



IBM Software Group

# IBM WebSphere Application Server V6.1

## *New features overview*



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This presentation will introduce the new features in WebSphere® Application Server V6.1.

## Agenda

- Overview
- Programming model enhancements
- Usability enhancements
- Security enhancements
- Enterprise class function enhancements
- Application Server Toolkit V6.1
- Serviceability enhancements



This presentation will briefly introduce WebSphere Application Server V6.1, and then cover the major new feature areas, including programming model enhancements, usability enhancements, security enhancements, enterprise-class function enhancements, enhancements to the Application Server Toolkit, and serviceability enhancements.

## Section

# ***Overview***



This section will introduce the main focus areas of WebSphere Application Server V6.1.

## WebSphere Application Server V6.1 overview

- V6.1 is built on top of V6.0 and uses similar application programming interfaces
- Extends the V6.0 system management model
- Focus areas:
  - ▶ Ease of use
  - ▶ Extending programming model
    - Support for Portlet and SIP (Session Initiation Protocol) applications
    - Upgrade to Java™ 5.0 SDK
    - Support for additional Web services (WS-\*) specifications
  - ▶ Security enhancements include simplified certificate key management and federated repositories

WebSphere Application Server V6.1 builds upon and extends the V6.0 product. It utilizes the programming interfaces and system management model that you are used to from V6.0, and extends them in key areas. The enhancements to this version are focused on increasing usability by simplifying administrative tasks, and also on extending the WebSphere Application Server programming model to new application types, such as Portlet applications and Session Initiation Protocol applications. This version is the first WebSphere Application Server release to support Java 5.0 and includes the new IBM Virtual Machine for Java on most platforms. Finally, this release has introduced many new security features and options.

## Section

# ***Programming model enhancements***



This section will cover enhancements to the WebSphere Application Server foundation and support for new programming models.

## Upgrade to Java SDK 5.0

### ■ New specifications

- ▶ JSR 003: The JMX 1.0 specification. Packages: javax.management.\*
- ▶ JSR 013: Additions to java.math for improved arithmetic operations using BigDecimal.
- ▶ JSR 028: The Java SASL packages: javax.security.sasl
- ▶ JSR 114: JDBC Rowset implementations, which specify rowset more completely.
- ▶ JSR 160: JMX remote API, V1.0
- ▶ JSR 163: Java Platform Profiling Architecture, JVMTI (Replacement for JVMPI).
- ▶ JSR 166: Concurrency utilities. Packages: java.util.concurrent.\*
- ▶ JSR 174: Monitoring and Management Specification for the Java Virtual Machine
- ▶ JSR 200: Network Transfer Format for Java Archives.
- ▶ JSR 206: Java API for XML Processing (JAXP) 1.3
- ▶ JSR 204: Unicode Supplementary Character Support

### ■ Features

- ▶ Generics
- ▶ Auto-boxing of primitives
- ▶ Annotations
- ▶ Support for enumerated types



WebSphere Application Server V6.1 is the first release of WebSphere Application Server to support the Java 5.0 SDK. This includes support for several new specifications shown here, and new features that make it easier to develop Java applications. These features include generics, which enable type abstraction and reduce casting, auto-boxing of primitive data types, support for enumerations, and annotation support, for embedding metadata in your source code that can be interpreted by the Java compiler. You can learn more about the features of Java 5.0 in the official Java specification.

## Upgrade to Java SDK 5.0 (cont.)

- IBM's Virtual Machine for Java and JIT includes
  - ▶ Improved performance
  - ▶ Improved startup
  - ▶ Improved garbage collection
- No Sun intellectual property
- IBM's Virtual Machine for Java used on Windows<sup>®</sup>, Linux<sup>®</sup>, AIX<sup>®</sup>, i5/OS<sup>®</sup>, z/Linux and z/OS<sup>®</sup>
- Sun's JVM used on Solaris and HP-UX



WebSphere Application Server V6.1 also includes a new version of the IBM Virtual Machine for Java Platforms that has been rewritten from the ground up, with performance and portability in mind. This new Virtual Machine includes improved startup time, a new Just-In-Time compiler, and new garbage collection algorithms. It also contains no Sun intellectual property. This new Virtual Machine is not used on the Solaris and HP-UX platforms, where Sun's Java Virtual Machine (or JVM) is still used.

## Componentization overview

- V6.1 leverages the Open Services Gateway Initiative (OSGi) framework
- Delivered as a componentized set of OSGi bundles
  - ▶ Each bundle is loaded by its own class loader
  - ▶ Class loading changes have no effect on application class loading
- Application code can be restricted from accessing internal runtime implementation classes



Modularity is an important focus area of this release. Version 6.1 of WebSphere Application Server leverages the Open Services Gateway Initiative (OSGi) framework, and is produced in a componentized fashion as a set of OSGi bundles. These bundles are loaded by a network of individual OSGi class loaders. These class loading changes are internal and do not affect your applications running on WebSphere Application Server. Also, version 6.1 introduces “restricted visibility mode”, an option that can prevent application code from loading internal WebSphere Application Server classes.



## Web services evolution

WebSphere V5.0.2/5.1	WebSphere V6.0	WebSphere V6.1
<b>JAX-RPC (JSR-101) 1.0</b> <ul style="list-style-type: none"> <li>New standard API for programming Web services in Java</li> </ul>	<b>JAX-RPC (JSR-101) 1.1</b> <ul style="list-style-type: none"> <li>Additional type support</li> <li>xsd:list</li> <li>Fault support</li> <li>Name collision rules</li> <li>New APIs for creating Services</li> <li>isUserInRole()</li> </ul>	<b>Performance Enhancements</b> <ul style="list-style-type: none"> <li>SAAJ changes</li> <li>SOAP/JMS</li> <li>New parser (Banshee instead of B2B)</li> </ul>
<b>JSR-109 1.0</b> <ul style="list-style-type: none"> <li>New J2EE deployment model for Java Web services</li> </ul>	<b>JSR-109 – WSEE 1.1</b> <ul style="list-style-type: none"> <li>Moved to J2EE 1.4 schema types</li> <li>Migration of web services client DD moving to appropriate container DDs</li> <li>Handlers support for EJBs</li> <li>EJB Service endpoint interface (SEI) is a peer to Local and Remote Interface</li> </ul>	<b>SOAP/JMS Enhancements</b> <ul style="list-style-type: none"> <li>Caching enhancements</li> <li>Text message enhancements</li> </ul>
<b>SAAJ 1.1</b>	<b>SAAJ 1.2</b> <ul style="list-style-type: none"> <li>APIs for manipulating SOAP XML messages</li> </ul>	<b>WS-I BSP (Basic Security Profile)</b>
<b>WS-Security</b> <ul style="list-style-type: none"> <li>Extensions added</li> </ul>	<b>WS-Security</b> <ul style="list-style-type: none"> <li>WSS 1.0</li> </ul>	<b>WS-N (Notification)</b>
<b>WS-I Basic Profile 1.0</b> <ul style="list-style-type: none"> <li>Profile compliance</li> </ul>	<b>WS-I Basic Profile 1.1</b> <ul style="list-style-type: none"> <li>Attachments support</li> </ul>	<b>WS-BA (Business Activity)</b>
<b>UDDI4J version 2.0 (client)</b>	<b>WS-TX AT (Atomic Transactions)</b>	<b>WS-ResourceFramework</b>
<b>Apache Soap 2.3 enhancements</b>	<b>JAXR support</b>	
The engine is a new high performance SOAP engine supporting both HTTP and JMS	<b>UDDI v3 support</b> <ul style="list-style-type: none"> <li>Includes both registry implementation and client API library</li> </ul>	

This table shows the evolution of Web services support in WebSphere Application Server over the last few releases. Many of the Java Web services standards were finalized around the time WebSphere Application Server V5.0.2 and V5.1 were released, and as such, these were the first versions to support the major Java Web services standards like JAX-RPC. Version 6.0 increased support for Web services by supporting the latest revisions of many specifications, and also supporting the final release of WS-Security 1.0 and new specifications like WS-Atomic Transaction. Version 6.1 continues to provide first-class support for Web services by introducing support for new specifications, including WS-Notification, WS-Business Activity, and the new Basic Security Profile for secure Web services interoperability. Web services performance is also significantly improved in this release.

## Portlet support overview

- WebSphere Application Server V6.1 includes support for running JSR168 compliant Portlets
  - ▶ Portlet container provides Portlet runtime environment and lifecycle management
  - ▶ Supports calling Portlets directly from a browser by URL, and from Servlet or JSP code
    - Example URL: `http://host:port/context/portlet-name/portletwindow`
- Does not include advanced capabilities of WebSphere Portal, such as Portlet aggregation, personalization, and collaboration



Portlets are one of the new application types that are supported in V6.1. WebSphere Application Server provides support for running JSR168-compliant Portlet applications. The Portlet container is an extension of the Web container, and provides lifecycle management and runtime services for Portlets. It allows Portlets to be called directly from a Web browser by URI, and also enables Portlet markup to be included in the output of Servlets or Java Server Pages. While WebSphere Application Server provides a Portlet runtime environment, it does not replace the WebSphere Portal product, and does not provide the advanced capabilities of that product, such as portlet aggregation and page layout, personalization and member services, or collaboration features.

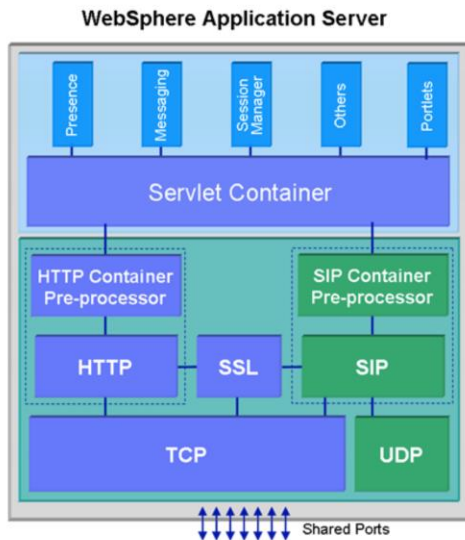
## Session Initiation Protocol overview

- V6.1 contains support for JSR116-compliant SIP Servlets
- The SIP infrastructure is a general-purpose extension to WebSphere Application Server
  - ▶ Installed automatically
- SIP is a key element for many new applications, especially when converged with HTTP
  - ▶ Click-To-Call
  - ▶ Voice over IP (VOIP)
  - ▶ Third-party call control and call monitoring
  - ▶ Presence and instant messaging



Version 6.1 supports Session Initiation Protocol applications, as defined by JSR116. Like the Portlet container, the SIP container is installed automatically and works in concert with the Web container. SIP supports negotiating connections for many new application types, such as voice over IP, instant messaging, and videoconferencing. Support for converged HTTP and SIP Servlet applications open the door for new solutions like “click to call” applications.

## Converged container architecture



- **Standards-based platform**
  - ▶ Extending the J2EE application server for a truly converged HTTP/SIP environment
  - ▶ Leveraging proven SIP technology from IBM (Lotus) Workplace
- **Common administration**
  - ▶ JMX and command line support for configuration and administration

SIP support is implemented by a converged Servlet container that supports both HTTP and SIP Servlets, using common code for network transports and for integration with other application server components. This support is provided by proven code that has been used in the IBM Workplace suite of products, and is managed using the same management tools that are used for all other WebSphere Application Server components.

## IBM JSF Widget Library (JWL)

- JWL included in V6.1
- Contains FacesClient components based on Java Server Faces (JSF) technology
- Allows creation of rich interactive web pages and improves performance by reducing round-trip interactions with the server
- Sample components:
  - ▶ DatePicker
  - ▶ DataGrid
  - ▶ Graph
  - ▶ Input
  - ▶ Menu
  - ▶ TabbedPanel
  - ▶ TimePicker
  - ▶ Tree
  - ▶ More ...

**Date Restriction**

Default:

StartDate=2004/04/26, EndDate=2004/11/25

StartDate=2004/09/25, Range upto two weeks after start date

Range starts from one year before today

Range ends one year from today

Unselectable weekends

price	purchaseDate	quantity	refNum	symbol
6100.85	Jul 18, 2005	2012	2	IBM
1002.65	Jul 18, 2005	1330	3	SUNW
1000.95	Jul 18, 2005	4000		
1200.41	Jul 18, 2005	1750		
200.55	Jul 18, 2005	1000		
4800.12	Jul 18, 2005	2500		
1000.21	Jul 18, 2005	3000		
5400.75	Jul 18, 2005	5000		
900.85	Jul 18, 2005	5000		

• Allows sorting of data by column...

• Data sorted by content of column.

• Data can be sorted by date, number or alphabetically

**Stock Trend**

Chart Type: Bar      Series: Show All Series

The IBM JSF Widget Library is provided as an optional library in V6.1. Based on JavaServer Faces technology, FacesClient Components can simplify the development of interactive Web pages and improve their usability and performance by reducing the number of round-trip interactions with the server. This gives users faster response times and increased freedom to interact with the page. A developer's guide is available on IBM developerWorks.

## Section

# *Usability enhancements*



This section will cover usability enhancements.

## Installation enhancements

- Support for non-root/non-Administrator installation
- Option to enable administrative security “out of the box” (by default)
- Eclipse-based Profile Management Tool replaces the Profile Creation Tool from V6.0
- IBM HTTP Server installer includes capability to install and configure the Web server plug-in
- Installation Factory tool (distributed platforms only) allows customization of installation package
  - ▶ Included in V6.1 Installation Tools CD



Many changes have been made to improve the usability of the installation process. The installer now supports installing WebSphere Application Server as a non-root or non-Administrator user. You also have the option to enable administrative security during installation, so your administrative tools will be secured “out of the box”. The new Profile Management Tool replaces the Profile Creation Tool from V6.0, giving you more control over the process of creating a profile. The IBM HTTP Server now includes the ability to install and configure the Web server plug-in while installing the HTTP server, since those two tasks are often carried out at the same time. The Installation Factory tool is also provided with version 6.1, enabling you to build customized installation packages, including product maintenance, enterprise applications, and configuration actions, for improved installation repeatability.



## Simplified administrative console

- Improved scope-selection process for resources
- Enhanced resource management interface
  - ▶ Console navigation panel re-factored to manage frequently-used resources directly from the panel
  - ▶ New JDBC data source creation wizards
- Enhanced application installation user interface
  - ▶ Provides a “fast path” installation option
- Enhanced shared library configuration for new application install or existing applications



The administrative console has been simplified in this release, providing an improved user experience for many tasks that were previously challenging or confusing. These include an improved scope selection process that simplifies locating resources, a streamlined JDBC data source creation wizard, and an enhanced application installation interface, including a new “fast path” option that prompts you only for information that is required during installation. It is also easier to configure shared libraries for use by multiple applications in this release.



## Simplified administrative console (cont.)

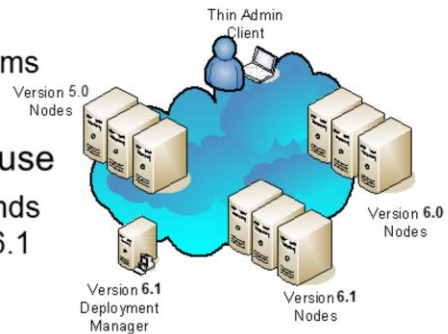
- Enhanced cluster management interface
  - ▶ New cluster creation panels
  - ▶ Simpler cluster member weight assignment
  - ▶ Guided task for configuring high availability
- Enhanced security administration panels, including new guided task
- Command assistance in the administrative console to view wsadmin scripting commands for the actions being performed



Creating and configuring clusters is also streamlined in this release, including a guided task for configuring a highly available cluster. Configuring security has also been simplified in this release, including a new security configuration wizard and new panels for configuring Service Integration Bus security. Creating repeatable tasks using wsadmin has also been simplified in this release, as the administrative console now has the ability to display the equivalent scripting command for many common tasks.

## Systems management enhancements

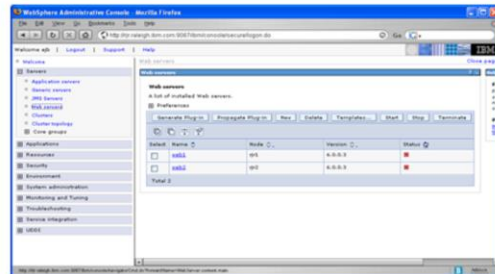
- Mixed version cell support
  - ▶ Similar to V6.0.2
  - ▶ Mixed version (V5 and V6) and platforms (z/OS, i5/OS and distributed)
- Administrative command ease of use
  - ▶ New high level administrative commands and new utility commands added to V6.1
- Thin administrative client
  - ▶ A lightweight runtime package to support administrative client functions to run wsadmin or stand-alone administrative Java client



The systems management architecture in version 6.1 is an extension of the version 6.0 architecture, and supports mixed version cells that contain older V5 and V6 nodes. This release also introduces several new high-level administrative commands and utilities that make command-line administration easier. These new commands give you the ability to perform complex tasks like renaming a node in a simple and supported fashion. V6.1 also includes new “thin administrative client” libraries that allow you to create and run administrative clients that rely only on a JAR file, rather than requiring a full installation of WebSphere Application Server or a WebSphere Application Server Client installation.

## IBM HTTP Server administration

- Allows complete configuration of IBM HTTP Server through the administrative console
- Provides operational management of IBM HTTP Server through the administrative console



Administrative integration with IBM HTTP Server has also been improved in this release. Not only can you start and stop local and remote IBM HTTP Servers directly from the administrative console, but you also have complete control of the IBM HTTP Server configuration by way of a robust configuration interface, including an easy-to-use virtual host creation wizard.

## Section

# ***Security enhancements***



This section will cover security enhancements.

## Security enhancements: overview

- Administrative security enabled “out of the box”
- Fine-grained administrative security capability
  - ▶ Users can now be defined to administrative roles on a specific set of resources
    - Cells, node groups, nodes, clusters, servers and applications



WebSphere Application Server V6.1 provides several security enhancements.

First, there is now the ability to enable administrative security out of the box at the time of installation. Enabling this option at installation time allows the application server administrative system and its data to be protected automatically with minimal administrative overhead. In the past, securing the application server environment required you to configure the appropriate security settings after the product was installed.

In previous releases of WebSphere Application Server, users granted administrative roles could administer all of the resource instances under the cell. WebSphere Application Server is now more fine-grained, in that access can be granted to each user per resource instance. For example, users can be granted "configurator" access to a specific instance of a resource only (an application, an application server or a node). Users cannot access any other resources outside of the resources assigned to them. This support is only provided for command-line administration, and not in the administrative console.

## Security enhancements: overview (cont.)

- Federated repositories feature
  - ▶ Ability to use multiple heterogeneous user repositories
  - ▶ User identity, profile, and relationship management
- Simplified administrative console tasks and guided tasks
- SPNEGO support for single sign-on authentication through Windows desktop



Another new security feature found in WebSphere Application Server V6.1 is the introduction of the “federated repositories” option. This option is available as part of the integration of WebSphere Virtual Member Manager into the application server. This integration not only provides the ability to federate multiple heterogeneous user repositories for security purposes, it also provides the ability to manage user and groups in the federated repositories through the application server administrative console and command line utilities.

V6.1 provides a trust association interceptor (TAI) that uses the Simple and Protected GSS-API Negotiation Mechanism (SPNEGO) to securely negotiate and authenticate HTTP requests for secured resources in WebSphere Application Server. SPNEGO TAI will enable Single Sign On capability so that end-users login and authenticate once at their Windows 2003 desktop and are silently authenticated with WebSphere Application Server.

## Simplified certificate and key management

- Integration of key management tools into the administrative console
- Easier to understand and use the configuration of SSL attributes
- Management of Web server and plug-in certificates built into the console
- Use of the TrustManager to automatically trust hosts or signers
- V6.1 creates a unique self-signed certificate for each node
  - ▶ No longer uses a "default" or "dummy" certificate

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New features overview

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In version 6.1, the SSL key management functionality that used to be provided in the IBM Key Management Tool (or “ikeyman”) is now implemented in the administrative console. You can create SSL certificates directly from the administrative console, and you can easily propagate those keys to managed Web servers, speeding up a task that could be quite time consuming in previous releases.

The V6.1 administrative console also provides an interface for managing trusted hosts and certificate signers. The “default” or “dummy” key ring is no longer provided with WebSphere Application Server. This file, which was intended to enable testing a WebSphere Application Server environment with security enabled, has been replaced by a unique self-signed certificate that is created during profile creation for each node.

## Federated repositories overview

- A set of security features used to manage user identities, profiles, and relationships
  - ▶ Administrative utilities to manage users and groups through
    - The administrative console
    - Command line utilities
    - Public APIs
- Integrated with WebSphere Application Server security
  - ▶ As a user registry option
    - Federated Repositories option
  - ▶ To support authentication with the JAAS framework
  - ▶ To support access control with a JACC extension provider

The primary purpose of the federated repositories feature is to allow the management of user identities, profiles, and relationships. These management features are available through the administrative console, command line utilities, and public APIs.

User management capabilities are integrated into WebSphere Application Server security in several important ways. First, the federated repositories option enables you to integrate multiple user repositories into a single security domain. It also provides the appropriate JAAS and JACC framework to allow for application security using federated repositories.



## Section

# ***Enterprise-class function enhancements***

This section will cover enhancements to some of WebSphere Application Server's enterprise-class features.

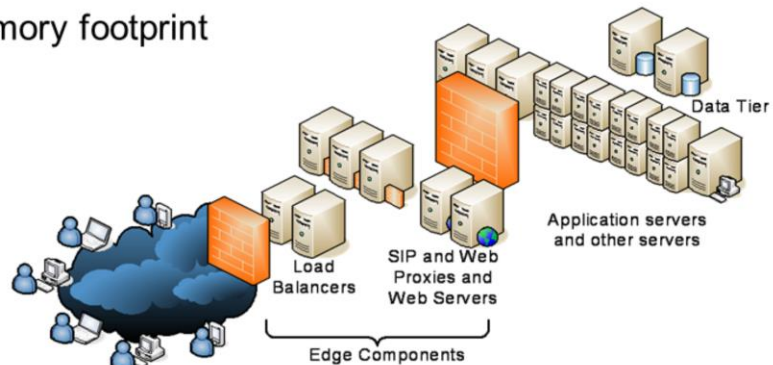
## Messaging enhancements

- V6.1 includes several messaging enhancements
- Optional file-based message store offers simpler configuration and improved performance
- Enhanced security configuration from wsadmin and the administrative console makes it easier to configure secure messaging resources
- New server type, “WebSphere MQ Server”, simplifies z/OS WebSphere MQ integration
  - ▶ J2EE applications use z/OS WebSphere MQ-hosted queues the same way they use V6.1 messaging hosted queues

Version 6.1 includes several enhancements to the built-in Java messaging infrastructure. You now have the option to use a file-based data store, which offers improved performance and requires less configuration than a JDBC database. It is also much easier to secure your messaging resources in this release, using a new “bus security” interface in the administrative console and equivalent wsadmin scripting commands. Additionally, a new server type, called a “WebSphere MQ Server” enables you to take advantage of the qualities of service of queues hosted by WebSphere MQ queue sharing groups on z/OS. J2EE applications can use these destinations just as they would use destinations hosted by WebSphere Application Server.

## Proxy server enhancements

- Increased Dynamic caching support
- Increased management capabilities
  - ▶ Dynamic Routing rules
  - ▶ Clustering Support
- Reduced memory footprint



There have also been enhancements to the Java proxy server in version 6.1. It now includes more robust support for dynamically caching content, and new dynamic routing rules that give you more control over how incoming traffic is routed to your application servers.

## Section

# *Application Server Toolkit*

This section will cover the Application Server Toolkit.

## Application Server Toolkit V6.1

- Eclipse 3.1
- Web Tools Platform (WTP) 1.0
  - ▶ J2EE tools
  - ▶ XML tools
  - ▶ Web tools
  - ▶ Web Service tools
  - ▶ Database tools
- Test and performance tools
- Graphical wizards
- Eclipse modeling framework (EMF)
- JDK 1.4.2 (also supports 5.0)
- WebSphere additions:
  - ▶ WebSphere Rapid Deployment
  - ▶ Graphical deployment descriptors
  - ▶ IBM Web Services tools
  - ▶ Automation Toolkit for WebSphere for writing and testing wsadmin Jython scripts
  - ▶ EJB deployment support
  - ▶ WebSphere server integration



Version 6.1 of the Application Server Toolkit includes much more functionality than previous releases. It inherits much of this functionality from the open source Web Tools Platform, including full-fledged J2EE and Web services development tools, XML tools, and relational database tools. It also includes WebSphere Application Server specific functionality, such as graphical tools for editing IBM extended deployment descriptors, wsadmin script development tools, and integrated support for deploying and testing applications with WebSphere Application Server.

## Section

# ***Serviceability enhancements***



This section covers serviceability enhancements.

## Serviceability enhancements overview

- WebSphere Application Server V6.1 contains the following major serviceability-related enhancements
- IBM Support Assistant
  - ▶ Local serviceability tool that enables you to investigate problems quickly and work more efficiently with IBM support
  - ▶ Included in V6.1 tools package
  - ▶ Integrated tools help solve software problems
    - Memory Dump Diagnostic Tool for Java (MDD4J)
- Diagnostic Providers
  - ▶ New framework in V6.1 that enables the server components to provide more useful diagnostic data



Version 6.1 now includes the IBM Support Assistant, a local serviceability tool that makes it easier and faster to resolve your software product challenges. It is available for free download on the IBM Software Support Web site, but it is now also distributed with the WebSphere Application Server product on the Installation Tools CD. It is a software support enabler for several IBM software products, not just WebSphere Application Server. It provides a number of features to aid you in problem determination and resolution, including federated search, data collection, problem submission, and diagnostic tools. Version 6.1 also includes support for Diagnostic Providers, which enable individual server components to generate more useful diagnostic data.

## Diagnostic providers

- Diagnostic providers are MBeans that provide diagnostic data for individual components
  - ▶ State dump
  - ▶ Configuration dump
  - ▶ Self-diagnostic test routines
- Error messages from supported components contain a diagnostic provider identifier (DPID)
  - ▶ Components can be queried directly by DPID to get more information
  - ▶ Components can also be selected from a tree view



The Diagnostic Provider framework is a new feature in WebSphere Application Server V6.1. Diagnostic Providers are JMX MBeans that provide diagnostic data for individual components within WebSphere Application Server processes. They enable you to ask a selected component to dump its configuration data, current state data, or to run a self-diagnostic test routine. Components that are instrumented with Diagnostic Providers can log their Diagnostic Provider ID, which is a JMX ObjectName to log files when they write error messages. This allows you to directly query the component that generated the error message. You can also query a component at any time by selecting it from a tree view.



## Summary

- V6.1 extends the proven V6.0 code base
- Focus areas:
  - ▶ Ease of use
  - ▶ Extending programming model
    - Support for Portlet and SIP (Session Initiation Protocol) applications
    - Upgrade to Java 5.0 SDK
    - Support for additional Web services (WS-\*) specifications
  - ▶ Security enhancements include simplified certificate key management and federated repositories

In summary, WebSphere Application Server V6.1 builds upon and extends the proven V6.0 code base. It utilizes the programming interfaces and system management model that you are used to from V6.0, and extends them in key areas. The enhancements to this version are focused on increasing usability by simplifying administrative tasks, and also on extending the WebSphere Application Server programming model to new application types, such as Portlet applications and Session Initiation Protocol applications. This version is the first WebSphere Application Server release to support Java 5.0 and includes the new IBM Virtual Machine for Java on most platforms. Finally, this release has introduced many new security and serviceability features. IBM Education Assistant contains many more presentations and demonstrations that will explain these new features in more depth.

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Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. All customer examples described are presented as illustrations of how those customers have used IBM products and the results they may have achieved. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput or performance improvements equivalent to the ratios stated here.

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