however, CCI can work with non-relational systems. Although it's possible for application developers to call CCI directly, in most cases an application developer will write to an abstraction layer, provided by the connector provider or enterprise application integration (EAI) framework vendor, simplifying the development process. To simplify development, WebSphere Application Server, Version 6.0 provides a relational resource adapter (RRA) that has an implementation for both the CCI and the traditional JDBC interfaces.

On the platform side, JCA defines a set of service contracts that a connector developer can expect will be available to the adapter at application runtime. The primary services defined in JCA 1.5 and implemented in WebSphere Application Server include:

- *Connection management* - Enables WebSphere Application Server to create and manage connections to back-end systems. WebSphere Application Server also implements connection pooling, because connections to back-end systems are expensive.
- *Transaction management* - Supports XAResource transactional access to underlying resource managers. This service enables the transaction manager within the EJB server to manage transactions

across multiple back-end systems. Transaction Inflow is a new feature of JCA 1.5, which allows a resource adapter to propagate an existing two phase transaction into the application server.

- *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.
- *Work-management* - Supports synchronous or asynchronous execution of work with timed, delayed, or periodic work execution central to transactional control in long running workflows.
- *Message-inflow* - Enables simplified and expanded support for message driven beans. A message driven bean is an enterprise bean that allows J2EE applications to process messages asynchronously, unlike session or entity beans that allow you to send JMS messages and to receive them synchronously only. The message driven bean acts as a JMS message listener and contains methods for message processing. This provides ability for a resource adapter to invoke an application asynchronously through a message-driven bean. Essentially this allows plug-in of a variety of messaging providers into an application server.

With WebSphere Application Server, Version 6.0, IBM delivers a robust infrastructure for SOA. WebSphere Application Server, Version 6.0 enables customers to create a SOA that is the path to business flexibility and on demand business. WebSphere Application Server, Version 6.0 helps customers to increase their return on existing investments and lower total cost of ownership with support for the latest web services standards, a unified communications bus infrastructure, standards-based integration of existing applications, and optimal resource utilization in a secure and robust transactional environment.

Rapid Development and Deployment

WebSphere Application Server and the Rational tools for WebSphere provide integrated visual development tools and dynamic frameworks to leverage existing skills and assets, as well as to help build agile applications. With open-service-oriented architecture, you can easily integrate new and existing assets, increase your business flexibility and facilitate the efficient use of your IT resources. With WebSphere Application Server, Version 6.0 and the Rational Software Development Platform, you have a comprehensive build-to-integrate foundation for SOA applications.

The Rational tools provide an easy to use environment for the many different developer roles throughout the application lifecycle. With WebSphere Application Server, Version 6.0 you have an integrated application development and deployment platform that can provide direct positive impact on your return on investment 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
- Facilitating the reuse of existing assets and skills when creating new applications
- Building in flexibility that makes it easy to expand and adapt applications as business needs change
- Driving productivity for the individual developer with support for rapid development frameworks and extensive automation — and within the development team by supporting different developer roles throughout the organization

A Highly Integrated Development and Deployment Environment

WebSphere Application Server, Version 6.0 provides a highly integrated and productive application development environment for SOA. It features tight integration with the IBM Rational Software Development Platform, which provides a powerful and flexible foundation for business-driven development for SOA. The IBM Rational Software Development Platform is a framework of integrated tools and best practices that support a proven end-to-end process for all developer roles in the application development life cycle.

Rational Web Developer, Version 6.0 and Rational Application Developer Version 6.0 share in common an Eclipse V3 based Integrated Development Environment (IDE) and are the principal tools for developing WebSphere SOA applications (Figure 3). These Rational tools are available separately, although Rational Web Developer is included with WebSphere Application Server – Express Edition. The WebSphere Application Server Toolkit (AST) is a core included part of the WebSphere Application Server that provides substantial integral development and deployment capabilities. The AST provides J2EE assembly and deployment perspective tools, including the rapid deployment feature, which dramatically simplifies application deployment and ongoing deployment management. Rational Web Developer is an easy to learn IDE primarily used for building dynamic web sites applications and interfaces using JavaServer Faces (JSF), JavaServer Pages (JSPs), servlets, and Web services. Rational Application Developer adds additional developer focused support for the entire J2EE programming model, including EJBs and JCA. This tools platform for WebSphere Application Server, Version 6.0 provides extensive automation and visual tools for building new services and composing new applications out of a set of enterprise services—whether they are Web services, EJB applications or legacy resources. Both tools provide an integrated WebSphere runtime

test environment, speeding iterative development and testing and enabling developers to build in quality at all stages of development. The result for your company is higher quality, lower cost, more flexibility and faster time to value.

Built on the Eclipse V3 open systems development platform, the Rational tools for WebSphere Application Server, Version 6.0 provide open tools integration and the ability to adapt and extend the development environment with best-of-breed plug-in tools from IBM, IBM Business Partners and the Eclipse community at large.

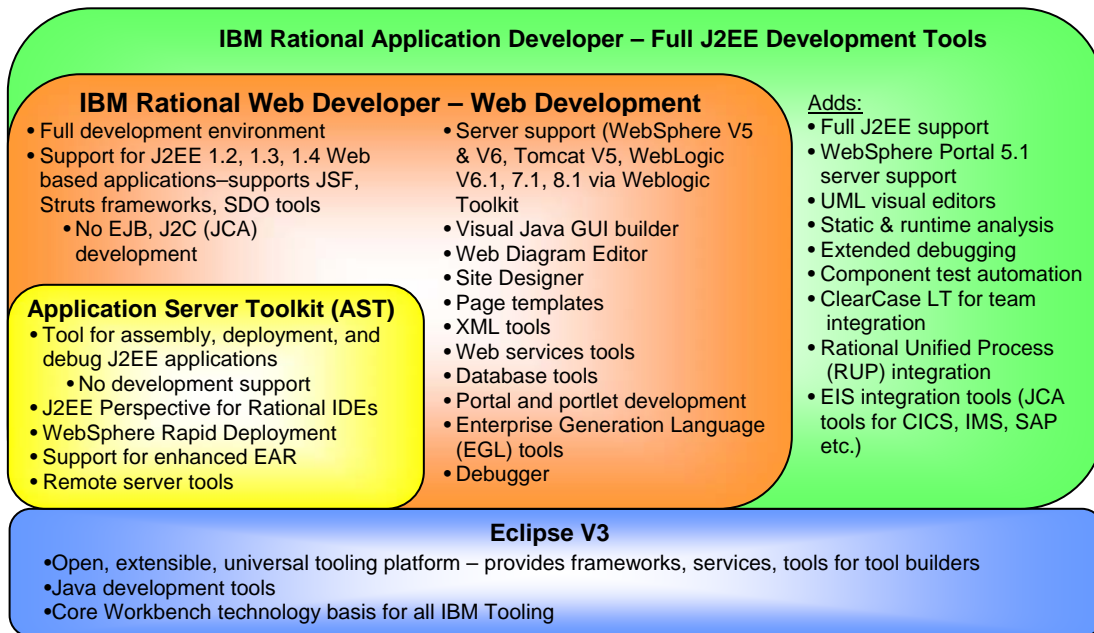


Figure 3 - Integrated development and deployment tools for WebSphere Application Server V6

Build Quickly; Expand Easily

The time required to roll out new applications is a key concern throughout all industries, and improved developer productivity is clearly a way to address this concern. One way to vastly improve productivity is to reduce the need for manual programming. You can do this through powerful frameworks that absorb much of the work involved in development, or through tools that generate code used by the runtime. With SOA, developers are tasked with creating Web services or developing systems that consume Web services. Doing this manually involves a substantial amount of tedious and potentially error prone work. With IBM's developer tools for WebSphere, developers can focus on writing the business logic, while the tools (e.g. Rational Application Developer, Figure 4) automate everything from the WSDL file and code generation to test-client generation and WS-I conformance verification.

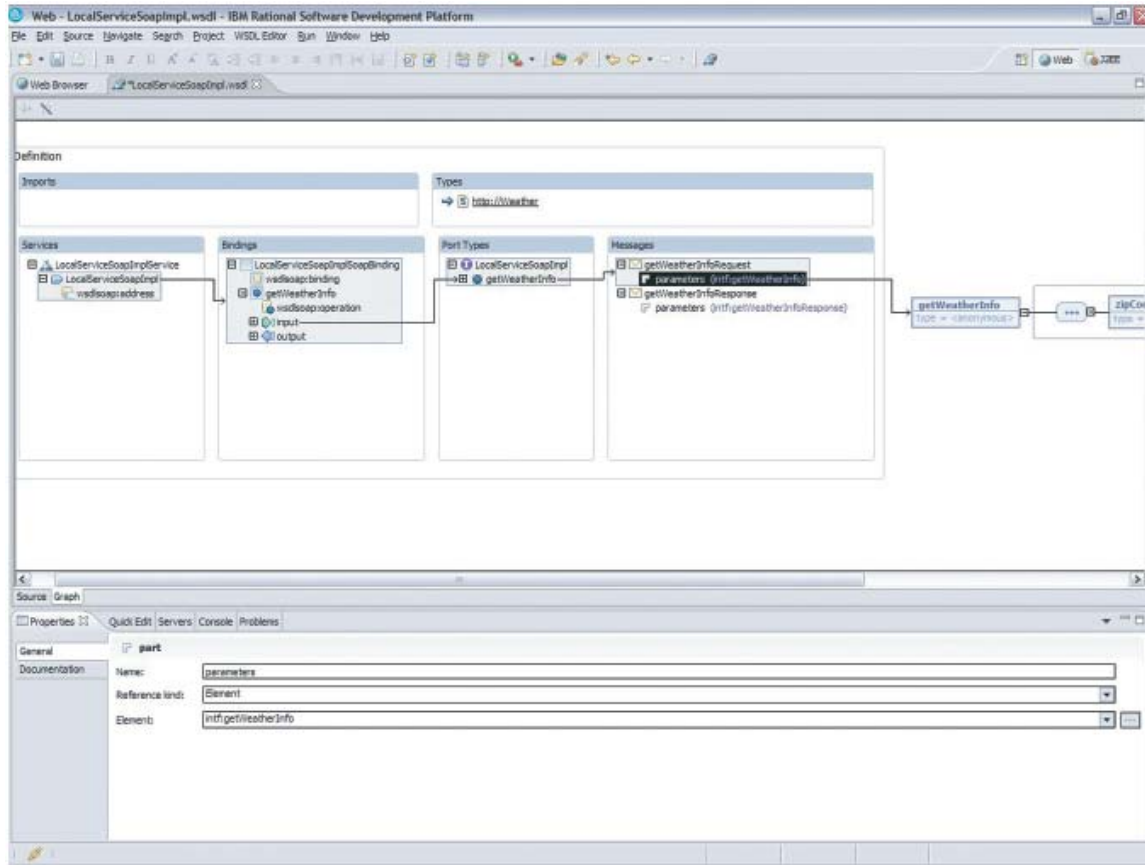


Figure 4 - IBM Rational Application Developer – automates creation of Web services from existing assets (e.g. JavaBeans, EJBs, etc.)

WebSphere software delivers a combination of frameworks and tools that work together to provide best practice implementations, a realization of the industry's best architectures. With the Rational development tools for WebSphere, developing and maintaining applications is simplified through visual programming, and use of standards-based frameworks. For example, user interface developers can use JavaServer Faces to visually wire together JSF UI components. Similarly, developers can visually connect Java applications to enterprise information systems using JCA integration components or as Web services. Similarly, Service Data Objects (now in the standardization path of the Java Community Process) provide a unified framework for connecting to disparate data sources rapidly and easily. Overall, these tools minimize the amount of time and effort needed to create and deploy new application functionality. They provide features that simplify SOA development and maximize developer productivity, including:

- Extensive automation and generation, for the core elements of J2EE and Web services, with automatic WS-I conformance verification.
- Automatic creation of Web services from existing assets (e.g. Java classes, EJBs, or EIS – JCA assets) enabling rapid reuse and integration within new SOA applications.
- Support for rapid development frameworks, such as JavaServer Face and Struts visual UI construction, and Service Data Objects which provide a unified programming model for data access across disparate data sources and protocols. This simplifies development and improves flexibility.

- Support for UML model driven development “top-down”, with generation of Web services elements from requirements specifications and UML models. (e.g. generation of WSDL files and XML schema to describe the Web services, and JavaBeans or EJB skeletons to implement the services).
- Integrated WebSphere Application Server runtime test environment, with automatic generation of Web services test clients, stubs, and harnesses. This enables you to test the new services and applications immediately and implement subsequent changes without disruption to the running production applications. The integrated tools and server enable a tight develop, test and debug cycle for both functional and performance testing by each developer.
- The rapid deployment feature, which simplifies both development and deployment experiences via support for annotation based programming and automating deployment including change detection management.

The Rational tools provide extended support for rapid development of new applications. However WebSphere Application Server includes substantial support for assembling, deploying, unit testing, debugging, and profiling WebSphere applications with the included Application Server Toolkit (AST). The AST is based on the familiar Eclipse v3.0 workbench technology and provides features for team programming, local and remote debugging, J2EE application deployment and more. The AST allows you to perform assembly tasks for web applications (e.g., importing WAR files, creating web projects, copying code artifacts from one Web project to another, and editing HTML, JavaScript and XML). The AST also supports assembly tasks for enterprise applications (e.g., importing EJB JAR files, creating new EJB projects, copying code artifacts, and generating EJB deployment code). Importantly, the AST (like the Rational tools) includes the WebSphere rapid deployment feature that provides annotation based programming support and automated deployment / change detection management, which simplifies both development and deployment. These features and functions help you to assemble and deploy applications faster than ever.

These many rapid development and deployment features deliver real business benefits in terms of reduced development cycle times, maximization of existing skills and resources. They free-up developers to focus on implementing the business logic of the services they are developing, and build in quality early in (and throughout) the development cycle.

Maximize the Value of Development Assets and Investments

Building new applications that integrate multiple back-end systems requiring data transformation and transactional integrity is critical to maximizing the value of existing assets. WebSphere Application Server, Version 6.0 delivers productivity through an open approach to transforming any application asset into a modular, network-accessible service, which others can easily identify and reuse. With support for Java API for XML-based RPC (JAX-RPC) 1.1, developers can map and create interoperable and portable Web services from existing Java assets. For packaged applications, enterprise information systems, and other legacy assets, full support for the Java Connector Architecture (JCA) 1.5 allows easy integration as either a JCA resource managed by WebSphere Application Server, or as a reusable and interoperable Web service.

Most companies are not starting from a “blank page” as they move forward to standardize their business processes and increase business flexibility with SOA technology based applications. In most cases, they have significant investments in existing systems that they need to leverage in combination with newer

business logic written in Java as they migrate to a SOA. Comprehensive analysis of existing legacy assets is critical to successfully leveraging these assets for reuse. IBM WebSphere Studio Asset Analyzer is a powerful tool 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 assets, WebSphere Studio Asset Analyzer helps identify reusable components, helps you understand the impact of changing them and helps prepare them for broader use as services accessible by new and existing business applications. As a result, you can maximize the value of existing assets that have been running your business for years (if not decades) and continue to leverage the skills and experience of all your developers.

Develop Dynamic Applications

WebSphere Application Server simplifies the development of dynamic applications through an industry-leading J2EE technology and Web services-based application server platform that provides advanced programming model extensions. It allows a business to create new opportunities by exposing application services for integration by other businesses, organizations or platforms. WebSphere programming extensions, such as the Internationalization Framework and application profiling capabilities provide strong separation between underlying development infrastructure and the runtime deployment experience of the applications. This functional abstraction enables dynamic applications that can respond and adapt automatically to global constituencies and be easily modified as business conditions and policies change, without modifying the underlying code of the application. Similarly, Service Data Objects provide a unified programming model for data access, that decouples the business logic code of a WebSphere application from the specifics and APIs of the target back end resource. This not only improves development productivity but provides a more flexible architecture for accommodating change.

Other features of WebSphere Application Server, Version 6.0 contribute to dynamic application flexibility. The Dynamic Query Service (a WebSphere programming extension) lets you dynamically build and submit queries and perform calculations on application data at run-time. This ability to pass in and process EJB query language queries at run-time, eliminates the need to hard-code required queries into deployment descriptors during application development. This not only speeds development (by allowing interactive testing) but results in a more flexible, dynamic, and maintainable application. These dynamic application adaptability features deliver clear business benefits and also helps eliminate months of programming costs and significant IT maintenance costs.

Agile Deployment and Administration

WebSphere Application Server systems management has been significantly enhanced in Version 6.0. It is now easier to deploy, manage, and tune the J2EE and Web services composite applications that are typical of SOA environments. WebSphere Application Server, Version 6.0 has a unified deployment and administration model that spans all configurations, from single servers to highly distributed, clustered, high availability configurations. This unified administration facility across all configurations of WebSphere Application Server, Version 6.0¹, minimizes training costs and makes it much easier to migrate across the entire family of WebSphere Application server configurations – from Express to Network Deployment and z/OS.

Efficient Deployment

Deploying WebSphere Application Server and applications has never been easier. With Version 6.0, IBM is delivering significant enhancements to improve the deployment from initial out-of-the-box experience, through ongoing deployment and administration of highly distributed and clustered applications.

Rolling out WebSphere Application Server, Version 6.0 throughout your organization is now much easier with significantly streamlined packaging and simplified installation with a single CD install image for the application server per platform. The biggest improvement is support for installation profiles – you can install one copy of the core files and then roll out multiple application server runtimes based on the common profile. You can install WebSphere Application Server smoothly across platforms and configurations improving ease of migration with a single consistent installation. Even easier, IBM WebSphere Application Server - Express offers a simplified installation (a profile) that accelerates time to value for Small-Medium Businesses or ISVs delivering WebSphere solutions.

WebSphere Application Server, Version 6.0 introduces significantly simplified and enhanced deployment facilities. The WebSphere rapid deployment feature is an easy to use framework for quickly and easily deploying applications to the WebSphere Application Server. It significantly reduces the complexity of building J2EE applications by automating the most common aspects of creating, assembling, configuring / packaging, and deploying J2EE applications and their myriad of artifacts (e.g. Java source files, Java class files, images, XML, HTML, etc.). The rapid deployment tools free you from having to understand J2EE application structure and dramatically simplify the process of installing, modifying, and uninstalling applications on a WebSphere Application Server.

The rapid deployment feature is a collection of Eclipse plug-ins to the WebSphere Application Server Toolkit, Rational Web Developer and Rational Application Developer environments. The rapid deployment feature extends these tools to support annotation-based programming and deployment automation. Annotation based programming allows developers to maintain a single Java source file with embedded metadata “annotations”, and automatically generate the multiple source files and artifacts on deployment using those metadata (Figure 5). Deployment automation provides automated “file copy like” installation as well as automated change detection management and regeneration of required artifacts as needed (Figure 6).

Single Java source file with annotation-based programming

```

package com.ibm.wrd;
/**
 * @ejb.session name="Hello" type="Stateless"
 * view-type=both jndi-name="HelloBean"
 */
public class Hello
{
/**
 * @ejb.interface-method view-type=both
 */
public String hello(String name)
{
return "Hello: " + name;
}
}
    
```

Hello.java

Multiple Java source files and application artifacts

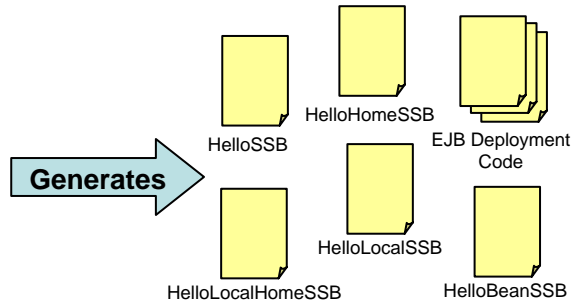


Figure 5 - Annotation based source coding simplifies development and deployment

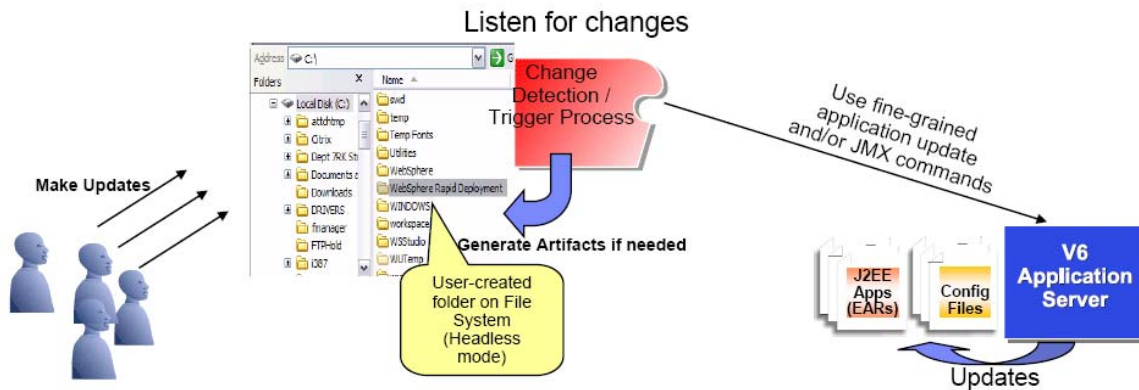


Figure 6 - Automatic installation and change detection simplifies deployment and management

These advanced development and deployment features enable customers to improve time to value and make the most of existing technology skills, by:

- Simplifying the development experience for WebSphere applications by reducing the number of development artifacts, concepts, and technologies; and by providing support in established familiar tools for the development and deployment model.
- Simplifying the deployment experience for WebSphere applications by automating the process of installing an application on WebSphere, reducing the amount of information that must be collected by the installer, and automating the process of activating incremental changes to an application on a running server.

WebSphere Application Server, Version 6.0 provides improved flexibility to deploy your applications across all configurations¹ of the platform. WebSphere Application Server, Version 6.0 implements the same core application server platform across all configurations¹ (Express, Base, Network Deployment, z/OS). Common

code and delivery allows you to deploy to the platforms best suited to your needs and enhances mobility of applications as your needs evolve and grow.

To make deploying updated applications (and migration to Version 6.0) more seamless in multi-server and clustered topologies, WebSphere Application Server Network Deployment, Version 6.0 supports mixed (V5 and V6) clustered deployments, with centralized administration via the Version 6.0 Deployment Manager. Importantly, deployment across clusters is significantly improved, allowing you to install, update, or delete an application and have the updates automatically distributed to all members in a cluster. Incremental updates are now supported, allowing a cluster cell to be upgraded to a new release one node at a time, which minimizes the impact to the applications running within the cell, improving availability. In the previous version (WebSphere Application Server V5), if you updated an application on a cluster, you had to stop the application on every server in the cluster, install the update, and then restart the server. With WebSphere Application Server Version 6.0, the rollout update option allows you to update and restart the application servers on each node, one node at a time, providing continuous availability of the application. You can add more WebSphere Application Server nodes dynamically and manage them in the network asynchronously, regardless of individual or overall network status and with updates assured when server and network communication is available. Server configuration is stored as XML files, created as part of the installation Profile wizard routine and administered through the Administration Console / Deployment Manager views. The new profiles feature allows you to more quickly and conveniently configure and deploy new servers that have similar requirements.

Simplified Administration

Administration has never been easier than with the new web-based, graphical Administration Console. This central administration portal provides easy access to all aspects of server, cluster, dynamic cache, and resource management, including resources participating in the Service Integration Bus architecture (such as the integrated JMS services and Web Services Gateway). This unified administration console offers consistency across all WebSphere Application Server, Version 6.0 configurations¹ which contributes to reduced training costs and lower total cost of ownership overall. With Version 6.0, there are many Administration Console enhancements, including:

- Streamlined interface that provides a consistent (Integrated Solutions Console - ICS) look and feel across WebSphere and other products in the IBM family (Figure 7).
- Integration of the Deployment Manager (WebSphere Application Server Network Deployment) into the administration console providing a single administrative interface for managing a logical group of servers across clusters of nodes, cells, and machines.
- Unified management for mixed deployment environments of WebSphere Application Server V5.0, V5.1, and V6 for Network Deployment and z/OS configurations.
- Adapt-a-View support that tailors the console view based on the administrator's role (privileges), and the version, platform, and installed capabilities of your WebSphere Application Server environment.
- Integrated management for the IBM HTTP Server.
- Enhanced performance monitoring tools, including performance monitoring of dynamic caches of the application server and Edge components in the Network Deployment configuration, and Tivoli Performance Viewer integrated into the console (Figure 7) for all configurations¹.

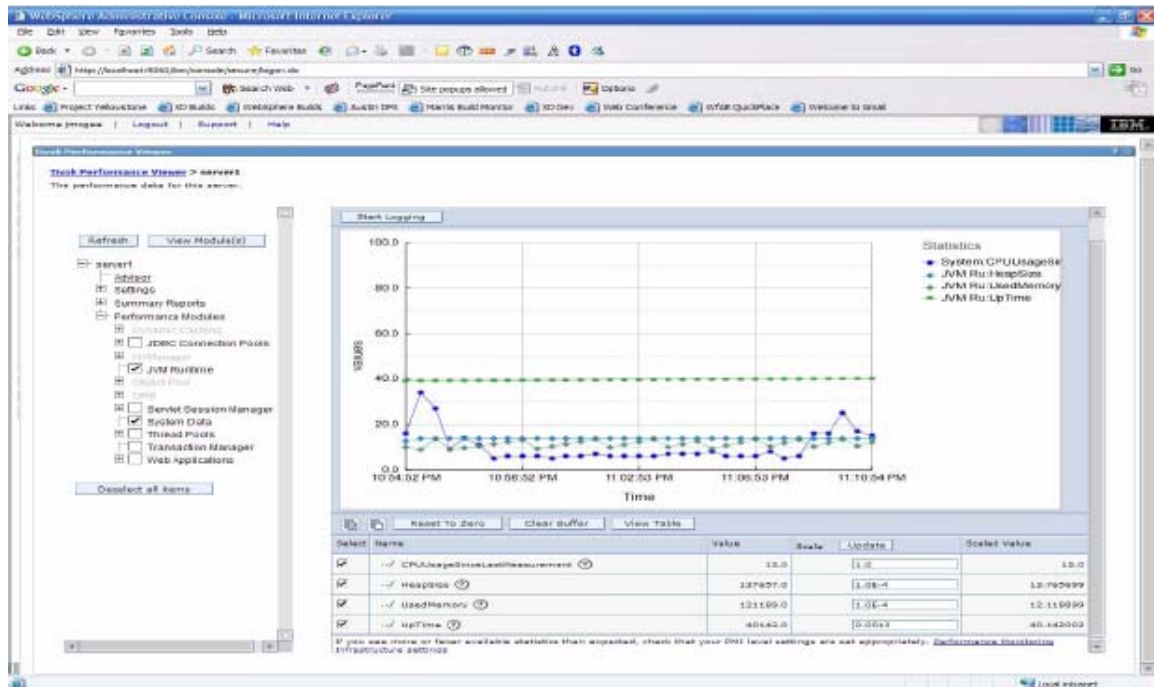


Figure 7 - Tivoli Performance Viewer integrated in Administration Console

In addition to the Administration Console, WebSphere Application Server supports traditional scripting administration tools (such as the wsadmin, ANT, and JCAL files), as well as integration of external administration solutions via the JMX API. Because the WebSphere administration model is based on JMX, it is highly extensible. JMX is a framework that provides a standard way of exposing Java resources, for example application servers, to a system management infrastructure. Within the standard WebSphere infrastructure, all of the managed resources are represented as JMX MBeans (JMX MBeans represent the management interface for a particular piece of logic). This provides you with an open and highly extensible administration infrastructure that can be extended with MBeans to include other administration applications. JMX support also allows you to use external enterprise solutions (such as Tivoli security products) to manage WebSphere software in a standard way.

With WebSphere Application Server Network Deployment, base administration capabilities are extended to help manage configurations that include large numbers of servers. Automated application-server management functions help enhance productivity and help reduce administrative costs. The roles-based, tiered administration system and automated management functions dramatically simplify tasks, with automatic distributed process discovery (e.g. when a server starts and joins a cluster), and automatic publishing and synchronization of configuration information between the master configuration repository and each cluster node. In a WebSphere Application Server Network Deployment environment, multiple WebSphere Application Server nodes are managed from a single central location. However, administration tasks and configuration files are distributed among the cluster nodes and each application server starts from its local configuration file which reduces the reliance on a central repository or administration server.

Although a master configuration is maintained via the Deployment Manager, this is pushed out (published) and automatically synchronized to the local node configurations, providing a unified view and automated approach to cluster wide management.

Extended Manageability with WebSphere Extended Deployment

To reduce the complexity and cost of managing complex distributed environments, WebSphere Extended Deployment delivers extended manageability features on top of the core capabilities provided with the Network Deployment configuration. Extended manageability facilities offer simpler and improved management of complex system operations with real-time advanced, meaningful visualization tools, controlled implementation of autonomic capabilities, and application edition management. These key features help to reduce the complexity and cost of managing your IT resources in highly distributed and clustered environments.

Visualization Tools provide “at a glance” understanding of your systems, including the status and health of applications running in the WebSphere Extended Deployment dynamic shared resource environment in the context of how they are meeting your established business goals. WebSphere Extended Deployment extends the Administration Console with three primary visualizations (Runtime Topology, TreeMap, and Custom Charting) that allow rapid understanding of your application deployments in the dynamic, shared resource environment of WebSphere Extended Deployment. These visualizations are updated in near real time to reflect the on demand changes to the environment, allowing full understanding of autonomic management capabilities of the dynamic WebSphere Extended Deployment environment.

Autonomic capabilities in WebSphere Extended Deployment help you to reduce the cost (and complexity) of managing your IT resources. Autonomics deliver increased system resiliency, responsiveness, and availability, with autonomics covering:

- WebSphere Extended Deployment goals directed WLM
- Health Policies for early proactive detection and automated correction of system problems
- Self managing and self allocating server resources such as dynamic clusters
- High availability management for server and application services with the HAManager.

Importantly, WebSphere Extended Deployment provides a gradual controlled implementation of autonomic capabilities, with manual, supervised, and on demand modes. This allows you to maintain control and incrementally adopt and leverage WebSphere Extended Deployment autonomic computing capabilities.

Application Edition Management (AEM) in WebSphere Extended Deployment simplifies the process of rolling out updates to your business applications without interrupting service and while maintaining high availability. Application Edition Manager allows you to have multiple application editions deployed to a WebSphere cell. The Application Edition Manager makes it possible to choose and control which edition to activate on a WebSphere Application Server cluster, enabling you to either rollout new application updates, or revert to previous editions as required, while maintaining availability. Application Edition Manager supports rolling upgrades and atomic upgrade strategies for rolling out application editions. The Application Edition Manager also supports a Validation deployment mode which is tremendously useful during testing to verify functionality of a new application edition in your production environment without exposing it to your real users.

Performance Monitoring

WebSphere Application Server V6.0 provides a comprehensive performance monitoring infrastructure and tools which allow administrators to easily visualize and analyze performance data collected in real time from various areas of your business application environment. This allows you to make informed decisions when it comes to diagnosing and performance-tuning the environment. WebSphere Application Server, Version 6.0 implements the J2EE 1.4 standard Performance Data Framework, with application server elements instrumented and exposed using JMX. WebSphere Application Server provides a comprehensive performance monitoring solution out-of-the-box, with an integral Performance Monitoring Infrastructure (PMI), integrated performance visualization and analysis tools, and intelligent Performance Advisors.

- Performance Monitoring Infrastructure collects performance metrics data from the running application server and makes them available via JMX. The PMI collects data on your application resources (e.g. EJBs, servlets/JSPs, Web services, JMS, SiBus, or custom PMI), the application server's runtime resources (e.g. JVM memory, thread pools, database connection pools, dynamic caches, etc.), and system resources (e.g. processor usage, total free memory, etc.).
- Tivoli Performance Viewer (TPV), integrated into the Administration Console (Figure 7), allows you to visualize the collected PMI data from local and remote application servers in your environment. TPV provides summary reports that show key areas of contention (e.g. EJBs and their methods, thread pools, connection pools, etc.), graphical and tabular views of raw PMI data allowing you to drill down to view individual performance metrics, and give you the ability to save PMI data to logs for detailed review.
- Performance Advisors are integrated into the Administration Console and Tivoli Performance Viewer. They provide tuning advice formulated from the gathered PMI data and configuration data. This determination requires considerable expert knowledge about the various components in the application server and their performance characteristics. The Performance Advisors generate intelligent tuning advice in real-time or offline, jump starting the tuning process and lowering the "expert skills" bar that otherwise would be required.

The Performance Monitoring Infrastructure in WebSphere Application Server is extremely extensible because it is based on open, industry standards and PMI data are exposed in a standards based manner (JMX). Support for custom PMIs allows you to add your own performance metric counters tailored to the business function. For example, for an online-sales application you could add a PMI counter for the number of items sold per day. Further you can extend the built-in performance monitoring and management capability with more extensive performance monitoring and management products from IBM Tivoli and third parties that also support the JMX standard.

The built in performance monitoring and tuning capabilities of WebSphere Application Server allows not only initial deployment tuning but also the flexibility to adapt on demand to changing business needs using real-time feedback from the production application.

Secure Optimum Resource Utilization for on demand Operations

WebSphere Application Server, Version 6.0 provides a secure, dynamic platform that allows you to do more work with fewer resources. In today's volatile business environment, the ability to continually optimize your network for enhanced performance, scalability and availability has a direct impact on the top and bottom lines of your business. High-volume, dynamic Web sites place significant demands on an SOA infrastructure. Attracting and keeping customers who have a choice to go elsewhere requires reliable and secure access to business-critical applications. And refreshing frequently requested data must occur 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 leverages proven experience to deliver a scalable, highly available and security-rich platform. Through performance and availability features, together with edge-of-network technology and advanced security capabilities, WebSphere Application Server, Version 6.0 can dynamically and more securely react to network pressures. WebSphere software provides an intelligent, optimized application platform that benefits business today and lays the foundation for grid services capabilities.

Always On, Always Available

WebSphere Application Server Network Deployment, Version 6.0 is the foundation for high availability solutions that leverage world class clustering, edge-of-network services, distributed caching, improved workload management at all server tiers, and improved fault tolerance with the new integral High Availability Manager (HAManager), and Backup Cluster support. In clustered configurations, WebSphere Application Server Network Deployment can deliver high availability and failover capability at the HTTP server, Web container, and EJB container application tiers.

At the HTTP tier, the Load Balancer, which is part of the Edge Components delivered in WebSphere Application Server Network Deployment V6, can provide both scalability and high availability for the web servers by distributing the incoming workload across multiple web servers. The Load Balancer is an edge-of-network system that directs network traffic flow, reducing congestion and balancing the load directed to back end services and systems. The Load Balancer provides site selection, workload management, session affinity, and transparent failover. In most cases it can also be configured to provide content-based routing. The Load balancer monitors the availability of web servers in the cluster and dispatches incoming requests to the appropriate server in the cluster based on both weighting metrics and availability. Because the Load Balancer is the entry point for clients accessing your application, high availability for this component itself is important. HA for the Load Balancer can be achieved by setting up a replicate Load Balancer, supporting either an active/active configuration with mutual takeover on failure or an active/passive failover configuration. Load balancing can be tuned for specific application and platform criteria using custom advisors code that feeds performance monitoring metrics into the load balancing manager for optimum server allocation.

New in WebSphere Application Server Network Deployment V6, the Proxy Server for WebSphere provides a high performing web intermediary that can dynamically route traffic to WebSphere Applications with minimal configuration or administrative actions. It provides integrated workload management, caching and

administration capabilities and can be used outside a typical Application Server environment to include routing and caching for any HTTP server as well. It includes support for IPV6 and 64-bit platforms.

For the Web container tier, the WebSphere web server plug-in provides workload management and failover across web containers in the cluster and also can distribute requests around (bypass) cluster members that are not available.

The Application Server provides distributed in-memory session replication and failover capabilities by leveraging the High Availability manager. Session state can also be preserved using database persistence.

EJB high availability is achieved by the combined functions of the EJB workload management (WLM) across an EJB server cluster, and the new HAManager which protects the EJB WLM service (and eliminating a previous single point of failure).

New in WebSphere Application Server Network Deployment V6, the High Availability Manager enhances availability by protecting critical singleton services (such as transaction and messaging services, or the EJB WLM service) from becoming single points of failure. The High Availability Manager is responsible for running key services on available servers and supports hot standby and peer failover for these services. These automated hot failover capabilities deliver near real-time recovery when fail-over is detected in a cluster and permits, for example, peer recovery of in-flight transactions or messages among clustered WebSphere Application Servers.

Also new in WebSphere Application Server Network Deployment, Version 6.0 is support for a mirrored backup cluster. This can be used to failover EJB requests from a primary cluster to the mirror cluster if the primary cluster fails, with automatic failback when the primary cluster becomes available again. As such, without manual intervention, Backup Cluster Support will send a workload to another cluster if a cluster goes down.

WebSphere Application Server Network Deployment, Version 6.0 can take advantage of fault tolerant storage technologies such as Network Attached Storage (NAS). For example, WebSphere Application Server Network Deployment, Version 6.0 can be configured to store transaction logs for each server on a NAS shared file system. This allows all peers to see all the transaction logs, permitting rapid recovery of a transaction by any peer in the cluster, while lowering the cost and complexity of high availability configurations.

Continuous Availability and High Performance Computing

WebSphere Extended Deployment builds on the WebSphere Application Server Network Deployment V6 foundation to achieve near-continuous availability for high volume business critical transactions, previously only achieved with traditional transaction processing monitors.

WebSphere Extended Deployment delivers dynamic operations enhancements which allow your application environment to scale on demand with improved resource utilization and lower TCO. With the WebSphere Extended Deployment Business Grid, resources are virtualized in a common pool so that they can be shared amongst multiple, transactional applications and long running workloads, including batch processing and computationally intense applications (such as scientific, CAD, statistical modeling, etc.). With the goals directed infrastructure, workloads are classified, prioritized, queued and routed according to customer

business goals and relative application importance. Automatic managers provide dynamic adjustment of application resources based on actual demand and workload.

The On Demand Router (ODR) is a major functional element of WebSphere Extended Deployment that provides this business goals and service policy directed workload management. The ODR sits in front of the WebSphere Extended Deployment cluster and controls and shapes the traffic to the clustered servers. When an incoming request arrives, the ODR first classifies the requests based on business goals (e.g., a stock trading application could be assigned a higher business importance than a portfolio advice application) and places the incoming requests on a processing queue that corresponds to their service class. The ODR runs an Autonomic Request Flow Manager (ARFM) that prioritizes these requests, based on defined service policies (for example, to enforce a service level agreement), and controls the rate and order of traffic flow (e.g., stock trading vs. portfolio advice) to the routing and load balancing component which delivers the requests to the appropriate servers.

High Performance Computing facilities in WebSphere Extended Deployment extend the WebSphere Application Server Network Deployment environment to optimize high volume transaction processing environments, achieve near-continuous availability, and to provide near-linear scalability with commodity hardware as transaction load increases. WebSphere Extended Deployment addresses these capabilities with the Partitioning Facility, high end caching with the ObjectGrid, and by extending autonomic High Availability management to key application singleton services in addition to the application server HA management delivered by WebSphere Application Server Network Deployment server configuration. The ObjectGrid is an extensible, fault tolerant, transactional object caching fabric delivering quick and easy object data sharing and high performance access that improves application scalability and performance. For high volume OLTP applications (such as equity trading, reservation systems, etc.) the Partitioning Facility addresses the bottlenecks that can occur with intensive read and write operations. It enables the partitioning of applications, the ObjectGrid, and data (e.g. based on stock ticker symbol, etc.), improving database as well as in-memory caching and workload management, dramatically decreasing contention for shared data and application resources. With clustered application partitions, WebSphere Extended Deployment can deliver low response times, near continuous availability, and near linear scalability on commodity hardware.

Enhanced User Experiences

For improved system response times and enhanced user experiences, you can deploy edge-of-network services using the Edge Components of WebSphere Application Server Network Deployment, Version 6.0. The Edge Components provide sophisticated load balancing, edge-of-network caching, and centralized security services to address the needs of high volume, highly available web application environments. In addition to the web server load balancing and failover capabilities (discussed above), the Edge Components Caching Proxy has the ability to cache, serve, and invalidate not just static HTML but also dynamic content in the form of JavaServer Pages and servlet responses generated by a WebSphere Application Server creating a virtual extension of the application server dynamic caches out into edge-of-network caches. Edge-of-network caching technology can reduce network congestion by storing frequently accessed content so information need be retrieved only once. Information can be cached and invalidated depending on when it will expire, how large the cache should be, when the information should be updated, or invalidated or refreshed in response to a back end application event. Edge caching can improve response time (and user

experience) dramatically and offloads unnecessary processing from the backend servers, while maintaining tight integration with enterprise security and access managers (via plug in support) with Tivoli Access Manager, LDAP directories, or third party authentication and authorization mechanisms.

Caching can be further extended out into network based caches (such as the Akamai network) through use of Edge Side Include (ESI) technology. ESI mechanisms permit pages to be assembled from cached content (page fragments) at the edge of the network, thereby reducing bandwidth consumption and decreasing response time further. ESI is a simple markup language and proposed open standard (now in the public review path of the Java Community Process) 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 the Akamai network. This enables caching to occur at a more granular level and allows 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 help reduce workload on the network servers that occurs because of fragmented offload to the edge. This is particularly useful in a B2C scenario for delivering personalized pages to end users, whereby only the personalized page elements need come from the backend application and most elements could be served from static or dynamic content in edge-of-network or out-in-network caches.

Instill Confidence with Security-Rich Features

WebSphere Application Server offers a sophisticated security-rich infrastructure, single sign-on capabilities and extensive support of open, standards-based Java and Web services specifications. WebSphere Application Server provides a secure infrastructure to help prevent unauthorized access to the J2EE technology and Web resources it protects, through strong authentication capabilities that consist of basic (userID/password), forms-based certificate and encryption options for secure user validation and roles-based authorization. The WebSphere Application Server, Version 6.0 security infrastructure provides integral support for :

- JAAS for authenticating new principals and managing privilege information for a principal.
- Java 2 Platform, Standard Edition (J2SE) V1.4 for securing system resources, and Java 2 Platform, Enterprise Edition (J2EE) V1.4 for securing and controlling access to WebSphere Application Server application and resources.
- Java Secure Socket Extension (JSSE) for securing communication channels based on transport level security (TLS/SSL).
- Java Cryptographic Extension (JCE) framework for security encryption and message authentication.
- Java Cryptographic Architecture (JCA) for PKI integration.
- Common Secure Interoperability V2 (CSlv2) for vendor-neutral, secure interoperability between application servers. This protocol adds additional security features that enable interoperable authentication, delegation and privileges in a CORBA environment. CSLv2 supports interoperability with the EJB 2.1 specification and is the mechanism employed by WebSphere for interoperability between Java clients and EJBs, or between EJBs and remote ORBs.

WebSphere Application Server includes integral Single Sign-on (SSO) capability across multiple WebSphere Application Servers and Lotus Domino servers in the same domain, using Lightweight Third Party

Authentication (LTPA), with capability to integrate LDAP or custom user registries. With SSO support, web users can authenticate once and not be prompted for credentials again when accessing WebSphere Application Server resources (e.g. HTML pages, JSP files, servlets, EJBs, etc.) and Lotus Domino resources such as documents in a Domino database.

You can also leverage WebSphere's pluggable security architecture (Java Contract for Containers (JACC) standards-based support) to implement sophisticated enterprise topologies and infrastructure including the use of third-party authorization providers for access decisions. This includes: pluggable user registries to enable you to exploit the local OS registry, LDAP or custom registries. Web single sign-on can be provided by integral WebSphere SSO capabilities, pluggable integration of credential mapping services for access to enterprise information systems, or through pluggable integration with IBM or third party front-end authentication endpoints through Trust Association Interceptor (TAI) technology, with support for both TAI and TAI++ interfaces. For example, via TAI you could use a reverse proxy security server such as Tivoli WebSEAL to shield a Web server from unauthorized requests, combined with Tivoli Access Manager to provide a unified identity management and security solution.

For a centralized approach to security, WebSphere Application Server provides tight integration with the IBM Tivoli Access Manager. Integration with IBM Tivoli Access Manager provides a centralized identity management solution with global sign-on capabilities and enforceable policies to secure cached and noncached J2EE, portal, Web and legacy resources. The integration of Tivoli Access Manager with the WebSphere Application Server platform provides enterprise-wide management of authentication and authorization with SSO. Companies that implement this integrated solution can 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, with greatly simplified administration and enhanced end user experience.

For secure Web services, WebSphere Application Server supports the OASIS Web Services Security V1.0 standard (WS-Security 2004). WS-Security defines the propagation of security credentials, including identity assertions, digital signature support (UsernameToken 1.0, X.509 Certificate Token 1.0) and XML-based encryption for more secure Web services interactions. WebSphere Application Server, Version 6.0 provides significantly enhanced capabilities for ensuring integrity and confidentiality of XML-SOAP messages, supporting signing and or encryption of any part of the message. In addition to the base WS-Security support, WebSphere Application Server, Version 6.0 provides programming extensions to extend the capability to support higher-level specifications proposed to extend the WS-Security specification, such as WS-SecurityKerberos, and WS-SecureConversation and WS-Trust.

Additional Web services security is provided by the Web services gateway component of the service integration bus of WebSphere Application Server Network Deployment, Version 6.0. This allows businesses to securely externalize and expose applications as Web services. For most secure consumption of web services (particularly those external to your organization), WebSphere Application Server, Version 6.0 supports the latest UDDI V3, with its improved security features, including digital signing of UDDI entries.

Harness the Power of z/OS

WebSphere Application Server for z/OS, Version 6.0 brings the qualities-of-services of the z/OS platform to J2EE and Web services applications to support the demanding requirements of large-scale on demand

enterprise computing. WebSphere Application Server for z/OS, Version 6.0 is specifically optimized to utilize the unique qualities of services provided by IBM zSeries™ hardware and the z/OS™ operating system, providing the ultimate in availability, scalability, and security. These unique capabilities translate into real, tangible business benefits for the demanding requirements of large scale on demand enterprises.

- *Eliminate Lost Business Opportunities:* WebSphere Application Server for z/OS, Version 6.0 provides an on demand infrastructure for near continuous uptime for mission critical applications. 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, Version 6.0 features a High Availability Manager (HA Manager) to assist in monitoring and recovering WebSphere servers, resources, and components. This works in synergy with the underlying WebSphere Application Server for z/OS design which focuses 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).
- *Service Level Agreements:* WebSphere Application Server for z/OS leverages the z/OS WLM to provide performance goal-oriented workload balancing, management and reporting within a system and across a Parallel Sysplex cluster. New in Version 6.0, the eWLM integrates with the native WLM capabilities of z/OS to extend reporting and monitoring of transaction performance, across conformant platforms of the multiple, disparate servers that are invariably involved in web-centric transactions. WebSphere Application Server on z/OS enables the ability to help ensure service levels (response time, throughput and so on) for specific types of customers and high-priority workloads as defined by business needs.
- *Integration and Extension 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 IBM IMS™, CICS and DB2. Using WebSphere Application Server for z/OS as your integration engine can 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. Further, WebSphere Application Server for z/OS, Version 6.0 provides support for unified administration of a mixed WebSphere Application Server for z/OS environment (e.g. V5 and V6) for more flexible implementation and eventually migration to V6.
- *Lower TCO with dedicated Java processor:* WebSphere Application Server for z/OS V6 (6.01) supports the new zSeries Application Assist Processor (zAAP) which can drastically reduce the cost of running new Java workloads on the mainframe. Available on z890 and z990 (and follow on models), the zAAP is a dedicated processor for Java workloads that can operate asynchronously with the general purpose processors, free from ISV or OS processor charging. This allows you to offload processing cycles from the general purpose processor, improving performance and reducing TCO (via freeing up cycle charges from the GP processor).
- *Efficiency:* Maximizing people and system resources. z/OS is 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. 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:* 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 is designed to fully integrate with the IBM Tivoli Access Manager, z/OS Security Server for z/OS or equivalent z/OS security products.

For the existing z/OS customer, WebSphere Application Server for z/OS helps you fully leverage your existing investment in zSeries in new ways. Utilize the skills and procedures already in place for your data center with WebSphere Application Server for z/OS as you extend and reuse these battle-tested, proven assets in web, traditional J2EE or SOA environments.

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 J2EE 1.4 and Web services standards. As business needs demand, you can redeploy a J2EE application or Web service already deployed to another platform 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 you can reuse well-established operational procedures for the zSeries to provide a strong foundation for your SOA environment.

A Leading Technology Partner

WebSphere Application Server, Version 6.0 delivers a robust and comprehensive foundation for SOA for the on demand enterprise. When selecting a strategic foundation for your business, there is more to the decision than selecting a product – it is also about selecting a strategic business and technology partner. There are three main reasons why IBM is the premier strategic partner for SOA: standards leadership, product leadership, and proven experience.

- *Leadership in open standards:* IBM is committed to open standards to provide the greatest flexibility, interoperability, and investment protection. IBM continues to be the clear leader in supporting industry standards and has a tremendous history of leadership in standards development. IBM has led or co-authored the development of many of the key standards for J2EE, XML, and Web services. For example, WebSphere engineers have contributed to more than 80 percent of the J2EE specification, and these engineers continue to drive the evolution of J2EE standards through the Java Community Process. Similarly, for Web services and SOA, IBM continues to lead open standards development. IBM co-authored the WSDL and SOAP 1.1 specifications, which are the underpinnings of Web services today. Similarly, IBM authored the original UDDI specification and co-founded UDDI.org. In the area of Web services interoperability, security and transactions, IBM has been a leader as well, as the founder and chair of the WS-I organization, chair of the WS-I Basic Profile 1.0 working group, co-author for the standards for Web Services Security, Web Services Transactions, and the submission of Business Process Execution Language for Web Services to OASIS, to name just a few. IBM was the founder of Eclipse.org and provided the Eclipse platform to open source, which now provides the common tools interoperability framework for most J2EE vendors. Similarly, IBM was instrumental in the formation of OASIS, the industry consortium responsible for many of the Web services/SOA standards.
- *Product leadership:* WebSphere Application Server incorporates IBM's core capabilities and expertise in building system software. These capabilities include transactional and security leadership; an ongoing focus on interoperability; IBM's heritage in delivering robust and assured messaging infrastructure, expertise in distributed object and component technologies; strengths related to Web services and XML; industry-best support for manageability (including synergies with IBM Tivoli enterprise security and management capabilities); and significant experience in the area of application integration and connectivity. For J2EE, Web services and SOA, WebSphere Application Server continues to lead. WebSphere was the first J2EE 1.4 server, first with WS-I Basic Profile support, first with a Web Services Gateway, first integrated UDDI directory, and first to leverage the Enterprise Service Bus to integrate applications and services across your organization and beyond with ease. WebSphere is leading with Web services support above and beyond initial specifications with additional programming model enhancements to provide a secure foundation for a SOA. Similarly, in the areas of rapid development and deployment, WebSphere product leadership is evident with frameworks that speed and simplify development and deployment such as Service Data Objects (SDO) and the rapid deployment facility. With the broadest platform support (including z/OS), the same core application server programming model across all configurations¹, and connectivity and integration for enterprise systems, WebSphere Application Server, Version 6.0 leads the industry in delivering business flexibility, scalability, high availability, and extending high-performance, proven application environment assets to your SOA.

- *Proven experience:* IBM has long heritage and extensive experience in transactions, security, and in developing extremely scalable and highly available applications and systems. With WebSphere Application Server, IBM is bringing the benefits of this experience to SOA applications, with a highly scalable transaction engine, leading security, world class clustering, and high availability management. Nobody has broader or deeper experience, or invests more in these technologies than IBM. IBM is investing over \$1 billion a year in SOA and Web services, has more than 40,000 developers actively working on the WebSphere software platform and 6,700 working on SOA based offerings alone. In addition, IBM has over 10,750 IGS technical practitioners trained on WebSphere, providing a breadth and depth of expertise to assist customers that cannot be matched by any other vendor. With over 300 SOA engagements and counting, IBM's has extensive real world experience with helping enterprises transform their businesses with SOA for on demand operations. This experience in helping customers implement high volume, highly available WebSphere applications feeds right back into the product development process. WebSphere Extended Deployment is a clear example of this, delivering to all customers many of the enhancements in terms of virtualization, high availability, workload management, application partitioning, and support for mixed workloads that were developed as part of IBM's direct experience in customer implementations. IBM's proven experience in helping customers implement a SOA and implement highly scalable and available enterprise systems means that you can mitigate your risk in adopting these technologies, leverage the best practices IBM has developed through actual engagements using current products, and improve your time to value.

For More Information

Contact your local IBM representative today for more information about how you can achieve business results well ahead of your competition.

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Somers, NY 10589
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¹ WebSphere Application Server Community Edition does not share this functionality

² The focus of this whitepaper is WebSphere Application Server V6.0, and not WebSphere Application Server Community Edition V1.0. For more information on WebSphere Application Server Community Edition, please go to: <http://www-306.ibm.com/software/webservers/appserv/community/>