WebSphere® Application Server for z/OS, Version 5.1

Security

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Note
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Chapter 1. Welcome to Security

IBM WebSphere Application Server for z/OS Version 5 provides security infrastructure and mechanisms to protect sensitive J2EE resources and administrative resources and to address enterprise end-to-end security requirements on authentication, resource access control, data integrity, confidentiality, privacy, and secure interoperability. IBM WebSphere Application Server for z/OS security is based on industry standards. Version 5 has an open architecture that processes secure connectivity and interoperability with Enterprise Information Systems including:

- DB2
- CICS
- MQ Series
- Lotus Domino
- IBM Directory

WebSphere Application Server also supports other security providers including:

- z/OS Security Server (RACF)
- WebSEAL secure proxy server

Based on industry standards

The product provides a unified, policy-based, and permission-based model for securing Web resources and enterprise JavaBeans according to J2EE specifications. Specifically Version 5 complies with J2EE specification Version 1.3 and has passed the J2EE Compatibility Test Suite. Product security is a layered architecture built on top of an operating system platform, a Java virtual machine (JVM), and Java 2 security. This security model employs a rich set of security technology including the:

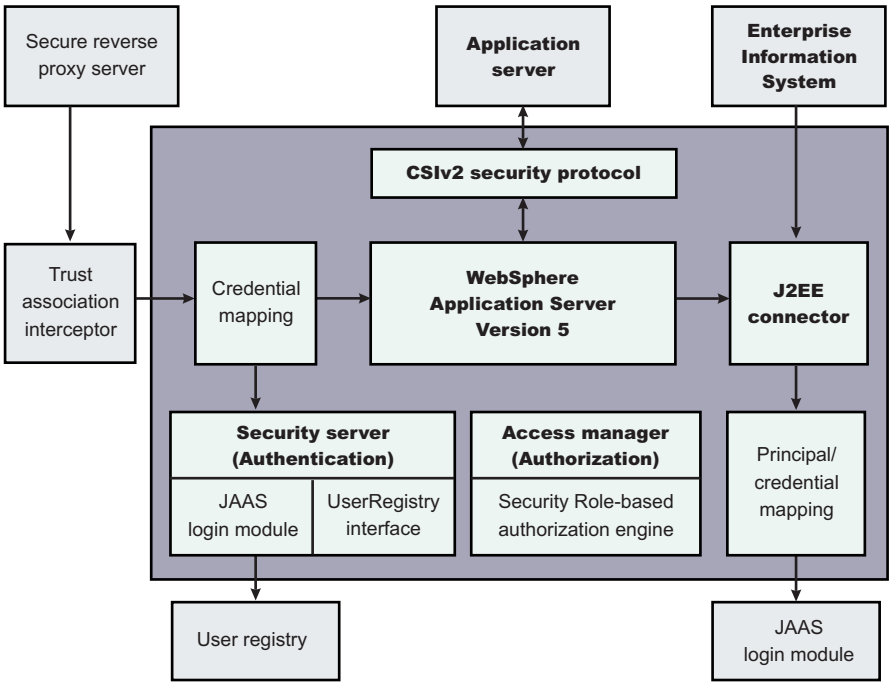
- Java 2 security model, which provides policy-based, fine-grained, and permission-based access control to system resources.
- Common Secure Interoperability Version 2 (CSIv2) security protocol, in addition to the z/OS Secure Authentication Services (z/SAS) security protocol. CSIv2 is an integral part of J2EE 1.3 specification and is essential for interoperability among application servers from different vendors. z/SAS is supported by prior product releases.
- Java Authentication and Authorization Service (JAAS) programming model for Java applications, servlets, and enterprise beans.
- J2EE Connector architecture for plugging in resource adapters that support access to Enterprise Information Systems.

The standard security model and interface supported include Java Secure Socket Extension (JSSE) and Java Cryptographic Extension (JCE) provider for secure socket communication, message encryption, and data encryption.

Open architecture paradigm

An application server plays an integral part in the multiple-tier enterprise computing framework. IBM WebSphere Application Server adopts the open

architecture paradigm and provides many plug-in points to integrate with enterprise software components. Plug-in points are based on standard J2EE specifications wherever applicable.

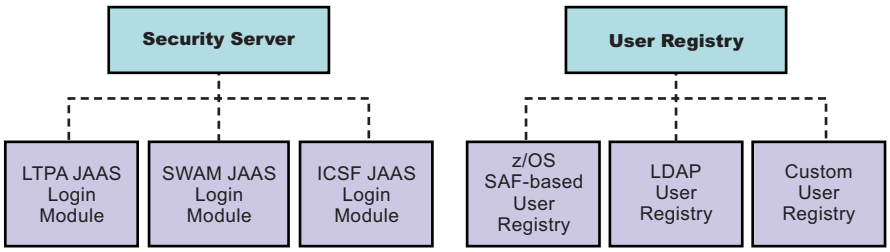


The light blue shaded background indicates the boundary between the product and other business application components.

Key concepts

In WebSphere Application Server for zOS Version 5, security services are configured at a cell level. The configurable services include a web authentication mechanism, a user registry, and an access control manager. In Version 5, unless otherwise specified the access control facility is provided by WebSphere bindings.

Authentication Mechanism and User Registry



User registries and access control

Information about users and groups reside in a user registry. In WebSphere Application Server, a user registry authenticates a user and retrieves information about users and groups to perform security-related functions, including

authentication and authorization. The Local OS registry implementation of WebSphere Application Server for z/OS integrates the functionality of the z/OS Security Server, such as RACF, using the Security Access Facility (SAF) in the WebSphere environment. When Local OS is configured, the SAF authorization may be chosen to provide J2EE access control.

Alternatively an LDAP (Lightweight Directory Access Protocol) registry may be configured contain user and group information.

In addition to Local OS and LDAP registries, WebSphere Application Server also provides a plug-in to support any registry by using the custom registry feature (also referred as custom user registry). See "User registries" on page 226.

The product provides the following user registry implementations:

- LocalOS (SAF-based)
- LDAP

Web authentication mechanisms

In WebSphere Application Server for z/OS Version 5, three Web authentication mechanisms are supported:

- Simple WebSphere Authentication Mechanism (SWAM)

  SWAM is simple to configure and is useful for a single application server environment, but forces a user ID and password authentication for each request.
- Lightweight Third Party Authentication (LTPA)

  Lightweight Third Party Authentication generates a security token for authenticated users, which can be used to represent that authenticated user on subsequent calls to the same or other servers within a Single Sign On (SSO) domain. If you need to interoperate with network distributed servers you must use LTPA.
- Integrated Cryptographic Services Facility (ICSF)

  ICSF can be configured as an alternative to LTPA on the z/OS platform to generate a security token for authenticated users. It takes advantage of a cryptographic programming interface to the secure hardware cryptographic features of the zSeries processors. The keys are stored in secure hardware using ICSF and only the key label is externalized. ICSF is a cryptographic programming interface to the secure hardware cryptographic features of the zSeries processors. ICSF also generates security tokens for authenticated users which can be propagated over to other servers. The main advantage of ICSF is that the keys are stored in secure hardware and only the key label is provided. However, if you need to interoperate with network distributed servers you must use LTPA.

Note: LTPA authentication tokens are propagated using Single Sign On (SSO). These tokens are not used for authentication when enterprise beans are invoked on other servers.

IIOP authentication protocols

IIOP Authentication protocol refers to the mechanisms used to authenticate requests from a Java Client to a WebSphere Application Server for z/OS, or between J2EE Application Servers. There are two sets authentication protocols supported by WebSphere Application Server for z/OS Version 5. z/OS Secure Association Service (z/SAS) is the set of authentication protocols used by all

previous releases of the WebSphere product, such as user ID and PassTicket, SSL Basic Authentication, and Kerberos. Common Secure Interoperability Version 2 (CSIv2) is implemented in WebSphere Application Server for z/OS Version 5 and is considered the strategic protocol. All IIOP authentication protocols support is restricted to those identities that can be mapped to a Local OS registry.

WebSphere Application Server for z/OS Connector security

The product supports the J2EE Connector architecture and offers container-managed authentication. It provides a default J2C principal and credential mapping module that maps any authenticated user credential to a password credential for the specified Enterprise Information Systems (EIS) security domain. z/OS-specific connectors are also supported when the EIS system is in the same security domain as WebSphere Application Server. In this case, passwords are not required, because authenticated credentials used for J2EE requests can be used as EIS credentials.

Backward compatibility

While adding new security functions and moving towards new industry standards, this version maintains backward compatibility with the 4.0.x and 3.5.x releases. Applications created in the Version 4.x development environment can deploy in Version 5. When Java 2 Security is enforced in Version 5, give special consideration to Version 4.0.x applications because Version 4.0 applications might not be Java 2 security compliant. Refer to the Security migration section for steps to port Version 4.0.x to Version 5. See also the Security section of New in this release.

Security for J2EE resources is provided by Web containers and EJB containers

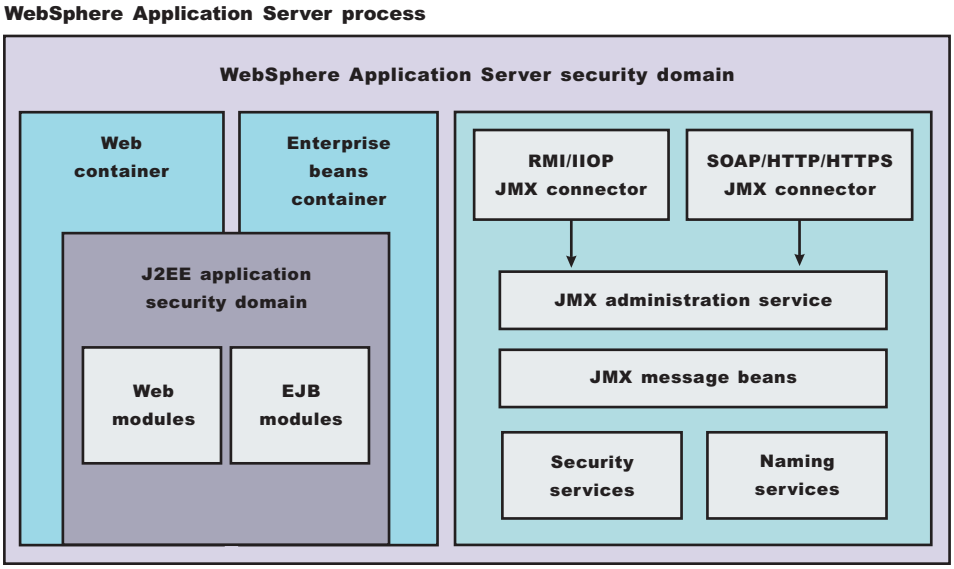
Each container provides two kinds of security: *declarative security* and *programmatic security*. In declarative security, the security structure of an application, including data integrity and confidentiality, authentication requirements, security roles, and access control, is expressed in a form external to the application. In particular the deployment descriptor is the primary vehicle for declarative security in the J2EE platform. The product maintains a J2EE security policy, including information derived from the deployment descriptor and specified by deployers and administrators in a set of XML descriptor files. At run time, the container uses the security policy defined in the XML descriptor files to enforce data constraints and access control. When declarative security alone is not sufficient to express the security model of an application, the application code can use programmatic security to make access decisions. The API for programmatic security consists of two methods of the EJB EJBContext interface (`isCallerInRole`, `getCallerPrincipal`) and two methods of the servlet HttpServletrequest interface (`isUserInRole`, `getUserPrincipal`).

Securing resources in WebSphere Application Server for z/OS Version 5

From a security perspective, every application server process consists of a Web container, an EJB container, and the administrative subsystem. There are many other components that constitute a server process, which are not discussed here. Remote interfaces to the administrative subsystem, including the Administrative Service interface through JMX connectors, the user registry interface, and the naming interface are protected by extended security role-based access control.

Java 2 security:The product supports the Java 2 security model. All the system code, including the administrative subsystem, the Web container, and the EJB

container code, are running in the product security domain. The system code, shown in the WebSphere Application Server security domain box in the following diagram, is granted AllPermission and can access all system resources. Application code running in the application security domain, which by default is granted with permissions according to J2EE specifications, only can access a restricted set of system resources. The product run-time classes are protected by the product class loader and are kept invisible to application code.



All of the application server processes, by default, share a common security configuration, which is defined in a cell-level security XML document. The security configuration determines whether product security is enforced, whether Java 2 security is enforced, the authentication mechanism and user registry configuration, security protocol configurations, JAAS login configurations, and Secure Sockets Layer configurations. Applications can have their own unique security requirements. Each application server process can create a per server security configuration to address its own security requirement. Not all security configurations can be modified at the application server level. That can be modified at application server level include whether application security should be enforced, whether Java 2 security should be enforced, and security protocol configurations. The administrative subsystem security configuration is always determined by the cell level security document. The Web container and EJB container security configuration are determined by the optional per server level security document, which has precedence over the cell-level security document.

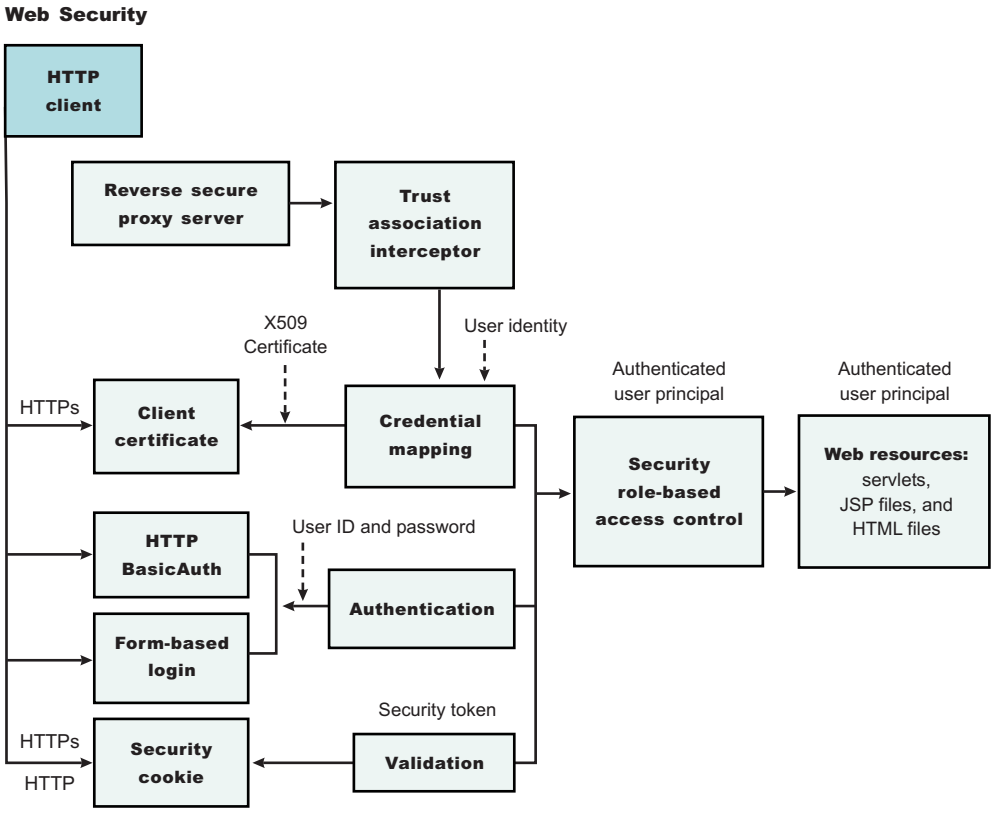
Security configuration, both at the cell level and at the application server level, are managed either by the Web-based administrative console application or by the WSADMIN scripting application.

Web security

When a security policy is specified for a Web resource and IBM WebSphere Application Server security is enforced, the Web container performs access control when the resource is requested by a Web client. The Web container challenges the Web client for authentication data if none is present according to the specified authentication method, ensure the data constraints are met, and determine whether

the authenticated user has the required security role. The product supports the following login methods: HTTP basic authentication, Hypertext Transfer Protocol with Secure Sockets Layer (HTTPS) client authentication, and form-based Login. Mapping a client certificate to a product security credential uses the UserRegistry implementation to perform the mapping. The LDAP UserRegistry supports the mapping function .

When the LTPA or ICSF authentication mechanism is configured and single signon (SSO) is enabled, an authenticated client is issued a security cookie, which can represent the user within the specified security domain. It is recommended that you use Secure Sockets Layer (SSL) to protect the security cookie from being intercepted and replayed. When a trust association is configured, the product can map an authenticated user identity to security credentials based on the trust relationship established with the secure reverse proxy server.



The Web security collaborator enforces role-based access control by using an access manager implementation. An access manager makes authorization decisions based on the security policy derived from the deployment descriptor. An authenticated user principal can access the requested Servlet or JSP file if it has one of the required security roles. Servlets and JSP files can use the HttpServletRequest methods: isUserInRole and getUserPrincipal. As an example, the administrative console uses the isUserInRole method to determine the proper set of administrative functionality to expose to a user principal.

EJB security

When security is enabled, the EJB container enforces access control on EJB method invocation. The authentication takes place regardless of whether a method permission is defined for the specific EJB method.

An access manager makes authorization decisions based on the security policy derived from the deployment descriptor. An authenticated user principal can access the requested EJB method if it has one of the required security roles. EJB code can use the EJBContext methods isCallerInRole and getCallerPrincipal. EJB code also can use the JAAS programming model to perform JAAS login and WSSubject doAs and doAsPrivileged methods. The code in the doAs and doAsPrivileged PrivilegedAction block executes under the Subject identity. Otherwise, the EJB method executes under either the RunAs identity or the caller identity, depending on the RunAs configuration. The J2EE RunAs specification is at the enterprise bean level. When RunAs identity is specified, it applies to all bean methods. The method level IBM RunAs extension introduced in Version 4.0 is still supported in this version.

The EJB security collaborator enforces role-based access control by using an access manager implementation. An access manager makes authorization decisions based on the security policy derived from the deployment descriptor. An authenticated user principal can access the requested EJB method if it has one of the required security roles. EJB code can use the EJBContext methods isCallerInRole and getCallerPrincipal. EJB code also can use the JAAS programming model to perform JAAS login and WSSubject doAs and doAsPrivileged methods. The code in the doAs and doAsPrivileged PrivilegedAction block executes under the Subject identity. Otherwise, the EJB method executes under either the RunAs identity or the caller identity, depending on the RunAs configuration.

Chapter 2. Securing applications and their environments

WebSphere Application Server supports the J2EE model for creating, assembling, securing, and deploying applications. This article provides a high-level description of what is involved in securing resources in a J2EE environment. Applications are often created, assembled and deployed in different phases and by different teams.

Consult the J2EE specifications for complete details.

1. Plan to secure your applications and environment. For more information, see "Planning to secure your environment" on page 10. Complete this step before you install the WebSphere Application Server.
2. Consider pre-installation and post-installation requirements. For more information, see "Implementing security considerations" on page 24. For example, during this step, you learn how to protect security configurations after you install the product.
3. Migrate your existing security systems. For more information, see "Migrating security configurations from WebSphere Application Server Version 4.0.1" on page 58.
4. Develop secured applications. For more information, see "Developing secured applications" on page 70.
5. Assemble secured applications. For more information, see "Assembling secured applications" on page 122.

   Development tools, such as the Deployment Tool for Enterprise JavaBeans (EJBDeploy) and the Assembling applications with the Assembly Toolkit are used to assemble J2EE modules and to set the attributes in the deployment descriptors.

   Most of the steps in assembling J2EE applications involve deployment descriptors; deployment descriptors play a central role in application security in a J2EE environment.

   Application assemblers combine J2EE modules, resolve references between them, and create from them a single deployment unit, typically an Enterprise Archive (EAR) file. Component providers and application assemblers can be represented by the same person but do not have to be.
6. Deploy secured applications. For more information, see "Deploying secured applications" on page 134.

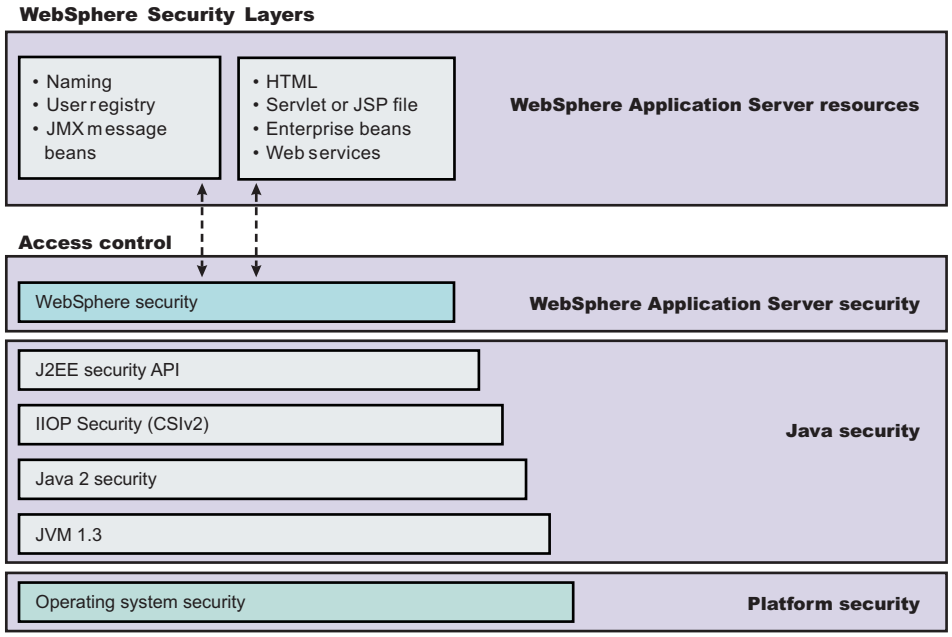
   One of the important tasks the deployer performs is mapping actual users and groups to application roles. For z/SAS authorization, user or group to role mapping is done by the security administrator (through permission to a SAF EJBROLE representing the application role).
7. Test secured applications. For more information, see "Testing security" on page 144.
8. Manage security configurations. For more information, see "Managing security" on page 144.
9. Improve performance by tuning security configurations. For more information, see "Tuning security configurations" on page 390.
10. Troubleshoot security configurations. For more information, see "Troubleshooting security configurations" on page 389.

Your applications and production environment are secured.

See “Security: Resources for learning” on page 407 for more information on the WebSphere Application Server security architecture.

Planning to secure your environment

There are several communication links from a browser on the Internet, through web servers and product servers, to the enterprise data at the back end. This section examines some typical configuration and common security practices. WebSphere Application Server security is built on a layered security architecture as showed below. This section also examines the security protection offered by each security layer and common security practice for good quality of protection in end-to-end security. The following figure illustrates the building blocks that comprise the operating environment of WebSphere Security:



- **Operating System Security** -

  The security infrastructure of the underlying operating system provides certain security services to the WebSphere Security Application. The operating system identity of the Servant task, as established by the STARTED profile, is the identity used to control access to system resources (such as files or sockets). For additional access protection to these resources, Java 2 security is required. For z/OS, in addition to knowledge of Secure Sockets Layer (SSL) and Transport Layer Security (TLS), the administrator will have to be familiar with System Authorization Facility (SAF) and a z/OS Security Server such as Resource Access Control Facility (RACF). Using RACF, an administrator can:
  - Identify and verify users
  - Protect user and group resources at the operating system level
  - Assign identities to WebSphere Application Server started tasks
  - Utilize the z/OS Security Server facilities for authentication and mapping of network clients to SAF (such as Kerberos, PassTicket authentication, errors authentication and X.509 client certificates)
  - Record and analyze (audit) security information

In addition to these tasks, if local OS user registry or SAF authorization is selected, you can use operating system security for authentication and authorization to J2EE resources.

- **Network Security** - The Network Security layers provide transport level authentication and message integrity and encryption. Communication between separate WebSphere Application Servers can be configured to use Secure Socket Layer (SSL) and HTTPS. Additionally IP Security and Virtual Private Network (VPN) might be used for added message protection.

  z/OS provides SystemSSL for communication using the Internet. SystemSSL is composed of the Secure Sockets Layer (SSL) and Transport Layer Security (TLS), which enable secure file transfer by providing data privacy and message integrity using the FTP control and data connections.
- **JVM 1.3.1** - The JVM security model provides a layer of security above the operating system layer.
- **Java 2 Security** - The Java 2 Security model offers fine grained access control to system resources including file system, system property, socket connection, threading, class loading, and so on. Application code must explicitly grant the required permission to access a protected resource.
- **CSIv2 Security** - CSIv2 is an IIOP-based, three-tiered, security protocol developed by the Object Management Group (OMG). It provides for message protection, interoperable authentication, delegation, and privileges. The three layers include a base transport security layer, a supplemental client authentication layer, and a security attribute layer. WebSphere Application Server for z/OS Version 5.0 supports CSIv2, conformance level 0.
- **J2EE Security** - The security collaborator enforces J2EE based security policies and supports J2EE security APIs.
- **WebSphere Security** - WebSphere Application Server security enforces security policies and services in a unified manner on access to Web resources, enterprise beans, and JMX administrative resources. It consists of WebSphere Application Server security technologies and features to support the needs of a secure enterprise environment.
- **CORBA Security** - Any calls made among secure ORBs are invoked over the Common Security Interoperability Version 2 security protocol that sets up the security context and the necessary quality of protection. After the session is established, the call is passed up to the enterprise bean layer. WebSphere Application Server continues to support the Secure Authentication Service (SAS) security protocol which was used in prior releases of WebSphere Application Server and other IBM products for backward compatibility.

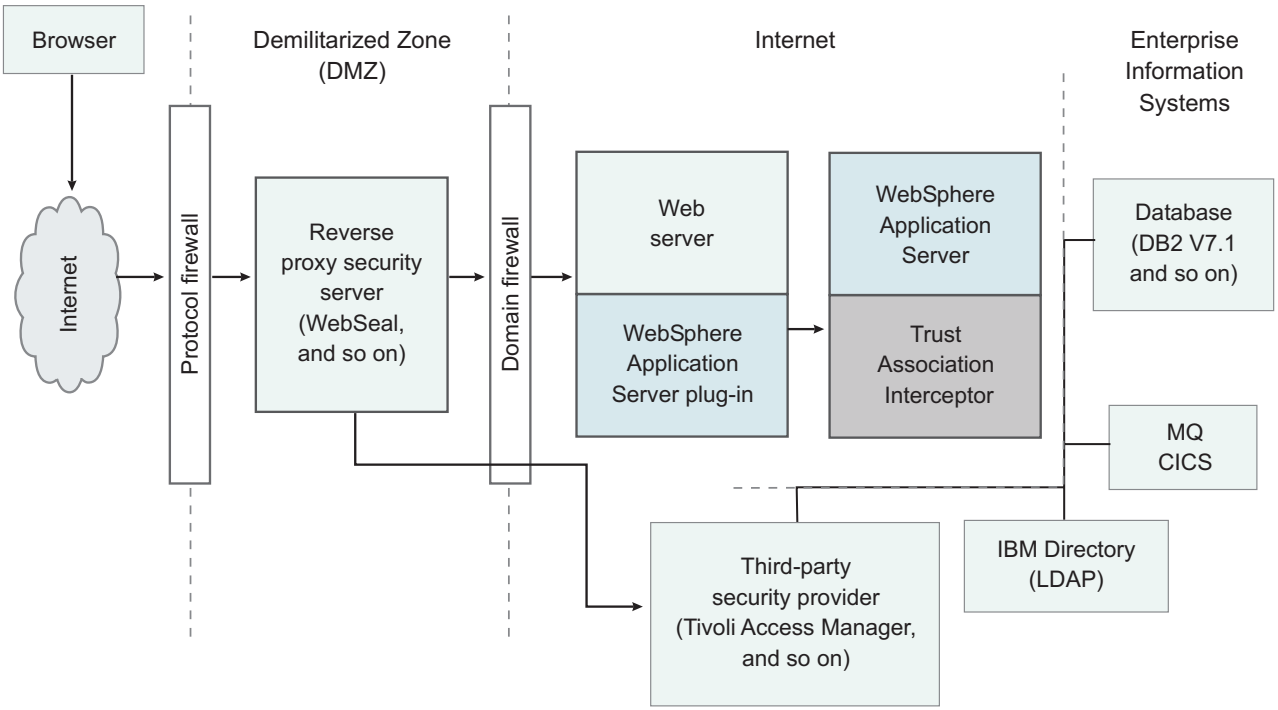
  (SAF authorization is an alternative to WebSphere Application Server authorizations)

The following picture shows a typical multiple-tier business computing environment. Shown in the picture is a WebSphere Application Server Network Deployment (ND) installation. Note that there is a Node Agent instance on every computer node which is omitted in the picture. Each product application server consists of a web container, an EJB container, and the administrative subsystem. The WebSphere Application Server Deployment Manager contains only WebSphere administrative code and the administrative console application. The administrative console is a special J2EE Web Application that provides the GUI interface for performing administrative functions. WebSphere Application Server configuration data is stored in XML descriptor files. Those XML configuration files should be protected by operating system security. Passwords and other sensitive configuration data can be modified using the administrative console.

(When using SAF registries and ICSF encryption, the requirement for passwords to be stored in configuration data is generally avoided.)

Hence, the administrative console Web application has a setup data constraint that requires the administrative console servlets and JSP files to be accessed only through an SSL connection when global security is enabled.

During installation, the administrative console is configured to use a System SSL port with a keyring you define. The Customization Dialogs provide ACF customization jobs to create unique server certificates (for servers within a given cell) using a common certificate authority. It is more secure if you first enable global security and complete other configuration tasks after global security is enforced.



WebSphere Application Server servers interact with each other through CSIv2 and z/SAS security protocols as well and HTTP and or HTTPS protocols. Those protocols can be configured to use SSL when WebSphere Application Server global security is enabled. The WebSphere Application Server administrative subsystem in every server uses SOAP JMX connectors and or RMI/IIOP JMX connectors to pass administrative commands and configuration data. When global security is disabled, the SOAP JMX connector uses HTTP protocol and the RMI/IIOP connector uses TCP/IP protocol. When global security is enabled, the SOAP JMX connector always uses HTTPS protocol. When global security is enabled, the RMI/IIOP JMX connector may be configured to either use SSL or to use TCP/IP. Again it is recommended to enable global security and enable SSL to protect the sensitive configuration data.

Note: Global security and administrative security configuration is at the cell level.

While global security is enabled, application security at each individual application server may be disabled by disabling the **per server level security enable** flag. Disabling application server security does not affect the administrative subsystem

in that application server which is controlled only by the global security configuration. Both administrative subsystem and application code in an application server share the optional per server security protocol configuration.

Security for J2EE resources is provided by Web container and EJB container. Each container provides two kind of security: declarative security and programmatic security.

In declarative security, an application security structure includes data integrity and confidentiality, authentication requirements, security roles, and access control. Access control is expressed in a form external to the application. In particular the deployment descriptor is the primary vehicle for declarative security in the J2EE platform. The WebSphere Application Server maintains J2EE security policy including information derived from the deployment descriptor and specified by deployers and administrators in a set of XML descriptor files. At run time, the container uses the security policy defined in the XML descriptor files to enforce data constraints and access control.

When declarative security alone is not sufficient to express the security model of an application, "Programmatic login" on page 86 can be used by application code to make access decisions. When global security is enabled and application server security is not disabled at the server level, J2EE applications security will be enforced. When the security policy is specified for a web resource, the web container performs access control when the resource is requested by a web client. The web container would challenge the web client for authentication data if none is present according to the specified authentication method, ensure the data constraints are met, and determine whether the authenticated user has the required security role. The web security collaborator enforces role-based access control by using an access manager implementation. An access manager makes authorization decision based on security policy derived from the deployment descriptor. An authenticated user principal is allowed to access the requested Servlet or JSP file if it has one of the required security roles. Servlets and JSP pages may use the `HttpServletRequest` methods `isUserInRole` and `getUserPrincipal`. When cell level security is enabled, unless server security has been disabled, EJB container will enforce access control on EJB method invocation. The authentication would take place regardless of whether method permission was defined for the specific EJB method. The EJB security collaborator enforces role-based access control by using an access manager implementation. An access manager makes authorization decisions based on security policy derived from the deployment descriptor. An authenticated user principal is allowed to access the requested EJB method if it has one of the required security roles. EJB code may use the `EJBContext` methods `isCallerInRole` and `getCallerPrincipal`. The J2EE role based access control should be used to protect valuable business data from being accessed by unauthorized users from both the Internet and the Intranet.

For enabling J2EE application security, please refer to "Securing Web applications using the Assembly Toolkit" on page 125 and "Securing enterprise bean applications using the Assembly Toolkit" on page 123.

WebSphere Application Server extends the security, role-based access control to administrative resources including the JMX system management subsystem, user registries, and JNDI name space. WebSphere administrative subsystem defines four administrative security roles:

- **Monitor role**, which can view configuration information and status but not anything more

- **Operator role**, which is a monitor that can trigger run time state changes, such as start an application server or stop an application, but cannot change configuration
- **Configurator role**, which is a monitor that can modify configuration information but cannot change run-time state
- **Administrator role**, which is an operator as well as a configurator

A user with the configurator role can perform most administrative work including installing new applications and application servers. There are certain configuration tasks a configurator does not have sufficient authority to do when global security is enabled, including modifying WebSphere Application Server server identity and password, LTPA password and keys, and assigning users to administrative security roles. Those sensitive configuration tasks require the administrative role.

WebSphere Application Server administrative security is enforced when global security is enabled. It is recommended that WebSphere Application Server global security be enabled to protect administrative subsystem integrity. Application server security can be selectively disabled if there is no sensitive information to protect. For securing administrative security, refer to "Assigning users to administrator roles" on page 176 and "Assigning users to naming roles" on page 181 WebSphere Application Server uses Java 2 Security Model to create a secure environment to run application code. Java 2 Security provides a fine, grained and policy based access control to protect system resources such as files, system properties, opening socket connections, loading libraries, and so on. J2EE Version 1.3 Specification defines typical set of Java 2 Security permissions that Web and EJB components should expect to have, which is shown in the table below.

Table 1. Java 2 Security Permissions set for Web components

Security Permission	Target	Action
java.lang.RuntimePermission	loadLibrary	
java.lang.RuntimePermission	queuePrintJob	
java.net.SocketPermission	*	connect
java.io.FilePermission	*	read, write
java.util.PropertyPermission	*	read

Table 2. Java 2 Security Permissions set for EJB components

Security Permission	Target	Action
java.lang.RuntimePermission	queuePrintJob	
java.net.SocketPermission	*	connect
java.util.PropertyPermission	*	read

WebSphere Application Server Java 2 Security implementation was based on J2EE Version 1.3 Specification. The Specification granted Web components read and write file access permission to any file in the file system, which may be too broad. WebSphere Application Server default policy gives Web components read and write permission to the sub directory and the sub tree where the Web module was installed. The default Java 2 Security policy for all Java virtual machines and WebSphere Application Server server processes are contained in the following policy files:

${java.home}/jre/lib/security/java.policy
Used as the default policy for the Java Virtual Machine (JVM).

$*WAS_HOME*/properties/server.policy
Used as the default policy for all product server processes

To simplify policy management, WebSphere Application Server policy is based on resource type rather than code base (location). Default policy for WebSphere Application Server subsystem that considered as an extension of WebSphere Application Server run time, which is referred to as *SPI*, for library shared by multiple applications, and for J2EE applications, are:

$*WAS_HOME*/config/cells/<cellname>/nodes/<nodename>/spi.policy
Used for embedded resources defined in the `resources.xml` file, such as the Java Messaging Service (JMS), JavaMail and JDBC drivers.

$*WAS_HOME*/config/cells/<cellname>/nodes/<nodename>/library.policy
Used by the shared library defined by WebSphere Application Server administrative console.

$*WAS_HOME*/config/cells/<cellname>/nodes/<nodename>/app.policy
Used as the default policy for J2EE applications.

In general, applications should not require more permissions to run than those recommended by the J2EE Specification in order to be portable among various application servers. But some applications may require more permissions. WebSphere Application Server allows a per application policy file, `was.policy`, to be packaged together with each application from granting extra permissions to that application. Note that granting extra permissions to an application should be handled with great care because of the potential of compromising system integrity.

WebSphere Application Server uses a permission filtering policy file to alert users when an application requires permissions that are on the filter list during application installation and cause the offended application installation to fail. For example, the `java.lang.RuntimePermission` *`exitVM`* permission should not be given to an application so that application code is not allowed to terminate the WebSphere Application Server. The filtering policy is defined by the `filterMask` in `${was.install.root}/config/cells/<cellname>/filter.policy`. Moreover, WebSphere Application Server also performs run time permission filtering based on the run time filtering policy to ensure no application code has been granted any permission that is considered harmful to system integrity. Applying Java 2 Security model to application server is new.

Hence many applications developed for prior releases of WebSphere Application Server might not be Java 2 Security ready. To migrate those applications to WebSphere Application Server Version 5 quickly, you might temporarily give those applications `java.security.AllPermission` in the `was.policy` file. It is recommended to test or make those applications Java 2 Security ready, for example, identity what extra permissions, if any, are required and to just grant those permissions to a particular application. Not granting applications `AllPermission` can certainly reduce the risk of compromising system integrity. For more information on migrating applications to WebSphere Application Server Version 5, refer to “Migrating Java 2 security policy” on page 381.

WebSphere Application Server run time uses Java 2 Security to protect sensitive run-time functions and hence it is always a good idea to enforce Java 2 Security. Applications that are granted with `AllPermission` not only have access to sensitive system resources but also WebSphere Application Server run-time resources and can potential cause damage to both. In cases where an application can be trusted to be safe, WebSphere Application Server allows Java 2 Security to be disabled on a

per application server basis. In other words, you can enforce Java 2 Security by default in security center and disable the per application server Java 2 Security flag to disable it at the particular application server.

The global security enable flag and Java 2 Security enable flag along with other sensitive configuration data are stored in a set of XML configuration files. Both role based access control and Java 2 Security permission based access control are employed to protect the integrity of the configuration data. We will use configuration data protection as an example to illustrate how system integrity is maintained.

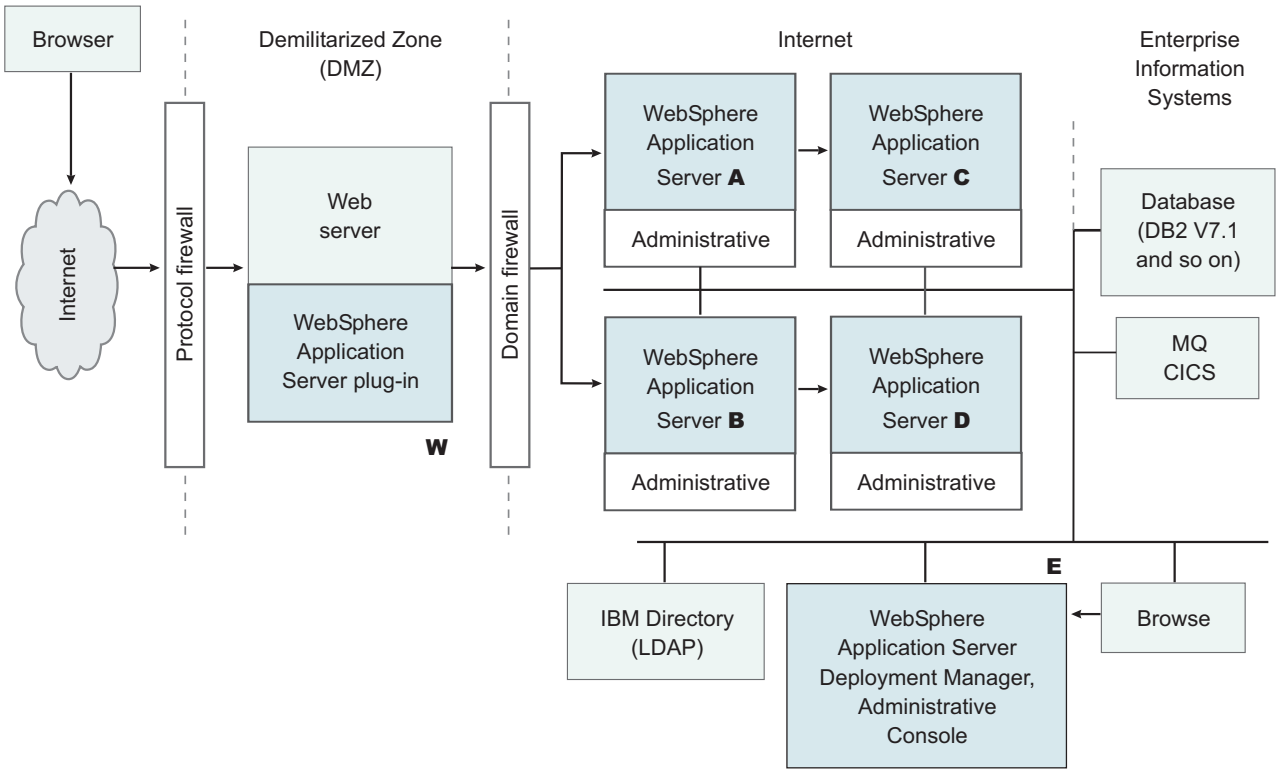
- When Java 2 Security is enforced, application code cannot access the WebSphere Application Server run-time classes that manages the configuration data unless it has been granted the required WebSphere Application Server run-time permissions.
- When Java 2 Security is enforced, application code cannot access the WebSphere Application Server configuration XML files unless it has been granted the required file read and write permissions.
- The JMX administrative subsystem provides SOAP over HTTP or HTTPS and RMI/IIOP remote interface to allow application programs to extract and to modify configuration files and data. When global security is enabled, an application program can modify WebSphere Application Server configuration provided that the application program has presented valid authentication data and that the security identity has the required security roles.
- If a user is allowed to disable Java 2 Security, then that user can modify the WebSphere Application Server configuration including the WebSphere Application Server security identity and authentication data along with other sensitive data. Hence, only users with the administrator security role are allowed to disable Java 2 Security.
- Only users with administrator role are allowed to disable global security, to change server ID and password, and to map users and groups to administrative roles, and so on.

Other WebSphere Application Server for z/OS run time resources are protected by similar mechanism as described previously. Hence it is very important to enable WebSphere Application Server global security and to enforce Java 2 Security. WebSphere Application Server for z/OS supports HTTP basic authentication, form-based authentication, and HTTPS client certificate authentication. When using client certificate login, it is recommended that the Web resources have the integral or confidential data constraint. If a browser uses HTTP to access the Web resource, the Web container automatically redirects it to the HTTPS port.

The CSIv2 security protocol also supports client certificate authentication. SSL client authentication can also be used to set up secure communication among selected set of servers based on trust relationship.

If you start from the WebSphere Application Server plug-in at the Web server, SSL mutual authentication can be configured between it and the WebSphere Application Server HTTPS server. When using self signed certificate, one can restrict the WebSphere Application Server plug-in to communicate with only the selected two WebSphere Application Server servers as shown in the following picture. Suppose you want to restrict the HTTPS server in WebSphere Application Server **A** and in WebSphere Application Server **B** to accept secure socket connections only from WebSphere Application Server plug-in **W**. You can generate three self-signed certificates using RACF, such as certificate **W, A**, and **B**. The WebSphere Application Server plug-in is configured to use certificate **W** and trust certificate **A** and **B**. The HTTPS server of WebSphere Application Server **A** is

configured to use certificate **A** and to trust certificate **W**. The HTTPS server of WebSphere Application Server **B** is configured to use certificate **B** and to trust certificate **W**.



The trust relationship depicted in the previous picture is shown in the following table.

Server	Key	Trust
WebSphere Application Server plug-in	W	A, B
WebSphere Application Server A	A	W
WebSphere Application Server B	B	W

In a z/OS installation, the WebSphere Application Server Deployment Manager is a central point of administration. System management commands are sent from the deployment manager to each individual application server. When global security is enabled, all WebSphere Application Server servers can be configured to require SSL and mutual authentication. Suppose one wants to further restrict that WebSphere Application Server application. Server **A** can only communicate with WebSphere Application Server **C** and WebSphere Application Server **B** can only communicate with WebSphere Application Server **D**. Note that as mentioned previously, all WebSphere Application Servers must be able to communicate with WebSphere Application Server Deployment Manager **E**. Hence, when using self-signed certificates, you might setup CSIv2 and SOAP/HTTPS Key and trust relationship as shown in the following table.

Server	Key	Trust
WebSphere Application Server A	A	C, E
WebSphere Application Server B	B	D, E
WebSphere Application Server C	C	A, E
WebSphere Application Server D	D	B, E
WebSphere Application Server Deployment Manager E	E	A, B, C, D

When WebSphere Application Server is configured to use an LDAP user registry, SSL with mutual authentication also can be configured between every application server and the LDAP server with self-signed certificate so that no password will be passed in clear text from WebSphere Application Server to the LDAP server. In this example, the node agent processes were not discussed. Each node agent needs to communicate with application servers on the same node and with the Deployment Manager. Node agents also need to communicate with LDAP servers when they are configured to use LDAP user registry. It is reasonable to let the Deployment manager and the node agents use the same certificate. Suppose application server **A** and **C** are on the same computer node. The Node agent on that node needs to have certificates **A** and **C** in its trust file.

1. Determine which versions of WebSphere Application Server you are using.
2. Review the WebSphere Application Server security architecture.
3. Review each of the following topics as also defined in Related reference.
   - "Global security and server security" on page 167
   - "Authentication protocol for EJB security" on page 287
     - "Supported IBM protocols: Secure Authentication Service and Common Secure Interoperability Version 2" on page 294
     - "Common Secure Interoperability Version 2 features" on page 291
     - "Identity assertion" on page 291
   - "Authentication mechanisms" on page 182
     - "Lightweight Third Party Authentication settings" on page 188
     - "Trust Associations" on page 190
     - "Single Signon" on page 197
   - "User registries" on page 226
     - "Local operating system user registries" on page 228
     - "Lightweight Directory Access Protocol" on page 233
   - "Custom user registries" on page 246
   - "Java 2 security" on page 346
     - "Java 2 security policy files" on page 357
   - "Java Authentication and Authorization Service" on page 274
     - "Programmatic login" on page 86
   - "Java 2 Connector security" on page 284
   - "AccessControlException" on page 352
     - "Role-based authorization" on page 128
     - "Administrative console and naming service authorization" on page 173
   - "Secure Sockets Layer" on page 316
     - "Authenticity" on page 318
     - "Confidentiality" on page 319
     - "Integrity" on page 321

Security considerations when adding a Base Application Server node to Network Deployment

At some point, you might decide to centralize the configuration of your stand-alone base application servers by adding them into a Network Deployment cell. If your base application server is currently configured with security, there are some issues to be considered. The major issue when adding a node to the cell is whether the user registries between the base application server and the Deployment Manager are the same. When adding a node to the cell, you automatically inherit both the user registry and the authentication mechanism of the cell.

In addition, if this is a LocalOS SAF registry, you automatically inherit the type of authorization used, (such as SAF EJBROLE profiles or WebSphere bindings).

Another major issue is the SSL public-key infrastructure. Prior to performing `addNode` with the Deployment Manager, verify that `addNode` can communicate as an SSL client with the Deployment Manager. This requires that the addNode truststore (configured in `sas.client.props`) contains the signer certificate of the Deployment Manager personal certificate as found in the keystore (specified in the administrative console).

The following are other issues to consider when running the `addNode` command with security:

1. When attempting to run system management commands such as `addNode`, you need to explicitly specify administrative credentials to perform the operation. The `addNode` command accepts `-username` and `-password` parameters to specify the userid and password, respectively. The user ID and password, which are specified should be an administrative user, for example, a user that is a member of the console users with **Operator** or **Admistrator** privileges or the admistrative user ID configured in the User Registry. An example for `addNode`, `addNode CELL_HOST 8879 -includeapps -username user -password pass`. `-includeapps` is optional, but this option attempts to include the server applications into the Deployment Manager. The `addNode` command might fail if the user registries used by the WebSphere Application Server and the Deployment Manager are not the same. To correct this problem, either make the user registries the same or turn off security. If you change the user registries, remember to verify that the users to roles and groups to roles mappings are correct. See addNode command for more information on the addNode syntax.

   Note that you might also run the addNode command using the Customization Dialog.
2. Adding a secured remote node through the administrative console is not supported. You can either disable security on the remote node before performing the operation or perform the operation from the command line using the addNode script.
3. Before running the `addNode` command, you must verify that the truststore files on the nodes communicate with the keystore files and SAF Keyring owned by the Deployment Manager and vice versa. If you have generated the certificates for deployment manager using the same certificate authority as you used for the node agent process, this will be successful. Note that the following SSL configurations must contain keystores and truststores that can interoperate:

- System SSL repertoire specified in the Administrative Console using **System Administration > Deployment Manager > HTTP Transports > sslportno > SSL**
- SSL repertoire for appropriate JMX Connector if SOAP is specified **System Administration > dmgr > Administration Services > JMX Connectors > SOAPConnector > Custom Properties > sslConfig**
- SSL repertoire specified in NodeAgent **System Administration > Node agents > NodeAgent Server > Administration Services > JMX Connectors > SOAPConnector > Custom Properties > sslConfig**

4. After running addNode, the application server is in a new SSL domain. It might contain SSL configurations that point to keystore and truststore files that are not prepared to interoperate with other servers in the same domain. Consider which servers will be intercommunicating and ensure that the servers are trusted within your truststore files.

Proper understanding of the security interactions between distributed servers greatly reduces problems encountered with secure communications. Security adds complexity because additional function needs to be managed. For security to function, it needs thorough consideration during the planning of your infrastructure. This document helps to reduce the problems that could occur due to inherent security interactions.

When you have security problems related to the WebSphere Application Server Network Deployment environment, check the "Troubleshooting security configurations" on page 389 section to see if you can get information about the problem. When trace is needed to solve a problem, because servers are distributed, quite often it is required to gather trace on all servers simultaneously while recreating the problem. This trace can be enabled dynamically or statically, depending on the type problem occurring.

Security considerations specific to a multi-node or process Network Deployment environment

WebSphere Application Server Network Deployment allows for centralized management of distributed nodes and application servers. This inherently brings complexity, especially when security is included into the mix. Because everything is distributed, security plays an even larger role in ensuring that communications are appropriately secure between applications servers and node agents, and between node agents (a node specific configuration manager) and the Deployment Manager (a domain-wide, centralized configuration manager). The following issues should be considered when operating in this environment, but preferably prior to going to this environment.

Because the processes are distributed, an authentication mechanism must be selected that supports an authentication token such as LTPA or ICSF. The ICSF tokens are encrypted and signed and therefore, forwardable to remote processes. However, the tokens have expirations. The SOAP connector (the default connector) used for administrative security does not have retry logic for expired tokens, however, the protocol is stateless so a new token is created for each request (if there is not sufficient time to execute the request with the given time left in the token). An alternative connector is the RMI connector, which is stateful and has some retry logic to correct expired tokens by resubmitting the requests after the error is detected.

Additional considerations are dealing with SSL. WebSphere Application Server for z/OS uses RACF keyrings to store the keys and truststores used for SSL, but different SSL protocols are used internally. You must be sure to set up both:

- A System SSL repertoire for use by the Web Container
- A JSSE SSL repertoire for use by the SOAP HTTP connector if the SOAP connector is used for administrative requests

Verify that the keystores and truststores you configure are setup to trust only the servers in which they communicate. But make sure they do include the necessary signer certificates from those servers in the trustfiles of all servers in the domain. When using a certificate authority (CA) to create personal certificates, it is easier to ensure that all servers trust one another by having the CA root certificate in all the signers. The customization dialogues for WebSphere Application Server for z/OS use the same certificate authority to generate certificates for all servers within a given cell, including those of the node agents and the deployment manager.

The following are issues to consider when using or planning for a Network Deployment environment.

1. When attempting run system management commands such as stopNode, you need to explicitly specify administrative credentials to perform the operation. Most commands accept `-username` and `-password` parameters to specify the user ID and password, respectively. The user ID and password that are specified should be an administrative user, for example, a user who is a member of the console users with **Operator** or **Admistrator** privileges or the administrative user ID configured in the user registry. An example for stopNode, `stopNode -username user -password pass`.
2. Verify that the configuration at the node agents are always synchronized with the Deployment Manager prior to starting or restarting a node. To manually get the configuration synchronized, issue the syncNode command from each node that is not synchronized. To synchronize the configuration for node agents that are started, click **System Administration** > **Nodes** and select all started nodes. Click **Synchronize**.
3. Verify that the LTPA token expiration period is long enough to complete your longest downstream request. Some credentials are cached and therefore the timeout does not always count in the length of the request. There is a LTPA token expiration *cushion* period for Web requests so that the LTPA token has sufficient time to make a downstream request. The cushion is 20 percent of the LTPA expiration period up to a maximum of ten minutes (configurable by a system property `com.ibm.ws.security.cacheCushionMax` specified in minutes) and usually not below the ORB request time-out (default 3 minutes, but the minute value is configurable by a system property `com.ibm.ws.security.cacheCushionMin` specified in minutes). When considering the actual expiration period of the LTPA token, you should consider this cushion. This helps prevent downstream expirations occurring in EJB servers. Verify that the LTPA token expiration period is long enough to complete your longest downstream request. Some credentials are cached and therefore the timeout does not always count in the length of the request.
4. The administrative connector used by default for system management is SOAP. SOAP is a stateless HTTP protocol. For most situations, this connector is sufficient. When running into a problem using the SOAP connector it might be desirable to change the default connector on all servers from SOAP to RMI. The RMI connector uses CSIv2, a stateful or interoperable protocol, and can be configured to use identity assertion (downstream delegation), message layer authentication (BasicAuth or Token), and or client certificate authentication (for

server trust isolation). To change the default connector on a given server, go to the **Administration Services** in Additional Properties for that server.

5. The following error message might occur within the administrative subsystem security. This indicates that the sending process did not supply a credential to the receiving process. Typically the causes for this problem are:
   - The sending process has security disabled while the receiving process has security enabled. This typically indicates one of the two processes are not in sync with the cell.

     Note: Having security disabled for a specific application server should not have any effect on administrative security.

Proper understanding of the security interactions between distributed servers will greatly reduce problems encountered with secure communications. Security adds complexity because additional function needs to be managed. For security to work properly, it needs thorough consideration during the planning of your infrastructure. Hopefully, this document will help to reduce the problems that could occur due to inherent security interactions.

When you have security problems related to the WebSphere Application Server Network Deployment environment, check the "Troubleshooting security configurations" on page 389 section to find additional information about the problem. When trace is need to solve a problem, because servers are distributed, quite often it is required to gather trace on all servers simultaneously while recreating the problem. This trace can be enabled dynamically or statically, depending on the type problem occurring.

Creating login key files

1. Create a login key file. The authenticating user IDs, passwords, and target realms for each different z/OS target are specified in the login key file, which is an ASCII file. When the security authentication service processes the login key file, the passwords in the file are encoded.
2. Add information to the login key file in the following format:

   Realm_name User_ID Password
3. Make sure that the data conforms to the following rules:
   - One realm name
   - One user ID, and one password defined in each entry
   - One entry per line
   - No blank lines between entries
   - Comments on separate lines only
   - Begin any comment with a pound sign (#):

     Example:

     ```
     # Sample key file
     #
     # First target realm
     #
     TargetRealm serverID serverPassword
     #
     # Second target realm
     #
     ```

```
TargetRealm2 serverID2 serverPassword2
#
# End of key file
```

The realm name of a WebSphere Application Server for z/OS target is the IP name of the daemon, as specified in the configuration of the WebSphere Application Server for z/OS product. The user ID and password are those defined for secured WebSphere Application Server for z/OS servers.

A sample file named `wsserver.key` also contains these instructions. After installation, you can locate this sample file in the *install_root*`/properties` directory. You can use or modify the sample file as needed for testing.

Note: 5.1+ You can place the login key file anywhere on a host machine running the application server. However, it is recommended that you place the login key file under a securable file system.

After creating the login key files, read the article entitled, "Preparing truststore files."

Preparing truststore files

Secure Sockets Layer (SSL) protocol protects the communication between WebSphere Application Server and WebSphere Application Server for z/OS application servers. To complete the SSL connection, establish a valid truststore file for the WebSphere Application Server. A truststore file is a key database file that contains the public keys (See "Creating login key files" on page 22 for information about how to create a new keystore file.)

1. Extract the public key of the z/OS server by using the key management tool from WebSphere Application Server z/OS. For details, see Configuring the server for request decryption: choosing the decryption method.
2. With the key management utility (iKeyman) from WebSphere Application Server, add the public key from the WebSphere Application Server for z/OS server as a signer certificate into the requesting WebSphere Application Server truststore file. For details, see the related information about how to .

The WebSphere Application Server truststore file is now ready to use for SSL connections with the WebSphere Application Server for z/OS servers.

See "Configuring the application server for interoperability" for interoperability.

Configuring the application server for interoperability

After the truststore file is ready, complete the following steps to configure the WebSphere Application Server.

1. Configure the enterprise beans that access WebSphere Application Server for z/OS. Before deploying the enterprise beans, configure the RunAs Identity. Because the Security Authentication Service (SAS) only supports WebSphere Application Servers to interoperate with WebSphere Application Server for z/OS, set the RunAs Identity to `System Identity`.
2. Enable security.
3. Enable outbound SAS authentication protocol.
4. Specify the truststore file in an Secure Sockets Layer (SSL) configuration alias and configure the WebSphere Application Server with that alias.

5. Set the **Request timeout** and **Locate request timeout** values to zero for the Object Request Broker (ORB) service. When the WebSphere Application Server z/OS application server first starts, no server region is available for processing work. It is therefore recommended that you set these two properties to zero to prevent potential timeouts.
6. Specify a security property named com.ibm.CORBA.keyFileName for the absolute path of the login key file created earlier.
7. Restart the WebSphere Application Server.

Implementing security considerations

Complete the following tasks to implement security before, during, and after installing WebSphere Application Server.

1. Migrate your security configurations from previous releases. This step provides information about migrating WebSphere Application Server from Version 4.0.1 to Version 5.
2. Installing and Customizing WebSphere Application Server This step describes how to install WebSphere Application Server as the root user on a UNIX platform or as an administrator on a Windows platform. Some of the WebSphere Application Server for z/OS security considerations during the install are defined using Customization dialog settings.
3. Secure your environment after you install the WebSphere Application Server product. This step provides information on how to protect password information after you install WebSphere Application Server.

Securing your environment after installation

WebSphere Application Server depends on several configuration files created during installation. These files contain password information and need protection. Although the files are protected to a limited degree during installation, this basic level of protection is probably not sufficient for your site. Verify that these files are protected in compliance with the policies of your site.

The files in the *WAS_HOME*/config and *WAS_HOME*/properties directories need protection. For example, give permission to the user who logs onto the system for WebSphere Application Server primary administrative tasks. Other users or groups, such as WebSphere Application Server console users and console groups, who perform partial WebSphere Application Server administrative tasks, like configuring, starting servers and stopping servers, need permissions as well. The files, in the *WAS_HOME*/properties directory that should not be protected are:

- TraceSettings.properties
- client.policy
- client_types.xml
- implfactory.properties
- sas.client.props
- sas.stdclient.properties
- sas.tools.properties
- soap.client.props
- wsadmin.properties
- wsjaas_client.conf

Note: The value for *WAS_HOME* directory is specified in the customization dialogs when WebSphere Application Server for z/OS is installed (for both Base and Network deployment).

Secure files on z/OS systems.

1. Execute the z/OS systems using the customization dialogs and follow the generated instructions to customize your system.

   The customization jobs that are generated provide the following functions:

   - Create SAF WebSphere Application Server user IDs needed for WebSphere administrator and WebSphere server processes
   - Create a SAF WebSphere Application Server Configuration Group and add the SAF WebSphere Application Server user IDs
   - Associate WebSphere Application Server started tasks with the SAF user IDs and groups defined previously
   - Populate the file system with the system and property files needed to run WebSphere Application Server
   - Change the ownership of these files to that of the WebSphere Application Server administrator
   - Create appropriate file permissions

   Note: All files in *WAS_HOME*/config directory must have write and read access by all members of the WebSphere Configuration group, but must not be accessible by everyone (mode 770). All files in *WAS_HOME*/properties must have write and read access by all members of the WebSphere Configuration group. but some must readable by everybody (mode 775). Those files which must be readable by everybody are:

   - TraceSettings.properties
   - client.policy
   - client_types.xml
   - implfactory.properties
   - sas.client.props
   - sas.stdclient.properties
   - sas.tools.properties
   - soap.client.props
   - wsadmin.properties
   - wsjaas_client.conf

2. Add WebSphere administrators who perform full or partial WebSphere Application Server administration tasks to the WebSphere Configuration group.
3. Restrict access to the /var/mqm directories and log files needed for WebSphere embedded messaging (or WebSphere MQ as the JMS provider). Give write access only to the mqm user ID or members of the mqm user group.

After securing your environment, only the users given permission can access the files. Failure to adequately secure these files can lead to a breach of security in your WebSphere Application Server applications.

If there are any failures caused by file accessing permissions, check the permission settings.

Protecting plain text passwords

The WebSphere Application Server has several plain text passwords. These passwords are not encrypted, but are encoded. The following is a list of files with encoded passwords:

File name	Additional information
security.xml	The following fields contain encoded passwords: • **LTPA password** • **JAAS Auth Data** • **User Registry server password** • **LDAP User Registry bind password** • **Key file password** • **Trust file password**
sas.client.props	
war/WEB-INF/ibm_web_bnd.xml	Specify passwords for the default basic authentication for the ″resource-ref″ bindings within all descriptors (except in the Java crytography architecture)
ejb jar/META-INF/ibm_ejbjar_bnd.xml	Specify passwords for the default basic authentication for the ″resource-ref″ bindings within all descriptors (except in the Java crytography architecture)
client jar/META-INF/ibm-appclient_bnd.xml	Specify passwords for the default basic authentication for the ″resource-ref″ bindings within all descriptors (except in the Java crytography architecture)
ear/META-INF/ibm_application_bnd.xml	Specify passwords for the default basic authentication for the ″run as″ bindings within all descriptors
server.xml	The following fields contain encoded passwords: • **key file password** • **trust file password** • **auth target password** • **Session persistence password** • **DRS Client data replication password** (not available in WebSphere Application Server, Version 5
resource.xml (for cells, servers, and nodes)	The following fields contain encoded passwords: • **WAS40Datasource password** • **mailTransport password** • **mailStore password** • **MQQueue queue mgr password**
ws-security.xml	
ibm-webservices-bnd.xmi	
ibm-webservicesclient-bnd.xmi	
/properties/soap.client.props	

File name	Additional information
/properties/sas.tools.properties	
/properties/sas.stdclient.properties	
wsserver.key	

To re-encode a password in one of the previous files, complete the following steps:

1. Access the file using a text editor and type over the encoded password in plain text. The new password is shown in plain text and must be encoded.
2. Use the PropFilePasswordEncoder.bat or PropFilePasswordEncode.sh file in the *install_dir*/bin/ directory to re-encode the password.

   If you are re-encoding z/SAS properties files, type PropFilePasswordEncoder *file_name* -sas and the PropFilePasswordEncoder.bat file encodes the known z/SAS properties.

   If you are encoding files that are not z/SAS properties files, type PropFilePasswordEncoder *file_name password_properties_list*

   file_name is the name of the z/SAS properties file. *password_properties_list* is the name of the properties to encode within the file.

   Use the PropFilePasswordEncoder utility to encode WebSphere Application Server password files only. The utility cannot encode passwords contained in XML files or other files that contain open and close tags.

If you reopen the affected file or files, the passwords do not display in plain text. Instead, the passwords appear encoded. WebSphere Application Server does not provide a utility for decoding the passwords.

Note: The reliance on passwords in configuration files can be minimized on WebSphere Application Server for z/OS by taking advantage of z/OS-specific features:

- Using a SAF registry removes the requirement for a user registry server password.
- Using ICSF as the encryption mechanism moves the encryption key into the hardware.
- Selection of SAF authorization and delegation so case role-to-user binding passwords are removed.
- Trust and key file passwords are no longer required when a RACF keyring is used for all SSL repertoires.
- The need for JAAS authentication data is removed when native connectors are used.

PropFilePasswordEncoder command reference

Purpose

The **PropFilePasswordEncoder** command encodes passwords located in plain text property files. This command encodes both Secure Authentication Server (SAS) property files and non-SAS property files. After you have encoded the passwords, note that a decoding command does not exist. To encode passwords, you must run this command from the *install_dir*/bin directory of a WebSphere Application Server installation.

Syntax

The command syntax is as follows:

```
PropFilePasswordEncoder file_name
```

Parameters

The following option is available for the PropFilePasswordEncoder command:

-sas
Encodes SAS property files.

The following examples demonstrate the correct syntax.

```
PropFilePasswordEncoder file_name password_properties_list
PropFilePasswordEncoder file_name -SAS
```

Setting up WebSphere Application Server for z/OS security

WebSphere Application Server for z/OS supports access to resources by clients and servers in a distributed. Determine how to control access to these resources and prevent inadvertent or malicious destruction of the system or data.

These are the pieces in the distributed network that you must consider:

- You must authorize servers to the base operating system services in z/OS or OS/390. These services include SAF security, database management, and transaction management.
  - For the server clusters, you must distinguish between controllers and servants. Controllers run authorized system code, so they are trusted. Servants run application code and are given access to resources, so carefully consider the authorization you give servants.
  - You must also distinguish between the level of authority for run-time servers and for your own application servers have. For example, the node needs the authority to start other clusters, while your own application clusters do not need this authority.
- You must authorize clients (users) to servers and objects within servers. The characteristics of each client requires special consideration:
  - Is the client on the local system or is it remote? The security of the network becomes a consideration for remote clients.
  - Will you allow unidentified (unauthenticated) clients to access the system? Some resources on your system might be intended for public access, while others you might need to protect. To access protected resources, clients must establish their identities and have authorization to use those resources.
- *Authentication* is the process of establishing the identity of a client in a particular context. A client can be an end user, a machine, or an application. The term authentication mechanism in WebSphere Application Server on z/OS refers more specifically to the facility in which WebSphere identifies an authenticated identity, using HTTP and JMX facilities. When configuring a cell, you must select a single authentication mechanism. The choices for authentication mechanism include:
  - Simple WebSphere Authorization Mechanism (SWAM) - only on Base Application Server, not available on the Network Deployment configuration
  - Lightweight Third Party Authentication (LTPA)
  - Integrated Cryptograqphic Service Facility (ICSF)
- Information about users and groups reside in a user registry. In WebSphere Application Server, a user registry authenticates a user and retrieves information

about users and groups to perform security-related functions, including authentication and authorization. Implementation is provided to support multiple operating system or operating environment-based user registries. When configuring a cell, you must select a single user registry. The user registry can be local or remote. The choices for user registry include:
  – SAF-based local registry (default)
  – Lightweight Directory Access Protocol (LDAP) - LDAP can be either a local or remote registry
  – Custom user registry - A custom user registy is set up to meet unique registry needs. WebSphere provides a simple user registry sample called the FileBasedRegistrySample.

If you need to protect resources, it is critical that you identify who accesses those resources. Thus, any security system requires client (user) identification, also known as authentication. In a distributed network supported by WebSphere Application Server for z/OS, clients can access resources from:
- Within the same system as a server
- Within the same sysplex as the server
- Remote z/OS or OS/390 systems
- Heterogeneous systems, such as WebSphere Application Server on distributed platforms, CICS, or other J2EE -compliant systems.

Additionally, clients can request a service that requires a server to forward the request to another cluster. In such cases, the system must handle delegation, the availability of the client identity for use by intermediate clusters and target clusters.

Finally, in a distributed network, how do you verify that messages being passed are confidential and have not been tampered? How do you verify that clients are who they claim to be? How do you map network identities to z/OS or OS/390 identities? These issues are addressed by the following support in WebSphere Application Server for z/OS:
- The use of SSL and digital certificates
- Kerberos
- Common Secure Interoperability, Version 2 (CSIv2)

Authorization checking

Each controller, servant, and client must be associated with an MVS user ID. When a request flows from a client to the server or from a server to another server, WebSphere Application Server for z/OS passes the user identity (client or server) with the request. This way, each request is performed on behalf of the user identity and the system checks to see if the user identity has the authority to make such a request.

There are three distinct levels of authorization checking.

1. The first level, which is always in effect, is required to protect z/OS operating system resources. Authentication occurs based on an operating system credentials using SAF. For SAF, controllers, servants, and default clients must be associated with an MVS user ID. Operating system resources are accessible by applications when they are granted access to the MVS user ID of the servant region.
2. The second level, which is in effect whenever WebSphere Application Server security is enabled at the cell level, is required to protect WebSphere's administrative resources.

3. The third level, which is in effect whenever WebSphere Application Server security is enabled for a given server, is a set of authorization checking mechanisms required to control access to WebSphere J2EE applications. On a base server, the cell and server levels of security can be viewed as the same.

When WebSphere Application Server security is enabled, WebSphere administrative and Java 2 Platform, Enterprise Edition (J2EE) authorizations can be performed using the identity authenticated with the configured user registry. When the user registry is configured to be `LocalOS`, the operating system and WebSphere identities are the same. WebSphere authorization checking can be configured to use SAF EJBROLE profiles if `LocalOS` is configured and the custom property `SAF.authorization` is set to **true**. Otherwise, WebSphere application bindings are used to provide user to role mappings.

Controlling access to console users when using a Local OS Registry:

The user registry and authorization settings for the cell control how you add console users. If the user registry is defined as LocalOS (RACF), either SAF Authorization (such as, RACF EJBROLE profiles) or WebSphere Authorization (such as console users and groups as specified on the console) can be used as the mechanism. LDAP and Custom Registries always use WebSphere Authorization. You can determine which one was chosen by clicking **GlobalSecurity > UserRegistries > LocalOS > CustomProperties > com.ibm.SAFAuthorization**

Regardless of which type of registry or authorization setting is chosen, the configuration process authorizes the WebSphere configuration group (to which all WebSphere Server identities are permitted), and an MVS user ID for the WebSphere administrator identity to do the following tasks:

- Access all administrative console functions
- Use the administrative scripting tool when security is first enabled

For the local operating system (LocalOS) registry on z/OS, the special subject of server is not used as the administrative user ID.

Using SAF Authorization to control access to Administrative functions: When SAF Authorization is selected during systems customization, administrative EJBROLE profiles for all administrative roles are defined by the RACF jobs generated using the Configuration Dialog. If SAF Authorization is selected subsequently, issue the following RACF commands (or equivalent security server commands) to enable your servers and administrator to administer WebSphere Application Server:

```
RDEFINE EJBROLE (optionalSecurityDomainName.)administrator UACC(NONE)
RDEFINE EJBROLE (optionalSecurityDomainName.)monitor       UACC(NONE)
RDEFINE EJBROLE (optionalSecurityDomainName.)configurator  UACC(NONE)
RDEFINE EJBROLE (optionalSecurityDomainName.)operator      UACC(NONE)

PERMIT (optionalSecurityDomainName.)administrator CLASS(EJBROLE) ID(configGroup) ACCESS(READ)
PERMIT (optionalSecurityDomainName.)monitor       CLASS(EJBROLE) ID(configGroup) ACCESS(READ)
PERMIT (optionalSecurityDomainName.)configurator  CLASS(EJBROLE) ID(configGroup) ACCESS(READ)
PERMIT (optionalSecurityDomainName.)operator      CLASS(EJBROLE) ID(configGroup) ACCESS(READ)
```

If additional users require access to administrative functions, you can permit a user to any of the above roles as follows by issuing the following RACF command:

```
PERMIT (optionalSecurityDomainName.)rolename CLASS(EJBROLE) ID(mvsid)
ACCESS(READ)
```

Using WebSphere Authorization to control access to administrative functions: To assign users to administrative roles, go to the administrative console, expand **System Administration**, and click **Console Users** or **Console Groups**. For more information on console user roles, refer to the "Administrative console and naming service authorization" on page 173 article.

Note: When SAF Authorization is chosen, authorization, as specified in the administrative console, is ignored.

Summary of controls: Each controller, servant, and client must have its own MVS user ID. When a request flows from a client to the cluster or from a cluster to a cluster, WebSphere Application Server for z/OS passes the user identity (client or cluster) with the request. Thus, each request is performed on behalf of the user identity and the system checks to see if the user identity has the authority to make such a request. The tables in this article outline System Authorization Facility (SAF) and non-SAF authorizations.

Summary of z/OS security controls independent of global security setting

In a WebSphere Application Server for z/OS configuration, there are many different types of processes:

- Deployment managers
- Node agents
- Location service daemons
- WebSphere Application Servers

Each of these can be viewed as either a WebSphere Application Server for z/OS controller process or pair of processes (a controller and servant).

Each controller and servant must run under a valid MVS user ID assigned as part of the definition of a started task. This MVS user ID must have a valid UNIX Systems Services user identity (UID) and be connected to WebSphere configuration group that is common to all servers in the cell with a valid MVS and UNIX System Services group identity (GID) identity.

The following table summarizes the controls used to grant authorizations needed by these controllers and servants to access operating system resources. By understanding and using these controls, you can control all resource accesses in WebSphere Application Server for z/OS.

Table 3. Summary of controls and SAF authorizations

Control	Authorization
DATASET class	Access to data sets
DSNR class	Access to Database 2 (DB2)
FACILITY class (IMSXCF.OTMACI)	Access to Open Transaction Manager Access (OTMA) for Information Management System (IMS)
FACILITY class (BPX.WLMSERVER)	Access to the BPX.WLMSERVER profile to perform Workload Management (WLM) enclave management in the servant. Without this access, classification is not performed.
HFS file permissions	Access to Hierarchical File System (HFS) files

Table 3. Summary of controls and SAF authorizations (continued)

Control	Authorization
LOGSTRM class	Access to log streams
OPERCMDS class	Access to `startServer.sh` shell script and Integral JMSProvider
SERVER class	Access to controller by a servant
STARTED class	Associate user ID (and optionally group ID) to start procedure
SURROGAT class (*.DFHEXCI)	Access to EXCI for Customer Information Control System (CICS) access

The customization dialogs and Resource Access Control Facility (RACF) customization jobs set these up for the initial server settings for the `*'ed` profiles.

Note: Examples of authorizations for the other profiles can be found in the generated `exec` file in `HLQ.DATA(BBOWBRAC)`. The selection of an identity to be used for authorization to native connector resources (CICS, DB2, IMS) is dependent on the:

- Type of connector
- Resource authentication (resAuth) setting of the deployed application
- Availability of an alias
- Global security setting

MVS SAF Authorization to all other MVS subsystem resources accessed by J2EE applications is performed using the identity of the servant region MVS user ID.

Resource managers such as DB2, IMS, and CICS have implemented their own resource controls, which control the ability of clients to access resources. When resource controls are used by DB2, use the DSNR RACF class (if you have RACF support) or issue the relevant DB2 GRANT statements. You can:

- Access OTMA for IMS through the FACILITY Class (`IMSXCF.OTMACI`)
- Access EXCI for CICS through the SURROGAT class (`*.DFHEXCI`)
- Control access to data sets through the DATASET class and HFS files through file permission

5.1 + Note that MVS SAF Authorization to all other MVS subsystem resources accessed by J2EE applications is typically performed using the identity of the servant region MVS user ID. Refer to “Understanding Java 2 Platform, Enterprise Edition identities and operating system thread identities” on page 164 for more information.

5.1 + The BPX.WLMSERVER profile in the FACILITY class is used to authorize an address space to use the Language Environment (LE) runtime services that interface with WLM to perform workload management within a server region. These LE runtime services are by used by WebSphere Application Server to extract classification information from enclaves and to manage the association of work with an Enclave. Because unauthorized interfaces are used to manipulate WLM enclaves for server region work that has not been passed from a controller to a servant, WebSphere Application

Server servant regions should be permitted READ access to this profile. Without this permission, attempts to create, delete, join, or leave a WLM enclave fails with a `java.lang.SecurityException`.

Summary of z/OS security controls in effect when global security is enabled

When global security is enabled, SSL must be available for encryption and message protection. In addition, authentication and authorization of J2EE and administrative clients is enabled.

The FACILITY class authorization needed for SSL services and the definition of SAF keyrings are required when global security is enabled. The remainder of the z/OS security controls described here are valid only when LocalOS is chosen as the registry. For a description of non-z/OS-specific WebSphere Application Server controls, refer to Assembling secured applications, Deploying secured applications, and Managing security.

When a request flows from a client to the WebSphere Application Server or from a cluster to a cluster, WebSphere Application Server for z/OS passes the user identity (client or cluster) with the request. Thus each request is performed on behalf of the user identity and the system checks to see if the user identity has the authority to make such a request. The tables in this article outline z/OS specific authorizations using SAF.

The following table summarizes the controls used to grant authorizations to resources. By understanding and using these controls, you can control access to all resources in WebSphere Application Server for z/OS.

Table 4. Summary of controls and SAF authorizations

Control	Authorization
CBIND class	Access to a cluster
EJBROLE or GEJBROLE class	Access to methods in enterprise beans
FACILITY class (IRR.DIGTCERT.LIST and IRR.DIGTCERT.LISTRING)	SSL key rings, certificates, and mappings
FACILITY Class (IRR.RUSERMAP)	Kerberos credentials
PTKTDATA class	PassTicket enabling in the sysplex
Set OS Thread Identity to RunAs Identity	J2EE cluster property used to enable the execution identity for non-J2EE resources

Cluster authorizations:

This section discusses the kinds of authorization checking WebSphere Application Server for z/OS does for a clusters. Servants must have access to profiles in the RACF SERVER class. This controls whether a servant can call authorized routines in the controller.

The following explains the kinds of authorization checking WebSphere Application Server for z/OS does for clusters.

1. Servants must have access to profiles in the RACF SERVER class. This controls whether a servant can call authorized routines in the controller.

   Controllers do not require such access control. Only authorized programs, loaded from Authorized Program Facility (APF) libraries, run in controllers.

2. Resource managers such as DB2, IMS, and CICS have implemented their own resource controls, which control the ability of applications to access resources.

   When resource controls are used by DB2, all controllers and servants need to be granted access to the relevant resources. You can grant access by using the DSNR RACF class (if you have RACF support) or by issuing the relevant DB2 GRANT statements.

   Access to OTMA for IMS access is accomplished through the FACILITY Class (IMSXCF.OTMACI). Access to EXCI for CICS is accomplished through the SURROGAT class (*.DFHEXCI).

   You can control access to data sets through the DATASET class and HFS files through file permissions.

Specifics about server process authorization checking: To control access to WebSphere Application Server for z/OS resources:

- As a general rule, give greater authority to controllers and less authority to servants.

Table 5. Level of trust and authority for regions

Region	Level of trust and access authority
Controller	**Note:** • Contains WebSphere Application Server for z/OS system code. • Trusted, runs APF-authorized • Contains communication ports and manipulation of SAF client identities
Servant	**Note:** • Contains WebSphere Application Server for z/OS system code, application code, and pluggable service providers (such as jdbc drivers) • Supports Java 2 Security to protect sensitive data and system services • Untrusted

- Regarding the WebSphere Application Server for z/OS run-time clusters, the general rule is to give less authority to the location service daemon, and greater authority to the node, as explained in the table below:

Table 6. Assigning authorities to WebSphere Application Server for z/OS run-time cluster control and servants

Run-time Cluster	Region	Required Authorities
Location service daemon	Control	• STARTED class • Access to WLM services • Access to DNS • OPERCMDS access to START, STOP, CANCEL, FORCE, and MODIFY other clusters • IRR.DIGTCERT.LIST and IRR.DIGCERT.LISTRING in FACILITY (SSL)
Node	Control	STARTED class
Controller	Control	• SSL • Kerberos • READ authority to the SERVER class, • OPERCMDS access to START, STOP, CANCEL, FORCE and MODIFY other servers

Table 6. Assigning authorities to WebSphere Application Server for z/OS run-time cluster control and servants (continued)

Run-time Cluster	Region	Required Authorities
Servant	Control	The following classes: • OTMA • SERVER • DSNR, • DATASET • SURROGATE • STARTED • LOGSTREEAM

- Remember to protect the RRS log streams. By default, UACC is READ.
- Protect the WebSphere Application Server for z/OS properties XML files, especially if they contain passwords. For more information, see the WebSphere Application Server variables in the administrative console or the documentation.
- Deployment Manager also needs permission to start and stop servers.

Using CBIND to control access to clusters:

You can use the CBIND class in RACF to restrict a client's ability to access clusters from Java Application Clients or other J2EE compliant servers. The access needed to access clusters is READ permission.

You can also use this class to specify which servers are trusted to assert identities (with no authenticator):

- z/SAS Identity Assertion accepted
- CSIv2 Identity Assertion
- Web Container HTTP Transport

This validates an intermediate server to send certificates (`MutualAuthCBindCheck=true.certificates`). You can deactivate the class if you do not require this kind of access control.

Servers are either clustered or not clustered. The value of cluster_name is:

1. For a clustered server, the cluster_name used in these profiles is the cluster short name.
2. For an unclustered server, instead of a cluster_name a server custom property (ClusterTransitionName) is used.

Note: When you convert a server into a clustered server the ClusterTransitionName becomes the cluster's short name.

The following explains the CBIND authorization checking by WebSphere Application Server for z/OS.

1. You can use the CBIND class in RACF to restrict a client's ability to access clusters, or you can deactivate the class if you do not require this kind of access control. There are two types of profiles WebSphere Application Server for z/OS uses in the CBIND class:
   - One that controls whether a local or remote client can access clusters. The name of the profile has this form:

     `CB.BIND.`**`cluster_name`**

     where *cluster_name* is the name of the cluster.

- One that controls whether a client can invoke J2EE applications in a cluster. The name of the profile has this form:

  `CB.`**`cluster_name`**

  where *cluster_name* is the name of the cluster.

  Note: When you add a new cluster, you must authorize all Java Client user IDs and Servers to have read access to the CB.**cluster_name** and CB.BIND.**cluster_name** RACF profiles.

  Example: WSADMIN needs read authority to the CB.BBOC001 and CB.BIND.BBOC001 profiles:

  ```
  PERMIT CB.BBOC001      CLASS(CBIND) ID(WSADMIN) ACCESS(READ)
  PERMIT CB.BIND.BBOC001 CLASS(CBIND) ID(WSADMIN) ACCESS(READ)
  ```

2. You can also use the SAF CBIND class to indicate that a process is trusted to assert identities to WebSphere Application Server for z/OS. This usage is primarily intended for use by trusted intermediate servers who have already authenticated their callers.

   The intermediate server (or process) must establish its network identity to WebSphere Application Server for z/OS using SSL client certificates. This network identity is mapped to an MVS user ID by SAF security service. This mapped identity must be granted CONTROL access to the `CB.BIND.cluster_name` process in order to be authorized to assert identities.

   The use of CBIND profiles to establish trust is used by the following authentication mechanisms:
   - Web Container HTTP Transport (which validates unencrypted client certificates when the property: `MutualAuthCBindCheck=true` is set)
   - CSIv2 identity assertion for IIOP
   - z/SAS Identity Assertion accepted

   For example, WEBSERV needs to assert client certificates received from its callers: `PERMIT CB.BBOC001 CLASS(CBIND) ID(WEBSERV) ACCESS(CONTROL)`
3. Using EJBROLE to control access to J2EE Roles:
   - Use the EJBROLE (or GEJBROLE) class in RACF to control a client's access to enterprise beans. There are two distinct sets of tasks that are required to protect an application using EJB roles.
     a. The security administrator must define the roles and set up access rights in RACF.
        - Define a profile name using the EJBROLE (or GEJBROLE) class.

          Example:

          ```
          RDEF EJBROLE role_name
           UACC(NONE)
          ```

          where *role_name* matches the security role attribute specified either in the jar file or for the application. A role name cannot contain blanks, and cannot exceed 245 characters. Role names, however, may be in mixed case.
        - Create membership in the role by granting MVS user IDs or groups permission to the defined EJBROLE profile.

          Example:

          ```
          PERMIT role_name
           CLASS(EJBROLE)  ID(mvsid_gp
          ) ACCESS(READ)
          ```
        - Activate and RACLIST the EJBROLE class.

          Example:

```
SETROPTS CLASSACT(EJBROLE)
SETROPTS RACLIST(EJBROLE) GENERIC(EJBROLE)
```

b. 5.1 + The application assembler must assign method permissions to the bean or method using the Assembly Toolkit.
   - Define the roles relevant to the application. These role names must match the profile names assigned to RACF.
   - Once defined, the role can be assigned to access an application (as a method permission).
   - After the application assembly is complete, the application must be reinstalled using the Administration application.

   For details about assigning method permissions, refer to the WebSphere Application Server for z/OS documentation. Topics related to assigning method permissions are located in the Application section.

EJBROLES and GEJBROLES:

System Authorization Facility (SAF)-based authorization (for example, using the RACF EJBROLE profile) can be used as the mechanism for adding console users if the user registry is defined as LocalOS. The user registry and the authorization mechanism for the cell control how you add these users.

System Authorization Facility (SAF)-based authorization (for example, using the RACF EJBROLE profile) can be used as the mechanism for adding console users if the user registry is defined as LocalOS.

EJBROLE: The user registry and authorization setting for the cell control how you access J2EE roles. If the user registry is defined as LocalOS (RACF), either SAF Authorization (such as RACF EJBROLE profiles) or WebSphere Authorization (user to role mappings defined in WebSphere Application Server binding files) can be used.

If SAF authorization is set to true (see setting via admin console: **GlobalSecurity > UserRegistries > LocalOS > Custom Properties > com.ibm.SAF.authorization = true)**, SAF EJBROLE profiles are used to control which users are in a specified Java 2 Platform, Enterprise Edition (J2EE) role.

Defining EJBROLES belongs to the application deployment process. If the user ID has at least READ access to the EJBROLE profile defined in that corresponds to the j2ee role defined by the application, the user ID is considered to be *in Role*.

Roles, as defined by J2EE, are not inherent in the SAF model. In order to implement J2EE roles, a new SAF class, EJBROLE, was created. (Do not be confused by the name EJBROLE. It is used for J2EE roles in both EJBs and Web applications.)

When an application deployer uses a role in a component's deployment descriptor, the role name must be identical to the name of an EJBROLE profile. A security administrator defines EJBROLE profiles and permits SAF users or groups to the profiles. In order to be considered as eligible for a role, a user must have read access to the EJBROLE profile or must be connected to a SAF group that has read access.

The specification of a security domain prefix affects the specific EJBROLE profiles used by WebSphere Application Server for z/OS system resources when SAF authorization is chosen. When `SecurityDomainType = cellQualified`, the WebSphere Application Server for z/OS run time J2EE application EJBROLE

profiles are done by the specification of a security domain prefix. This enables you to deploy the same application on different cells in the same sysplex, but have different user to role mappings if desired.

Example: Your application has two J2EE role names: `juniorTellers` and `seniorTellers`. These are mixed case roles.

In your SAF registry, you have an MVS group called `JTELLER` and `STELLER` and a MVS user ID called BANKADM. The `JTELLER` group is required to access to the juniorTellers role, and the `STELLER` group is required to acces the seniorTellers role. The `BANKADM` user ID is required to access both roles.

For example, if you have an application with a J2EE role of `juniorTellers`, and you have two cells, both defined to use a security Domain prefix. The security domain names are `PRODCELL` and `TESTCELL`, respectively.

If you wanted to deploy the same application in both cells, you must define distinct profiles using a RACF (or equivalent security subsystem) as follows.

If RACF is used as your security server, enable this by issuing the following commands:

```
/* the EJBROLE class must be active, this step is done by the customization dialogs  */
SETROPTS CLASSACT(EJBROLE)

/* first define the roles in RACF */
RDEFINE EJBROLE PRODCELL.juniorTellers UACC(NONE)
RDEFINE EJBROLE PRODCELL.seniorTellers UACC(NONE)

RDEFINE EJBROLE TESTCELL.juniorTellers UACC(NONE)
RDEFINE EJBROLE TESTCELL.seniorTellers UACC(NONE)

/* permit the appropriate users and groups to the various roles */
PERMIT PRODCELL.juniorTellers CLASS(EJBROLE)  ID(JTELLER BANKADM) ACCESS(READ)
PERMIT PRODCELL.seniorTellers CLASS(EJBROLE)  ID(STELLER BANKADM) ACCESS(READ)

/* refresh the EJBROLE class in RACF *
SETROPTS RACLIST(EJBROLE) REFRESH"
```

Grouping EJBROLES (GEJBROLE): The SAF interface also supports a grouping class for the EJBROLE class. This grouping class is called GEJBROLE. It is particularly useful when you have a need to give access to the same users or groups for several roles.

The GEJBROLE grouping class provides a capability not natively available in other J2EE servers. Using the J2EE security model, if we have several components or applications that use different role names for similar functions (such as Hire, Promote, GrantPayraise for managerial functions), there are several options to handle this issue:

- Adjust the applications' deployment descriptors so that they conform to the roles already defined in our enterprise (such as Managers). This is time consuming and error prone, especially since it might require a readjustment of the deployment descriptor each time the application was changed or reinstalled.
- Define the EJBROLE profiles for each of the roles required by the application. Then the users and groups to be given access to these roles would have to be permitted. This could become an administrative headache, since the same users and groups would be permitted to several different profiles with similar meanings.

- Use the grouping class to avoid the worst pitfalls of the other two options. You must still define EJBROLE profiles for each of the roles required by the application. Instead of permitting all of the same users and groups to the new profiles, create a profile (such as Supervisors) in the grouping class and add all of the new EJBROLE profiles to it. Every user and group that needs access to these roles can now be permitted in one place--the Supervisors profile. You can further avoid administrative work by simply adding our existing EJBROLE profile (Managers) to the grouping class profile (Supervisors).

This following explains the relation between GEJBROLES, EJBROLES and EJBROLES within the GEJBROLE (ADDMEM).

Tip: Implementing GEJBROLES includes:

1. Plan organizational role profiles in RACF class GEJBROLEs.
2. Create the access list by permitting user groups to the GEJBROLE profiles, then add roles to the GEJBROLE profiles.
3. A GEJBROLE with only one EJBROLE is OK.
4. Do not use a mixture of EJBROLE and GEJBROLE for permitting users to roles.
5. If possible, permit users to GEJBROLE profiles only.
6. Generally use GEJBROLE in preference to EJBROLE.

Steps for enabling global security for WebSphere Application Server

Before you can enable global security you must select both an authentication mechanism and a user registry.

You need to start the administrative console by specifying the following Web site: `http://server_hostname:9090/admin.`

Perform the following steps to enable global security

1. Click **Security** > **Global Security** in the Navigation tree on the left.
2. On the Global Security Configuration tab, click the **Enabled** check box. The **Enabled** option allows you to enable global security. Global security is disabled by default.
3. The Enforce Java 2 Security option enables you to enable or not enable Java 2 Security permission checking. By default, Java 2 security is disabled. However, if you enable global security, Java 2 security is automatically enabled. You can choose to disable Java 2 security, even when global security is enabled.

   When Java 2 Security is enabled and if an application requires more Java 2 security permissions then are granted in the default policy, then the application might fail to run properly until the required permissions are granted in either the `app.policy` file or the `was.policy` file of the application. AccessControl exceptions are generated by applications that do not have all the required permissions. Review the Java 2 Security and Dynamic Policy documentation if you are unfamiliar with Java 2 security.
4. Select the **Use Domain Qualified User IDs** option. If this option is enabled, user names appear with their fully qualified domain attribute when retrieved programmatically.
5. Enter the timeout value for security cache in seconds in the **Cache Timeout** field. When the timeout is reached, the Application Server clears the security cache and rebuilds the security data. Since this affects performance, this value should not be set too low. Default: 600 seconds.

6. Select the **Issue Permission Warning** option. The `filter.policy` file contains a list of permissions that an application should not have according to the J2EE 1.3 Specification. If an application is installed with a permission specified in this policy file and this option is enabled, a warning is issued. The default is enabled.
7. Select which security protocol is active when security is enabled from the Active Protocol menu. Specifies the active authentication protocol for RMI/IIOP requests when security is enabled. In previous releases the z/OS Secure Authentication Services (z/SAS) protocol was the only available protocol.

   This release includes an Object Management Group (OMG) protocol called CSIv2, which supports increased vendor interoperability and additional features. If all servers in your entire security domain are Version 5 servers, it is best to specify CSI as your protocol. If some servers are 3.x or 4.x servers, specify CSI and z/SAS. The default is both CSI and z/SAS.
8. Select which authentication mechanism is active which security is enabled from the Active Authentication Mechanism menu. The Active Authentication Mechanism menu specifies the authentication mechanism which is active when security is enabled. In WebSphere Application Server, Version 5, Simple WebSphere Authentication Mechanism (SWAM), Lightweight Third Party Authentication (LTPA), and Integrated Cryptographic Services Facility (ICSF) are the supported authentication mechanisms. Only ICSF and LTPA are configurable on WebSphere Application Server Network Deployment, Version 5. SWAM is not configurable on WebSphere Application Server Network Deployment.
9. Use Active User Registry menu to specify the user registry that is active when security is enabled. You can configure settings for one of the following user registries:
   - Local operating system. The implementation is a SAF compliant registry such as the Resource Access Control Facility (RACF), which is shared in an MVS sysplex.
   - LDAP user registry. The LDAP User Registry settings are used when users and groups reside in an external LDAP directory. When security is enabled and any of these properties are changed, go to the Global Security panel and click **OK** or **Apply** to validate the changes.
   - Custom user registry.

   Default: Local OS.
10. Click **OK**.

    This panel performs a final validation of the security configuration. When you click **OK** or **Apply** from this panel, the security validation routine is performed and any problems are reported at the top of the page. When you complete all of the fields, click **OK** or **Apply** to accept the selected settings. Click **Save** (at the top of the panel) to persist these settings out to a file. If you see any informational messages in red text color, then there is a problem with the security validation. Typically, the message indicates the problem. So, review your configuration to verify that the user registry settings are accurate and the correct registry is selected. In some cases, the LTPA configuration may not be fully specified. See “Global security settings” on page 153 for detailed information.

Configuration is successful when error messages do not display at the top of the panel.

Enabling global security on a base application server node:

Global security activates a number of WebSphere security settings. Most of the settings receive their default value from the installation scripts, run during server installation. The following is a checklist for enabling global security on a base application server node:

1. Verify that you are running W500101 or later.
2. Verify that the installation scripts were run, including the security panel. On the security panel, make sure you select the **generate RACF commands** option.
3. Verify that you ran the job that submits the RACF commands created by the installation scripts. This builds the keyrings and certificates.
4. Start the server if it is not already up.
5. Access the administrative console. You can use any user ID. A password is not necessary.
6. Click **Security > Authentication Mechanisms > LTPA**. Enter a password and confirm the password by entering it again. Click **Apply** and **Save**.
7. Click **Security > User Registries > Local OS**. On the *Local OS User Registry* page, click **Custom Properties**. If you want WebSphere Application Server for z/OS to use RACF EJBROLE profiles for determining if a user has a role, select `com.ibm.security.SAF.authorization` and `com.ibm.security.SAF.delegation` and set them to true. Otherwise, leave them set to false. If you change them, click **Apply** and **Save**. If you chose to use EJBROLE profiles, use RACF to PERMIT your administrative user IDs to use the *administrator* EJBROLE class profile. If you chose not to use EJBROLE profiles, click **System Administration > Console Users**, and add your user IDs as administrators. Click **Apply** and **Save**.
8. Click **Security > User Registries > Local OS**. Click **OK**. This takes you to the *Global Security* page.
9. On the *Global Security* page, scroll to the bottom and click **Custom Properties**. On the *Custom Properties* page, click **EnableTrustedApplications** and set its value to *true*. Click **Apply** and **Save**.
10. Click **Security > Global Security**. Check the box that says **Enabled**, then uncheck the box that says **Enforce Java 2 Security**. The *Active Protocol* should be `CSI` and `zSAS`. The *Active Authentication Mechanism* should be `LTPA`. The *Active User Registry* should be **Local OS**. Click **Apply** and **Save**.
11. Restart the server and connect to the administrative console using your browser. The server should successfully redirect you to the SSL port, where you get the usual certificate warnings. Then, you should see the login page where you can enter the valid administrative user ID and password.

Disabling global security:

To disable global security, log on to the administrative console and select **Security > Global Security**. Uncheck the **Enabled** check box. Restart the server and global security is off.

If global security is not working properly, it can cause the server to not start, or start without providing you with the ability to log on. To disable global security in this case, edit the server `security.xml` file. The `security.xml` file can be found in the `<mountpoint>/AppServer/config/cells//AppServer/config/cells/<cell name/` directory.

To disable global security, edit the `security.xml`. Search for the line that begins with the following tag: `<security:Security:`. In that line search for **Enabled**. The word following **Enabled** is **True**. Change it to **False**. **Save** the file. Restart the server. Global security is now disabled.

Enabling global security: Global security can be thought of as a ″big switch″ that activates a wide variety of WebSphere security settings. Values for these settings can be specified, but they will not take effect until global security is activated. The settings include the authentication of users, the use of SSL, the choice of user registry and Java 2 security. In particular, application security, including authentication and role-based authorization, is not enforced unless global security is active. Global security is disabled by default to simplify the installation of the server. However, after you build a server and install the administrative console, any user can log on to the administrative console and a password is not required. Global security is necessary to secure the administrative console. However, proper planning is required because incorrectly enabling global security can lock you out of the administrative console, or cause the server to abend.

Why turn on global security?

Turning on global security activates the settings that protect your server from unauthorized users. There might be some environments where no security is needed such as a development system. On these systems you can elect not to enable global security. However, in most environments you should keep unauthorized users from accessing the administrative console and your business applications. Global security must be enabled to restrict access.

What does global security protect?

The settings that are activated when global security is enabled include:
- Authentication of HTTP clients
- Authentication of IIOP clients
- Administrative console security
- Naming security
- Use of SSL transports
- Role-based authorization checks of servlets, EJBs, and mbeans
- Propagation of identies (RunAs)
- CBIND checks

Security customization dialog settings

This topic describes using the base panel to configure security for the base application server node.

```
----------------     WebSphere for z/OS Customization    ----------------

Option  ===>

Security Customization (1 of 1)

   Specify the following for your WebSphere customization.
   Press ENTER to continue.

Installation dependent WebSphere Security Customization definitions

   SSL Customization

    WebSphere Certificate Authority Keylabel:  WAS TestCertAuth
    RACF Keyring Name.....................:  WASKeyring

   Use RACF Authorization and Delegation.......:  Y
   Support Passtickets for z/SAS authentication:  N
       Passticket Profile name.................:  CBS390
       Passticket KEYMASK value................:  _

   Enable WebSphere Application Server to authenticate
    RACF users via WebSphere login tokens......:  Y
```

```
   Generate RACF commands for above.............:  Y

Installation dependent z/OS Security Customization definitions

  Authorize Servers to APPL profile.................:  N
  Sample OPERCMDS definitions for WebSphere Servers:  N
```

Specify `Y` (yes) in some fields to define the profile or enable an option in RACF. Specify `N` (no) to not define the profile or enable the option. The following fields customize security. They are installation-dependent for the base WebSphere Application Server.

SSL Customization
: Identifies the SSL customization properties.

WebSphere Certificate Authority Keylabel
: Identifies the name of the keylabel that identifies the WebSphere Application Server for z/OS certificate authority (CA) that is generated when you run the RACF jobs.

RACF Keyring Name
: Identifies the keyring owned by the server. A RACF keyring is uniquely identified by its keyring name and the user identity running the job.

Use RACF Authorization and Delegation
: Specify `Y` to use the SAF EJBROLE class for the authorization and delegation of requests.

Support Passtickets for z/SAS authentication
: Specify `Y` to support PassTickets for z/SAS authentication, in which case KEYMASK is required.

PassTicket Profile name
: Identifies the name of the PassTicket profile. This must be `CBS390` to indicate WebSphere Application Server for z/OS.

PassTicket KEYMASK value
: Specify any string of 16 hexadecimal characters as a secret KEYMASK for PassTickets.

Enable WebSphere Application Server to authenticate RACF users via WebSphere login tokens
: Specify `Y` to enable WebSphere Application Server to use WebSphere Application Server for z/OS login tokens to authenticate RACF users. You must specify `Y` if the user registry is localOS and either LTPA or ICSF authentication is specified.

Generate RACF commands for above
: Specify `Y` to automatically generate RACF commands for all preceding options. You must complete this customization prior to before enabling security on WebSphere Application Server for z/OS.

Customize the following installation-dependent fields to define z/OS security.

Authorize Servers to APPL profile
: Specify `Y` to authorize Application Servers to APPL profile. The CBS390 APPL profile is an optional mechanism to control which users can use an application. If the APPL class is active on your system and you choose this option, you must use the **RACF PERMIT** command to grant all WebSphere Application Server users READ access to this profile. This includes the WebSphere Application Server configuration group users, unauthenticated user IDs, and any MVS user ID that represents WebSphere Application Server clients (including administrators). For example:

  ```
  PERMIT CBS390 CLASS(APPL) ID(WSCFG1 WSCLGP) ACCESS(READ)
  ```

WSCLGP is the group WSGUEST belongs to. In this example, two groups (users connected to the WSCFG1 and WSCLGP groups) are authorized to authenticate to WebSphere Application Server for z/OS. These might be group names given to represent base Application Servers and clients, respectively.

Sample OPERCMDS definitions for WebSphere Servers
Specify Y to generate sample OPERCMDS definitions that permit WebSphere Application Server for z/OS to start and stop servers. You must edit these samples for your specific installation.

The following is for configuring security using the Network Deployment panel.

You must set up a base Application Server using the dialogs before using this one to set up a Network Deployment node, which is managed by the deployment manager process (dmgr). It is critical that you **LOAD** saved environment variables from the base Application Server into the deployment manager node that federates the base node. Do this before performing security customization on the deployment manager node.

```
-----------------     WebSphere for z/OS Customization    -----------------

Option  ===>

Security Customization (1 of 1)

   Specify the following for your WebSphere customization.
   Press ENTER to continue.

Installation dependent WebSphere Security Customization definitions

   SSL Customization

    WebSphere Certificate Authority Keylabel:  WAS TestCertAuth
    RACF Keyring Name.....................:  WASKeyring

   Use RACF Authorization and Delegation.......:  Y

   Generate default RACF realm name:  Y
   Default RACF realm name.........:  MCLXCF01

   Enable WebSphere Application Server to authenticate
    RACF users via WebSphere login tokens......:  Y

   Generate RACF commands for above............:  Y

Installation dependent z/OS Security Customization definitions

  Authorize Servers to APPL profile.................:  N
  Sample OPERCMDS definitions for WebSphere Servers:  N
```

This panel lets you specify authentication and authorization options for run-time resources. Specify Y (yes) in some fields to define the profile or enable an option in RACF. Specify N (no) to not define the profile or enable the option.

SSL Customization
Identifies the SSL customization properties.

WebSphere Certificate Authority Keylabel
Identifies the name of the keylabel that identifies the WebSphere Application Server for z/OS certificate authority (CA) that is used to generate WebSphere Application Server for z/OS server certificates when you run the RACF jobs.

RACF Keyring Name
Identifies the keyring owned by the server. A RACF keyring is uniquely identified by its keyring name and the user identity running the job.

Use RACF Authorization and Delegation
Specify `Y` to use the SAF EJBROLE class for the authorization and delegation of requests.

Generate default RACF realm name
Specify `Y` to set up a sysplex-wide SAF default realm name. If you do not specify a default RACF realm name, WebSphere Application Server for z/OS will use the daemon IP name as the SAF default realm name. It is recommended that you specify `Y` here.

Default RACF realm name
Identifies the name of the SAF default realm to use across the sysplex. This name lets you switch servers and determine whether to remain in the same realm.

Enable WebSphere Application Server to authenticate RACF users via WebSphere login tokens
Specify `Y` to enable WebSphere Application Server to use WebSphere Application Server for z/OS login tokens to authenticate RACF users. You must specify `Y` if the user registry is localOS and either LTPA or ICSF authentication is specified.

Generate RACF commands for above
Specify `Y` to automatically generate RACF commands for all preceding options. Complete this customization before enabling security on WebSphere Application Server for z/OS.

Customize the following installation-dependent fields to define z/OS security..

Authorize Servers to APPL profile
Specify `Y` to authorize Application Servers to APPL profile. The APPL profile controls which users can use an application as they enter the system.

Sample OPERCMDS definitions for WebSphere Servers
Specify `Y` to generate sample OPERCMDS definitions that permit WebSphere Application Server for z/OS to start and stop Application Servers. You must edit these samples for your specific installation.

Note:

- If the APPL class is active and you have defined a profile for WebSphere, make sure that all z/OS identities using WebSphere services have READ permission to the WebSphere Application Server APPL profile. This includes all WebSphere Application Server identities, WebSphere Application Server unauthenticated identities, WebSphere Application Server administrative identities, user IDs based on role-to-user mappings, and all user identities for system users. If you have not defined a security domain, the APPL profile used is CBS390 or the name used as the security domain identifier. If you have defined a security domain, the APPL profile used is the security domain name.
- When adding an administrator to the administrative console using local operating system security, if the APPL class is activated, the administrator's user ID must be authorized to the CBS390 (or the name specified as the security domain identifier) APPL class for RACF as well. If the administrator's user ID is not authorized to CBS390 APPL, message BBOS0108E is issued, indicating that the credential-handling function (RunAsGetSpecCred) failed in routine because the user is not authorized.

Setting up Secure Sockets Layer security for WebSphere Application Server for z/OS

This topic assumes you understand the SSL protocol and how cryptographic services system SSL works on z/OS or OS/390. Secure sockets layer (SSL) is used by multiple components within WebSphere Application Server to provide trust and privacy. Such components include the built-in HTTP transport, the ORB (client and server), and the secure LDAP client. Configuring SSL is different between client and server with WebSphere Application Server. If you want the added security of protected communications and user authentication in a network, you can use secure sockets layer (SSL) security.

Secure Socket Layer (SSL) is an integral part of the security provided by WebSphere Application Server for z/OS. It is activated when global security is enabled. When global security is enabled, SSL is always used by the administrative subsystem to secure administrative commands, the administration console, and communications between WebSphere processes.

The WebSphere Application Server for z/OS run time can optionally use SSL when server security is enabled in these cases:

- SSL is used to protect Web application when confidentiality is specified as a Web Application Security Constraint. A transport guarantee of CONFIDENTIAL or INTEGRAL guarantees that the communication between the Web client and the Web server is secured and is transported over HTTPS (HTTP SSL). In addition, you can use SSL to perform client authentication when the security constraint (CLIENT_CERT) is specified during application deployment .
- SSL can be used to protect Inter-ORB Protocol (IIOP) requests when SSL/TLS is supported (or required) in the CSIV2 Transport settings. These are set by clicking **Security > AuthenticationProtocol > CSI Inbound or Outbound Transport settings**.
- SSL can be used to protect IIOP requests when z/SAS protocols are selected. SSL is used with SSL basic authentication, SSL client authentication, z/SAS identity assertion, and z/SAS Kerberos. SSL client authentication and z/SAS identity assertion also uses SSL transmitted digital certificates to authenticate the sender of the request.
- SSL can be used to protect communications between an LDAP client and server when the active user registry is LDAP.

When configuring SSL, there are two types of SSL repertoires on WebSphere Application Server for z/OS. The type of repertoire relates to the underlying services used to process SSL.

- System SSL (SSSL repertoires) are required for Web container (HTTP Transports) SSL, and Inter-ORB (IIOP) SSL processing, both CSIV2 and zSAS SSL Transports. In addition a System SSL repertoire must be specified if the RMI connector is chosen for administrative requests. System SSL repertoires use a SAF Keyring to retrieve the personal certificate and trust stores of the Application Server. All system SSL repertoires for a given process must use the same SAF Keyring.
- Java Secure Socket Extension (JSSE) must be chosen for the SSL repertoire type used by the HTTP/SOAP Connector request for administrative requests. JSSE repertoires can (with APAR PQ77586 applied) specify either a SAF keyring for the keystore or truststore, or an HFS file.

This topic gives a brief explanation of the SSL protocol and how SSL works on z/OS or OS/390. For information about the SSL protocol, go to the following Web site: http://home.netscape.com/eng/ssl3/ssl-toc.html

For more information about Cryptographic Services System SSL, go to the following Web site: z/OS System Secure Sockets Layer Programming.

Secure Sockets Layer (SSL) is used by multiple components within WebSphere Application Server to provide trust and privacy. These components are the built-in HTTP Transport, the ORB (client and server), and the secure LDAP client. Configuring SSL is different between client and server with WebSphere Application Server. If you want the added security of protected communications and user authentication in a network, you can use Secure Sockets Layer (SSL) security. The SSL support in WebSphere Application Server for z/OS has several objectives:

- To provide ways accepted by the industry to protect the security of messages as they flow across the network. This is often called *transport layer security*. Transport layer security is a function that provides privacy and data integrity between two communicating applications. The protection occurs in a layer of software on top of the base transport protocol (for example, on top of TCP/IP).

  SSL provides security over the communications link through encryption technology, ensuring the integrity of messages in a network. Because communications are encrypted between two parties, a third party cannot tamper with messages. SSL also provides confidentiality (ensuring the message content cannot be read), replay detection, and out-of-sequence detection.
- To provide a secure communications medium through which various authentication protocols can operate. A single SSL session can carry multiple authentication protocols, that is, methods to prove the identities of the parties communicating.

  SSL support always provides a mechanism by which the server proves its identity. The SSL support on WebSphere Application Server for z/OS allows these ways for the client to prove its identity:
  - Basic authentication (also known as SSL Type 1 authentication), in which a client proves its identity to the server by passing a user identity and password known by the target server.

    With SSL basic authentication:
    - A z/OS or OS/390 client can communicate securely with WebSphere Application Server for z/OS with a user ID and password as defined by the CSIv2 user name and password mechanism (GSSUP).
    - A WebSphere Application Server client can communicate securely with a WebSphere Application Server for z/OS server by using a MVS user ID and password.
    - Because a password is always required on a request, only simple client-to-server connections can be made. That is, the server cannot send a client's user ID to another server for a response to a request.
  - Client certificate support, in which both the server and client supply digital certificates to prove their identities to each other.

    When digital certificates are provided for authentication to WebSphere Application Server for z/OS the decrypted certificate is mapped to a valid user identity in the active user registry. Web applications can have thousands of clients, which makes managing client authentication an administrative burden. When Local OS is the active registry on WebSphere Application Server for z/OS, SAF certificate name filtering allows you to map client certificates, without storing them, to MVS user IDs. Through *certificate name filtering*, you can authorize sets of users to access servers without the administrative overhead of creating MVS user IDs and managing client certificates for every user.
  - SSL support always provides a mechanism by which the server proves its identity. A variety of mechanisms can be used to prove the clients identity. The SSL v3 (and TLS) protocol provides for the ability for client digital

certificates to optionally be exchanged. These certificates can be used for authentication. CSIv2 identity assertion support, which includes z/OS and OS/390 principals, X501 distinguished names, and X509 digital certificates.
  - Identity assertion, or trusted association, in which an intermediate server can send the identities of its clients to a target server in a secure yet efficient manner. This support uses client certificates to establish the intermediate server as the owner of an SSL session. Through RACF, the system can check that the intermediate server can be trusted (to confer this level of trust, CBIND authorization is granted by administrators to RACF IDs that run secure system code exclusively). Once trust in this intermediate server is established, client identities (MVS user IDs) need not be separately verified by the target server; those client identities are simply asserted without requiring authentication.
- To be securely interoperable with other products, such as:
  - CICS Transaction Server for z/OS
  - Other WebSphere Application Server versions
  - CORBA-compliant object request brokers

SSL is disabled by default and SSL support is optional. If you are running WebSphere Application Server for z/OS with security turned on, SSL is required by the administrative console.

If you choose to use SSL, there are two types of SSL repertoires from which you must choose:
- System SSL (SSSL) is the SSL repertoire type used for Web container and ORB transport.
- Java Secure Socket Extension (JSSE) is the SSL repertoire type used for the JMX SOAP Connector

The following table describes how an SSL connection works:

Stage	Description
Negotiation	After the client locates the server, the client and server negotiate the type of security for communications. If SSL is to be used, the client is told to connect to a special SSL port.
Handshake	The client connects to the SSL port and the SSL handshake occurs. If successful, encrypted communication starts. The client authenticates the server by inspecting the server's digital certificate. If client certificates are used during the handshake, the server authenticates the client by inspecting the client's digital certificate.
Ongoing communication	During the SSL handshake, the client and server negotiate a cipher spec to be used to encrypt communications.
First client request	The determination of client identity depends upon the client authentication mechanism chosen, which is one of the following: • CSIv2 user ID and password (GSSUP) • CSIv2 asserted identity • zSAS Kerberos • zSAS basic authentication assertediIdentities • zSAS asserted identities • CSIv2 client certificates • zSAS client certificates

Rules:

- Only server controllers and z/OS or OS/390 clients require access to Cryptographic Services System SSL. Your controllers and z/OS or OS/390 clients require access to the *hlq*. SGSKLOAD data set. Place SGSKLOAD into LPA. You must use system SSL to establish secure communications. It is recommended that the system SSL load library exist in the linklist and be under program control. Verify that the load library exists in the link list. To turn on program control for the library, issue the following RACF commands from a user ID that has the proper authority:

  RALTER PROGRAM * ADDMEM('*hlq*.SGSKLOAD' //NOPADCHK) UACC(READ)
  SETROPTS WHEN(PROGRAM) REFRESH

  For more information, see *z/OS System Secure Sockets Layer Programming*.
- Either a Java or C++ client on z/OS or OS/390 is interoperable with a WebSphere Application Server for z/OS or workstation Application Server, and can use SSL. CSIv2 security only supports Java clients on z/OS or OS/390.
- Part of the handshake is to negotiate the cryptographic specs used by SSL for message protection. There are two factors that determine the cipher specs and key sizes used:
  - The security level of the cryptographic services installed on the system, which determines the cipher specs and key sizes available to WebSphere Application Server for z/OS.
  - The configuration of the server through the administrative console allows you to specify SSL cipher suites.

  For more information, see *z/OS System Secure Sockets Layer Programming*.
- For z/OS system SSL sockets you must use RACF or an equivalent to store digital certificates and keys. Placing digital certificates and keys into a key database in the HFS is not an option.

Tip: To define SSL basic authentication security, you must first request a signed certificate for your server and a certificate authority (CA) certificate from the certificate authority that signed your server certificate. After you have received a signed certificate for your server and a CA certificate from the certificate authority, you must use RACF to authorize the use of digital certificates, store server certificates, and server key rings in RACF, create an SSL repertoire alias, and define SSL security properties for your server through the administrative console.

For clients, you must create a key ring and attach to it the CA certificate from the certificate authority that issued the server's certificate. For a z/OS or OS/390 client, you must use RACF to create a client key ring and to attach the CA certificate to that key ring. For the client to authenticate the server, the server (actually, the controller user ID) must possess a signed certificate created by a certificate authority. The server passes the signed certificate to prove its identity to the client. The client must possess the CA certificate from the same certificate authority that issued the server's certificate. The client uses the CA certificate to verify that the server's certificate is authentic. Once verified, the client can be sure that messages are truly coming from that server, not someone else. For the server to authenticate the client, note that there is no client certificate that the client passes to prove its identity to the server. In the SSL basic authentication scheme, the server authenticates the client by challenging the client for a user ID and password.

See "Setting up a Keyring for use by Daemon SSL" on page 53 for information on creating a keyring for the daemon's MVS user ID.

SSL repertoires:

The SSL configuration repertoire allows administrators to define any number of SSL settings which can be used to make HTTPS, IIOPS or LDAPS connections.

Using the SSL configuration repertoire, you can pick one of the SSL settings defined here from any location within the administrative console which allows SSL connections. This simplifies the SSL configuration process since you can reuse many of these SSL configurations by simply specifying the alias in multiple places. The appropriate repertoire is referenced during the configuration of a service that sends and receives requests encrypted using SSL, such as the Web and enterprise beans containers. Before deleting SSL configurations from the repertoire, remember that if an SSL configuration alias is referenced somewhere, and it is deleted here, an SSL connection will fail if the deleted alias is accessed.

Note: You can also create an alias, but first you must create an SSL configuration repertoire alias or entry. You can then select the alias later when a component is configured for SSL support.

If you choose to use SSL, there are two types of SSL repertoires from which you must choose:
- System SSL (SSSL) is the SSL repertoire type used for Web container and ORB transport
- Java Secure Socket Extension (JSSE) is the SSLrepertoire type used for the JMX SOAP Connector

Defining SSL security for clients and servers:

You need to request a certificate authority (CA) certificate and a signed certificate for your server. If you plan to implement SSL client certificate support, you must also have certificate authority certificates from each certificate authority that verifies your client certificates. You must have a user ID with the authority to use the RACDCERT command in the Resource Access Control Facility (RACF) (for example, SPECIAL authority).

Complete the following steps for RACF to authorize the server to use digital certificates. SSL uses digital certificates and public and private keys. If your application server uses Secure Sockets Layer (SSL), you must use RACF to store digital certificates and public and private keys for the user identities under which the server controllers run.

1. For each server that uses SSL, create a key ring for that server's controller user ID. **Example**: Your controller is associated with the user ID called ASCR1. Issue the following command:

   ```
   RACDCERT ADDRING(ACRRING) ID(ASCR1)
   ```

2. Receive the certificate for your application server from the certificate authority. **Example**: You requested a certificate and the certificate authority returned the signed certificate to you, which you stored in a file called ASCR1.CA. Issue the following command:

   ```
   RACDCERT ID (ASCR1) ADD('ASCR1.CA') WITHLABEL('ACRCERT') PASSWORD('password')
   ```

3. Connect the signed certificate to the controller user ID's key ring and make the certificate the default certificate. **Example**: Connect the certificate labelled ACRCERT to the key ring ACRRING owned by ASCR1. Issue the following command:

   ```
   RACDCERT ID(ASCR1) CONNECT (ID(ASCR1) LABEL('ACRCERT') RING(ACRRING) DEFAULT)
   ```

4. If you plan to have the server authenticate clients (SSL client certificate support), complete the following steps:

a. Receive each certificate authority (CA) certificate that verifies your client certificates. **Example**: Receive the CA certificate that will verify a client with user ID CLIENT1. That certificate is in a file called USER.CLIENT1.CA. Issue the following command:

```
RACDCERT ADD('USER.CLIENT1.CA') WITHLABEL('CLIENT1 CA') CERTAUTH
```

b. Give each CA certificate the CERTAUTH attribute.

   Connect each client's certificate authority (CA) certificate to the controller user ID's key ring.

   Example: Connect the CLIENT1 CA certificate to the ring ACRRING owned by ASCR1.

```
RACDCERT ID(ASCR1) CONNECT(CERTAUTH LABEL('CLIENT1 CA') RING(ACRRING))
```

5. Give read access for IRR.DIGTCERT.LIST and IRR.DIGTCERT.LISTRING in the RACF FACILITY class to the controller user ID. **Example**: Your controller user ID is ASCR1. Issue:

```
PERMIT IRR.DIGTCERT.LIST CLASS(FACILITY) ID(ASCR1) ACC(READ)
PERMIT IRR.DIGTCERT.LISTRING CLASS(FACILITY) ID(ASCR1) ACC(READ)
```

You are done with the RACF phase when the RACF commands succeed.

Steps to create a new System SSL repertoire alias:

You must start the Administrative console.

The steps outline the necessary actions to generate a new System SSL repertoire alias. Using the SSL configuration repertoire, you can pick one of the SSL settings defined here from any location within the administrative console that allows SSL connections. This simplifies the SSL configuration process since you can reuse many of these SSL configurations by simply specifying the alias in multiple places.

1. Click **Security > SSL** on the left-hand navigation tree to open the SSL Configuration Repertoires panel.
2. To create a new System SSL alias, select the check box next to the word **Alias** and click on the **New SSSL Repertoire** button near the top of the panel. The System SSL Repertoire panel appears.
3. Enter the alias name in the **Alias** field.
4. Specify the SSL RACF key ring in the **Key File Name** field. All repertoires used by the same server (such as HTTPS, CSIV2, z/SAS) must have the same keyring name. If the keyring names are not the same, the HTTPS keyring name is used to initialize the server. If you specify the wrong RACF key ring, the server gets an error message at run time.
5. Optional: Select the **Client Authentication** option. This option enables client authentication to occur if this repertoire is selected for HTTPS. However, the value is ignored if you use using CSIv2 or z/SAS.

   To enable client authentication for CSIv2, click **Security > Authentication Protocol > CSIv2 Inbound Authentication**. Select the appropriate option for **Client Certificate Authentication**.

   To enable client authentication for z/SAS, click **Security > Authentication Protocol > zSAS Transport**. Select the **Client Certificate** option.
6. Select *High*, *Medium*, or *Low* from the **Security Level** menu to specify the high, medium, or low set of cipher suites. If you add specific cipher suites on this panel, those cipher suites take precedence over the high, medium, or low specification. If a cipher list is specified, WebSphere Application Server uses the

list. If the cipher list is empty, WebSphere Application Server uses the high, medium, low specification. The following list explains these specifications:

High 128-bit cipher suites with digital signature.

Medium
40-bit cipher suites with digital signature.

Low No encryption is used, but digital signature is used.

7. Specify the SSL V3 timeout value in the **V3 Timeout** field. This value is the length of time, in seconds, that the system holds session keys. The range is 0-86400 (1 day). The default is 600 seconds.
8. Select the cipher suites that you want to add from the **Cipher Suites** menu. By default, this is not set and the cipher suites available are determined by the value of the Security Level (*High*, *Medium*, or *Low*). A cipher suite is a combination of cryptographic algorithms used for an SSL connection.
9. Click **OK** when you have made all your selections.

Steps to create a new Java Secure Socket Extension repertoire alias:

The steps describe how to generate a new Java Secure Socket Extension (JSSE) repertoire alias. Using the JSSE repertoire, you can pick one of the JSSE repertoire settings defined here from any location within the administrative console. This simplifies the JSSE repertoire configuration process since you can reuse many of these JSSE configurations by simply specifying the alias in multiple places.

1. Click **Security > SSL** on the left-hand navigation tree to open the SSL Configuration Repertoires panel.
2. To create a new JSSE repertoire, click **New JSSE Repertoire** near the top of the panel. The JSSE Repertoire panel appears.
3. Enter the alias name in the **Alias** field.
4. Specify the name of the key file in the **Key File Name** field. Specify the fully qualified path to the Secure Sockets Layer (SSL) key file that contains public keys and private keys. Type `safkeyring:///` if you are using a RACF key ring for the key file.
5. Specify the password needed to access the key file in the **Key File Password** field. Type `password` if you are using a RACF key ring for the key store.
6. Select the format of the key file from the **Key File format** menu.
7. Optional: Select the **Client Authentication** option. This option enables client authentication to occur if this repertoire is selected for HTTPS. However, the value is ignored if you use using CSIv2 or z/SAS.

   To enable client authentication for CSIv2, click **Security > Authentication Protocol > CSIv2 Inbound Authentication**. Select the appropriate option for **Client Certificate Authentication**.

   To enable client authentication for z/SAS, click **Security > Authentication Protocol > zSAS Transport**. Select the **Client Certificate** option.
8. Select *High*, *Medium*, or *Low* from the **Security Level** menu to specify the high, medium, or low set of cipher suites. If you add specific cipher suites on this panel, those cipher suites take precedence over the high, medium, or low specification. If a cipher list is specified, WebSphere Application Server uses the list. If the cipher list is empty, WebSphere Application Server uses the high, medium, low specification. The following list is an explanation of the high, medium, and low specifications:

   High 128-bit cipher suites with digital signature.

Medium
40-bit cipher suites with digital signature.

Low No encryption is used, but digital signature is used.

9. Select the cipher suites that you want to add from the **Cipher Suites** menu. By default, this is not set. The set of cipher suites available is determined by the value of the Security Level (*High*, *Medium*, or *Low*). A cipher suite is a combination of cryptographic algorithms used for an SSL connection.
10. Select the **Cryptographic Token** option if hardware or software cryptographic support is available.
11. Indicate which JSSE provider that you are using by selecting either **Predefined JSSE provider** or **Custom JSSE provider** in the **Provider** field. WebSphere Application Server comes with the IBMJSSE provider predefined.

    If you are not using the IBMJSSE provider, configure a custom provider by selecting **Custom JSSE provider**. Under additional properties, click **Custom Properties > New**. After specifying the custom provider, return to the JSSE repertoire panel.
12. Select an SSL or TLS protocol version.

    Note: The protocol chosen for the server must match the protocol chosen for the client. Also, in order for two servers to interoperate, they must use the same protocol.
13. Click **OK** when you have made all your selections.

Setting up a Keyring for use by Daemon SSL:

Modify the customization job commands generated in BBOCBRAK (or HLQ.DATA(BBODBRAK) on WebSphere Application Server Network Deployment) to perform these steps:

1. Create a keyring for the daemon's MVS user ID to own. Generally, this is the same keyring name that was created for your application servers. Issue the following TSO command: `RACDCERT ADDRING(keyringname) ID(daemonUserid)`
2. Generate a digital certificate for the daemon's MVS user ID to own. Issue the following TSO command: `RACDCERT ID (daemonUserid) GENCERT SUBJECTSDN(CN('create a unique CN') O('IBM')) WITHLABEL('labelName') SIGNWITH(CERTAUTH LABEL('WebSphereCA'))`
3. Connect the generated certificate to the daemon's keyring. Issue the following TSO command: `RACDCERT ID(daemonUserid) CONNECT (LABEL('labelName') RING(keyringname) DEFAULT)`
4. Connect the certificate authority (CA) certificate to the server's keyring. Issue the following TSO command: `RACDCERT CONNECT (CERTAUTH LABEL(WebSphereCA) RING(keyringname))`

Tip: The CA certificate generated during configuration (WAS Test CertAuth) is an example. Use the CA you normally use to create user certificates, and connect the CA certificate to the daemon and server keyrings.

Daemon Secure Sockets Layer:

Use the administrative console panel to modify the port and Secure Sockets Layer (SSL) port settings and to specify the SSL settings (the SSL repertoire). The default repertoire is the same one used for the server, which is a SystemSSL IIOP

repertoire. During daemon initialization the SSL usage initialization is attempted if security is enabled and a valid repertoire is found. There is no specific *on* or *off* setting for daemon SSL.

SSL can be used to protect locations in the SSL daemon using the Location Service Daemon if:

- Global security is enabled
- A daemon SSL repertoire is configured in the administrative console (the daemon SSL repertoire refers to a valid RACF keyring that is owned by the MVS user ID associated with the daemon process)
- A certificate and keyring have been defined

On the administrative console, click **System Administration > z/OS Location Service**.

Location service daemon

This panel specifies the configuration settings for the location service daemon for this cell. Changes made to these settings to the entire cell and to the location service daemon instance on each node in the cell.

Job Name	BBODMNC	Specifies z/OS jobname of location service daemon.
Host Name	BOSSXXXX.PLEX1.L2.IBM.COM	Specifies host name to be used when contacting location service daemon.
Port	5755	Specifies port location service daemon listens on for unencrypted communication.
SSL Port	5756	Specifies port location service daemon listens on for encrypted communication.
SSL Setting	PLEX1Manager/DefaultIIOPSSL	Specifies a list of predefined SSL settings to choose from for connections. These are configured at the SSL repertoire panel.

You can use the customization dialog to specify authentication information, including the daemon's user ID, UID, and SSL port. This panel is located under **Server Customization**. RACF commands are generated to create a keyring for server use (the default is WASKeyring).

The customization dialog generates the daemon keyring and the certificate. To generate the daemon keyring and certificate from the customization dialog, select **Security Domain > SSL Customization > Enable SSL on the Location Service Daemon.** If you type `Y` next to this option, the RACF commands are generated to do the following tasks:

- Create a daemon keyring and certificate
- Connect the certificate and certificate authority (CA) certificates to the keyring.

Important: This option does not control the use of the daemon SSL.

This is appropriate if the user IDs are the same, but if the daemon has a separate user ID, see Setting up a Keyring for use by WebSphere Application Server for z/OS. The values selected are picked up by the administrative console.

If the daemon process is assigned the same MVS user ID assigned to a secure WebSphere Application Server, the keyring you use to secure WebSphere Application Server can also be used to secure daemon requests. If the daemon process is not assigned the same MVS user ID assigned to a secure WebSphere Application Server, it is recommended that you perform the daemon SSL setup

similarly to the setup for your WebSphere Application Server. Modify the customization job commands generated in BBOCBRAK (or HLQ.DATA(BBODBRAK) on WebSphere Application Server Network Deployment) to perform the steps in Setting up a Keyring for use by WebSphere Application Server for z/OS.

SSL considerations for WebSphere Application Server administrators:

The RACF customization jobs create an SSL Keyring owned by the WebSphere Application Server for z/OS administrator containing the digital certificate needed to communicate with WebSphere Application Server. However, additional customization is required for administration by other MVS user IDs.

Note that the MVS user ID in the description below is the MVS user ID under which the `wsadmin.sh` process is running, not the user ID specified in the wsadmin request.

In the example below:

- `yyyyy` is the user ID of the new WebSphere Application Server for z/OS administrator
- `xxxxx` is the name of the keyring specified in soap.client.props
- `zzzzz` is the label name used in the BBOSBRAK jobs to specify which certificate authority certificate was used to generate server keys

1. If the new administrator is not a member of the WebSphere Application Server for z/OS administrative group, make sure that the new user ID has access to the appropriate RACF keyrings and digital certificates. For example:

   ```
   PERMIT IRR.DIGTCERT.LIST CLASS(FACILITY) ID(yyyyy) ACC(READ)
   PERMIT IRR.DIGTCERT.LISTRING CLASS(FACILITY) ID(yyyyy) ACC(READ)
   ```

2. Use the setup completed by the customization jobs as a model for the additional steps. This information is in the BBOCBRAK member of the <HLQ>.DATA data set generated during the customization process. The BBOCBRAK job contains the set of RACF commands that were used:

   ```
     /* Generating SSL keyrings for WebSphere administrator                  */
   RACDCERT ADDRING(xxxxx) ID( yyyyyy )
     /* Connect WAS CA Certificates to Servers keyring                       */
   "RACDCERT ID(yyyyy) CONNECT (RING(xxxxxx) LABEL('zzzzzzz')   CERTAUTH"
   SETROPTS RACLIST(FACILITY) REFRESH"
   ```

Setting up SSL connections for Java clients:

To configure SSL for use between Java clients running on a workstation and the WebSphere Application Server for z/OS J2EE server:

1. Determine what SSL repertoire the server is using. For example: `WASKeyring`.
2. Determine the user ID the server is running. For example: `CBSYMSR1`.
3. Export the certificate authority from RACF. For example: `RACDCERT CERTAUTH EXPORT(LABEL('WebSphereCA')) DSN('IBMUSER.WAS.CA') FORMAT(CERTDER)`
4. Move the file to the workstation. (Note that the FTP transfer must use binary.) For example: `c:\tmp` directory
5. Add the digital certificate to the TrustStore used by the client. For example: DummyClientTrustFile.jks file: `keytool -import -file c:\tmp\IBMUSER.WAS.CA -keystore DummyClientTrustFile.jks]`

Setting permission for files created by applications

Files created by applications running in the servant will have permission bits set according to the default umask. To change the default umask for the servant, specify the _EDC_UMASK_DFLT environment variable in the JCL procedure for the servant. Deployment manager and application servers require group read/write access to the data in their config root.

Deployment manager and application servers require group read/write access to the data in their config root. The server must run with a `007` umask in order to support system management functions. Do not change this umask setting and your server will function correctly.

On the JCL EXEC statement, specify:

```
PARM='ENVAR("_EDC_UMASK_DFLT=xxx")
```

where `xxx` is the umask value to use (which is `007`).

Recommendation: A umask value of `007` will cause files to be created with permission bits set to `770`. This is the value recommended by IBM.

Note: See the following documents for more information:

- *z/OS Language Environment Programming Reference*, for more information on ENVAR
- *z/OS C/C++ Programming Guide*, for more information on how to change the UMASK defaults
- *z/OS UNIX System Services Command Reference*

Security auditing: Security auditing is handled in the usual way by the security product. WebSphere Application Server for z/OS uses the System Authorization Facility (SAF), which provides an auditing mechanism consistent with other functions in z/OS or OS/390.

Setting up RACF protection for DB2

You can use the RACF DSNR resource class to protect DB2 resources. This helps you centralize security management. This section gives you pointers to general information about setting up RACF protection for DB2 and specific information about the resources, groups, user IDs, and permissions used by WebSphere for z/OS.

You can use the RACF DSNR resource class to protect DB2 resources. This helps you centralize security management. This section gives you pointers to general information about setting up RACF protection for DB2 and specific information about the resources, groups, user IDs, and permissions used by WebSphere for z/OS.

There are three functional areas in RACF to consider regarding protection for DB2:

- The RACF DSNR class controls access to the DB2 subsystems. If the DSNR class is active, then WebSphere for z/OS controllers and servants need access to the *db2_ssn*. RRSAF profiles, where *db2_ssn* is your DB2 subsystem name. If a controller or servant does not have access, then that region will not initialize.
- DB2 identification and signon exits (DSN3@ATH and DSN3@SGN) assign authorization IDs. If you want to use secondary authorization IDs (RACF group names), then you must replace the default exits with these two sample routines. For details on how to install these sample routines, see *DB2 Administration Guide*.
- WebSphere for z/OS does not support the protection of DB2 objects through the DSNX@XAC exit. To protect DB2 objects, you must use GRANT statements.

Steps for defining DB2 options for RACF:

You must complete general tasks for enabling RACF protection for your DB2 system. This includes adding entries to the RACF router table, installing identification and signon exits, and defining RACF user IDs for DB2 started tasks. You must also have your copy of the BBOCBRAJ sample provided with WebSphere Application Server for z/OS.

Perform the following steps to define DB2 resources and authorizations in RACF:
1. Remove the comment marks that surround the REXX and RACF commands. As shipped, the DSNR profile section is commented out.
2. Copy the BBOCBRAJ job to a new file.
3. Submit the job from a user ID with RACF SPECIAL authority.

You know you are done when the job completes successfully.

Selecting a user registry

Information about users and groups reside in a user registry. In WebSphere Application Server, a user registry authenticates a user and retrieves information about users and groups to perform security-related functions, including authentication and authorization.

Implementation is provided to support multiple operating system or operating environment-based user registries (z/OS SAF registry) and most of the major Lightweight Directory Access Protocol (LDAP)-based user registries. You can use the custom LDAP feature to support any LDAP server by setting up the correct configuration (user and group filters). However, support is not extended to these custom LDAP servers because there are many possibilities that cannot be tested.

In addition to Local OS and LDAP registries, WebSphere Application Server also provides a plug-in to support any registry by using the custom registry feature (also referred as custom user registry). The custom registry feature supports any user registry that is not implemented by WebSphere Application Server. The possibilities are endless in that you can make any registry work in the product environment by implementing an interface called the UserRegistry interface. This interface is very helpful in situations where the current user and group information exists in some other formats (for example, a database) and cannot move to Local OS or LDAP. In such a case, implement the UserRegistry interface so that WebSphere Application Server can use the existing registry for all the security-related operations. Implementing a custom registry is a software implementation effort and it is expected that the implementation does not depend on other WebSphere Application Server resources, for example, data sources, for its operation.

Before configuring the user registry, decide which registry to use. The choices of user registry include:
- Local OS (SAF-based)
- LDAP
- Custom user registry

Though different types of user registries are supported, only a single user registry can be active at one time. All processes in WebSphere Application Server can use one active registry. Configuring the correct registry is a prerequisite to assigning users and groups to roles for applications. This is usually done as part of enabling global security. Restart the servers and assign users and groups to roles for all your applications.

Selecting an authentication mechanism

Once you have your system up and running, the next step in setting up security is to select an authentication mechanism. An authentication mechanism defines rules about security information (for example, whether a credential is forwardable to another Java process) and the format of how security information is stored in both credentials and tokens. Authentication is the process of establishing whether a client is valid in a particular context. A client can be either an end user, a machine, or an application.

An authentication mechanism in WebSphere Application Server typically collaborates closely with a user registry. The user registry is the user and groups accounts repository that the authentication mechanism consults with when performing authentication. The authentication mechanism is responsible for creating a credential which is an internal product representation of successfully authenticated client user. Not all credentials are created equal. The abilities of the credential are determined by the configured authentication mechanism.

Although this product provides several authentication mechanisms, only a single active authentication mechanism can be configured at once. The active authentication mechanism is selected when configuring WebSphere Application Server global security. WebSphere Application Server for z/OS Version 5 supports the following authentication mechanisms:

- Simple WebSphere Authentication Mechanism (SWAM)
- Light-Weight Third Party Authentication (LTPA)
- Integrated Cryptographic Service Facility (ICSF)

Migrating security configurations from WebSphere Application Server Version 4.0.1

1. Understand the Details and topology differences between V4.0.1 security and V5.
2. Understand the differences between the Administration application settings as they compare to the V5 Administrative console settings.

Details and topology differences between version 4.0.1 security and version 5

The following table shows some of the details and topology differences in migrating from version 4.0.1 security to version 5.

Table 7. Details and topology differences between version 4.0.1 security and version 5.

Version 4.0.1 Topology	Version 5 Topology
Security is server level based.	Security is cell based. A subset of cell security attributes such as Internet InterORB Protocol (IIOP) authentication protocols, SSL ports, and so on, can be overridden at a cell level. Refer to the security section in the documentation for information for cell and server level security attributes.
Security is automatically enabled.	Security, by default, is not enabled. You must turn it on.

Table 7. Details and topology differences between version 4.0.1 security and version 5. (continued)

Web Single Sign-on is only supported across WebSphere for z/OS version 4.0.1 servers using the ICSF Authentication mechanism.	Web Single Sign-on across WebSphere Application Server for z/OS version 5 servers can still be performed using the Integrated Cryptographic Services Facility (ICSF) Authentication Mechanism. Single Sign-on with WebSphere Application Server for distributed platforms servers and Domino can be achieved using the Lightweight Third Party Authentication (LTPA) authentication mechanism. You must configure either ICSF or LTPA as an authentication mechanism if you wish to have a secure server that can use forms-based authentication. Simple WebSphere Authentication Mechanism (SWAM) is configurable for base, but not recommended, since the administration console requires forms based authentication when security is enabled. For WebSphere Application Server Network Deployment, you must specify ICSF or LTPA. To view this administrative console page, click: **Security > Global Security**
Access to the data is controlled by DB2 authentication.	Access requires SSL encryption and forms based authentication when security is enabled. Authorization is done using administrative users and groups to define role based authorizations. **System Administration > Console Users** **System Administration > Console Group** The data is protected by Hierarchical File System (HFS) file permissions. Access from a remote workstation requires SSL and forms based. **Note:** EJBROLE role access to administrative roles (administrator, configurator, monitor, and operator roles) is an alternative to console users and console groups.
Authorization to Naming Services is accomplished using ACLs in the LDAP server that contains the name space.	Access to naming services is no longer controlled by LDAP Access Control Lists (ACLS) instead use: **Environment > Naming Service > CORBA Naming Service Users** **Environment > Naming Service > CORBA Naming Service Groups** The SAF EJBROLE profiles for the CosNamingRead, CosNamingWrite, CosNamingCreate and CosNamingDelete roles are an alternative to the CORBA Naming Service users and groups. **Attention:** MVS IDs and groups must have UNIX system services uids and gids in order to be given access to naming or administrative services.
Method authorization is done using SAF EJBROLE profiles.	The default form of method authorization is WebSphere Application Server bindings. You can continue to do method authorizations using existing SAF EJBROLE profiles, by clicking**Security > User Registries > Local OS > Custom Properties >** `com.ibm.security.SAF.authorization=true`
Resolving the identity when using the RUNAS role using APPLDATA on a SAF EJBROLE profile.	Use "Delegation RUNas specified" If you wish to use SAF APPLDATA to resolve the user ID, as in Version 4, you must go to the Custom Properties panel in the administrative console by clicking**Security > User Registries > Local OS > Custom Properties >** `com.ibm.security.SAF.delegation=true`

Table 7. Details and topology differences between version 4.0.1 security and version 5. (continued)

Basic server configuration was a SAF registry such as RACF.	If you wish SAF to be used as the registry for users of the system, specify LocalOS as the User Registry. jIn addition, version 5 supports additional registries such as LDAP. To view this administrative console page, click **Security > Global Security**
Version 4.0.1 IIOP Interoperability	In version 5, CSIv2 is the security default. If you use IIOP communications, and your server will interoperate with servers using WebSphere Application Server for OS/390 or z/OS version 4 (or 4.01), you must use protocols compatible with these servers. These are known as z/SAS and can be found on the administrative console page, by clicking **Security > Global Security > Active Authentication Protocol** They must be modified to show CSI and SAS. You must also select the appropriate authentication mechanism by clicking **Security > zSAS Transport** Otherwise, you should consider using CSIv2 Authentication Protocols as these provide more control over authenticating clients. If both are specified, z/OS version 5 clients will prefer CSIv2. If a client and server protocol match can be made using any configured CSIv2 protocol, it will be attempted prior to any z/SAS protocols.
Secure Socket Layer (SSL)- You set up a single keyring in RACF as a server. In version 4.0.1 all server supported ciphers were provided during the negotiation process (from no encryption to 128 bit).	If security is turned on and the default SOAP/HTTP administrative connector is enabled, the JSSE implementation has to be configured. JSSE implementation supports different key stores locations (server key, keys to those that you trust, and others) located in a HFS. SSL is now configured through SSL repertoires. You now configure all the attributes you expect in an SSL configuration, key ring or file name, sets of cipher suites. You can also save the definition as a repertoire; either a System SSL repertoire or a JSSE repertoire. The repertoire becomes active when you select it for use in a specific context. (Remember to use System SSL for HTTP and IIOP connectors. As in version 4, the key ring names must be identical within a process.) **Note:** • WSADMIN RMI Connector can use the same SSL configuration that is used for client applications. • WSADMIN SOAP Connector has to have JSSE implementation. In version 5 you only get the set of ciphers that you select. They are predefined as (High 128 bit), (Medium), (Low), or you can create a customized list of ciphers that you can export . To view this administrative console page, click **Security > SSL >** *alias_name*. This path is for both System SSL repertoire and JSSE SSL repertoire.
	Features no longer supported on version 5: • DCE authentication • SSL Version 2 support (V3 and TLS supported) • Security Preference List

Administration application settings as they compare to the Version 5 administrative console settings

The following table shows the version 4.0.1 Administration application settings as they compare to the version 5 Administrative console settings with associated notes.

Table 8. Administration application settings as they compare to the version 5 Administrative console settings.

Version 4.0.1 Administration application settings	Version 5 Administrative console settings	Notes
Server Region Identity	Click **Security > User Registries > Local OS User Registry > Server Userid**.	Required if SAF Registry
Local Identity	Click **Security > zSAS Authentication > Local Identity**. Click **Security > Global Security**. Under Additional Properties, click **z/OS Security Options**. Type the information in the **Local Identity** field.	* Required always
Remote Identity	Click **Security > zSAS Authentication > Remote Identity**. Click **Security > Global Security**. Under Additional Properties, click **z/OS Security Options**. Type the information in the **Remote Identity** field.	*Required always
Allow Unauthenticated Clients	Click **Security > zSAS Authentication > Allow Unauthenticated Clients**. Click **Security > Authentication Protocol > zSAS Transport**. Select the check box next to **AllowUnauthenticated Clients**.	
Userid Password Allowed	Click **Security > zSAS Authentication > Userid Password**. Click **Security > Authentication Protocol > zSAS Transport**. Select the check box next to **Userid Password**.	** Ignored unless SAS
Userid Passticket Allowed	Click **Security > zSAS Authentication > Userid Passticket**. Click **Security > Authentication Protocol > zSAS Transport**. Select the check box next to **Userid Passticket**.	** Ignored unless SAS
SSL Type 1 Allowed	Click **Security > zSAS Authentication > Basic Authentication**. Click **Security > Authentication Protocol > zSAS Transport**. Select the check box next to **Basic Authentication**.	** Ignored unless SAS

Table 8. Administration application settings as they compare to the version 5 Administrative console settings. (continued)

SSL Client Certificates Allowed	Click **Security > zSAS Authentication > Client Certificate**. Click **Security > Authentication Protocol > zSAS Transport**. Select the check box next to **Client Certificate**.	** Ignored unless SAS
Accept Asserted Identities Allowed	Click **Security > zSAS Authentication > Identity Assertion Inbound**. Click **Security > Authentication Protocol > zSAS Transport**. Select the check box next to **Identity Assertion Inbound** .	** Ignored unless SAS
Send Asserted Identities Allowed	Click **Security > zSAS Authentication > Identity Assertion Outbound**. Click **Security > Authentication Protocol > zSAS Transport**. Select the check box next to **Identity Assertion Outbound**.	** Ignored unless SAS
SSL RACF Keyring	Click **Defined in System SSL Repertoire > SSL Setting**.	
SSL V3 Timeout	Click **Defined in System SSL Repertoire > SSL Setting**.	
Enable Setting OS Thread Identity to RunAs	Click **Security > zSAS Authentication > Sync to OS Thread Allowed**. Click **Security > Global Security**. Under Additional Properties, click **zOS Security Options**. Select the check box next to **Sync to OS Thread Allowed**.	
IIOP Firewall Port	Click **Server >** *server_name* **> End Points > ORB Listener Address > Port**. Click **Servers > Application Servers >** *server_name*. Under Additional Properties, click **End Points > ORB_LISTENER_ADDRESS**. Type the port number into the **Port** field.	
SSL Firewall Port	Click **Servers >** *server_name* **> End Points > ORB SSL Listener Address > Port**. Click **Servers > Application Servers >** *server_name*. Under Additional Properties, click **End Points > ORB_SSL_LISTENER_ADDRESS**. Type the port number into the **Port** field.	
HTTPS No Default (8080 in examples)	Click **Servers >***server_name*. Click **Servers > Application Servers >** *server_name*. Under Additional Properties, click **Web Container > HTTP Transports >** *host_name*.	
LDAP Not Applicable	LDAP 1439	

Table 8. Administration application settings as they compare to the version 5 Administrative console settings. (continued)

Naming/IR Not Applicable	Naming/IR Dynamically chosen
ENABLE_TRUSTED_APPLICATIONS environment variable	Click **Security > Custom Properties > ENABLE_TRUSTED_APPLICATIONS control_region_security_enable_trusted_applications environment variable**. Click **Security > Global Security**. Under Additional Properties, click **Custom Properties > EnableTrustedApplications**.
REM_USERID environment variable	Click **Security > Custom Properties > client_protocol_user**.
REM_PASSWORD environment variable	Click **Security > Custom Properties > client_protocol_password**.

Notes:

* Required always, even if security is not on.

** Ignored unless Authentication Protocol is set to include CSI and SAS.

Migrating custom user registries

Before you perform this task, it is assumed that you already have a custom user registry implemented and working in WebSphere Application Server Version 4. The custom registry in WebSphere Application Server Version 4 is based on the CustomRegistry interface. For WebSphere Application Server Version 5, the interface is called the UserRegistry interface. The WebSphere Application Server Version 4-based custom registry works without any changes to the implementation in WebSphere Application Server Version 5 except when the implementation is using data sources to connect to a database during initialization. If the previous implementation is using a data source to access a database, change the implementation to use JDBC connections to connect to the database. The WebSphere Application Server Version 4 version of the CustomRegistry interface is deprecated in WebSphere Application Server Version 5. So, moving your implementation to the WebSphere Application Server Version 5-based interface is expected.

In WebSphere Application Server Version 5, in addition to the UserRegistry interface, the custom user registry requires the Result object to handle user and group information.

Note: In Version 4.0.1 in the z/OS version of the custom registry, a specialized file-based authorization table was used for user and group authorization roles. This function is being deprecated in Version 5, but is being supported. It is recommended that you use WebSphere Application Server bindings for this purpose.

This file is already provided in the package and you are expected to use it for the getUsers, getGroups and the getUsersForGroup methods.

Before proceeding, look at the new UserRegistry interface. See “Developing custom user registries” on page 108 for a description of each of these methods in detail and the changes from Version 4.

The following steps go through in detail all the changes required to move your WebSphere Application Server Version 4 custom user registry to the Version 5 custom user registry. The steps are very simple and involve minimal code changes. The sample implementation file is used as an example when describing some of the steps.

1. Change your implementation to `UserRegistry` instead of `CustomRegistry`. Change:

   ```
   public class FileRegistrySample implements CustomRegistry
   ```
   to
   ```
   public class FileRegistrySample implements UserRegistry
   ```
2. Throw the java.rmi.RemoteException in the constructors public FileRegistrySample() throws java.rmi.RemoteException
3. Change the mapCertificate method to take a certificate chain instead of a single certificate. Change

   ```
   public String mapCertificate(X509Certificate cert)
   ```
   to
   ```
   public String mapCertificate(X509Certificate[]cert)
   ```

   Having a certificate chain gives you the flexibility to act on the chain instead of one certificate. If you are only interested in the first certificate just take the first certificate in the chain before processing. In Version 5, the mapCertificate method is called to map the user in a certificate to a valid user in the registry, when certificates are used for authentication by the Web or the Java clients (transport layer certificates, Identity Assertion certificates). In Version 4, this was only called by Web clients since the Common Secure Interoperability Version 2 (CSIv2) protocol was not supported.
4. Remove the getUsers() method.
5. Change the signature of the getUsers(String) method to return a Result object and accept an additional parameter (int). Change:

   ```
   public List getUsers(String pattern)
   ```
   to
   ```
   public Result getUsers(String pattern, int limit)
   ```

   In your implementation, construct the Result object from the list of the users obtained from the registry (whose number is limited to the value of the limit parameter) and call the setHasMore() method on the Result object if the total number of users in the registry exceeds the limit value.
6. Change the signature of the getUsersForGroup(String) method to return a Result object and accept an additional parameter (int) and throw a new exception called NotImplementedException. Change the following:

   ```
   public List getUsersForGroup(String groupName)
             throws CustomRegistryException,
                    EntryNotFoundException {
   ```

   to

```
public Result getUsersForGroup(String groupSecurityName, int limit)
            throws NotImplementedException,
                   EntryNotFoundException,
                   CustomRegistryException {
```

In Version 5, this method is not called directly by the WebSphere Application Server Security component. However, other components of the WebSphere Application Server like the process choreographer use this method when staff assignments are modeled using groups. Since this already is implemented in WebSphere Application Server Version 4, it is recommended that you change the implementation similar to the `getUsers` method as explained in step 5.

7. Remove the getUniqueUserIds(String) method.
8. Remove the getGroups() method.
9. Change the signature of the getGroups(String) method to return a Result object and accept an additional parameter (int). change the following:

   ```
   public List getGroups(String pattern)
   ```

   to

   ```
   public Result getGroups(String pattern, int limit)
   ```

   In your implementation, construct the Result object from the list of the groups obtained from the registry (whose number is limited to the value of the limit parameter) and call the setHasMore() method on the Result object if the total number of groups in the registry exceeds the limit value.
10. Add the `createCredential` method. This method is not called at this time, so return as `null`.

    ```
    public com.ibm.websphere.security.cred.WSCredential
       createCredential(String userSecurityName)
             throws CustomRegistryException,
                    NotImplementedException,
                    EntryNotFoundException {
             return null;
       }
    ```

    The first and second lines of the previous code example normally appear on one line. However, it extended beyond the width of the page.
11. To build the Version 5 implementation make sure you have the `sas.jar` and `wssec.jar` in your class path.

    ```
    %install_root%\java\bin\javac -classpath %WAS_HOME%\lib\wssec.jar;
    %WAS_HOME%\lib\sas.jar FileRegistrySample.java
    ```

    Type the previous lines as one continuous line.

    To build the Version 4 custom registry in Version 5.0.2, only the `sas.jar` file is required.
12. Copy the implementation classes to the product class path. The *%install_root%*`/lib/ext` directory is the preferred location. If you are using the Network Deployment product, make sure that you copy these files to the cell and all the nodes. Without the files in each of the node class paths the nodes and the application servers in those nodes cannot start when security is on.

13. Use the administrative console to set up the custom registry. Follow the instructions in the "Configuring custom user registries" on page 248 article to set up the custom registry including the IgnoreCase flag. Make sure that you add the `WAS_UseDisplayName` properties, if required.

Migrates a Version 4 custom registry to the Version 5 custom registry.

This step is required to migrate a custom registry from WebSphere Application Server Version 4 to WebSphere Application Server Version 5.

If you are enabling security, make sure you complete the remaining steps. Once completed, save the configuration and restart all the servers. Try accessing some J2EE resources to verify that the custom registry migration was successful.

Migrating Common Object Request Broker Architecture programmatic login to Java Authentication and Authorization Service

Note: Common Object Request Broker Architecture (CORBA) APIs are not supported in the WebSphere Application Server for z/OS environment. If you have an application that you are porting from another WebSphere Application Server product to WebSphere Application Server for z/OS you must be aware that the security APIs from Version 4 are deprecated in Version 5. While the applications are supported in WebSphere Application Server Version 5, if you wish to use these applications on WebSphere Application Server Version 5 for z/OS, you must migrate to Java Authentication and Authorization Service (JAAS).

WebSphere Application Server Version 5 fully supports the Java Authentication and Authorization Service (JAAS) as programmatic login APIs. See Configuring Java Authentication and Authorization Service and Developing with JAAS to log in programmatically, for more details on JAAS support. Customers migrating from CORBA applications on previous versions of WebSphere Application Server to WebSphere Application Server for z/OS Version 5 need to migrate their CORBA applications to use JAAS to log in programmatically.

This document outlines the deprecated CORBA programmatic login APIs and the alternatives provided by JAAS. The following are the deprecated CORBA programmatic login APIs and are not supported on WebSphere Application Server for z/OS:

- `${user.install.root}/installedApps/sampleApp.ear/default_app.war/WEB-INF/classes/LoginHelper.java`.

  The `sampleApp` is not included in Version 5.
- `${user.install.root}/installedApps/sampleApp.ear/default_app.war/WEB-INF/classes/ServerSideAuthenticator.java`.

  The `sampleApp` is not included in Version 5.
- **com.ibm.IExtendedSecurity._LoginHelper**.

  This API is not included in Version 5.
- **org.omg.SecurityLevel2.Credentials**. This API is included with the product, but not used with z/OS.

The supported APIs provided in WebSphere Application Server for z/OS Version 5 are a combination of standard JAAS APIs and product implementation of standard JAAS interfaces (also some minor extension).

- Programmatic login APIs:
  - javax.security.auth.login.LoginContext
  - javax.security.auth.callback.CallbackHandler interface: The WebSphere Application Server product provides the following implementation of the javax.security.auth.callback.CallbackHandler interface:
    - **com.ibm.websphere.security.auth.callback.WSCallbackHandlerImpl**: A non-prompt CallbackHandler, application pushes basic authentication data (user ID, password, and security realm) or token data to product LoginModules. This API is recommended for server-side login.
    - **com.ibm.websphere.security.auth.callback.WSGUICallbackHandlerImpl**: (Not supported on z/OS) An administrative console login prompt CallbackHandler to gather basic authentication data (user ID, password, and security realm). This API is recommended for client-side login.

      Note: If this API is used on the server side, the server is blocked for input.
    - **com.ibm.websphere.security.auth.callback.WSStdinCallbackHandlerImpl**: A stdin login prompt CallbackHandler to gather basic authentication data (user ID, password, and security realm). This API is recommended for client-side login.

      Note: If this API is used on the server side, the server is blocked for input.
  - javax.security.auth.callback.Callback interface:
    - **javax.security.auth.callback.NameCallback**: Provided by JAAS to pass the user name to the LoginModules interface.
    - **javax.security.auth.callback.PasswordCallback**: Provided by JAAS to pass the password to the LoginModules interface.
    - **com.ibm.websphere.security.auth.callback.WSCredTokenCallbackImpl**: Provided by the product to perform a token-based login. With this API, an application can pass a token-byte array to the LoginModules interface.
  - **javax.security.auth.spi.LoginModule interface**: WebSphere Application Server provides LoginModules implementation for client and server-side login. Refer to Configuring Java Authentication and Authorization Service for details.
- javax.security.Subject:
  - **com.ibm.websphere.security.auth.WSSubject**: An extension provided by the product to invoke remote J2EE resources using the credentials in the javax.security.Subject

    Note: An application must invoke the WSSubject.doAs() method for J2EE resources to be accessed using the subject generated by an explicit invocation of a WebSphere login module.
  - **com.ibm.websphere.security.cred.WSCredential**: After a successful JAAS login with the WebSphere Application Server LoginModules intefaces, a `com.ibm.websphere.security.cred.WSCredential` credentials is created and stored in the Subject.
  - **com.ibm.websphere.security.auth.WSPrincipal**: An authenticated principal, that is created and stored in a Subject that is authenticated by the WebSphere LoginModules interface.

Use the following example to migrate the CORBA-based programmatic login APIs to the JAAS programmatic login APIs. The following example assumes that the application code is granted for the required Java 2 security permissions. See Configuring Java Authentication and Authorization Service, Configuring Java 2 security and JAAS documentation located in the `${was.install.root}/web/docs/jaas/JaasDocs.zip` file for details.

```
public class TestClient {
...
private void performLogin() {
// Create a new JAAS LoginContext.
javax.security.auth.login.LoginContext lc = null;

try {
// Use GUI prompt to gather the BasicAuth data.
lc = new javax.security.auth.login.LoginContext("WSLogin",
new com.ibm.websphere.security.auth.callback.WSGUICallbackHandlerImpl());

// create a LoginContext and specify a CallbackHandler implementation
// CallbackHandler implementation determine how authentication data is collected
// in this case, the authentication date is collected by GUI login prompt
//   and pass to the authentication mechanism implemented by the LoginModule.
} catch (javax.security.auth.login.LoginException e) {
System.err.println("ERROR: failed to instantiate a LoginContext and the exception: "
+ e.getMessage());
e.printStackTrace();

// may be javax.security.auth.AuthPermission "createLoginContext" is not granted
//   to the application, or the JAAS Login Configuration is not defined.
}

if (lc != null)
try {
lc.login();  // perform login
javax.security.auth.Subject s = lc.getSubject();
// get the authenticated subject

// Invoke a J2EE resources using the authenticated subject
com.ibm.websphere.security.auth.WSSubject.doAs(s,
new java.security.PrivilegedAction() {
public Object run() {
try {
bankAccount.deposit(100.00);  // where bankAccount is an protected EJB
} catch (Exception e) {
System.out.println("ERROR: error while accessing EJB resource, exception: "
+ e.getMessage());
e.printStackTrace();
}
return null;
}
}
);

// Retrieve the name of the principal from the Subject
// so we can tell the user that login succeeded,
// should only be one WSPrincipal.
java.util.Set ps =
s.getPrincipals(com.ibm.websphere.security.auth.WSPrincipal.class);
java.util.Iterator it = ps.iterator();
while (it.hasNext()) {
com.ibm.websphere.security.auth.WSPrincipal p =
(com.ibm.websphere.security.auth.WSPrincipal) it.next();
System.out.println("Principal: " + p.getName());
```

```
}
} catch (javax.security.auth.login.LoginException e) {
System.err.println("ERROR: login failed with exception: " + e.getMessage());
e.printStackTrace();

// login failed, might want to provide relogin logic
}
}
...
}
```

Migrating CORBA-based programmatic login application to JAAS-based applications.

Migrating from the CustomLoginServlet class to servlet filters

If you are migrating from WebSphere Application Server for z/OS Version 4.0.1, this information does not apply since the CustomLoginServlet class was not in that product. If, however, you are migrating from a previous version of WebSphere Application Server to WebSphere Application Server for z/OS Version 5, you might need to follow these steps. The CustomLoginServlet class is deprecated in Version 5. Those applications using the CustomLoginServlet class to perform authentication now need to use form-based login. Using the form-based login mechanism, you can control the look and feel of the login screen. In form-based login, a login page is specified that displays when retrieving the user ID and password information. You also can specify an error page that displays when authentication fails.

If login and error pages are not enough to implement the CustomLoginServlet class, use servlet filters. Servlet filters can dynamically intercept requests and responses to transform or use the information contained in the requests or responses. One or more servlet filters attach to a servlet or a group of servlets. Servlet filters also can attach to JSP files and HTML pages. All the attached servlet filters are called before invoking the servlet.

Both form-based login and servlet filters are supported by any Servlet 2.3 specification-compliant Web container. A form login servlet performs the authentication and servlet filters can perform additional authentication,auditing, or logging tasks.

To perform pre-login and post-login actions using servlet filters, configure these servlet filters for either form login page or for `/j_security_check` URL. The `j_security_check` is posted by the form login page with the `j_username` parameter, containing the user name and the `j_password` parameter containing the password. A servlet filter can use user name and password information to perform more authentication or meet other special needs.

1. Develop a form login page and error page for the application, as described in "Developing form login pages" on page 79.
2. **5.1 +** Configure the form login page and the error page for the application as described in "Securing Web applications using the Assembly Toolkit" on page 125.
3. Develop servlet filters if additional processing is required before and after form login authentication. Refer to "Developing servlet filters for form login processing" on page 74 for details.

4. Configure the servlet filters developed in the previous step for either the form login page URL or for the /j_security_check URL. Use an assembly tool or development tools like WebSphere Application Development Studio to configure filters. After configuring the servlet filters, the web-xml file contains two stanzas. The first stanza contains the servlet filter configuration, the servlet filter, and its implementation class. The second stanza contains the filter mapping section and a mapping of the servlet filter to the URL. In this case, the servlet filter maps to /j_security_check.

```
<filter id="Filter_1">
   <filter-name>LoginFilter</filter-name>
   <filter-class>LoginFilter</filter-class>
   <description>Performs pre-login and post-login operation</description>
   <init-param>
    <param-name>ParamName</param-name>
   <param-value>ParamValue</param-value>
  <init-param>
 </filet>

 <filter-mapping>
  <filter-name>LoginFilter</filter-name>
  <url-pattern>/j_security_check</url-pattern>
  </filter-mapping>
```

This migration results in an application that uses form-based login and servlet filters without the use of the CustomLoginServlet class.

The use of form-based login and servlet filters by the new application are used to replace the CustomLoginServlet class. Servlet filters also are used to perform additional authentication, auditing and logging.

Developing secured applications

IBM WebSphere Application Server provides security components that provide or collaborate with other services to provide authentication, authorization, delegation, and data protection. WebSphere Application Server also supports the security features described in the Java 2 Enterprise Edition (J2EE) specification. An application goes through three stages before it is ready to run:

- Development
- Assembly
- Deployment

Most of the security for an application is configured during the assembly stage. The security configured during the assembly stage is called *declarative security* because the security is *declared* or *defined* in the deployment descriptors. The declarative security is enforced by the security run time. For some applications, declarative security is not sufficient to express the security model of the application. For these applications, you can use *programmatic security*.

1. Develop secure Web applications. For more information, see "Developing with programmatic security APIs for Web applications" on page 71.
2. Develop servlet filters for form login processing. For more information, see "Developing servlet filters for form login processing" on page 74.
3. Develop form login pages. For more information, see "Developing form login pages" on page 79.

4. Develop enterprise bean component applications. For more information, see "Developing with programmatic APIs for EJB applications" on page 82.
5. Develop with Java Authentication and Authorization Service to log in programmatically. For more information, see "Developing programmatic logins with the Java Authentication and Authorization Service" on page 95.
6. Develop your own Java 2 security mapping module. For more information, see "Configuring application logins for Java Authentication and Authorization Service" on page 277.
7. Develop custom user registries. For more information, see "Developing custom user registries" on page 108.
8. 5.1 Develop a custom interceptor for trust associations. For more information, see "Developing a custom interceptor for trust associations" on page 117

Developing with programmatic security APIs for Web applications

Programmatic security is used by security-aware applications when declarative security alone is not sufficient to express the security model of the application. Programmatic security consists of the following methods of the HttpServletRequest interface:

getRemoteUser()
: Returns the user name the client used for authentication. Returns **null** if no user is authenticated.

isUserInRole
: (String role name): Returns **true** if the remote user is granted the specified security role. If the remote user is not granted the specified role, or if no user is authenticated, it returns **false**.

getUserPrincipal()
: Returns the java.security.Principal object containing the remote user name. If no user is authenticated, it returns **null**.

When the `isUserInRole()` method is used, declare a security-role-ref element in the deployment descriptor with a `role-name` subelement containing the role name passed to this method. Since actual roles are created during the assembly stage of the application, you can use a logical role as the role name and provide enough hints to the assembler in the description of the security-role-ref element to link that role to the actual role. During assembly, the assembler creates a role-link subelement to link the role name to the actual role. Creation of a security-role-ref element is possible if development tools such as WebSphere Studio Application Developer is used. You also can create the security-role-ref element during assembly stage using the assembly tool.

1. Add the required security methods in the servlet code.
2. Create a security-role-ref element with the **role-name** field. If a security-role-ref element is not created during development, make sure it is created during the assembly stage.

A programmatically secured servlet application.

This step is required to secure an application programmatically. This action is particularly useful is when a Web application wants to access external resources and wants to control the access to external resources using its own authorization table (external-resource to remote-user mapping). In this case, use the `getUserPrincipal()` or `getRemoteUser()` methods to get the remote user and then

it can consult its own authorization table to perform authorization. The remote user information also can help retrieve the corresponding user information from an external source such as a database or from an enterprise bean. You can use the isUserInRole() method in a similar way.

After development, a security-role-ref element can be created:

```
<security-role-ref>
<description>Provide hints to assembler for linking this role
name to an actual role here<\description>
<role-name>Mgr<\role-name>
</security-role-ref>
```

During assembly, the assembler creates a role-link element:

```
<security-role-ref>
<description>Hints provided by developer to map the role
name to the role-link</description>
<role-name>Mgr</role-name>
<role-link>Manager</role-link>
</security-role-ref>
```

You can add programmatic servlet security methods inside any servlet doGet(), doPost(), doPut(), doDelete() service methods. The following example depicts using a programmatic security API:

```
public void doGet(HttpServletRequest request,
HttpServletResponse response) {

   ....

   // to get remote user using getUserPrincipal()
   java.security.Principal principal = request.getUserPrincipal();
   String remoteUser = principal.getName();

   // to get remote user using getRemoteUser()
   remoteUser = request.getRemoteUser();

   // to check if remote user is granted Mgr role
   boolean isMgr = request.isUserInRole("Mgr");

   // use the above information in any way as needed by
   // the application
   ....

}
```

5.1+ After developing an application, use the Assembly Toolkit to create roles and to link the actual roles to role names in the security-role-ref elements. For more information, see "Securing Web applications using the Assembly Toolkit" on page 125.

Example: Web applications code

The following example depicts a Web application or servlet using the programmatic security model. The following example is one usage and not necessarily the only usage of the programmatic security model. The application can

use the information returned by the `getUserPrincipal()`, `isUserInRole()` and `getRemoteUser()` methods in any other way that is meaningful to that application. Using the declarative security model whenever possible is strongly recommended.

File : HelloServlet.java

```
public class HelloServlet extends javax.servlet.http.HttpServlet {

 public void doPost(
  javax.servlet.http.HttpServletRequest request,
  javax.servlet.http.HttpServletResponse response)
  throws javax.servlet.ServletException, java.io.IOException {
 }
public void doGet(
  javax.servlet.http.HttpServletRequest request,
  javax.servlet.http.HttpServletResponse response)
  throws javax.servlet.ServletException, java.io.IOException {

        String s = "Hello";


        // get remote user using getUserPrincipal()
        java.security.Principal principal = request.getUserPrincipal();
        String remoteUserName = "";
        if( principal != null )
          remoteUserName = principal.getName();
// get remote user using getRemoteUser()
        String remoteUser = request.getRemoteUser();

        // check if remote user is granted Mgr role
        boolean isMgr = request.isUserInRole("Mgr");

        // display Hello username for managers and bob.
        if ( isMgr || remoteUserName.equals("bob") )
            s = "Hello " + remoteUserName;

   String message =  "<html> \n" +
              "<head><title>Hello Servlet</title></head>\n" +
         "<body> /n +"
    "<h1> "  +s+ </h1>/n " +
  byte[] bytes = message.getBytes();

  // displays "Hello" for ordinary users
        // and displays "Hello username" for managers and "bob".
        response.getOutputStream().write(bytes);
 }

}
```

After developing the servlet, you can create a security role reference for the HelloServlet as shown in the following example:

```
<security-role-ref>
<description> </description>
<role-name>Mgr</role-name>
</security-role-ref>
```

Developing servlet filters for form login processing

You can control the look and feel of the login screen using the form-based login mechanism. In form-based login, you specify a login page that is used to retrieve the user ID and password information. You also can specify an error page that displays when authentication fails.

If additional authentication or additional processing is required before and after authentication, servlet filters are an option. Servlet filters can dynamically intercept requests and responses to transform or use the information contained in the requests or responses. One or more servlet filters can attach to a servlet or a group of servlets. Servlet filters also can attach to JSP files and HTML pages. All the attached servlet filters are called before the servlet is invoked.

Both form-based login and servlet filters are supported by any servlet version 2.3 specification complaint Web container. The form login servlet performs the authentication and servlet filters perform additional authentication, auditing, or logging information.

To perform pre-login and post-login actions using servlet filters, configure these filters for either form login page support or for the `/j_security_check` URL. The j_security_check is posted by a form login page with the `j_username` parameter containing the user name and the j_password parameter containing the password. A servlet filter can use the user name parameter and password information to perform more authentication or other special needs.
A servlet filter implements the javax.servlet.Filter class. There are three methods in the filter class that need implementing:

- **init(javax.servlet.FilterConfig cfg)**. This method is called by the container exactly once when the servlet filter is placed into service. The `FilterConfig` passed to this method contains the init-parameters of the servlet filter. Specify the init-parameters for a servlet filter during configuration using the assembly tool.
- **destroy()**. This method is called by the container when the servlet filter is taken out of a service.
- **doFilter(ServletRequest req, ServletResponse res, FilterChain chain)**. This method is called by the container for every servlet request that maps to this filter before invoking the servlet. FilterChain passed to this method can be used to invoke the next filter in the chain of filters. The original requested servlet executes when the last filter in the chain calls the `chain.doFilter()` method. Therefore, all filters should call the chain.doFilter() method for the original servlet to execute after filtering. If an additional authentication check is implemented in the filter code and results in failure, the original servlet does not be execute. The chain.doFilter() method is not called and can be redirected to some other error page.

If a servlet maps to many servlet filters, servlet filters are called in the order that is listed in the deployment descriptor of the application (`web.xml`).

An example of a servlet filter follows: This login filter can map to /j_security_check to perform pre-login and post-login actions.

```
import javax.servlet.*;

     public class LoginFilter implements Filter {

     protected FilterConfig filterConfig;
```

```
// Called once when this filter is instantiated.
// If mapped to j_security_check, called
// very first time j_security_check is invoked.
public void init(FilterConfig filterConfig) throws ServletException {
   this.filterConfig = filterConfig;
   }

public void destroy() {
   this.filterConfig = null;
   }

// Called for every request that is mapped to this filter.
// If mapped to j_security_check,
// called for every  j_security_check action
public void doFilter(ServletRequest request,
ServletResponse response, FilterChain chain)
    throws java.io.IOException, ServletException   {

    // perform pre-login action here

    chain.doFilter(request, response);
    // calls the next filter in chain.

    // j_security_check if this filter is

    // mapped to j_security_check.

   // perform post-login action here.

            }
  }
```

Place the servlet filter class file in the `WEB-INF/classes` directory of the application.

Configuring servlet filters:

WebSphere Application Development Studio or the Assembly Toolkit can configure the servlet filters.

There are two steps in configuring a servlet filter.

1. Name the servlet filter and assign the corresponding implementation class to the servlet filter.

   Optionally, assign initialization parameters that get passed to the `init()` method of the servlet filter.After configuring the servlet filter, the application deployment descriptor, `web.xml`, contains a servlet filter configuration similar to the following example:

```
<filter id="Filter_1">
   <filter-name>LoginFilter</filter-name>
   <filter-class>LoginFilter</filter-class>
   <description>Performs pre-login and post-login
        operation</description>
   <init-param>// optional
     <param-name>ParameterName</param-name>
```

```
      <param-value>ParameterValue</param-value>
    </init-param>
</filter>
```

2. Map the servlet filter to URL or servlet.

   After mapping the servlet filter to a servlet or a URL, the application deployment descriptor (`web.xml`) contains servlet mapping similar to the following example:

```
<filter-mapping>
    <filter-name>LoginFilter</filter-name>
    <url-pattern>/j_security_check</url-pattern>
                  // can be servlet <servlet>servletName</servlet>
</filter-mapping>
```

You can use servlet filters to replace the CustomLoginServlet, and to perform additional authentication, auditing, and logging.

Example: Servlet filters: This example illustrates one way the servlet filters can perform pre-login and post-login processing during form login.

```
Servlet filter source code: LoginFilter.java
/**
 * A servlet filter example: This example filters j_security_check and
 * performs pre-login action to determine if the user trying to log in
 * is in the revoked list. If the user is on the revoked list, an error is
 * sent back to the browser.
 *
 * This filter reads the revoked list file name from the FilterConfig
 * passed in the init() method. It reads the revoked user list file and
 * creates a revokedUsers list.
 *
 * When the doFilter method is called, the user logging in is checked
 * to make sure that the user is not on the revoked Users list.
 *
 */

import javax.servlet.*;
import javax.servlet.http.*;
import java.io.*;

public class LoginFilter implements Filter {

   protected FilterConfig filterConfig;

   java.util.List revokeList;


   /**
    * init() : init() method called when the filter is instantiated.
    * This filter is instantiated the first time j_security_check is
    * invoked for the application (When a protected servlet in the
    * application is accessed).
    */
   public void init(FilterConfig filterConfig) throws ServletException {
      this.filterConfig = filterConfig;
```

```
      // read revoked user list
      revokeList = new java.util.ArrayList();
      readConfig();
   }


   /**
    * destroy() : destroy() method called when the filter is taken
    * out of service.
    */
   public void destroy() {
      this.filterConfig = null;
      revokeList = null;
   }

   /**
    * doFilter() : doFilter() method called before the servlet to
    * which this filteris mapped is invoked. Since this filter is
    * mapped to j_security_check,this method is called before
    * j_security_check action is posted.
    */
   public void doFilter(ServletRequest request, ServletResponse response,
FilterChain chain) throws java.io.IOException, ServletException {


      HttpServletRequest req = (HttpServletRequest)request;
      HttpServletResponse res = (HttpServletResponse)response;

      // pre login action

      // get username
      String username = req.getParameter("j_username");

      // if user is in revoked list send error
      if ( revokeList.contains(username) ) {
      res.sendError(javax.servlet.http.HttpServletResponse.SC_UNAUTHORIZED);
      return;
      }

      // call next filter in the chain : let j_security_check authenticate
      // user
      chain.doFilter(request, response);

      // post login action

   }

   /**
    * readConfig() : Reads revoked user list file and creates a revoked
    * user list.
    */
   private void readConfig() {
      if ( filterConfig != null ) {

         // get the revoked user list file and open it.
         BufferedReader in;
```

```
        try {
              String filename = filterConfig.getInitParameter("RevokedUsers");
              in = new BufferedReader( new FileReader(filename));
        } catch ( FileNotFoundException fnfe) {
              return;
        }

        // read all the revoked users and add to revokeList.
        String userName;
        try {
              while ( (userName = in.readLine()) != null )
                  revokeList.add(userName);
        } catch (IOException ioe) {
        }

     }

  }


}
```

Important: In the previous code sample, the line that begins `public void doFilter(ServletRequest request` was broken into two lines due to the width of the page. The `public void doFilter(ServletRequest request` line and the line after it are one continuous line.

Portion of the `web.xml` file showing the LoginFilter configured and mapped to j_security_check:

```
<filter id="Filter_1">
    <filter-name>LoginFilter</filter-name>
    <filter-class>LoginFilter</filter-class>
         <description>Performs pre-login and post-login operation</description>
    <init-param>
    <param-name>RevokedUsers</param-name>
    <param-value>c:\WebSphere\AppServer\installedApps\
                                <app-name>\revokedUsers.lst</param-value>
    </init-param>
</filter-id>

<filter-mapping>
 <filter-name>LoginFilter</filter-name>
     <url-pattern>/j_security_check</url-pattern>
</filter-mapping>
```

An example of a revoked user list file:

```
user1
cn=user1,o=ibm,c=us
user99
cn=user99,o=ibm,c=us
```

Developing form login pages

A Web client or browser can authenticate a user to a Web server using one of the following mechanisms:

- **HTTP basic authentication**: A Web server requests the Web client to authenticate and the Web client passes a user ID and password in the HTTP header.
- **HTTPS client authentication**: This mechanism requires a user (Web client) to possess a public key certificate. The Web client sends the certificate to a Web server that requests the client certificates. This is a strong authentication mechanism and uses the Hypertext Transfer Protocol with Secure Sockets Layer (HTTPS) protocol.
- **Form-based Authentication**: A developer controls the look and feel of the login screens using this authentication mechanism.

The Hypertext Transfer Protocol (HTTP) basic authentication transmits a user password from the Web client to the Web server in simple base64 encoding. Form-based authentication transmits a user password from the browser to the Web server in plain text. Therefore, both HTTP basic authentication and form-based authentication are not very secure unless the HTTPS protocol is used.

The Web application deployment descriptor contains information about which authentication mechanism to use. When form-based authentication is used, the deployment descriptor also contains entries for login and error pages. A login page can be either an HTML page or a JavaServer pages (JSP) page. This login page displays on the Web client side when a secured resource (servlet, JSP file, HTML page) is accessed from the application. On authentication failure, an error page displays. You can write login and error pages to suit the application needs and control the look and feel of these pages. During assembly of the application, an assembler can set the authentication mechanism for the application and set the login and error pages in the deployment descriptor.

Form login uses the servlet sendRedirect() method, which has several implications for the user. The sendRedirect() method is used twice during form login:

- The sendRedirect() method initially displays the form login page in the Web browser. It later redirects the Web browser back to the originally requested protected page. The sendRedirect(String URL) method tells the Web browser to use the HTTP GET (not the HTTP POST) request to get the page specified in the URL. If HTTP POST is the first request to a protected servlet or JavaServer pages (JSP) file, and no previous authentication or login occurred, then HTTP POST is not delivered to the requested page. However, HTTP GET is delivered because form login uses the sendRedirect() method, which behaves as an HTTP GET request that tries to display a requested page after a login occurs.
- Using HTTP POST, you might experience a scenario where an unprotected HTML form collects data from users and then posts this data to protected servlets or JSP files for processing, but the users are not logged in for the resource. To avoid this scenario, structure your Web application or permissions so that users are forced to use a form login page before the application performs any HTTP POST actions to protected servlets or JSP files.

See the “Example: Form login” on page 80 article for sample form login pages.

1. Create a form login page with the required look and feel including the required elements to perform form-based authentication. For an example, see “Example: Form login” on page 80
2. Create an error page. You can program error pages to retry authentication or display an appropriate error message.

3. Place the login page and error page in the Web archive (WAR) file relative to the top directory. For example, if the login page is configured as `/login.html` in the deployment descriptor, place it in the top directory of the WAR file. An assembler can also perform this step using the assembly tool.
4. Create a form logout page and insert it to the application only if required.

This step is required when a Web application requires a form-based authentication mechanism.

After developing login and error pages, add them to the Web application. Use the assembly tool to configure an authentication mechanism and insert the developed login page and error page in the deployment descriptor of the application.

Example: Form login

For the authentication to proceed appropriately, the action of the login form must always be `j_security_check`. The following example shows how to code the form into the HTML page:

```
<form method="POST" action="j_security_check">
<input type="text" name="j_username">
<input type="text" name="j_password">
<\form>
```

use the **j_username** input field to get the user name and use the **j_password** input field to get the user password.

On receiving a request from a Web client, the Web server sends the configured form page to the client and preserves the original request. When the Web server receives the completed Form page from the Web client, it extracts the user name and password from the form and authenticates the user. On successful authentication, the Web server redirects the call to the original request. If authentication fails, the Web server redirects the call to the configured error page.

The following example depicts a login page in HTML (`login.html`):

```
<!DOCTYPE HTML PUBLIC "-//W3C/DTD HTML 4.0 Transitional//EN">
<html>
<META HTTP-EQUIV = "Pragma" CONTENT="no-cache">
<title> Security FVT Login Page </title>
<body>
<h2>Form Login</h2>
<FORM METHOD=POST ACTION="j_security_check">
<p>
<font size="2"> <strong> Enter user ID and password: </strong></font>
<BR>
<strong> User ID</strong> <input type="text" size="20" name="j_username">
<strong> Password </strong>  <input type="password" size="20" name="j_password">
<BR>
<BR>
<font size="2">  <strong> And then click this button: </strong></font>
<input type="submit" name="login" value="Login">
</p>

</form>
</body>
</html>
```

The following example depicts an error page in a JSP file:

```
<!DOCTYPE HTML PUBLIC "-//W3C/DTD HTML 4.0 Transitional//EN">
<html>
<head><title>A Form login authentication failure occurred</head></title>
<body>
<H1><B>A Form login authentication failure occurred</H1></B>
<P>Authentication may fail for one of many reasons. Some possibilities include:
<OL>
<LI>The user-id or password may be entered incorrectly; either misspelled or the
wrong case was used.
<LI>The user-id or password does not exist, has expired, or has been disabled.
</OL>
</P>


</body>
</html>
```

After an assembler configures the Web application to use form-based authentication, the deployment descriptor contains the login configuration as shown:

```
<login-config id="LoginConfig_1">
<auth-method>FORMauth-method>FORM>
<realm-name>Example Form-Based Authentication Area</realm-name>
<form-login-config id="FormLoginConfig_1">
<form-login-page>/login.html</form-login-page>
<form-error-page>/error.jsp</form-error-page>
</form-login-config>
</login-config>
```

A sample Web application archive (WAR) file directory structure showing login and error pages for the previous login configuration:

```
META-INF
     META-INF/MANIFEST.MF
     login.html
     error.jsp
     WEB-INF/
     WEB-INF/classes/
     WEB-INF/classes/aServlet.class
```

Form logout

Form logout is a mechanism to log out without having to close all Web-browser sessions. After logging out the form logout mechanism, access to a protected Web resource requires reauthentication. This feature is not required by J2EE specifications, but is provided as an additional feature in WebSphere security.

Suppose that it is desirable to log out after logging into a Web application and perform some actions. A form logout works in the following manner:

1. The logout-form URI is specified in the Web browser and loads the form.
2. The user clicks **Submit** on the form to log out.
3. The WebSphere security code logs the user out.
4. Upon logout, the user is redirected to a logout exit page.

Form logout does not require any attributes in a deployment descriptor. It is an HTML or JSP file that is included with the Web application. The form-logout page is like most HTML forms except that like the form-login page, it has a special post action. This post action is recognized by the Web container, which dispatches it to a special internal WebSphere form-logout servlet. The post action in the form-logout page must be `ibm_security_logout`.

You can specify a logout-exit page in the logout form and the exit page can represent an HTML or JSP file within the same Web application to which that the user is redirected after logging out. The logout-exit page is specified as a parameter in the form-logout page. If no logout-exit page is specified, a default logout HTML message is returned to the user. Here is a sample form logout HTML form. This form configures the logout-exit page to redirect the user back to the login page after logout.

```
<!DOCTYPE HTML PUBliC "-//W3C/DTD HTML 4.0 Transitional//EN">
<html>
  <META HTTP-EQUIV = "Pragma" CONTENT="no-cache">
  <title>Logout Page </title>
  <body>
  <h2>Sample Form Logout</h2>
      <FORM METHOD=POST ACTION="ibm_security_logout" NAME="logout">
      <p>
      <BR>
      <BR>
      <font size="2"><strong> Click this button to log out: </strong></font>
      <input type="submit" name="logout" value="Logout">
      <INPUT TYPE="HIDDEN" name="logoutExitPage" VALUE="/login.html">
      </p>
      </form>
  </body>
</html>
```

Developing with programmatic APIs for EJB applications

Programmatic security is used by security-aware applications when declarative security alone is not sufficient to express the security model of the application. The `javax.ejb.EJBContext` interface provides two methods whereby the bean provider can access security information about the enterprise bean caller.

- **IsCallerInRole**(String rolename): Returns true if the bean caller is granted the specified security role (specified by role name). If the caller is not granted the specified role, or if the caller is not authenticated, it returns false. If the specified role is granted **Everyone** access, it always returns true.
- **getCallerPrincipal()**: Returns the java.security.Principal object containing the bean caller name. If the caller is not authenticated, it returns a principal containing UNAUTHENTICATED name.

When the `isCallerInRole()` method is used, declare a security-role-ref element in the deployment descriptor with a role-name subelement containing the role name passed to this method. Since actual roles are created during the assembly stage of the application, you can use a logical role as the role name and provide enough hints to the assembler in the description of the security-role-ref element to link that role to actual role. During assembly, assembler creates a role-link sub element to link the role-name to the actual role. Creation of a security-role-ref element is

possible if development tools such as WebSphere Studio Application Developer is used. You also can create the security-role-ref element during the assembly stage using an assembly tool.

1. Add the required security methods in the EJB module code.
2. Create a security-role-ref element with a role-name field for all the role names used in the `isCallerInRole()` method. If a security-role-ref element is not created during development, make sure it is created during the assembly stage.

A programmatically secured EJB application.

Hard coding security policies in applications is strongly discouraged. The J2EE security model capabilities of declaratively specifying security policies is encouraged wherever possible. Use these APIs to develop security-aware EJB applications. An example where this implementation is useful is when an EJB application wants to access external resources and wants to control the access to these external resources using its own authorization table (external-resource to user mapping). In this case, use the `getCallerPrincipal()` method to get the caller identity and then the application can consult its own authorization table to perform authorization. The caller identification also can help retrieve the corresponding user information from an external source, such as database or from another enterprise bean. You can use the isCallerInRole() method in a similar way.

After development, a security-role-ref element can be created:

```
<security-role-ref>
<description>Provide hints to assembler for linking this role-name to
actual role here<\description>
<role-name>Mgr<\role-name>
</security-role-ref>
```

During assembly, the assembler creates a role-link element:

```
<security-role-ref>
<description>Hints provided by developer to map role-name to role-link</description>
<role-name>Mgr</role-name>
<role-link>Manager</role-link>
</security-role-ref>
```

You can add programmatic EJB component security methods (isCallerInRole() and getCallerPrincipal()) inside any business methods of an enterprise bean. The following example of programmatic security APIs includes a session bean:

```
public class aSessionBean implements SessionBean {

       .....

       // SessionContext extends EJBContext. If it is entity bean use EntityContext
       javax.ejb.SessionContext context;

       // The following method will be called by the EJB container
       // automatically
       public void setSessionContext(javax.ejb.SessionContext ctx) {
              context = ctx; // save the session bean's context
       }
```

```
        ....

        private  void aBusinessMethod()  {
        ....

        // to get  bean's caller using getCallerPrincipal()
        java.security.Principal principal = context.getCallerPrincipal();
        String  callerId= principal.getName();

        // to check if  bean's caller is granted Mgr role
        boolean isMgr = context.isCallerInRole("Mgr");

        // use the above information in any way as needed by the
        //application

        ....
        }

        ....
}
```

After developing an application, use the Assembly Toolkit to create roles and to link the actual roles to role names in the security-role-ref elements. For more information, see "Securing enterprise bean applications using the Assembly Toolkit" on page 123.

Example: Enterprise bean application code

The following EJB component example illustrates the use of isCallerInRole() and getCallerPrincipal() methods in an EJB module. Using that declarative security is recommended. The following example is one way of using the isCallerInRole() and getCallerPrincipal() methods. The application can use this result in any way that is suitable.

A remote interface

```
File : Hello.java

package tests;
import java.rmi.RemoteException;
/**
 * Remote interface for Enterprise Bean: Hello
 */
public interface Hello extends javax.ejb.EJBObject {
      public abstract String getMessage()throws RemoteException;
     public abstract void setMessage(String s)throws RemoteException;
}
```

A home interface

```
File : HelloHome.java
package tests;
/**
 * Home interface for Enterprise Bean: Hello
 */
public interface HelloHome extends javax.ejb.EJBHome {
 /**
```

```
  * Creates a default instance of Session Bean: Hello
  */
 public tests.Hello create() throws javax.ejb.CreateException,
  java.rmi.RemoteException;
}
```

A bean implementation

```
File : HelloBean.java

package tests;
/**
 * Bean implementation class for Enterprise Bean: Hello
 */
public class HelloBean implements javax.ejb.SessionBean {
 private javax.ejb.SessionContext mySessionCtx;
 /**
  * getSessionContext
  */
 public javax.ejb.SessionContext getSessionContext() {
  return mySessionCtx;
 }
 /**
  * setSessionContext
  */
 public void setSessionContext(javax.ejb.SessionContext ctx) {
  mySessionCtx = ctx;
 }
 /**
  * ejbActivate
  */
 public void ejbActivate() {
 }
 /**
  * ejbCreate
  */
 public void ejbCreate() throws javax.ejb.CreateException {
 }
 /**
  * ejbPassivate
  */
 public void ejbPassivate() {
 }
 /**
  * ejbRemove
  */
 public void ejbRemove() {
 }

 public java.lang.String message;


      //business methods

      // all users can call getMessage()
      public String getMessage() throws java.rmi.RemoteException {
```

```
        return message;
    }

    // all users can call setMessage() but only few users can set new message.
    public void setMessage(String s) throws java.rmi.RemoteException {

      // get  bean's caller using getCallerPrincipal()
      java.security.Principal principal = mySessionCtx.getCallerPrincipal();
      java.lang.String  callerId= principal.getName();

      // check if  bean's caller is granted Mgr role
      boolean isMgr = mySessionCtx.isCallerInRole("Mgr");

      // only set supplied message if caller is "bob" or caller is granted Mgr role
      if ( isMgr || callerId.equals("bob") )
          message = s;
      else
          message = "Hello";
    }

}
```

After development of the entity bean, create a security role reference in the deployment descriptor under the session bean, Hello:

```
<security-role-ref>
<description>Only Managers can call setMessage() on this bean (Hello)</description>
<role-name>Mgr</role-name>
</security-role-ref>
```

5.1 + For an explanation of how to create a `<security-role-ref>` element, see "Securing enterprise bean applications using the Assembly Toolkit" on page 123. Use the information under Map security-role-ref and role-name to role-link to create the element.

Programmatic login

Programmatic login is a type of form login that supports application presentation site-specific login forms for the purpose of authentication.

When enterprise bean client applications require the user to provide identifying information, the writer of the application must collect that information and authenticate the user. You can broadly classify the work of the programmer in terms of where the actual user authentication is performed:

- In a client program
- In a server program

Users of Web applications can receive prompts for authentication data in many ways. The `<login-config>` element in the Web application deployment descriptor file defines the mechanism used to collect this information. Programmers who want to customize login procedures, rather than relying on general purpose devices like a 401 dialog window in a browser, can use a form-based login to provide an application-specific HTML form for collecting login information.

No authentication occurs unless WebSphere Application Server global security is enabled. If you want to use form-based login for Web applications, you must

specify FORM in the auth-method tag of the <login-config> element in the deployment descriptor of each Web application.

Applications can present site-specific login forms by using the WebSphere Application Server form-login type. The Java 2 Platform, Enterprise Edition (J2EE) specification defines form login as one of the authentication methods for Web applications. However, the Servlet Version 2.2 specification does not define a mechanism for logging out. WebSphere Application Server extends J2EE by also providing a form-logout mechanism.

Java Authentication and Authorization Service programmatic login

Java Authentication and Authorization Service (JAAS) is a new feature in WebSphere Application Server. It is also mandated by the J2EE 1.3 Specification. JAAS is a collection of WebSphere strategic authentication APIs and replace of the CORBA programmatic login APIs. WebSphere Application Server provides some extensions to JAAS:

Before you begin developing with programmatic login APIs, consider the following points :

- For the pure Java client application or client container application, initialize the client Object Request Broker (ORB) security prior to performing a JAAS login. Do this by executing the following code prior to the JAAS login:

```
...
import java.util.Hashtable;
import javax.naming.Context;
import javax.naming.InitialContext;
...
// Perform an InitialContext and default lookup prior to logging
// in to initialize ORB security and for the bootstrap host/port
// to be determined for SecurityServer lookup. If you do not want
// to validate the userid/password during the JAAS login, disable
// the com.ibm.CORBA.validateBasicAuth property in the
// sas.client.props file.

Hashtable env = new Hashtable();
env.put(Context.INITIAL_CONTEXT_FACTORY,
    "com.ibm.websphere.naming.WsnInitialContextFactory");
env.put(Context.PROVIDER_URL,
     "corbaloc:iiop:myhost.mycompany.com:2809");
Context initialContext = new InitialContext(env);
Object obj = initialContext.lookup("");
```

  For more information, see “Example: Programmatic logins” on page 96.
- For the pure Java client application or client container application, make sure that the host name and the port number of the target JNDI bootstrap properties are specified properly. See the Developing applications that use CosNaming (CORBA Naming interface) section for details.
- If the application uses custom JAAS login configuration, make sure that the custom JAAS login configuration is properly defined. See the “Configuring application logins for Java Authentication and Authorization Service” on page 277 section for details.
- Some of the JAAS APIs are protected by Java 2 security permissions. If these APIs are used by application code, make sure that these permissions are added to the application was.policy file. See “Adding the was.policy file to

applications" on page 373 to the application, "Using PolicyTool to edit policy files" on page 355 and "Configuring the was.policy file" on page 368 sections for details. For more details of which APIs are protected by Java 2 Security permissions, check the IBM Developer Kit, Java edition; JAAS and the WebSphere public APIs Javadoc for more details. The following list indicates the APIs used in the samples code provided in this documentation.
  - javax.security.auth.login.LoginContext constructors are protected by javax.security.auth.AuthPermission ″createLoginContext″.
  - javax.security.auth.Subject.doAs() and com.ibm.websphere.security.auth.WSSubject.doAs() are protected by javax.security.auth.AuthPermission ″doAs″.
  - javax.security.auth.Subject.doAsPrivileged() and com.ibm.websphere.security.auth.WSSubject.doAsPrivileged() are protected by javax.security.auth.AuthPermission ″doAsPrivileged″.
- com.ibm.websphere.security.auth.WSSubject: Due to a design oversight in the JAAS 1.0, javax.security.auth.Subject.getSubject() does not return the Subject associated with the thread of execution inside a java.security.AccessController.doPrivileged() code block. This can present an inconsistent behavior that is problematic and causes undesirable effort. The com.ibm.websphere.security.auth.WSSubject API provides a work around to associate Subject to thread of execution. The com.ibm.websphere.security.auth.WSSubject API extends the JAAS model to J2EE resources for authorization checks. The Subject associated with the thread of execution within com.ibm.websphere.security.auth.WSSubject.doAs() or com.ibm.websphere.security.auth.WSSubject.doAsPrivileged() code block is used for J2EE resources authorization checks.
- UI support for defining new JAAS login configuration: You can configure JAAS login configuration in the administrative console and store it in the WebSphere Configuration API. Applications can define new JAAS login configuration in the administrative console and the data is persisted in the configuration repository (stored in the WebSphere Configuration API). However, WebSphere Application Server still supports the default JAAS login configuration format (plain text file) provided by the JAAS default implementation. But if there are duplication login configurations defined in both the WebSphere Configuration API and the plain text file format, the one in the WebSphere Configuration API takes precedence. There are advantages to defining the login configuration in the WebSphere Configuration API:
  - UI support in defining JAAS login configuration.
  - You can manage the JAAS configuration login configuration centrally.
  - The JAAS configuration login configuration is distributed in a Network Deployment installation.
- WebSphere Application Server JAAS login configurations: WebSphere Application Server provides JAAS login configurations for application to perform programmatic authentication to the WebSphere Application Server security run time. These WebSphere Application Server JAAS login configurations perform authentication to the WebSphere Application Server configured authentication mechanism (SWAM or LTPA) and user registry (Local OS, LDAP, or Custom) based on the authentication data supplied. The authenticated Subject from these JAAS login configurations contain the required Principal and Credentials that can be used by WebSphere Application Server security run time to perform authorization checks on J2EE role-based protected resources. Here is the JAAS login configurations provided by WebSphere Application Server:
  - *WSLogin JAAS login configuration*: A generic JAAS login configuration that a Java Client, client container application, servlet, JSP file, enterprise bean, and so on, can use to perform authentication based on a user ID and password, or

a token to the WebSphere Application Server security run time. However, this does not honor the CallbackHandler specified in the Client Container deployment descriptor.
  - *ClientContainer JAAS login configuration*: This JAAS login configuration honors the CallbackHandler specified in the client container deployment descriptor. The login module of this login configuration uses the CallbackHandler in the client container deployment descriptor if one is specified, even if the application code specified one CallbackHandler in the LoginContext. This is for client container application.
  - Subject authenticated with the previously mentioned JAAS login configurations contain a com.ibm.websphere.security.auth.WSPrincipal and a com.ibm.websphere.security.auth.WSCredential. If the authenticated Subject is passed the in com.ibm.websphere.security.auth.WSSubject.doAs() (or the other doAs() methods), the WebSphere Application Server security run time can perform authorization checks on J2EE resources, based on the Subject com.ibm.websphere.security.auth.WSCredential.
- **Customer-defined JAAS login configurations**: You can define other JAAS login configurations. See "Configuring application logins for Java Authentication and Authorization Service" on page 277 section for details. Use these login configurations to perform programmatic authentication to the customer authentication mechanism. However, the subjects from these customer-defined JAAS login configurations might not be used by WebSphere Application Server security run time to perform authorization checks if the subject does not contain the required principal and credentials.

Finding the root cause login exception from a JAAS login

If you get a LoginException after issuing the LoginContext.login() API, you can find the root cause exception from the configured user registry. In the login modules, the registry exceptions are wrapped by a `com.ibm.websphere.security.auth.WSLoginFailedException`. This exception has a getCause() method that allows you to pull out the exception that was wrapped after issuing the above command.

Note: You are not always guaranteed to get an exception of type WSLoginFailedException, but you should note that most of the exceptions generated from the user registry show up here.

The following is a LoginContext.login() API example with associated catch block. WSLoginFailedException has to be casted to `com.ibm.websphere.security.auth.WSLoginFailedException` if you want to issue the getCause() API.

Note: The determineCause() example below can be used for processing CustomUserRegistry exception types.

```
try
    {
         lc.login();
    }
    catch (LoginException le)
    {
 // drill down through the exceptions as they might cascade through the runtime
 Throwable root_exception = determineCause(le);

 // now you can use "root_exception" to compare to a particular exception type
```

```
 // for example, if you have implemented a CustomUserRegistry type, you would
  //  know what to look for here.
    }


/* Method used to drill down into the WSLoginFailedException to find the
"root cause" exception */

    public Throwable determineCause(Throwable e)
    {
        Throwable root_exception = e, temp_exception = null;

 // keep looping until there are no more embedded WSLoginFailedException or
  // WSSecurityException exceptions
        while (true)
        {
  if (e instanceof com.ibm.websphere.security.auth.WSLoginFailedException)
        {
        temp_exception = ((com.ibm.websphere.security.auth.WSLoginFailedException)
        e).getCause();
        }
        else if (e instanceof com.ibm.websphere.security.WSSecurityException)
        {
        temp_exception = ((com.ibm.websphere.security.WSSecurityException)
        e).getCause();
        }
      else if (e instanceof javax.naming.NamingException)
        // check for Ldap embedded exception
  {
   temp_exception = ((javax.naming.NamingException)e).getRootCause();
  }
    else if (e instanceof your_custom_exception_here)
  {
   // your custom processing here, if necessary
  }
  else
  {
   // this exception is not one of the types we are looking for,
   // lets return now, this is the root from the WebSphere
       //  Application Server perspective
   return root_exception;
  }

         if (temp_exception != null)
  {
   // we have an exception, let's go back an see if this has another
       //  one embedded within it.
   root_exception = temp_exception;
   e = temp_exception;
   continue;
      }
  else
  {
        // we finally have the root exception from this call path, this
   // has to occur at some point
   return root_exception;
```

```
        }
          }
  }
```

Finding the root cause login exception from a Servlet filter

You can also receive the root cause exception from a servlet filter when addressing post-Form Login processing. This is suitable because it shows the user what happened. The following API can be issued to obtain the root cause exception:

```
Throwable t = com.ibm.websphere.security.auth.WSSubject.getRootLoginException();
if (t != null)
        t = determineCause(t);
```

Note: Once you have the exception you can run it through the determineCause() example above to get the native registry root cause.

Enabling root cause login exception propagation to pure Java clients

Currently, the root cause does not get propagated to a pure client for security reasons. However, you might want to propagate the root cause to a pure client in a trusted environment. If you want to enable root cause login exception propagation to a pure client, click **Security > Global Security > Custom Properties** on the WebSphere Application Server administrative console and set the following property:

```
com.ibm.websphere.security.registry.propagateExceptionsToClient=true
```

Non-prompt programmatic login

WebSphere Application Server provides a non-prompt implementation of the javax.security.auth.callback.CallbackHandler interface, which is called com.ibm.websphere.security.auth.callback.WSCallbackHandlerImpl. Using this interface, an application can push authentication data to the WebSphere Application Server LoginModule instance to perform authentication. This capability proves useful for server-side application code to authenticate an identity and to use that identity to invoke downstream J2EE resources.

```
javax.security.auth.login.LoginContext lc = null;

try {
lc = new javax.security.auth.login.LoginContext("WSLogin",
new com.ibm.websphere.security.auth.callback.WSCallbackHandlerImpl("user",
      "securityrealm", "securedpassword"));

// create a LoginContext and specify a CallbackHandler implementation
// CallbackHandler implementation determine how authentication data is collected
// in this case, the authentication data is "push" to the authentication mechanism
//   implemented by the LoginModule.
} catch (javax.security.auth.login.LoginException e) {
System.err.println("ERROR: failed to instantiate a LoginContext and the exception: "
+ e.getMessage());
e.printStackTrace();

// may be javax.security.auth.AuthPermission "createLoginContext" is not granted
//   to the application, or the JAAS login configuration is not defined.
```

```
}

if (lc != null)
try {
lc.login();  // perform login
javax.security.auth.Subject s = lc.getSubject();
// get the authenticated subject

// Invoke a J2EE resource using the authenticated subject
com.ibm.websphere.security.auth.WSSubject.doAs(s,
new java.security.PrivilegedAction() {
public Object run() {
try {
bankAccount.deposit(100.00);  // where bankAccount is a protected EJB
} catch (Exception e) {
System.out.println("ERROR: error while accessing EJB resource, exception: "
+ e.getMessage());
e.printStackTrace();
}
return null;
}
}
);
} catch (javax.security.auth.login.LoginException e) {
System.err.println("ERROR: login failed with exception: " + e.getMessage());
e.printStackTrace();

// login failed, might want to provide relogin logic
}
```

You can use the com.ibm.websphere.security.auth.callback.WSCallbackHandlerImpl callback handler with a pure Java client, a client application container, enterprise bean, JavaServer page (JSP) files, servlet, or other Java 2 Platform, Enterprise Edition (J2EE) resources. See "Example: Programmatic logins" on page 96 for more information about object request broker (ORB) security initialization requirements in a Java pure client.

User interface prompt programmatic login

WebSphere Application Server also provides a user interface implementation of the javax.security.auth.callback.CallbackHandler implementation to collect authentication data from user through user interface login prompts. This callack handler, `com.ibm.websphere.security.auth.callback.WSGUICallbackHandlerImpl`, presents a user interface login panel to prompt users for authentication data.

```
javax.security.auth.login.LoginContext lc = null;

try {
lc = new javax.security.auth.login.LoginContext("WSLogin",
new com.ibm.websphere.security.auth.callback.WSGUICallbackHandlerImpl());

// create a LoginContext and specify a CallbackHandler implementation
// CallbackHandler implementation determine how authentication data is collected
// in this case, the authentication date is collected by GUI login prompt
//   and pass to the authentication mechanism implemented by the LoginModule.
} catch (javax.security.auth.login.LoginException e) {
```

```
System.err.println("ERROR: failed to instantiate a LoginContext and the exception: "
+ e.getMessage());
e.printStackTrace();

// may be javax.security.auth.AuthPermission "createLoginContext" is not granted
//   to the application, or the JAAS login configuration is not defined.
}

if (lc != null)
try {
lc.login();  // perform login
javax.security.auth.Subject s = lc.getSubject();
// get the authenticated subject

// Invoke a J2EE resources using the authenticated subject
com.ibm.websphere.security.auth.WSSubject.doAs(s,
new java.security.PrivilegedAction() {
public Object run() {
try {
bankAccount.deposit(100.00);  // where bankAccount is a protected enterprise bean
} catch (Exception e) {
System.out.println("ERROR: error while accessing EJB resource, exception: "
+ e.getMessage());
e.printStackTrace();
}
return null;
}
}
);
} catch (javax.security.auth.login.LoginException e) {
System.err.println("ERROR: login failed with exception: " + e.getMessage());
e.printStackTrace();

// login failed, might want to provide relogin logic
}
```

Attention: Do not use the com.ibm.websphere.security.auth.callback.WSGUICallbackHandlerImpl callback handler for server-side resources (like enterprise bean, servlet, JSP file, or any other server side resources). The user interface login prompt blocks the server for user input. This behavior is not desirable for a server process.

Stdin prompt programmatic login

WebSphere Application Server also provides a stdin implementation of the javax.security.auth.callback.CallbackHandler interface to collect authentication data from a user through stdin, which is called `com.ibm.websphere.security.auth.callback.WSStdinCallbackHandlerImpl`. This callback handler prompts a user for authentication data.

```
javax.security.auth.login.LoginContext lc = null;

try {
lc = new javax.security.auth.login.LoginContext("WSLogin",
new com.ibm.websphere.security.auth.callback.WSStdinCallbackHandlerImpl());
```

```
// create a LoginContext and specify a CallbackHandler implementation
// CallbackHandler implementation determine how authentication data is collected
// in this case, the authentication date is collected by stdin prompt
//   and pass to the authentication mechanism implemented by the LoginModule.
} catch (javax.security.auth.login.LoginException e) {
System.err.println("ERROR: failed to instantiate a LoginContext and the exception:
          " + e.getMessage());
e.printStackTrace();

// may be javax.security.auth.AuthPermission "createLoginContext" is not granted
//   to the application, or the JAAS login configuration is not defined.
}

if (lc != null)
try {
lc.login();  // perform login
javax.security.auth.Subject s = lc.getSubject();
// get the authenticated subject

// Invoke a J2EE resource using the authenticated subject
com.ibm.websphere.security.auth.WSSubject.doAs(s,
new java.security.PrivilegedAction() {
public Object run() {
try {
bankAccount.deposit(100.00);
// where bankAccount is a protected enterprise bean
} catch (Exception e) {
System.out.println("ERROR: error while accessing EJB resource, exception: "
       + e.getMessage());
e.printStackTrace();
}
return null;
}
}
);
} catch (javax.security.auth.login.LoginException e) {
System.err.println("ERROR: login failed with exception: " + e.getMessage());
e.printStackTrace();

// login failed, might want to provide relogin logic
}
```

Do not use the com.ibm.websphere.security.auth.callback.WSStdinCallbackHandlerImpl callback handler for server side resources (like enterprise beans, servlets, JSP files, and so on). The input from the stdin prompt is not sent to the server environment. Most servers run in the background and do not have a console. However, if the server does have a console, the stdin prompt blocks the server for user input. This behavior is not desirable for a server process.

Developing programmatic logins with the Java Authentication and Authorization Service

Java Authentication and Authorization Service (JAAS) is a new feature in WebSphere Application Server Version 5. Java Authentication and Authorization Service represents the strategic application programming interfaces (API) for authentication. WebSphere Application Server provides some extension to JAAS:

- Refer to the Developing applications that use CosNaming (CORBA Naming interface) article for details on how to set up the environment for thin client applications to access remote resources on a server.
- If the application uses custom JAAS login configuration, verify that it is properly defined. See the "Configuring application logins for Java Authentication and Authorization Service" on page 277 article for details.
- Some of the JAAS APIs are protected by Java 2 Security permissions. If these APIs are used by application code, verify that these permissions are added to the application `was.policy` file. See "Adding the was.policy file to applications" on page 373, "Using PolicyTool to edit policy files" on page 355 and "Configuring the was.policy file" on page 368 articles for details. For more details on which APIs are protected by Java 2 Security permissions, check the IBM Application Developer Kit, Java Technology Edition; JAAS and WebSphere Application Server public APIs Javadoc in "Security: Resources for learning" on page 407. Some of the APIs used in the sample code in this documentation and the Java 2 Security permissions required by these APIs follow:
  - javax.security.auth.login.LoginContext constructors are protected by javax.security.auth.AuthPermission ″createLoginContext″
  - javax.security.auth.Subject.doAs() and com.ibm.websphere.security.auth.WSSubject.doAs() are protected by javax.security.auth.AuthPermission ″doAs″
  - javax.security.auth.Subject.doAsPrivileged() and com.ibm.websphere.security.auth.WSSubject.doAsPrivileged() are protected by javax.security.auth.AuthPermission ″doAsPrivileged″
- **Enhanced model to J2EE resources for authorization checks**. Due to a design oversight in JAAS Version 1.0, the `javax.security.auth.Subject.getSubject()` method does not return the Subject associated with the thread of execution inside a `java.security.AccessController.doPrivileged()` code block. This can present an inconsistent behavior, which might have undesirable effects. The `com.ibm.websphere.security.auth.WSSubject` provides a workaround to associate a Subject to a thread of execution. The `com.ibm.websphere.security.auth.WSSubject` extends the JAAS model to J2EE resources for authorization checks. If the Subject associates with the thread of execution within the `com.ibm.websphere.security.auth.WSSubject.doAs()` method or if the `com.ibm.websphere.security.auth.WSSubject.doAsPrivileged()` code block contains product credentials, the Subject is used for J2EE resources authorization checks.
- **User Interface support for defining new JAAS login configuration**. You can configure JAAS login configuration in the administrative console and store it in the WebSphere Common Configuration Model. Applications can define a new JAAS login configuration in the administrative console and the data is persisted in the configuration repository (stored in the WebSphere Common Configuration Model). However, WebSphere Application Server still supports the default JAAS login configuration format (plain text file) provided by the JAAS default implementation. If there are duplication login configurations defined in both the WebSphere Common Configuration and the plain text file format, the one in the WebSphere Common Configuration takes precedence. There are advantages to defining the login configuration in the WebSphere Common Configuration:

  - UI support in defining JAAS login configuration
  - JAAS configuration login configuration can be managed centrally
  - JAAS configuration login configuration is distributed in a Network Deployment installation
- **Application support for programmatic authentication**. WebSphere Application Server provides JAAS login configurations for applications to perform programmatic authentication to the WebSphere security run time. These configurations perform authentication to the WebSphere-configured authentication mechanism (Simple WebSphere Authentication Mechanism (SWAM) or Lightweight Third Party Authentication (LTPA)) and user registry (Local OS, Lightweight Directory Access Protocol (LDAP) or Custom) based on the authentication data supplied. The authenticated Subject from these JAAS login configurations contains the required Principal and Credentials that the WebSphere security run time can use to perform authorization checks on J2EE role-based protected resources. Here are the JAAS login configurations provided by the WebSphere Application Server:
  - **WSLogin JAAS login configuration**. A generic JAAS login configuration can use Java clients, client container applications, servlets, JSP files, and EJB components to perform authentication based on a user ID and password, or a token to the WebSphere security run time. However, this does not honor the CallbackHandler specified in the client container deployment descriptor.
  - **ClientContainer JAAS login configuration**. This JAAS login configuration honors the CallbackHandler specified in the client container deployment descriptor. The login module of this login configuration uses the CallbackHandler in the client container deployment descriptor if one is specified, even if the application code specified one CallbackHandler in the LoginContext. This is for a client container application.

    A Subject authenticated with the previously mentioned JAAS login configurations contains a `com.ibm.websphere.security.auth.WSPrincipal` principal and a `com.ibm.websphere.security.auth.WSCredential` credential. If the authenticated Subject is passed in `com.ibm.websphere.security.auth.WSSubject.doAs()` or the other doAs() methods, the product security run time can perform authorization checks on J2EE resources based on the `Subject` `com.ibm.websphere.security.auth.WSCredential`.

    Note: With WebSphere Application Server for z/OS Version 5, a client login using JAAS (either through WSLogin or the ClientContainer JAAS login Configuration) is restricted to using a local OS identity.
- **Customer-defined JAAS login configurations**. You can define other JAAS login configurations to perform programmatic authentication to your authentication mechanism. See the "Configuring application logins for Java Authentication and Authorization Service" on page 277 article for details. For the product security run time to perform authorization checks, the subjects from these customer-defined JAAS login configurations must contain the required principal and credentials.

See the article, Example: Java Authentication and Authorization Service programmatic login.

Example: Programmatic logins

The following example illustrates how application programs can perform a programmatic login using Java Authentication and Authorization Service (JAAS):

```
LoginContext lc = null;
```

```
try {
        lc = new LoginContext(″WSLogin″,
                    new WSCallbackHandlerImpl(″userName″, ″realm″, ″password″));
} catch (LoginException le) {
         System.out.println(″Cannot create LoginContext. ″ + le.getMessage());
         // insert error processing code
} catch(SecurityException se) {
         System.out.println(″Cannot create LoginContext.″ + se.getMessage();
         // Insert error processing
 }

 try {
          lc.login();
 } catch(LoginExcpetion le) {
          System.out.println(″Fails to create Subject. ″ + le.getMessage());
           // Insert error processing code
```

As shown in the example, the new LoginContext is initialized with the `WSLogin` login configuration and the `WSCallbackHandlerImpl CallbackHandler`. Use the `WSCallbackHandlerImpl` instance on a server-side application where prompting is not desirable. A `WSCallbackHandlerImpl` instance is initialized by the specified user ID, password, and realm information. The present `WSLoginModuleImpl` class implementation that is specified by `WSLogin` can only retrieve authentication information from the specified `CallbackHandler`. You can construct a `LoginContext` with a Subject object, but the Subject is disregarded by the present `WSLoginModuleImpl` implementation. For product client container applications, replace `WSLogin` by `ClientContainer` login configuration, which specifies the `WSClientLoginModuleImpl` implementation that is tailored for client container requirements.

For a pure Java application client, the product provides two other `CallbackHandler` implementations: `WSStdinCallbackHandlerImpl` and `WSGUICallbackHandlerImpl`, which prompt for user ID, password, and realm information on the command line and pop-up panel, respectively. You can choose either of these product `CallbackHandler` implementations depending on the particular application environment. You can develop a new `CallbackHandler` if neither of these implementations fit your particular application requirement.

You also can develop your own `LoginModule` if the default `WSLoginModuleImpl` implementation fails to meet all your requirements. This product provides utility functions that the custom LoginModule can use, which are described in the next section.

In cases where there is no `java.naming.provider.url` set as a system property or in the `jndi.properties` file, a default `InitialContext` does not function if the product server is not at the `localhost:2809` location. In this situation, perform a new `InitialContext` programmatically ahead of the JAAS login. JAAS needs to know where the SecurityServer resides to verify that the user ID or password entered is correct, prior to doing a commit(). By performing a new `InitialContext` in the way specified below, the security code has the information needed to find the SecurityServer location and the target realm.

Attention: The first line starting with `env.put` was split into two lines because it extends beyond the width of the printed page.

```
...
    import java.util.Hashtable;
    import javax.naming.Context;
    import javax.naming.InitialContext;
    ...

// Perform an InitialContext and default lookup prior to logging in so that target realm
// and bootstrap host/port can be determined for SecurityServer lookup.

    Hashtable env = new Hashtable();
    env.put(Context.INITIAL_CONTEXT_FACTORY,
              "com.ibm.websphere.naming.WsnInitialContextFactory");
    env.put(Context.PROVIDER_URL, "corbaloc:iiop:myhost.mycompany.com:2809");
    Context initialContext = new InitialContext(env);
    Object obj = initialContext.lookup("");

     LoginContext lc = null;
     try {
         lc = new LoginContext("WSLogin",
                       new WSCallbackHandlerImpl("userName", "realm", "password"));
     } catch (LoginException le) {
           System.out.println("Cannot create LoginContext. " + le.getMessage());
           // insert error processing code
     } catch(SecurityException se) {
           System.out.println("Cannot create LoginContext." + se.getMessage();
           // Insert error processing
     }

     try {
            lc.login();
     } catch(LoginException le) {
            System.out.println("Fails to create Subject. " + le.getMessage());
             // Insert error processing code
     }
```

Example: Customizing a server-side Java Authentication and Authorization Service authentication and login configuration

WebSphere Application Server supports plugging in a custom Java Authentication and Authorization Service (JAAS) login module before or after the WebSphere Application Server system login module. However, WebSphere Application Server does not support the replacement of the WebSphere Application Server system login modules, which are used to create WSCredential and WSPrincipal in the Subject. By using a custom login module, you can either make additional authentication decisions or add information to the Subject to make additional, potentially finer-grained, authorization decisions inside a Java 2 Platform, Enterprise Edition (J2EE) application.

Attention: 5.1 Information added to the Subject from the custom login module is not propagated downstream in the current implementation.

5.1 Only the identity gets propagated. Using a custom login module, the identity can be used to generate similar data downstream.

5.1 WebSphere Application Server server-side authentication mechanisms, both Simple WebSphere Authentication Mechanism (SWAM) and Lightweight Third Party Authentication (LTPA), are implemented as the JAAS LoginModule. The SWAM and LTPA login configurations are defined in the WebSphere Configuration API model within the `wsjaas.conf` properties file. There are two sets of JAAS login configuration defined in the WebSphere Configuration API model: the application login configuration and the system login configuration. SWAM and LTPA are defined in the system login configuration.

5.1 WebSphere Application Server Version 5.1 enables you to customize the LTPA system configuration. A new LTPA_WEB login configuration exists in the WebSphere Configuration API model, which is used exclusively by the Web container. The LTPA login configuration is used by the EJB container. The LTPA_WEB login configuration contains the `com.ibm.ws.security.web.AuthenLoginModule` module and the LTPA login configuration contains the `com.ibm.ws.security.server.lm.ltpaLoginModule` module. The new AuthenLoginModule is an enhanced ltpaLoginModule that can process the HttpServletRequest object, the HttpServletResponse object, and the Web application name that are passed in using the CallbackHandler.

5.1 WebSphere Application Server Version 5.1 exposes the server-side login configuration so that you may customize the LTPA authentication process. Both the LTPA login configuration and the LTPA_WEB login configuration enable you to add a custom LoginModule both before and after the ltpaLoginModule and the AuthenLoginModule. For example, one might add a LoginModule to perform principal or credential mapping function either before or after the authentication. In the Web configuration, a custom LoginModule might perform principal mapping using a combination of authenticated user name, application name, and URL patterns. WebSphere Application Server does not allow you to rename nor remove the LTPA and LTPA_WEB login configurations.

5.1 WebSphere Application Server Version 5.1 and all prior version 5.0.x releases do not expose the system login configuration in the administration console. The WebSphere Application Server version 5.0.x releases do not support the modification of the system login configuration. In WebSphere Application Server Version 5.1, the system login configuration is not exposed in the administrative console. However, you can modify the system login configuration using the wsadmin scripting utility.

Refer to the following code sample to configure a system login configuration using the wsadmin tool. The following sample JACL script adds a customLoginModule into the Lightweight Third-party Authentication (LTPA) Web system login configuration:

Attention: Lines 32, 33, and 34 in the following code sample were split onto two lines because of the width of the printed page.

```
1. ########################################
2. #
3. # Open security.xml
4. #
5. ########################################
6.
7.
```

```
8. set sec [$AdminConfig getid /Cell:hillside/Security:/]
9.
10.
11. ########################################
12. #
13. # Locate systemLoginConfig
14. #
15. ########################################
16.
17.
18. set slc [$AdminConfig showAttribute $sec systemLoginConfig]
19.
20. set entries [lindex [$AdminConfig showAttribute $slc entries] 0]
21.
22.
23. ########################################
24. #
25. # Append a new LoginModule to LTPA_WEB
26. #
27. ########################################
28.
29. foreach entry $entries {
30.    set alias [$AdminConfig showAttribute $entry alias]
31.    if {$alias == "LTPA_WEB"} {
32.       set newJAASLoginModuleId [$AdminConfig create JAASLoginModule
           $entry {{moduleClassName
           "com.ibm.ws.security.common.auth.module.proxy.WSLoginModuleProxy"}}]
33.       set newPropertyId [$AdminConfig create Property
           $newJAASLoginModuleId {{name delegate}{value
           "com.ABC.security.auth.CustomLoginModule"}}]
34.       $AdminConfig modify $newJAASLoginModuleId
           {{authenticationStrategy REQUIRED}}
35.       break
36.    }
37. }
38.
39.
40. ########################################
41. #
42. # save the change
43. #
44. ########################################
45.
46. $AdminConfig save
47.
```

Attention: The wsadmin scripting utility inserts a new object to the end of the list. To insert the custom LoginModule before the AuthenLoginModule, delete the AuthenLoginModule and then recreate it after inserting the custom LoginModule. Save the sample script into a file, sample.jacl, executing the sample script using the following command:

```
Wsadmin -f sample.jacl
```

You can use the following sample JACL script to remove the current LTPA_WEB login configuration and all the LoginModules:

```
48. ########################################
49. #
50. # Open security.xml
51. #
52. ########################################
53.
54.
55. set sec [$AdminConfig getid /Cell:hillside/Security:/]
56.
57.
58. ########################################
59. #
60. # Locate systemLoginConfig
61. #
62. ########################################
63.
64.
65. set slc [$AdminConfig showAttribute $sec systemLoginConfig]
66.
67. set entries [lindex [$AdminConfig showAttribute $slc entries] 0]
68.
69.
70. ########################################
71. #
72. # Remove the LTPA_WEB login configuration
73. #
74. ########################################
75.
76. foreach entry $entries {
77.    set alias [$AdminConfig showAttribute $entry alias]
78.    if {$alias == "LTPA_WEB"} {
79.       $AdminConfig remove $entry
80.       break
81.    }
82. }
83.
84.
85. ########################################
86. #
87. # save the change
88. #
89. ########################################
90.
91. $AdminConfig save
```

You can use the following sample JACL script to recover the original LTPA_WEB configuration:

Attention: Lines 122, 124, and 126 in the following code sample were split onto two or more lines because of the width of the printed page. The two lines of code for line 122 are normally one continuous line. The three lines of code for line 124 are normally one continuous line. Also, the three lines of code for line 126 are normally one continuous line.

```
92. ########################################
93. #
```

```
94. # Open security.xml
95. #
96. ########################################
97.
98.
99. set sec [$AdminConfig getid /Cell:hillside/Security:/]
100.
101.
102. ########################################
103. #
104. # Locate systemLoginConfig
105. #
106. ########################################
107.
108.
109. set slc [$AdminConfig showAttribute $sec systemLoginConfig]
110.
111. set entries [lindex [$AdminConfig showAttribute $slc entries] 0]
112.
113.
114.
115. ########################################
116. #
117. # Recreate the LTPA_WEB login configuration
118. #
119. ########################################
120.
121.
122. set newJAASConfigurationEntryId [$AdminConfig create JAASConfigurationEntry
     $slc {{alias LTPA_WEB}}]
123.
124. set newJAASLoginModuleId [$AdminConfig create JAASLoginModule
     $newJAASConfigurationEntryId
     {{moduleClassName
     "com.ibm.ws.security.common.auth.module.proxy.WSLoginModuleProxy"}}]
125.
126. set newPropertyId [$AdminConfig create Property
     $newJAASLoginModuleId {{name delegate}
     {value "com.ibm.ws.security.web.AuthenLoginModule"}}]
127.
128. $AdminConfig modify $newJAASLoginModuleId {{authenticationStrategy REQUIRED}}
129.
130.
131. ########################################
132. #
133. # save the change
134. #
135. ########################################
136.
137. $AdminConfig save
```

The WebSphere Application Server Version 5.1 ltpaLoginModule and AuthenLoginModule use the shared state to save state information so that custom LoginModules can modify the information. The ltpaLoginModule initializes the callback array in the login() method using the following code. The callback array is created by ltpaLoginModule only if an array is not defined in the shared state area.

In the following code sample, the error handling code was removed to make the sample concise. If you insert a custom LoginModule before the ltpaLoginModule, custom LoginModule might follow the same style to save the callback into the shared state.

Attention: In the following code sample, several lines of code have been split onto two lines because of the width of the printed page. Each of these split lines are one continuous line.

```
138.         Callback callbacks[] = null;
139.         if (!sharedState.containsKey(
                 com.ibm.wsspi.security.auth.callback.Constants.
                 CALLBACK_KEY)) {
140.             callbacks = new Callback[3];
141.             callbacks[0] = new NameCallback("Username: ");
142.             callbacks[1] = new PasswordCallback("Password: ", false);
143.             callbacks[2] = new com.ibm.websphere.security.auth.callback.
                 WSCredTokenCallbackImpl( "Credential Token: ");
144.             try {
145.                 callbackHandler.handle(callbacks);
146.             } catch (java.io.IOException e) {
147.                 . . .
148.            } catch (UnsupportedCallbackException uce) {
149.                 . . .
150.            }
151.            sharedState.put(
                com.ibm.wsspi.security.auth.callback.Constants.CALLBACK_KEY,
                callbacks);
152.         } else {
153.             callbacks = (Callback [])
                 sharedState.get( com.ibm.wsspi.security.auth.callback.
                 Constants.CALLBACK_KEY);
154.         }
```

ltpaLoginModule and AuthenLoginModule generate both a WSPrincipal and a WSCredential object to represent the authenticated user identity and security credentials. The WSPrincipal and WSCredential objects also are saved in the shared state. A JAAS login uses a two-phase commit protocol. First, the login methods in login modules, which are configured in the login configuration, are called. Then, their commit methods are called. A custom LoginModule, which is inserted after the ltpaLoginModule and the AuthenLoginModule, can modify the WSPrincipal and WSCredential objects before they are committed. The WSCredential and WSPrincipal objects must exist in the Subject after the login is completed. Without these objects in the Subject, WebSphere Application Server run-time code rejects the Subject when it is used to make any security decisions.

AuthenLoginModule uses the following code to initialize the callback array:

Attention: In the following code sample, several lines of code have been split onto two lines because of the width of the printed page. Each of these split lines are one continuous line.

```
155.         Callback callbacks[] = null;
156.         if (!sharedState.containsKey(
                 com.ibm.wsspi.security.auth.callback.Constants.
                 CALLBACK_KEY)) {
```

```
157.             callbacks = new Callback[6];
158.             callbacks[0] = new NameCallback("Username: ");
159.             callbacks[1] = new PasswordCallback("Password: ", false);
160.             callbacks[2] =
                 new com.ibm.websphere.security.auth.callback.WSCredTokenCallbackImpl(
                 "Credential Token: ");
161.             callbacks[3] =
                 new com.ibm.wsspi.security.auth.callback.WSServletRequestCallback(
                 "HttpServletRequest: ");
162.             callbacks[4] =
                 new com.ibm.wsspi.security.auth.callback.WSServletResponseCallback(
                 "HttpServletResponse: ");
163.             callbacks[5] =
                 new com.ibm.wsspi.security.auth.callback.WSAppContextCallback(
                 "ApplicationContextCallback: ");
164.             try {
165.                 callbackHandler.handle(callbacks);
166.             } catch (java.io.IOException e) {
167.               . . .
168.             } catch (UnsupportedCallbackException uce {
169.               . . .
170.             }
171.             sharedState.put( com.ibm.wsspi.security.auth.callback.
                 Constants.CALLBACK_KEY, callbacks);
172.         } else {
173.             callbacks = (Callback []) sharedState.get(
                 com.ibm.wsspi.security.auth.callback.
                 Constants.CALLBACK_KEY);
174.         }
```

Three more objects, which contain callback information for the login, are passed from the Web container to the AuthenLoginModule: a `java.util.Map`, a `HttpServletRequest`, and a `HttpServletResponse` object. These objects represent the Web application context. The WebSphere Application Server Version 5.1 application context, `java.util.Map` object, contains the application name and the error page URL. You can obtain the application context, `java.util.Map` object, by calling the `getContext()` method on the WSAppContextCallback object. The `java.util.Map` object is created with the following deployment descriptor information.

Attention: In the following code sample, several lines of code have been split onto two lines because of the width of the printed page. Each of these split lines are one continuous line.

```
175.         HashMap appContext = new HashMap(2);
176.         appContext.put(
             com.ibm.wsspi.security.auth.callback.Constants.WEB_APP_NAME,
             web_application_name);
177.         appContext.put(
             com.ibm.wsspi.security.auth.callback.Constants.REDIRECT_URL,
             errorPage);
```

The application name and the `HttpServletRequest` object might be read by the custom LoginModule to perform mapping functions. The error page of the

form-based login might be modified by a custom LoginModule. In addition to the JAAS framework, WebSphere Application Server supports the Trust Association Interface (TAI).

Other credential types and information can be added to the caller Subject during the authentication process using a custom LoginModule. The third-party credentials in the caller Subject are managed by WebSphere Application Server as part of the security context. The caller Subject is bound to the thread of execution during the request processing. When a Web or EJB module is configured to use the caller identity, the user identity is propagated to the downstream service in an EJB request. WSCredential and any third-party credentials in the caller Subject are not propagated downstream. Instead, some of the information can be regenerated at the target server based on the propagated identity. Add third-party credentials to the caller Subject at the authentication stage. The caller Subject, which is returned from the WSSubject.getCallerSubject() method, is read-only and thus cannot be modified. For more information on the WSSubject, see "Example: Getting the Caller Subject from the Thread."

Example: Getting the Caller Subject from the Thread

The Caller subject (or ″received subject″) contains the user authentication information used in the call for this request. This subject is returned after issuing the WSSubject.getCallerSubject() API to prevent replacing existing objects. The subject is marked read-only. This API can be used to get access to the WSCredential (documented in the Javadoc information) so that you can put or set data in the hashmap within the credential.

Most data within the subject is not propagated downstream to another server. Only the credential token within the WSCredential is propagated downstream (and a new caller subject generated).

```
try
{
 javax.security.auth.Subject caller_subject;
 com.ibm.websphere.security.cred.WSCredential caller_cred;

 caller_subject = com.ibm.websphere.security.auth.WSSubject.getCallerSubject();

 if (caller_subject != null)
 {
  caller_cred = caller_subject.getPublicCredentials
     (com.ibm.websphere.security.cred.WSCredential.class).iterator().next();
  String CALLERDATA = (String) caller_cred.get (″MYKEY″);
  System.out.println(″My data from the Caller credential is:  ″ + CALLERDATA);
 }
}
catch (WSSecurityException e)
{
 // log error
}
catch (Exception e)
{
 // log error
}
```

Requirement: You need the following Java 2 Security permissions to execute this API: `permission javax.security.auth.AuthPermission "wssecurity.getCallerSubject;".`

Example: User revocation from a cache

WebSphere Application Server allows revocation of a user from the security cache using an MBean interface.

Developing your own J2C principal mapping module

WebSphere Application Server provides principal mapping when Java 2 Connector (J2C) connection factory is configured to perform container managed sign-on. For example, the application server can map the caller principal to a resource principal to open a new connection to the backend server. With the container-managed signon, WebSphere Application Server creates a Subject instance that contains enterprise information systems (EIS) security domain credentials. A Subject object returned by a principal mapping module contains a Principal object represents the caller identity and a `PasswordCredential` or a `GenericCredential`. WebSphere Application Server provides a default principal mapping module that maps any authenticated user credentials to password credentials for the EIS security domain. The default mapping module is defined in the Application Login Configuration panel in the `DefaultPrincipalMapping` entry. The user ID and password for the EIS security domain is defined under each connection factory by an `authDataAlias` attribute *container-managed authentication alias* in the administrative console. The `authDataAlias` attribute does not actually contain the user name and password. An `authDataAlias` attribute contains an alias that refers to a user name and password pair that is defined in the security configuration document. Since it contains sensitive data, the security configuration document requires the most privileged **administrator** role for both read and write access. This indirection avoids saving sensitive user name and password in configuration documents other than the security document.

The J2C connection factory configuration contains a mapping module, which defines a principal mapping module alias (`mappingConfigAlias` attribute) and an authentication data alias (`authDataAlias` attribute). At run time, the J2C-managed connection factory code passes a reference of the `ManagedConnectionFactory` and an `authDataAlias` object to the configured principal mapping module through the `WSPrincipalMappingCallbackHandler` object. WebSphere Application Server supports plugging in a custom principal mapping module for a connection factory if the any-authenticated-to-one mapping provided by the default principal mapping module is insufficient. A custom mapping module is a special purpose Java Authentication and Authorization Service (JAAS) Login Module that performs principal or credential mapping in the login method. The `WSSubject.getCallerPrincipal()` method can be used to retrieve the application client identity. Plugging in a custom mapping module is very simple. Change the value of the `mappingConfigAlias` object to the custom mapping module. However, the configuration must be done through the `wsadmin` tool.

5.1 + The following steps are needed to perform this task. You can use the administrative console for these steps. However, you also can use the `wsadmin` tool to configure the J2C Connection Factory.

1. Start the administrative console. To add a custom mapping module for an application server, click **Servers > Application Servers**. Click the particular server on the right navigation panel.

2. Click **Security > JAAS Configuration**.
3. Select **JAAS Configuration** and **Application Logins**. Click **New**.
4. Enter a unique alias for the new mapping module, and click **Apply**.
5. Under Additional Properties, click **JAAS Login Modules** to define the custom mapping module class.
6. Click **New** and enter the **Module Classname** and the **Authentication Strategy**.
7. Click **Apply**. Click **Save** to save the new configuration.
8. Configure the J2C Connection Factory to use the new mapping module
   a. Using the administrative console to configure the J2C Connection Factory.
      1) Click **Resources > Resource Adapters >** *resource_adapter*.
      2) Under Additional Properties, click **CMP Connection Factories**.
      3) Click the name of your connection factory.
      4) Enter the resource name, Java Naming and Directory Interface (JNDI) name, a description of the resource, and a category in which to classify the resource.
      5) Click **OK**.
      6) Click **Save** in the upper-left section of the administrative console to save your configuration changes.
   b. Using the `wsadmin` tool to configure the J2C Connection Factory.
      1) At the wsadmin prompt, type the following command to show a list of `J2CConnectionFactory` objects: `wsadmin>$AdminConfig list J2CConnectionFactory`.
      2) Select the **J2C Connection Factory** and enter the following command to show all the attributes. For example,

         wsadmin>$AdminConfig show PetStore_CF(cells/hillsideNetwork/nodes /hillside/servers/server1:resources.xml#CMPConnectorFactory_4)

         The previous example was split onto two lines because it displayed beyond the width of the page.
      3) Type the following command to examine the current mapping module configuration:

         wsadmin>$AdminConfig show {mapping (cells/hillsideNetwork/nodes /hillside/servers/server1:resources.xml#MappingModule_7)}

         The previous example was split onto two lines because it displayed beyond the width of the page.

         The following shows sample results of the above command: `{authDataAlias {}} {mappingConfigAlias DefaultPrincipalMapping}`. As shown in the previous example, the J2C Connection factory is configured to use the DefaultPrincipalMapping login configuration.
      4) Type the following command to modify the mapping module configuration to use the new mapping module:

         wsadmin>$AdminConfig modify {mapping (cells/hillsideNetwork/nodes /hillside/servers/server1:resources.xml#MappingModule_7)} { {mappingConfigAlias myMappingModule}}

         The previous example was split onto three lines because it displayed beyond the width of the page.

         You can check the result by typing:

wsadmin>$AdminConfig show {mapping (cells/hillsideNetwork/nodes /hillside/servers/server1:resources.xml#MappingModule_7)} {authDataAlias {}} {mappingConfigAlias myMappingModule}

The previous example was split onto three lines because it displayed beyond the width of the page.

5) Type `save` at the `wsadmin` prompt to save your changes.

Note: The authDataAlias is left undefined. In practice, the authDataAlias passes at run time to the custom mapping module. But using the authDataAlias to look up user ID and password requires the WebSphere Configuration application programming interface (API), which is not available at this time.

A mapping module is defined and is configured for the specified J2C Connection factory.

Completing this task allows you to use your own mapping module to fit your application environment. The WebSphere Application Server default principal mapping module maps all authenticated user credentials to the same user id and password credentials of the EIS security domain. The user ID and password are stored in the security configuration document and is looked up using the configured alias as a key. Your mapping module may be programmed to perform more sophisticated mapping and store passwords in other persistent storage or from a remote service.

To develop your own principal and credential mapping LoginModule, refer to the JAAS documentation for general information. The JAAS documents are shipped with WebSphere Application Server are located in `$<install_root>/web/docs/jaas/JaasDocs.zip` file. Refer to the `login.html` in the `JaasDocs.zip` file for details of how to develop JAAS login module.

In particular, a mapping module needs to obtain the security identity of the caller. The `WSSubject.getCallerPrincipal()` static method returns an `com.ibm.websphere.security.auth.WSPrincipal` object, which represents the security identity of an authenticated caller.

Developing custom user registries

WebSphere Application Server security supports the use of custom registries in addition to Local OS and Lightweight Directory Access Protocol (LDAP) registries for authentication and authorization purposes. A custom user registry is a customer implemented user registry which implements the UserRegistry Java interface as provided by WebSphere Application Server. A custom implemented user registry can support virtually any type or notion of an accounts repository from a relational database, flat file, and so on. The custom user registry provides considerable flexibility in adapting WebSphere Application Server security to various environments where some notion of a user registry, other than LDAP or LocalOS, already exist in the operational environment.

Implementing a custom user registry is a software development effort. Use the methods defined in the UserRegistry interface to make calls to the desired registry to obtain user and group information. The interface defines a very general set of methods, for encapsulating a wide variety of registries. You can configure a custom user registry as the active user registry when configuring WebSphere Application Server global security.

Make sure that your implementation of the custom registry does not depend on any WebSphere Application Server components such as data sources, enterprise beans, and so on. Do not have this dependency because security is initialized and enabled prior to most of the other WebSphere Application Server components during startup. If your previous implementation used these components, make a change that will eliminate the dependency. For example, if your previous implementation used data sources to connect to a database, use Java database connectivity (JDBC) to connect to the database.

For backward compatibility, the WebSphere Application Server Version 4 custom registry is also supported. Refer to the "Migrating custom user registries" on page 63 for more information on migrating. If your previous implementation uses data sources to connect to a database, change the implementation to use Java database connectivity (JDBC) connections. However, it is recommended that you use the new interface to implement your custom registry.

1. If not familiar with the custom user registry concept, refer to the article, "Custom user registries" on page 246. This section explains each of the methods in the interface in detail and the changes for these methods from the version 4 release.
2. Implement all the methods in the interface except for the `CreateCredential` method, which is implemented by WebSphere Application Server. "FileRegistrySample.java file for WebSphere Application Server" on page 255 is provided for reference.
3. Build your implementation. You need the *%install_root%*`/lib/sas.jar` and *%install_root%*`/lib/wssec.jar` files in your class path. For example: *%install_root%*`\java\bin\javac -classpath` *%install_root%*`\lib\wssec.jar;`*%install_root%*`\lib\sas.jar yourImplementationFile.java`.
4. Copy the class files generated in the previous step to the product class path. The preferred location is the *%install_root%*`/lib/ext` directory. This should be copied to all the product processes (cell, all NodeAgents) class path.
5. Follow the steps in "Configuring custom user registries" on page 248 to configure your implementation using the administrative console.

This step is required to implement custom user registries in Version 5.

If you enabling security, make sure you complete the remaining steps. Once this is done, make sure you save and synchronize the configuration and restart all the servers. Try accessing some J2EE resources to verify that the custom registry implementation is successful.

Example: Custom user registries

A *custom user registry* is a customer-implemented user registry that implements the `UserRegistry` Java interface as provided by WebSphere Application Server. A custom-implemented user registry can support virtually any type or form of an accounts repository from a relational database, flat file, and so on. The custom user registry provides considerable flexibility in adapting WebSphere Application Server security to various environments where some form of a user registry, other than Lightweight Directory Access Protocol (LDAP) or Local OS, already exist in the operational environment.

Implementing a custom user registry is a software development effort. You must use the methods defined in the UserRegistry interface to make calls to the desired registry for obtaining user and group information. The interface defines a very

general set of methods, so it can encapsulate a wide variety of registries. You can configure a custom user registry as the active user registry when configuring the product global security.

If you are using the WebSphere Application Server Version 4.0 custom registry you can plug in your registry without any changes. However, using the new interface to implement your custom registry is recommended.

To view a sample custom registry, refer to the following files:
- "FileRegistrySample.java file for WebSphere Application Server" on page 255
- "users.props file" on page 273
- "groups.props file" on page 273

UserRegistry interface methods

Implementing this interface enables WebSphere Application Server security to use custom registries. This capability should extend the `java.rmi` file. With a remote registry, you can complete this process remotely.

Implementation of this interface must provide implementations for:
- initialize(java.util.Properties)
- checkPassword(String,String)
- mapCertificate(X509Certificate[])
- getRealm
- getUsers(String,int)
- getUserDisplayName(String)
- getUniqueUserId(String)
- getUserSecurityName(String)
- isValidUser(String)
- getGroups(String,int)
- getGroupDisplayName(String)
- getUniqueGroupId(String)
- getUniqueGroupIds(String)
- getGroupSecurityName(String)
- isValidGroup(String)
- getGroupsForUser(String)
- getUsersForGroup(String,int)
- createCredential(String)

```
public void initialize(java.util.Properties props)
      throws CustomRegistryException,
             RemoteException;
```

This method is called to initialize the UserRegistry method. All the properties defined in the Custom User Registry panel propagate to this method.

For the sample, the initialize method retrieves the names of the registry files containing the user and group information.

This method is called during server bring up to initialize the registry. This method is also called when validation is performed by the administrative console, when security is on. This method remains the same as in version 4.0.

```
public String checkPassword(String userSecurityName, String password)
      throws PasswordCheckFailedException,
             CustomRegistryException,
             RemoteException;
```

The checkPassword method is called to authenticate users when they log in using a name (or user ID) and a password. This method returns a string which, in most cases, is the user being authenticated. Then, a credential is created for the user for authorization purposes. This user name is also returned for the enterprise bean call, getCallerPrincipal(), and the servlet calls, getUserPrincipal() and getRemoteUser(). See the getUserDisplayName method for more information if you have display names in your registry. In some situations, if you return a user other than the one who is logged in, verify that the user is valid in the registry.

For the sample, the mapCertificate method gets the distinguished name (DN) from the certificate chain and makes sure it is a valid user in the registry before returning the user. For the sample, the checkPassword method checks the name and password combination in the registry and (if they match) returns the user being authenticated.

This method is called for various scenarios. It is called by the administrative console to validate the user information once the registry is initialized. It is also called when you access protected resources in the product for authenticating the user and before proceeding with the authorization. This method is the same as in WebSphere Application Server Version 4.

```
public String mapCertificate(X509Certificate[] cert)
      throws CertificateMapNotSupportedException,
             CertificateMapFailedException,
             CustomRegistryException,
             RemoteException;
```

The mapCertificate method is called to obtain a user name from an X.509 certificate chain supplied by the browser. The complete certificate chain is passed to this method and the implementation can validate the chain if needed and get the user information. A credential is created for this user for authorization purposes. If browser certificates are not supported in your configuration, you can throw the exception, CertificateMapNotSupportedException. The consequence of not supporting certificates is authentication failure if the challenge type is certificates, even if valid certificates are in the browser.

This method is called when certificates are provided for authentication. For Web applications, when the authentication constraints are set to CLIENT-CERT in the web.xml file of the application, this method is called to map a certificate to a valid user in the registry. For Java clients, this method is called to map the client certificates in the transport layer, when using the transport layer authentication. Also, when the Identity Assertion Token (when using the CSIv2 authentication protocol) is set to contain certificates, this method is called to map the certificates to a valid user.

In WebSphere Application Server Version 4.0, the input parameter was the X509Certificate certificate. In WebSphere Application Server Version 5, this parameter changes to accept an array of X509Certificate certificates (such as a certificate chain). In version 4, this parameter was called only for Web applications, but in version 5.0 you can call this method for both Web and Java clients.

```
public String getRealm()
      throws CustomRegistryException,
             RemoteException;
```

The getRealm method is called to get the name of the security realm. The name of the realm identifies the security domain for which the registry authenticates users. If this method returns a null value, a default name of `customRealm` is used.

For the sample, the getRealm method returns the string, `customRealm`. One of the calls to this method is when the registry information is validated. This method is the same as in version 4.

```
public Result getUsers(String pattern, int limit)
      throws CustomRegistryException,
             RemoteException;
```

The `getUsers` method returns the list of users from the registry. The names of users depend on the pattern parameter. The number of users are limited by the limit parameter. In a registry that has many users, getting all the users is not practical. So the limit parameter is introduced to limit the number of users retrieved from the registry. A limit of 0 indicates to return all the users that match the pattern and might cause problems for large registries. Use this limit with care.

The custom registry implementations are expected to support at least the wildcard search (*). For example, a pattern of (*) returns all the users and a pattern of (b*) returns the users starting with *b*.

The return parameter is an object of type `com.ibm.websphere.security.Result`. This object contains two attributes, a `java.util.List` and a `java.lang.boolean`. The list contains the users returned and the Boolean flag indicates if there are more users available in the registry for the search pattern. This Boolean flag is used to indicate to the client whether more users are available in the registry.

In the sample, the `getUsers` retrieves the required number of users from the registry and sets them as a list in the result object. To find out if there are more users than requested, the sample gets one more user than requested and if it finds the additional user, it sets the Boolean flag to `true`. For pattern matching, the match method in the `RegExpSample` class is used, which supports wildcard characters such as the asterisk (*) and question mark (?).

This method is called by the administrative console to add users to roles in the various map users to roles panels. The administrative console uses the Boolean set in the result object to indicate that more entries matching the pattern are available in the registry.

In WebSphere Application Server Version 4, this method specifies to take only the pattern parameter. The return is a list. In WebSphere Application Server Version 5, this method is changed to take one additional parameter, the limit. Ideally, your implementation should change to take the limit value and limit the users returned. The return is changed to return a result object, which consists of the list (as in version 4) and a flag indicating if more entries exist. So, when the list returns, use the `Result.setList(List)` to set the List in the result object. If there are more entries than requested in the limit parameter, set the Boolean attribute to `true` in the result object, using `Result.setHasMore()` method. The default for the Boolean attribute in the result object is `false`.

```
public String getUserDisplayName(String userSecurityName)
      throws EntryNotFoundException,
             CustomRegistryException,
             RemoteException;
```

The getUserDisplayName method returns a display name for a user, if one exists. The display name is an optional string that describes the user that you can set in some registries. This is a descriptive name for the user and does not have to be unique in the registry. If you do not need display names in your registry, return null or an empty string for this method.

Note: In WebSphere Application Server Version 4, if display names existed for any user these names were useful for the EJB method call getCallerPrincipal() and the servlet calls getUserPrincipal() and getRemoteUser(). If the display names were not the same as the security name for any user, the display names are returned for the previously mentioned enterprise beans and servlet methods. Returning display names for these methods might become problematic is some situations because the display names might not be unique in the registry. Avoid this problem by changing the default behavior to return the user's security name instead of the user's display name in this version of the product. However, if you want to have the same behavior as in version 4, set the property WAS_UseDisplayName to true in the **Custom Registry Properties** panel in the administrative console. For more information on how to set properties for the custom registry, see the section on *Setting Properties for Custom Registries*.

In the sample, this method returns the display name of the user whose name matches the user name provided. If the display name does not exist this returns an empty string.

This method can be called by the product to present the display names in the administrative console, or using the command line using the wsadmin tool. Use this method only for displaying. This method is the same as in Version 4.0.

```
public String getUniqueUserId(String userSecurityName)
      throws EntryNotFoundException,
             CustomRegistryException,
             RemoteException;
```

This method returns the unique ID of the user given the security name.

In the sample, this method returns the uniqueId of the user whose name matches the supplied name. This method is called when forming a credential for a user and also when creating the authorization table for the application.

```
public String getUserSecurityName(String uniqueUserId)
      throws EntryNotFoundException,
             CustomRegistryException,
             RemoteException;
```

This method returns the security name of a user given the unique ID. In the sample, this method returns the security name of the user whose unique ID matches the supplied ID.

This method is called to make sure a valid user exists for a given uniqueUserId. This method is called to get the security name of the user when the uniqueUserId is obtained from a token. This method is the same as in Version 4.

```
public boolean isValidUser(String userSecurityName)
      throws CustomRegistryException,
             RemoteException;
```

This method indicates whether the given user is a valid user in the registry.

In the Sample, this method returns `true` if the user is found in the registry, otherwise this method returns `false`. This method is primarily called in situations where knowing if the user exists in the directory prevents problems later. For example, in the mapCertificate call, once the name is obtained from the certificate if the user is found to be an invalid user in the registry, you can avoid trying to create the credential for the user. This method is the same as in WebSphere Application Server Version 4.0.

```
public Result getGroups(String pattern, int limit)
     throws CustomRegistryException,
            RemoteException;
```

The `getGroups` method returns the list of groups from the registry. The names of groups depend on the pattern parameter. The number of groups is limited by the limit parameter. In a registry that has many groups, getting all the groups is not practical. So, the limit parameter is introduced to limit the number of groups retrieved from the registry. A limit of 0 implies to return all the groups that match the pattern and can cause problems for large registries. Use this limit with care. The custom registry implementations are expected to support at least the wildcard search (*). For example, a pattern of (*) returns all the users and a pattern of (b*) returns the users starting with *b*.

The return parameter is an object of type `com.ibm.websphere.security.Result`. This object contains two attributes, a `java.util.List` and a `java.lang.boolean`. The list contains the groups returned and the Boolean flag indicates whether there are more groups available in the registry for the pattern searched. This Boolean flag is used to indicate to the client if more groups are available in the registry.

In the sample, the `getUsers` retrieves the required number of groups from the registry and sets them as a list in the result object. To find out if there are more groups than requested, the sample gets one more user than requested and if it finds the additional user, it sets the Boolean flag to `true`. For pattern matching, the match method in the `RegExpSample` class is used. It supports wildcards like *, ?.

This method is called by the administrative console to add groups to roles in the various map groups to roles panels. The administrative console will use the boolean set in the Result object to indicate that more entries matching the pattern are available in the registry.

In WebSphere Application Server Version 4, this method is used to take the pattern parameter only and returns a list. In WebSphere Application Server Version 5, this method is changed to take one additional parameter, the limit. Change to take the limit value and limit the users returned. The return is changed to return a result object, which consists of the list (as in version 4) and a flag indicating whether more entries exist. Use the `Result.setList(List)` to set the list in the result object. If there are more entries than requested in the limit parameter, set the Boolean attribute to `true` in the result object using `Result.setHasMore()`. The default for the Boolean attribute in the result object is `false`.

```
public String getGroupDisplayName(String groupSecurityName)
      throws EntryNotFoundException,
             CustomRegistryException,
             RemoteException;
```

The getGroupDisplayName method returns a display name for a group if one exists. The display name is an optional string describing the group that you can set in some registries. This name is a descriptive name for the group and does not have to be unique in the registry. If you do not need to have display names for groups in your registry, return null or an empty string for this method.

In the sample, this method returns the display name of the group whose name matches the group name provided. If the display name does not exist, this method returns an empty string.

The product can call this method to present the display names in the administrative console or through command line using the wsadmin tool. This method is only used for displaying and is the same as in Version 4.0.

```
public String getUniqueGroupId(String groupSecurityName)
      throws EntryNotFoundException,
             CustomRegistryException,
             RemoteException;
```

This method returns the unique ID of the group given the security name.

In the sample, this method returns the unique ID of the group whose name matches the supplied name. This method is called when creating the authorization table for the application and is the same as in Version 4.0.

```
public List getUniqueGroupIds(String uniqueUserId)
      throws EntryNotFoundException,
             CustomRegistryException,
             RemoteException;
```

This method returns the unique IDs of all the groups to which a user belongs.

In the sample, this method returns the unique ID of all the groups that contain this uniqueUserID. This method is called when creating the credential for the user. As part of creating the credential, all the groupUniqueIds in which the user belongs are collected and put in the credential for authorization purposes when groups are given access to a resource. This method is the same as in version 4.

```
public String getGroupSecurityName(String uniqueGroupId)
      throws EntryNotFoundException,
             CustomRegistryException,
             RemoteException;
```

This method returns the security name of a group given its unique ID.

In the sample, this method returns the security name of the group whose unique ID matches the supplied ID. This method verifies that a valid group exists for a given uniqueGroupId. This method is the same as in version 4.

```
public boolean isValidGroup(String groupSecurityName)
      throws CustomRegistryException,
             RemoteException;
```

This method indicates if the given group is a valid group in the registry.

In the sample, this method returns `true` if the group is found in the registry, otherwise the method returns `false`. This method can be used in situations where knowing whether the group exists in the directory might prevent problems later. This method is the same as in version 4.

```
public List getGroupsForUser(String userSecurityName)
      throws EntryNotFoundException,
             CustomRegistryException,
             RemoteException;
```

This method returns all the groups to which a user belongs whose name matches the supplied name. This method is similar to the `getUniqueGroupIds` method with the exception that the security names are used instead of the unique IDs.

In the sample, this method returns all the group security names that contain the userSecurityName.

This method is called by the administrative console or the scripting tool to verify that the users entered for the `RunAs` roles are already part of that role in the users and groups to role mapping. This check is required to ensure that a user cannot be added to a `RunAs` role unless that user is assigned to the role in the users and groups to role mapping either directly or indirectly (through a group that contains this user). Since a group in which the user belongs can be part of the role in the users and groups to role mapping, this method is called to check if any of the groups that this user belongs to mapped to that role. This method is the same as in Version 4.0.

```
public Result getUsersForGroup(String groupSecurityName, int limit)
      throws NotImplementedException,
             EntryNotFoundException,
             CustomRegistryException,
             RemoteException;
```

This method retrieves users from the specified group. The number of users returned is limited by the limit parameter. A limit of **0** indicates to return all the users in that group. This method is not directly called by the WebSphere Application Server security component. However, this can be called by other components. For example, this method issued by the process choreographer when staff assignments are modeled using groups. In rare situations, if you are working with a registry where getting all the users from any of your groups is not practical (for example, if there are a large number of users), you can throw the `NotImplementedException` exception for the particular groups. In this case, verify that if the process choreographer is installed (or if it is installed later) the staff assignments are not modeled using these particular groups. If there is no concern about returning the users from groups in the registry, it is recommended that you do not throw the `NotImplemented` exception when implementing this method.

The return parameter is an object of type `com.ibm.websphere.security.Result`. This object contains two attributes, `java.util.List` and `java.lang.boolean`. The list contains the users returned and the Boolean flag, which indicates whether there are more users available in the registry for the search pattern. This Boolean flag indicates to the client whether users are available in the registry.

In the example, this method gets one user more than the requested number of users for a group if the limit parameter is not set to **0**. If it succeeds in getting one more user, it sets the Boolean flag to `true`.

In WebSphere Application Server Version 4, this method was mandatory for the product. For WebSphere Application Server Version 5, this method can throw the exception `NotImplementedException` exception in situations where it is not practical to get the requested set of users. However, this exception should be thrown in rare situations, as other components can be affected. In version 4, this method accepted only the pattern parameter and the returned a list. In version 5, this method accepts one additional parameter, the limit. Change your implementation to take the limit value and limit the users returned. The return changes to return a result object, which consists of the list (as in version 4) and a flag indicating whether more entries exist. As in version 4, when the list is returned, use the `Result.setList(List)` method to set the list in the Result object. If there are more entries than requested in the limit parameter, set the Boolean attribute to `true` in the result object using `Result.setHasMore()`. The default for the Boolean attribute in the Result object is `false`.

Attention: The first two lines of the following code sample is one continuous line.

```
public com.ibm.websphere.security.cred.WSCredential
        createCredential(String userSecurityName)
     throws NotImplementedException,
            EntryNotFoundException,
            CustomRegistryException,
            RemoteException;
```

In this release of the WebSphere Application Server, this method is not called. You can return *null*. In the example, a *null* is returned.

Developing a custom interceptor for trust associations

If you are using a third party reverse proxy server other than Tivoli WebSEAL, you must provide an implementation class for the product interceptor interface for your proxy server. This article describes the interface you must implement.

1. Define the interceptor class method. WebSphere Application Server provides the interceptor Java interface, com.ibm.websphere.security.TrustAssociationInterceptor, which defines the following methods:
   - **`public boolean isTargetInterceptor(HttpServletRequest req)`** throws `WebTrustAssociationException;`.

     The `isTargetInterceptor` method determines whether the request originated with the proxy server associated with the interceptor. The implementation code must examine the incoming request object and determine if the proxy server forwarding the request is a valid proxy server for this interceptor. The result of this method determines whether the interceptor processes the request or not.
   - **`public void validateEstablishedTrust (HttpServletRequest req)`** throws `WebTrustAssociationException;`.

     The `validateEstablishedTrust` method determines if the proxy server from which the request originated is trusted or not. This method is called after the `isTargetInterceptor` method. The implementation code must authenticate the proxy server. The authentication mechanism is proxy-server specific. For example, in the product implementation for the WebSEAL server, this method retrieves the basic authentication information from the HTTP header and validates the information against the user registry used by WebSphere Application Server. If the credentials are invalid, the code throws the

WebTrustAssociationException, indicating that the proxy server is not trusted and the request is to be denied.

- **public String getAuthenticatedUsername(HttpServletRequest req)** throws WebTrustAssociationException;.

  The getAuthenticatedUsername method is called after trust is established between the proxy server and WebSphere Application Server. The product has accepted the proxy server authentication of the request and must now authorize the request. To authorize the request, the name of the original requestor must be subjected to an authorization policy to determine if the requestor has the necessary privilege. The implementation code for this method must extract the user name from the HTTP request header and determine if that user is entitled to the requested resource. For example, in the product implementation for the WebSEAL server, the method looks for an iv-user attribute in the HTTP request header and extracts the user ID associated with it for authorization.

2. Configuring the interceptor. To make an interceptor configurable, the interceptor must extend com.ibm.websphere.security.WebSphereBaseTrustAssociationInterceptor. Implement the following methods:

   public int init (java.util.Properties props);

   The init(Properties) method accepts a java.util.Properties object, which contains the set of properties required to initialize the interceptor. All the properties set for an interceptor (by using the **Custom Properties** link for that interceptor or using scripting) is sent to this method. The interceptor then can use these properties to initialize itself. For example, in the productimplementation for the WebSEAL server, this method reads the hosts and ports so that a request coming in can be verified to originate from trusted hosts and ports. A return value of **0** implies that the interceptor initialization is successful. Any other value implies that the initialization is not successful and the interceptor is ignored.

   Applicability of the following list

   If a previous implementation of the trust association interceptor returns a different error status you can either change your implementation to match the expectations or make one of the following changes:

   - Add the com.ibm.websphere.security.trustassociation.initStatus property in the trust association interceptor custom properties. Set the property to the value that indicates that the interceptor is successfully initialized. All of the other possible values imply failure. In case of failure, the corresponding trust association interceptor is not used.
   - Add the com.ibm.websphere.security.trustassociation.ignoreInitStatus property in the trust association interceptor custom properties. Set the value of this property to **true**, which tells WebSphere Application Server to ignore the status of this method. If you add this property to the custom properties, WebSphere Application Server does not check the return status, which is similar to previous versions of WebSphere Application Server.

   public void cleanup ();

   This method is called when the application server is stopped. It is used to prepare the interceptor for termination.

public void setVersion (String s);
This methods is optional. The method is used to set the version and is for informational purpose only. The default value is `Unspecified`.

You must configure the following methods implemented by the custom interceptor implementation. **This listing only shows the methods and does not include any implementation.**

```
*********************************************************************
import java.util.*;
import javax.servlet.http.HttpServletRequest;
import com.ibm.websphere.security.*;

public class myTAIImpl extends WebSphereBaseTrustAssociationInterceptor
      implements TrustAssociationInterceptor
{

      public myTAIImpl ()
      {
      }


      public boolean isTargetInterceptor (HttpServletRequest req)
           throws WebTrustAssociationException
      {

           //return true if this is the target interceptor, else return false.
      }


      public void validateEstablishedTrust (HttpServletRequest req)
           throws WebTrustAssociationFailedException
      {
           //validate if the request is from the trusted proxy server.
           //throw exception if the request is not from the trusted server.

      }

      public String getAuthenticatedUsername (HttpServletRequest req)
           throws WebTrustAssociationUserException
      {
           //Get the user name from the request and if the user is
           //entitled to the requested resource
           //return the user. Otherwise, throw the exception

      }


      public int init (Properties props)
      {
           //initialize the implementation. If successful return 0, else return -1.
      }

      public void cleanup ()
      {
           //Cleanup code.
```

```
        }

}
**********************************************************************
```

Note: If the `init(Properties)` method is implemented as described previously in your custom interceptor, this note does not apply to your implementation, and you can move on to the next step. Previous versions of `com.ibm.websphere.security.WebSphereBaseTrustAssociationInterceptor` include the public int init (String propsfile) method. This method is no longer required since the interceptor properties are not read from a file. The properties are now entered in the administrative console **Custom Properties** link of the interceptor using the administrative console or scripts. These properties then are made available to your implementation in the `init(Properties)` method. However, for backward compatibility, the `init(String)` method still is supported. The `init(String)` method is called by the default implementation of `init(Properties)` as shown in the following example.

```
// Default implementation of init(Properties props) method. A Custom
   // implementation should override this.
   public int init (java.util.Properties props)
   {
      String type =
       props.getProperty("com.ibm.websphere.security.trustassociation.types");
      String classfile=
       props.getProperty("com.ibm.websphere.security.trustassociation."
       +type+".config");
      if (classfile != null && classfile.length() > 0 ) {
         return init(classfile);
      } else {
         return -1;
      }
   }
```

Change your implementation to implement the `init(Properties)` method instead of relying on `init(String propsfile)` method. As shown in the previous example, this default implementation reads the properties to load the property file. The `com.ibm.websphere.security.trustassociation.types` property gets the file containing the properties by concatenating `.config` to its value.

Note: The `init(String)` method still works if you want to use it instead of implementing the init(Properties) method. The only requirement is that the file name containing the custom trust association properties should now be entered using the **Custom Properties** link of the interceptor in the administrative console or by using scripts. You can enter the property using *either* of the following methods. The first method is used for backward compatibility with previous versions of WebSphere Application Server.

You can use the second method with WebSphere Application Server, Version 5.0.2 and later.

Method 1:

The same property names used in the previous release are used to obtain the file name. The file name is obtained by

concatenating the .config to the com.ibm.websphere.security.trustassociation.types property value.

If the file name is called myTAI.properties and is located in the *properties_directory*, set the following properties:

- com.ibm.websphere.security.trustassociation.types = myTAItype
- com.ibm.websphere.security.trustassociation.myTAItype.config = *properties_directory*/myTAI.properties

Method 2:

You can set the com.ibm.websphere.security.trustassociation.initPropsFile property in the trust association custom properties to the location of the file. For example, set the following property:

```
com.ibm.websphere.security.trustassociation.initPropsFile=
properties_directory/myTAI.properties
```

Type the previous code as one continuous line.

The location of the properties file is fully qualified. For example:

properties_directory/myTAI.properties).

Since the location can be different in a Network Deployment environment, use variables such as ${USER_INSTALL_ROOT} to refer to the WebSphere Application Server installation directory.

For example, if the file name is called myTAI.properties, and it is located in the properties directory, then set the following properties:

- com.ibm.websphere.security.trustassociation.types = myTAItype
- com.ibm.websphere.security.trustassociation.myTAItype.config = *properties_directory*/myTAI.properties

3. Compile the implementation once you have implemented it. For example, *install_root*/java/bin/javac -classpath *install_root*/lib/wssec.jar;<install_root>/lib/j2ee.jar myTAIImpl.java
   a. Copy the class file to a location in the class path (preferably the *install_root*/lib/ext directory).
   b. Restart all the servers.
4. Delete the default WebSEAL interceptor in the administrative console and click **New** to add your custom interceptor. Verify that the class name is dot separated and appears in the class path.
5. Click the **Custom Properties** link to add additional properties that are required to initialize the custom interceptor. These properties are passed to the init(Properties) method of your implementation when it extends the com.ibm.websphere.security.WebSphereBaseTrustAssociationInterceptor as described in the previous step.
6. Save and synchronize (if applicable) the configuration.
7. Restart the servers for the custom interceptor to take effect.

Refer to the "Security: Resources for learning" on page 407 article, which references the WebSphere Application Server Version 5 Redbook to view an example of a custom interceptor.

Assembling secured applications

5.1 + The Assembly Toolkit is a graphical user interface for assembling enterprise (J2EE) applications. For additional information on the Assembly Toolkit, see Assembling applications with the Assembly Toolkit.

You can use the tool to assemble an application and secure EJB and Web modules in that application. An EJB module consists of one or more beans. You can enforce security at the EJB method level. A Web module consists of one or more Web resources (an HTML page, a JSP file or a servlet). You can also enforce security for each Web resource. You can use the tool to secure an EJB module (Java archive (JAR) file) or a Web module (Web archive (WAR) file) or an application (enterprise archive (EAR) file).

You can create an application, an EJB module, or a Web Module and secure them using the Assembly Toolkit or development tools like the IBM WebSphere Studio Application Developer.

1. Secure EJB applications using the Assembly Toolkit. For more information, see"Securing enterprise bean applications using the Assembly Toolkit" on page 123.
2. Secure Web applications using the Assembly Toolkit. For more information, see "Securing Web applications using the Assembly Toolkit" on page 125.
3. Add users and groups to roles while assembling secured application using the Assembly Toolkit. For more information, see "Adding users and groups to roles using the Assembly Toolkit" on page 133.
4. Map users to RunAs roles using the Assembly Toolkit. For more information, see "Mapping users to RunAs roles using the Assembly Toolkit" on page 133
5. Add the was.policy file to applications for Java 2 security. For more information, see "Adding the was.policy file to applications" on page 373
6. Assemble the application components that you just secured using the Assembly Toolkit. For more information, see Assembling applications with the Assembly Toolkit.

After securing an application, the resulting `.ear` file contains security information in its deployment descriptor. The EJB module security information is stored in the `ejb-jar.xml` file and the Web module security information is stored in the `web.xml` file. The `application.xml` file of the application EAR file contains all the roles used in the application. The user and group to roles mapping is stored in the `ibm-application-bnd.xmi` file of the application EAR file.

The `was.policy` file of the application EAR contains the permissions granted for the application to access system resources protected by Java 2 security.

This task is required to secure EJB modules and Web modules in an application. This task is also required for applications to run properly when Java 2 security is enabled. If the was.policy file is not created and it does not contain required permissions, the application might not be able to access system resources.

After securing an application, you can install an application using the administrative console. When you install a secured application, see "Deploying secured applications" on page 134 to complete this task.

Enterprise bean component security

An EJB module consists of one or more beans. You can use development tools such as WebSphere Studio Application Developer to develop an EJB module. You can also enforce security at the EJB method level.

You can assign a set of EJB methods to a set of one or more roles. When an EJB method is secured by associating a set of roles, grant at least one role in that set so that you can access that method. To exclude a set of EJB methods from being accessed by anyone mark them **excluded**. You can give everyone access to a set of enterprise beans method by clearing those methods. You can run enterprise beans as a different identity (runAs identity) before invoking other enterprise beans.

Securing enterprise bean applications using the Assembly Toolkit

You can protect enterprise bean methods by assigning security roles to them. Before you assign security roles, you need to know which EJB methods need protecting and how.

1. Open the EJB application file. This file can be an EJB `.jar` file or an application `.ear` file that contains one or more EJB modules. In the Assembly Toolkit, open a deployment descriptor editor on the EJB application file. In a J2EE Hierarchy view, right-click the file and click **Open With** > **Deployment Descriptor Editor**. If you selected an EJB `.jar` file, an EJB deployment descriptor editor opens. If you selected an application `.ear` file, an application deployment descriptor editor opens. To see online information about the editor, press F1 and click the editor name.
2. Create security roles. You can create security roles at the application level or at the EJB module level. If you create a security role at the EJB module level, the role displays in the application level. If a security role is created at the application level, the role does not appear in all the EJB modules. You can copy and paste one or more EJB module security roles that you create at application level:
   - Create a role at an EJB module level. In an EJB deployment descriptor editor, select the **Assembly Descriptor** tab. Under **Security Roles**, click **Add**. In the Add Security Role wizard, name and describe the security role; then click **Finish**.
   - Create a role at the application level. In an application deployment descriptor editor, select the **Security** tab. Under the list of security roles, click **Add**. In the Add Security Role wizard, name and describe the security role; then click **Finish**.
3. Create method permissions. Method permissions map one or more methods to a set of roles. An enterprise bean has four types of methods: Home methods, Remote methods, LocalHome methods and Local methods. You can add permissions to enterprise beans on the method level. You cannot add a method permission to an enterprise bean unless you already have one or more security roles defined. For version 2.0 EJB projects, there is an unchecked option that specifies that the selected methods from the selected beans do not require authorization to execute. To add a method permission to an enterprise bean:
   a. On the **Assembly Descriptor** tab of an EJB deployment descriptor editor, under **Method Permissions**, click **Add**. The Add Method Permission wizard opens.
   b. Select a security role from the list of roles found and click **Next**.

c. Select one or more enterprise beans from the list of beans found. You can click **Select All** or **Deselect All** to select or deselect all of the enterprise beans in the list. Click **Next**.

d. Select the methods that you want to bind to your security role. The Method Elements page lists all methods associated with the enterprise bean(s). You can click **Apply to All** or **Deselect All** to quickly select or clear multiple methods. It selects only the * method for each bean. Creating a method permission for the exact method signature overrides the default (*) method permission setting. The * method represents all methods within the bean. There are * for each interface as well. By not selecting all of the individual methods in the tree, you can set other permissions on the remaining methods.

e. Click **Finish**.

After the method permission is created, you can see the new method permission in the tree. Expand the tree to see the bean and methods defined in the method permission.

4. Exclude user access to methods. Users cannot access excluded methods. Any method in the enterprise beans that is not assigned to a role or is not excluded, is deselected during the application installation by the deployer.

   a. On the **Assembly Descriptor** tab of an EJB deployment descriptor editor, under **Excludes List**, click **Add**. The Exclude List wizard opens.

   b. Select one or more enterprise beans from the list of beans found and click **Next**.

   c. Select one or more of the method elements for the security identity and click **Finish**.

5. Map security-role-ref and role-name to role-link. When developing enterprise beans, you can create the security-role-ref element. The security-role-ref element contains only the role-name field. The role-name field determines if the caller is in a specified `role(isCallerInRole())` and contains the name of the role that is referenced in the code. Since you create security roles during the assembly stage, the developer uses a *logical rolename* in the **role-name** field and provides enough information in the **description** field for the assembler to map the actual role (role-link). The security-role-ref element is located at the EJB level. Enterprise beans can have zero or more security-role-ref elements.

   a. On the **References** tab of an EJB deployment descriptor editor, under the list of references, click **Add**. The Add Reference wizard opens.

   b. Select **Security role reference** and click **Next**.

   c. Name the security role reference, select a security role to link the reference to, describe the security role reference, and click **Finish**.

   d. Map every role-name used during development to the role (role-link) using the previous steps.

6. Specify the RunAs Identity for enterprise beans components. The RunAs Identity of the enterprise bean is used to invoke the next enterprise beans in the chain of EJB invocations. When the next enterprise beans are invoked, the `RunAsIdentity` passes to the next enterprise beans for performing an authorization check on the next enterprise bean. If the RunAs Identity is not specified, the client identity is propagated to the next enterprise bean. The RunAs Identity can represent each of the enterprise beans or can represent each method in the enterprise beans.

   a. On the **Access** tab of an EJB deployment descriptor editor, under **Security Identity (Bean Level)**, click **Add**. The Add Security Identity wizard opens.

b. Select the run as mode, describe the security identity, and click **Next**. Select the **Use identity of caller** mode to instruct the security service to make no changes to the principal's credential settings. Select the **Use identity assigned to specific role (below)** mode to use a principal that has been assigned to the specified security role for running of the bean's methods. This association is part of the application binding in which the role is associated with a user ID and password of a user who is granted that role. If you selected **Use identity assigned to specific role (below)**, you must specify a role name and role description.

c. Select one or more enterprise beans from the list of beans found and click **Next**. If **Next** is unavailable, click **Finish**.

d. Optional: On the Method Elements page, select one or more of the method elements for the security identity and click **Finish**.

7. Close the deployment descriptor editor and, when prompted, click **Yes** to save the changes.

After securing an EJB application, the resulting `.jar` file contains security information in its deployment descriptor. The security information of the EJB modules is stored in the `ejb-jar.xml` file.

After securing an EJB application using an assembly tool, you can install the EJB application using the administrative console. During the installation of a secured EJB application, follow the steps in the Deploying secured applications article to complete the task of securing the EJB application.

Web component security

A Web module consists of servlets, JSP files, server-side utility classes, static Web content (HTML, images, sound files, Cascading Style Sheets (CSS)), and client-side classes (applets). You can use development tools such as IBM WebSphere Studio Application Developer to develop a Web module and enforce security at the method level of each Web resource.

You can identify a Web resource by its URI pattern. A Web resource method can be any HTTP method (GET, POST, DELETE, PUT, for example). You can group a set of URI patterns and a set of HTTP methods together and assign this grouping a set of roles. When a Web resource method is secured by associating a set of roles, grant a user at least one role in that set to access that method. You can exclude anyone from accessing a set of Web resources by assigning an empty set of roles. A servlet or a JSP file can run as different identities (RunAs identity) before invoking another enterprise bean component. All the secured Web resources require the user to log in by using a configured login mechanism. There are three types of Web login authentication mechanisms: basic authentication, form-based authentication and client certificate-based authentication.

For more detailed information on Web security see the product architectural overview article.

Securing Web applications using the Assembly Toolkit

There are three types of Web login authentication mechanisms that you can configure on a Web application: basic authentication, form-based authentication and client certificate-based authentication. Protect Web resources in a Web application by assigning security roles to those resources.

To secure Web applications, determine the Web resources that need protecting and determine how to protect them.

Additional configuration might be needed for these authentication mechanisms (such as SSL or ICSF). The following steps detail securing a Web application using the Assembly Toolkit:

1. Open the Web application file. This file can be a Web archive (WAR) file or an application archive (EAR) file that contains one or more Web modules. In the Assembly Toolkit, open a deployment descriptor editor on the Web application file. In a J2EE Hierarchy view, right-click the file and click **Open With** > **Deployment Descriptor Editor**. If you selected Web archive (WAR) file, a Web deployment descriptor editor opens. If you selected an enterprise application (EAR) file, an application deployment descriptor editor opens. To see online information about the editor, press F1 and click the editor name.
2. Create security roles either at the application level or at Web module level. If a security role is created at the Web module level, the role also displays in the application level. If a security role is created at the application level, the role does not display in all the Web modules. You can copy and paste a security role at the application level to one or more Web module security roles.
   - Create a role at a Web-module level. In a Web deployment descriptor editor, select the **Security** tab. Under **Security Roles**, click **Add**. Double-click **(New Security Role)** and type the security role. Under **Details**, describe the security role.
   - Create a role at the application level. In an application deployment descriptor editor, select the **Security** tab. Under the list of security roles, click **Add**. In the Add Security Role wizard, name and describe the security role; then click **Finish**.
3. Create security constraints. Security constraints are a mapping of one or more Web resources to a set of roles.
   a. On the **Security** tab of a Web deployment descriptor editor, click **Security Constraints**. On the Security Constraints tab that opens, you can do the following:
      - Add or remove security constraints for specific security roles.
      - Add or remove Web resources and their HTTP methods.
      - Define which security roles are authorized to access the Web resources.
      - Specify None, Integral, or Confidential constraints on user data. *None* means that the application requires no transport guarantees. *Integral* means that data cannot be changes in transit between client and server. And *Confidential* means that data content cannot be observed while it is in transit. Integral and Confidential usually require the use of SSL.

   b. Under **Security Constraints**, click **Add**.

   c. Under **Details**, specify a display name for the security constraint.

   d. Under Web Resource Collections, click **Add**. The Web Resource Collections wizard opens.

   e. Type a name and description for the Web resource collection.

   f. Select one or more HTTP methods. The HTTP method options are: GET, PUT, HEAD, TRACE, POST, DELETE, and OPTIONS.

   g. Beside **URL Patterns**, click **Add**. Double-click on **(New URL pattern)** and type a URL pattern (for example: `- /*, *.jsp, /hello`). Consult the Servlet specification Version 2.3 for instructions on mapping URL patterns to servlets. Security run time uses the exact match first to map the incoming

URL with URL patterns. If the exact match is not present, the security run time uses the longest match. The wild card (`*.,*.jsp`) URL pattern matching is used last.

h. Repeat these steps to create multiple security constraints.

4. Map security-role-ref and role-name elements to the role-link element. During the development of a Web application, you can create the security-role-ref element. The security-role-ref element contains only the role-name field at this stage. The role-name field contains the name of the role that is referenced in the servlet or JSP code to determine if the caller is in a specified role (isUserInRole()). Since security roles are created during the assembly stage, the developer uses a logical role name in the **role-name** field and provides enough description in the **description** field for the assembler to map the role actual (role-link). The Security-role-ref element is at the servlet level. A servlet or JSP file can have zero or more security-role-ref elements.

   a. Go to the **References** tab of a Web deployment descriptor editor. On the **References** tab, you can add or remove the name of an enterprise bean reference to the deployment descriptor. There are 5 types of references you can define on this tab:
      - EJB
      - EJB Local (J2EE 1.3 only)
      - Resource
      - Resource Environment (J2EE 1.3 only)
      - JSP Tag Library

   b. Under the list of EJB references, click **Add**. Double-click on **(New EJB Ref)** and type an EJB reference.

   c. Under **Details**, click **Browse** beside **Link** and select a link for the EJB reference. Select a link type of ENTITY or SESSION. Select **Home** and **Remote** values, and describe the link.

   d. Map every role-name used during development to the role (role-link) using the previous steps. Every role name used during development maps to the actual role.

5. Specify the RunAs identity for servlets and JSP files. The RunAs identity of a servlet is used to invoke enterprise beans from within the servlet code. When enterprise beans are invoked, the RunAs identity is passed to the enterprise bean for performing an authorization check on the enterprise beans. If the RunAs identity is not specified, the client identity is propagated to the enterprise beans. The RunAs identity is assigned at the servlet level.

   a. On the **Servlets** tab of a Web deployment descriptor editor, under **Servlets and JSPs**, click **Add**. The Add Servlet or JSP wizard opens.

   b. Select whether to add a servlet or JavaServer page (JSP), define which servlet or JSP to add, and click **OK**.

   c. Under **Run As**, select the security role and describe the role.

   d. Specify a RunAs identity for each servlet and JSP file used by your Web application.

6. Configure the login mechanism for the Web module. This configured login mechanism applies to all the servlets, JavaServer page (JSP) files and HTML resources in the Web module.

   a. On the **Pages** tab of a Web deployment descriptor editor, under **Login**, select the required authentication method. Available method values include: Unspecified, Basic, Digest, Form, and Client-Cert.

   b. Specify a realm name.

c. If you select the Form authentication method, select a login page and an error page URLs (for example: `/login.jsp` and `/error.jsp`). The specified login and error pages are present in the `.war` file.

d. Install the client certificate on the browser (Web Client) and place the client certificate in the server trust keyring file, if `ClientCert` is selected. The public certificate of the clients Certificate Authority must be placed in the servers RACF keyring. If the registry is a local OS registry, use the RACDCERT MAP (or equivalent SAF) command to enable an MVS identity creation using the client's certificate."

7. Close the deployment descriptor editor and, when prompted, click **Yes** to save the changes.

After securing a Web application, the resulting WAR file contains security information in its deployment descriptor. The Web module security information is stored in the `web.xml` file. When you work in the Web deployment descriptor editor, you also can edit other deployment descriptors in the Web project, including information on bindings and IBM extensions in the `ibm-web-bnd.xmi` and `ibm-web-ext.xmi` files.

After using the Assembly Toolkit to secure a Web application, you can install the Web application using the administrative console. During the Web application installation, complete the steps in the "Deploying secured applications" on page 134 article to finish securing the Web application.

Role-based authorization

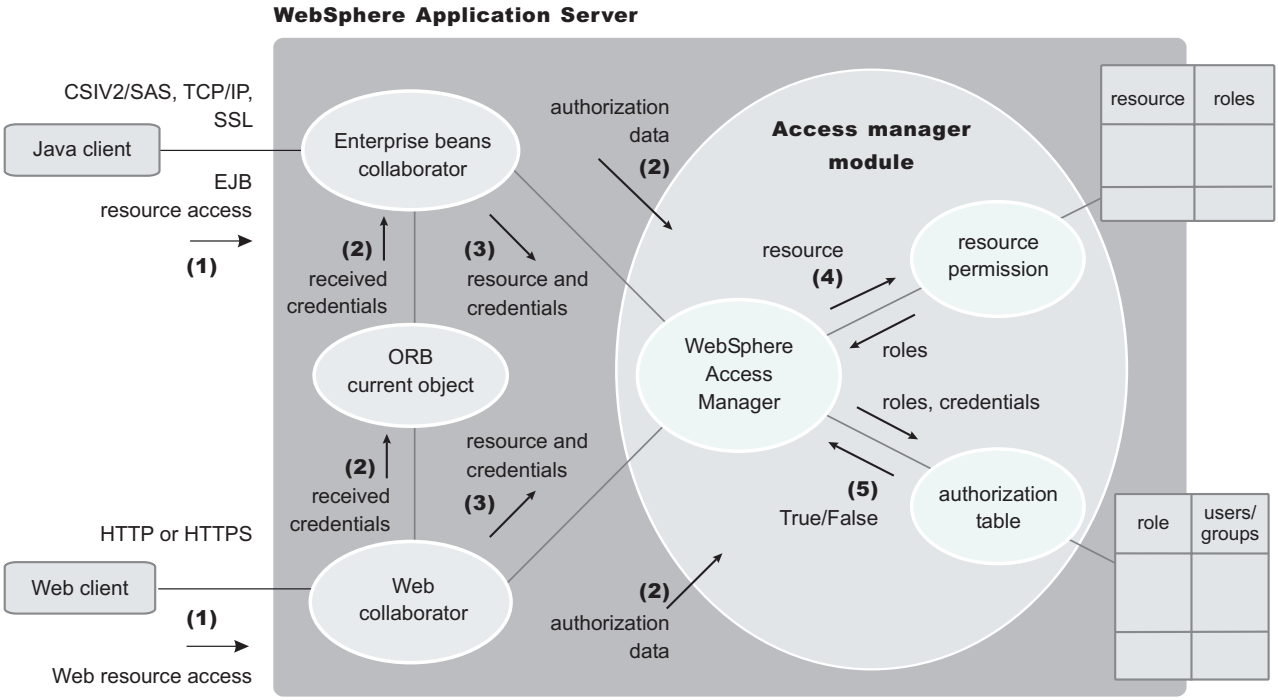
Use authorization information to determine whether a caller has the necessary privileges to request a service.

The following figure illustrates the process during authorization. Web resource access from a Web client is handled by a Web collaborator. The EJB resource access from a Java client (can be enterprise beans or a servlet) is handled by an EJB Collaborator. The resource and the received credentials are presented to WSAccessManager to check whether access is permitted to the client to access the requested resource.

The access manager module contains two main modules:

- Resource permission module helps determine the required roles for a given resource. It uses a resource to roles mapping table that is built by the security run time during application startup. To build the resource-to-role mapping table, the security run time reads the deployment descriptor of the enterprise beans or the Web module (`ejb-jar.xml` or `web.xml`)
- Authorization table module consults a role to user or group table to determine whether a client is granted one of the required roles. The role to user or group mapping table, also known as the *authorization table*, is created by the security run time during application startup. To build the authorization table, the security run time reads the application binding file (`ibm-application-bnd.xmi` file) or accesses the EJBROLE profiles using the Security Access Facility (such as RACF).

Authentication



Use authorization information to determine whether a caller has the necessary privilege to request a service. You can store authorization information many ways. For example, with each resource, you can store an *access-control list*, which contains a list of users and user privileges. Another way to store the information is to associate a list of resources and the corresponding privileges with each user. This list is called a *capability list*.

WebSphere Application Server uses the Java 2 Enterprise Edition (J2EE) authorization model. In this model, authorization information is organized as follows:

- During the assembly of an application, permission to invoke methods is granted to one or more roles. A role is a set of permissions; for example, in a banking application, roles can include teller, supervisor, clerk, and other industry-related positions. The teller role is associated with permissions to run methods related to managing the money in an account, such as the withdraw and deposit methods. The teller role is not granted permission to close accounts; this permission is given to the supervisor role. The application assembler defines a list of method permissions for each role; this list is stored in the deployment descriptor for the application.

There are two *special subjects* that are not defined by J2EE, but are worth understanding: AllAuthenticatedUsers and Everyone. (These special subjects are not available if you choose SAF as your authorization mechanism.) A special subject is a product-defined entity independent of the user registry. It is used to generically represent a class of users or groups in the registry.

- AllAuthenticatedUsers is a special subject that permits all authenticated users to access protected methods. As long as the user can authenticate successfully, the user is permitted access to the protected resource.
- Everyone is a special subject that permits unrestricted access to a protected resource. Users do not have to authenticate to get access because this special subject allows access to protected methods as if the resources are unprotected.

However, there are restrictions depending what environment you are working in. For example, when utilizing SAF, checks are always against the SAF database. If authentication has not been done prior to an access check against a given role, a default SAF identity will be used for the check. Unless a valid default user ID has been configured in the `com_ibm_security_SAF_unauthenticated` property, access will not be granted.

During the deployment of an application, real users or groups of users are assigned to the roles. The system deployer (or administrator) works with the roles, which represent semantic groupings of the methods. When a user is assigned to a role, the user gets all the method permissions that are granted to that role. Users can be assigned to more than one role; the permissions granted to the user are the union of the permissions granted to each role. Additionally, if the authentication mechanism supports the grouping of users, these groups can be assigned to roles. Assigning a group to a role has the same effect as assigning each individual user to the role.

A best practice during deployment is to assign groups, rather than individual users to roles. If you are using bindings rather than SAF EJBRoles for authorization and you need to change the binding value, you must restart the server to pick up new values. If you are using SAF EJBRoles, the application server automatically detects the changes.

At run time, WebSphere Application Server authorizes incoming requests based on the user's identification information and the mapping of the user to roles. If the user belongs to any role that has permission to execute a method, the request is authorized. If the user does not belong to any role that has permission, the request is denied.

The J2EE approach represents a declarative approach to authorization, but it also recognizes that you cannot deal with all situations declaratively. For these situations, methods are provided for determining user and role information programmatically. For Enterprise JavaBeans, the following two methods are supported by WebSphere Application Server:
- **getCallerPrincipal**: This method retrieves the user identification information.
- **isCallerInRole**: This method checks the user identification information against a specific role.

For servlets, the following methods are supported by WebSphere Application Server:
- getRemoteUser
- isUserInRole
- getUserPrincipal

These methods correspond in purpose to the enterprise bean methods.

For more information on the J2EE security authorization model see the following Web site: http://java.sun.com

Admin roles

The J2EE role-based authorization concept has been extended to protect the WebSphere Application Server administrative subsystem. A number of administrative roles have been defined to provide degrees of authority needed to perform certain WebSphere administrative functions from either the Web-based administrative console or the system management scripting interface. The

authorization policy is only enforced when global security is enabled. The following table describes the admin roles:

Admin roles

Role	Description
monitor	Least privileged that basically allows a user to view the WebSphere Application Server configuration and current state.
configurator	Monitor privilege plus the ability to change the WebSphere Application Server configuration.
operator	Monitor privilege plus the ability to change run-time state, such as starting or stopping services for example.
administrator	Operator plus configuration privilege.

The identity specified when enabling global security is automatically mapped to the administrator role. Users, groups, can be added or removed from the admin roles from the WebSphere Application Server administrative console at anytime. However, a server restart is required for the changes to take effect. A best practice is to map a group or groups, rather than specific users, to admin roles because it is more flexible and easier to administer in the long run. By mapping a group to an admin role, adding or removing users to or from the group occurs outside of WebSphere Application Server and does not require a server restart for the change to take effect.

In addition to mapping user or groups, a special-subject can also be mapped to the admin roles. A special-subject is a generalization of a particular class of users. The AllAuthenticated special subject means that the access check of the admin role ensures that the user making the request has at least been authenticated. The Everyone special subject means that anyone, authenticated or not, can perform the action, as if security was not enabled.

Naming roles

The J2EE role-based authorization concept has been extended to protect the WebSphere CosNaming service.

CosNaming security offers increased granularity of security control over CosNaming functions. CosNaming functions are available on CosNaming servers such as the WebSphere Application Server. They affect the content of the WebSphere Name Space. There are generally two ways in which client programs will result in CosNaming calls. The first is through the JNDI interfaces. The second is CORBA clients invoking CosNaming methods directly.

Four security roles are introduced: **CosNamingRead, CosNamingWrite, CosNamingCreate, and CosNamingDelete**. The name of the four roles are the same with WebSphere Advanced Edition Version 4.0.2. However, the roles now have authority level from low to high as follows:

- **CosNamingRead**. Users who have been assigned the CosNamingRead role will be allowed to do queries of the WebSphere Name Space, such as through the JNDI ″lookup″ method. The special-subject Everyone is the default policy for this role.

- **CosNamingWrite**. Users who have been assigned the CosNamingWrite role will be allowed to do write operations such as JNDI ″bind″, ″rebind″, or ″unbind″, plus CosNamingRead operations. The special-subject AllAuthenticated is the default policy for this role.
- **CosNamingCreate**. Users who have been assigned the CosNamingCreate role will be allowed to create new objects in the Name Space through such operations as JNDI ″createSubcontext″, plus CosNamingWrite operations. The special-subject AllAuthenticated is the default policy for this role.
- **CosNamingDelete**. And finally users who have been assigned CosNamingDelete role will be able to destroy objects in the Name Space, for example using the JNDI ″destroySubcontext″ method, as well as CosNamingCreate operations. The special-subject AllAuthenticated is the default policy for this role.

Users, groups, or the special subjects AllAuthenticated and Everyone can be added or removed to or from the naming roles from the WebSphere Application Server administrative console at anytime. However, you must restart the server for the changes to take effect. A best practice is to map groups or one of the special-subjects, rather than specific users, to Naming roles because it is more flexible and easier to administer in the long run. By mapping a group to an naming role, adding or removing users to or from the group occurs outside of WebSphere Application Server and does not require a server restart for the change to take effect.

If a user is assigned a particular naming role and that user is a member of a group that has been assigned a different naming role, the user will be granted the most permissive access between the role he was assigned and the role his group was assigned. For example, assume that user MyUser has been assigned the CosNamingRead role. Also, assume that group MyGroup has been assigned the CosNamingCreate role. If MyUser is a member of MyGroup, MyUser will be assigned the CosNamingCreate role because he is a member of MyGroup. If MyUser were not a member of MyGroup, he would be assigned the CosNamingRead role.

The CosNaming authorization policy is only enforced when global security is enabled. When global security is enabled, attempts to do CosNaming operations without the proper role assignment will result in a org.omg.CORBA.NO_PERMISSION exception from the CosNaming Server.

In WebSphere Application Server Version 4.0.2, each CosNaming function is assigned to only one role. Therefore, users who have been assigned CosNamingCreate role will not be able to query the Name Space unless they have also been assigned CosNamingRead. In most cases a creator would need to be assigned three roles: **CosNamingRead, CosNamingWrite, and CosNamingCreate**. This has been changed in the release. The **CosNamingRead** and **CosNamingWrite** roles assignment for the creator example in above have been included in **CosNamingCreate** role. In most of the cases, WebSphere Application Server administrators do not have to change the roles assignment for every user or group when they move to this release from previous one.

Although the ability exist to greatly restrict access to the Name space by changing the default policy, doing so may result in unexpected org.omg.CORBA.NO_PERMISSION exceptions at run time. Typically, J2EE applications access the Name space and the identity they use is that of the user that authenticated to WebSphere Application Server when they access the J2EE

application. Unless the J2EE application provider clearly communicates the expected Naming roles, care should be taken when changing the default naming authorization policy.

Adding users and groups to roles using the Assembly Toolkit

Before you perform this task, you should have already completed the steps in the Securing Web applications and Securing EJB applications articles where you created new roles and assigned those roles to EJB and Web resources. Complete these steps during application installation. This is because the environment (user registry) under which the application is running is not known until deployment.

If you already know the environment in which the application is running and the user registry that is used, then you can use the Assembly Toolkit to assign users and groups to roles. Using the administrative console to assign users and groups to roles is recommended. (The following information applies to authorization using WebSphere Application Server bindings. If you have created WebSphere Application Server bindings but have specified SAF authorization, the `websphere` bindings will be ignored.) If SAF authorization is to be used, you must create a SAF EJBROLE profile for each J2EE role in your application, and permit users and groups to that role. Refer to EJBROLES and GEJBROLES for reference.

1. In the J2EE Hierarchy view of the Assembly Toolkit, right-click an enterprise application project (EAR file) and click **Open With** > **Deployment Descriptor Editor**. An application deployment descriptor editor opens on the EAR file. To access information about the editor, press F1 and click **Application deployment descriptor editor**.
2. Click the **Security** tab and, under the main pane, click **Add**.
3. In the Add Security Role wizard, name and describe the security role. Then click **Finish**.
4. Under **WebSphere Bindings**, select the user or group extension properties for the security role. Available values include: Everyone, All authenticated users, and Users/Groups.
5. If you selected Users/Groups, click **Add** beside the **Users** or **Groups** panes. In the wizard that opens, specify a user or group name and click **Finish**. Repeat this step until you have added all users and groups to which the security role applies.
6. Close the application deployment descriptor editor and, when prompted, click **Yes** to save the changes.

The `ibm-application-bnd.xmi` file in the application contains the users and groups to roles mapping table (*authorization table*).

After securing an application, install the application using the administrative console.

Mapping users to RunAs roles using the Assembly Toolkit

RunAs roles are used for delegation. A servlet or enterprise bean component uses the RunAs role to invoke another enterprise bean by impersonating that role. You must define RunAs roles when a servlet or an enterprise bean in an application is configured with RunAs settings. Before you perform this task:

- Secure the Web application and enterprise bean applications, including creating and assigning new roles to enterprise bean and Web resources.

- Assign users and groups to roles. Complete this step during the installation of the application. The environment or user registry under which the application is going to run is not known until deployment. If you already know the environment in which the application is going to run and you know the user registry, then you can use the Assembly Toolkit to assign users to RunAs roles.

1. In the J2EE Hierarchy view of the Assembly Toolkit, right-click an enterprise application project (EAR file) and click **Open With** > **Deployment Descriptor Editor**. An application deployment descriptor editor opens on the EAR file. To access information about the editor, press F1 and click **Application deployment descriptor editor**.
2. On the **Security** tab, under **Security Role Run As Bindings**, click **Add**.
3. Click **Add** under **RunAs Bindings**.
4. In the Security Role wizard, select one or more roles and click **Finish**.
5. Repeat steps 3 through 5 for all the RunAs roles in the application.
6. Close the application deployment descriptor editor and, when prompted, click **Yes** to save the changes.

The `ibm-application-bnd.xmi` file in the application contains the user to RunAs role mapping table.

After securing an application, you can install the application using the administrative console. You can change the RunAs role mappings of an installed application.

Deploying secured applications

Before you perform this task, verify that you have already designed, developed and assembled an application with all the relevant security configurations. For more information on these tasks refer to the "Developing secured applications" on page 70 and "Assembling secured applications" on page 122 articles. In this context, deploying and installing an application are considered the same task.

Deploying applications that have security constraints (secured applications) is not much different than deploying applications any security constraints. The only difference is that you might need to assign users and groups to roles for a secured application, which requires that you have the correct active registry. To deploy a newly secured application click **Applications > Install New Application** in the navigation panel on the left and follow the prompts. If you are installing a secured application, roles would have been defined in the application. If delegation was required in the application, RunAs roles also are defined.

One of the steps required to deploy secured applications is to assign users and groups to roles defined in the application. This task is completed as part of the step titled *Map security roles to users and groups*.

This assignment might have already been done through the Assembly Toolkit.

In that case you can confirm the mapping by going through this step. You can add new users and groups and modify existing information during this step.

If the applications support delegation, then a RunAs role is already defined in the application. If the delegation policy is set to **Specified Identity** (during assembly) the intermediary invokes a method using an identity setup during deployment. Use the RunAs role to specify the identity under which the downstream

invocations are made. For example, if the RunAs role is assigned user ″bob″ and the client ″alice″ is invoking a servlet, with delegation set, which in turn calls the enterprise beans, then the method on the enterprise beans is invoked with ″bob″ as the identity. As part of the deployment process one of the steps is to assign or modify users to the RunAs roles. This step is titled ″Map RunAs roles to users″. Use this step to assign new users or modify existing users to RunAs roles when the delegation policy is set to Specified Identity.

These steps are common for both installing an application and modifying an existing application. If the application contains roles, you see the ″Map security roles to users and groups″ link during application installation and also during managing applications, as a link in the Additional Properties section.

1. Click **Applications > Install New Application**. Complete the steps (non-security related) required prior to the step titled **Map security roles to users and groups**.
2. “Assigning users to RunAs roles” on page 140 if RunAs roles exist in the application.
3. Click **Correct use of System Identity** to specify RunAs roles if needed. Complete this action if the application has delegation set to use System Identity (applicable to enterprise beans only). System Identity uses the WebSphere Application Server security server ID to invoke downstream methods and should be used with caution as this ID has more privileges than other identities in terms of accessing WebSphere Application Server internal methods. This task is provided to make sure that the deployer is aware that the methods listed in the panel have System Identity set up for delegation and to correct them if necessary. If no changes are necessary, skip this task.
4. Complete the remaining (non-security related) steps to finish installing and deploying the application.

Once a secured application is deployed, verify that you can access the resources in the application with the correct credentials. For example, if your application has a protected Web module, make sure only the users that you assigned to the roles are able to use the application.

Assigning users and groups to roles

Before you perform this task:

- Secure the Web applications and EJB applications where new roles were created and assigned to Web and EJB resources.
- Create all the roles in your application.
- Verify that you have properly configured the user registry that contains the users that you want to assign. It is preferable to have security turned on with the user registry of your choice before beginning this process.
- Make sure that if you change anything in the security configuration (for example, enable security or change the user registry) you save the configuration and restart the server before the changes become effective.

Since the default active registry is LocalOS, it is not necessary, although it is recommended, that you enable security if you want to use the LocalOS registry to assign users and groups to roles. You can enable security once the users and groups are assigned in this case. The advantage of enabling security with the appropriate registry before proceeding with this task is that you can validate the security setup (which includes checking the user registry configuration) and avoid any problems using the registry.

These steps are common for both installing an application and modifying an existing application. If the application contains roles, you see the Map security roles to users/groups link during application installation and also during application management, as a link in the Additional Properties section at the bottom.

1. Access the administrative console by typing `http://localhost:9090/admin` in a Web browser.
2. Click **Map security roles to users/groups**. A list of all the roles that belong to this application displays. If the roles already had users or special subjects (All Authenticated, Everyone) assigned, they display here.
3. To assign the special subjects, select either the **Everyone** or the **All Authenticated** check box for the appropriate roles.
4. Click **Apply** to save any changes and then continue working with user or group roles.
5. To assign users or groups, select the role. You can select multiple roles at the same time, if the same users or groups are assigned to all the roles.
6. Click **Lookup Users** or **Lookup groups**.
7. Get the appropriate users and groups from the registry by completing the **limit** (number of items) and the **Search String** fields and clicking **Search**. The **limit** field limits the number of users that are obtained and displayed from the registry. The pattern is a searchable pattern matching one or more users and groups. For example, `user*` lists users like user1, user2. A pattern of asterisk (*) indicates all users or groups.

   Use the limit and the search strings cautiously so as not to overwhelm the registry. When using large registries (like Lightweight Directory Access Protocol (LDAP)) where information on thousands of users and groups resides, a search for a large number of users or groups can make the system very slow and can make it fail. When there are more entries than requests for entries, a message displays on top of the panel. You can refine your search until you have the required list.
8. Select the users and groups to include as members of these roles from the **Available** box and click **>>** to add them to the roles.
9. To remove existing users and groups, select them from the **Selected** box and click **<<**. When removing existing users and groups from roles use caution if those same roles are used as RunAs roles.

   For example, if user1 is assigned to RunAs role, role1, and you try to remove user1 from role1, the administrative console validation does not delete the user since a user can only be a part of a RunAs role if the user is already in a role (User1 should be in role1 in this case) either directly or indirectly through a group. For more information on the validation checks that are performed between RunAs role mapping and user and group mapping to roles, see the “Assigning users to RunAs roles” on page 140 section.
10. Click **OK**. If there are any validation problems between the role assignments and the RunAs role assignments the changes are not committed and an error message indicating the problem dispalys at the top of the panel. If there is a problem, make sure that the user in the RunAs role is also a member of the regular role. If the regular role contains a group which contains the user in the RunAs role, make sure that the group is assigned to the role using the administrative console. Follow steps 4 and 5.

    5.1 + Avoid using the Assembly Toolkit or any other manual process where the complete name of the group, host name, group name, or distinguished name (DN) is not used.

The user and group information is added to the binding file in the application. This information is used later for authorization purposes.

This task is required to assign users and groups to roles, which enables the correct users and groups to access a secured application.

If you are installing an application, complete your installation. Once the application is installed and running you can access your resources according to the user and group mapping you did in this task. If you are managing applications and have modified the users and groups to role mapping, make sure you save, stop and restart the application so that the changes become effective. Try accessing the J2EE resources in the application to verify that the changes are effective.

Security role to user and group selections

Use this page to select users and groups for security roles.

To view this administrative console page, click **Application > Install New Application**.

While using the Install New Application Wizard, prompts appear to help you map security roles to users. You also can configure security roles to user mappings of deployed applications. Different roles can have different security authorizations. Mapping users or groups to a role authorizes those users or groups to access applications defined by the role. Users, groups and roles are defined when an application is installed or configured.

You also can select role to user and group mappings while you are deploying applications. After deployment in **Additional Properties**, click **Map Security roles to users** to change user and group mappings to a role.

Look up users:

Specifies whether the server looks up selected users.

Choose the role by selecting the check box beside the role and clicking **Lookup users**. Complete the **Limit** and the **Pattern** fields. The **Limit** field contains the number of entries that the search function returns. The **Pattern** field contains the search pattern used for searching entries. For example, `bob*` searches all users or groups starting with `bob`. A limit of zero returns all the entries that match the pattern. Use this value only when a small number of users or groups match this pattern in the registry. If the registry contains more entries that match the pattern than requested, a message appears in the console to indicate that there are more entries in the registry. You can either increase the limit or refine the search pattern to get all the entries.

Look up groups:

Specifies whether the server looks up selected groups.

Choose the role by selecting the check box beside the role and clicking **Lookup groups**. Complete the **Limit** and the **Pattern** fields. The **Limit** field contains the number of entries that the search function returns. The **Pattern** field contains the search pattern used for searching entries. For example, `bob*` searches all users or groups starting with `bob`. A limit of zero returns all the entries that match the pattern. Use this value only when a small number of users or groups match this pattern in the registry. If the registry contains more entries that match the pattern

than requested, a message appears in the console to indicate that there are more entries in the registry. You can either increase the limit or refine the search pattern to get all the entries.

Role:

Specifies user roles.

A number of administrative roles are defined to provide degrees of authority needed to perform certain WebSphere administrative functions from either the Web-based administrative console or the system management scripting interface. The authorization policy is only enforced when global security is enabled. The following roles are valid:

- **Monitor**--least privileged that basically allows a user to view the server configuration and current state
- **Configurator**--monitor privilege plus the ability to change the server configuration
- **Operator**--monitor privilege plus the ability to change the run time state, such as starting or stopping services
- **Administrator**--operator plus configurator privilege

Range	Monitor, Configurator, Operator, Administrator

Everyone:

Specifies to authenticate everyone.

Range	Monitor, Configurator, Operator, Administrator

All authenticated:

Range	Monitor, Configurator, Operator, Administrator

Mapped users:

Mapped groups:

Delegations

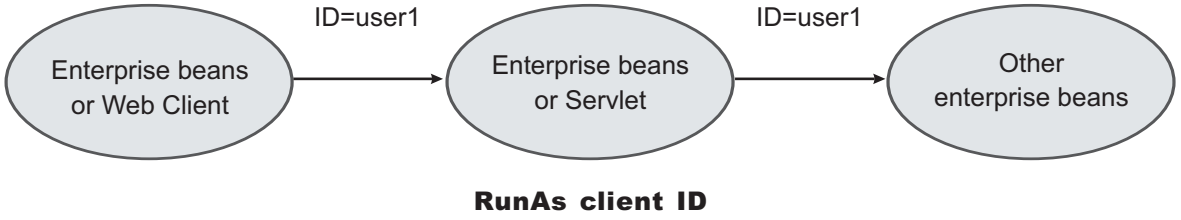
Delegation is a process security identity propagation from a caller to a called object. As per the J2EE specification, a servlet and enterprise beans can propagate either the client (remote user) identity when invoking enterprise beans or they can use another specified identity as indicated in the corresponding deployment descriptor.

The IBM extension supports Enterprise JavaBeans (EJB) to propagate to the server ID when invoking other entity beans. There are three types of delegations:

- Delegate (RunAs) Client Identity
- Delegate (RunAs) Specified Identity
- Delegate (RunAs) System Identity

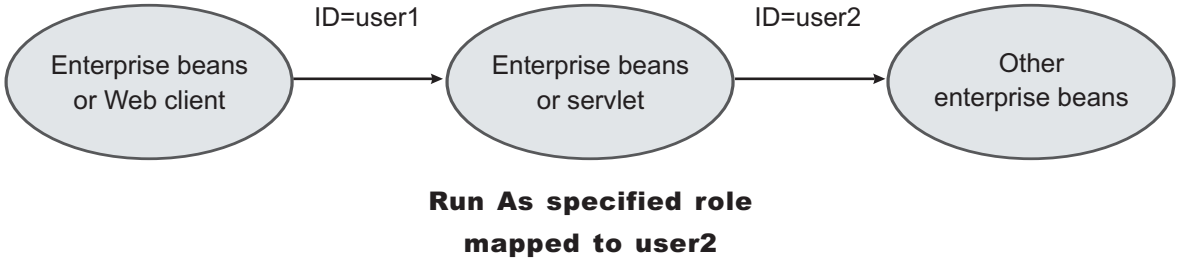
Delegate (RunAs) Client Identity

Delegate Client Identity



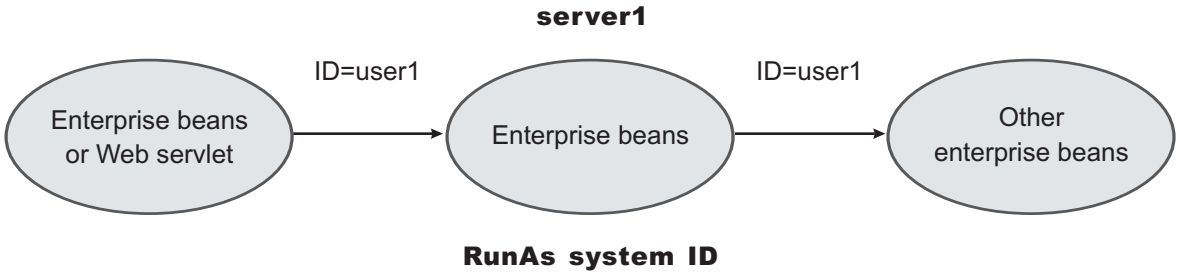
Delegate (RunAs) Specified Identity

Delegate Specified Identity



Delegate (RunAs) System Identity

Delegate System Identity



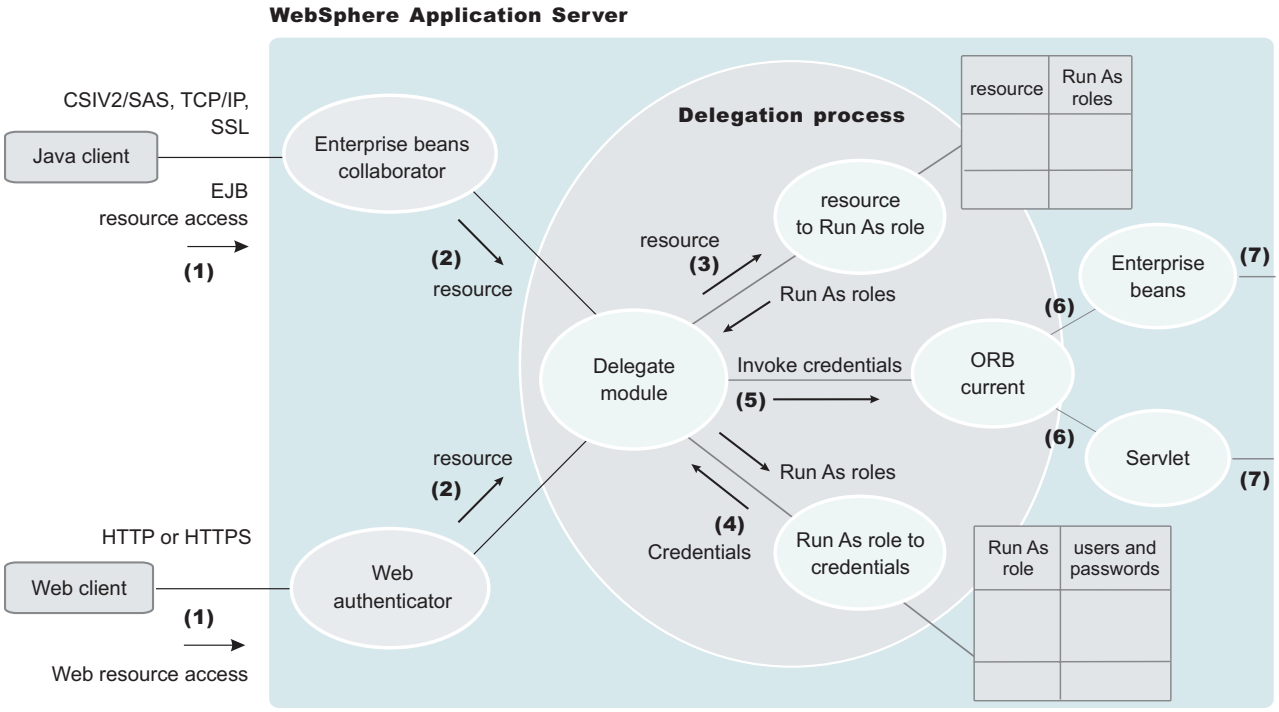
The EJB specification only supports delegation (RunAs) at the EJB level. But an IBM extension allows EJB method level RunAs specification. Method EJB method level runAs specification allows one to specify a different RunAs role for different methods within the same enterprise beans.

The RunAs specification is detailed in the deployment descriptor (the `ejb-jar.xml` file in the EJB module and the `web.xml` file in the Web module). The IBM extension to the RunAs specification is included in the `ibm-ejb-jar-ext.xmi` file.

There is also an IBM specific binding file for each application that contains a mapping from the RunAs role to the user. This file is specified in the `ibm-application-bnd.xmi` file.

These specifications are read by the run time during application startup. The following figure illustrates the delegation mechanism as implemented in the WebSphere Application Server security model.

Delegation



Delegation Process

There are two tables that help in the delegation process:
- Resource to RunAs role mapping table
- RunAs role to user ID and password mapping table

Use the Resource to RunAs role mapping table to get the role that is used by a servlet or by enterprise beans to propagate to the next enterprise beans call.

Use the RunAsRole to User ID and Password mapping table to get the user ID that belongs to the RunAs role and its password.

Delegation is performed after successful authentication and authorization. During this process, the delegation module consults the Resource to RunAs role mapping table to get the RunAs role (3). The delegation module consults the RunAs role to user ID and password mapping table to get the user that belongs to the RunAs role (4). The user ID and password is used to create a new credential using the authentication module, which is not shown in figure.

Assigning users to RunAs roles

Before you perform this task,

- Secure the Web applications and EJB applications where new RunAs roles were created and assigned to Web and EJB resources.
- Create all the RunAs roles in your application. The user in the RunAs role can only be entered if that user or a group to which that user belongs is already part of the regular role.
- Assign users and groups to security roles. Refer to Assigning users and groups to security roles for more information.
- Verify that the user registry requirements are met. These requirements are the same as those discussed in the same as in the case of Assigning users and groups to security roles task. For example, if role1 is a role that is also used as a RunAs role, then the user, user1, can be added to the RunAs role. role1, if user1 or a group that user1 belongs to, already is assigned to role1. The administrative console checks this logic when **Apply** or **OK** is clicked. If the check fails, the change is not made and an error message displays at the top of the panel.

If the special subjects ″Everyone″ or ″All Authenticated″ are assigned to a role, then no check takes place for that role.

The checking is done every time **Apply** in this panel is clicked or when **OK** is clicked in the **Map security roles to users and groups** panel. The check verifies that all the users in all the RunAs roles do exist directly or indirectly (through a group) in those roles in the **Map security roles to users and groups** panel. If a role is assigned both a user and a group to which that user belongs, then either the user or the group (not both) can be deleted from **Map security roles to users and groups** panel.

If the RunAs role user belongs to a group and if that group is assigned to that role, make sure that the assignment of this group to the role is done through administrative console and not through the Assembly Toolkit or any other method. When using the administrative console, the full name of the group is used (for example, hostname\groupName in windows systems, and distinguished names (DN) in Lightweight Directory Access Protocol (LDAP)). During the check, all the groups to which the RunAs role user belongs are obtained from the registry. Since the list of groups obtained from the registry are the full names of the groups, the check works correctly. If the short name of a group is entered using the Assembly Toolkit (for example, `group1` instead of `CN=group1, o=myCompany.com`) then this check fails.

These steps are common to both installing an application and modifying an existing application. If the application contains RunAs roles, you see the **Map RunAs roles to users** link during application installation and also during managing applications as a link in the **Additional Properties** section at the bottom.

1. Click **Map RunAs roles to users**. A list of all the RunAs roles that belong to this application displays. If the roles already had users assigned, they display here.
2. To assign a user, select the role. You can select multiple roles at the same time if the same user is assigned to all the roles.
3. Enter the user's name and password in the designated fields. The user name entered can be either the short name (preferred) or the full name (as seen when getting users and groups from the registry).
4. Click **Apply**. The user is authenticated using the active user registry. If authentication is successful, a check is made to verify that this user or group is mapped to the role in the **Map security roles to users and groups** panel. If authentication fails, verify that the user and password are correct and that the active registry configuration is correct.

5. To remove a user from a RunAs role, select the roles and click **Remove**.

The RunAs role user is added to the binding file in the application. This file is used for delegation purposes when accessing J2EE resources.

This step is required to assign users to RunAs roles so that during delegation the appropriate user is used to invoke the EJB methods.

If you are installing the application, complete installation. Once the application is installed and running you can access your resources according to the RunAS role mapping. Save the configuration.

If you are managing applications and have modified the RunAs roles to users mapping, make sure you save, stop and restart the application so that the changes become effective. Try accessing your J2EE resources to verify that the new changes are in effect.

EJB 1.0 method protection level settings

Use this page to verify that all unprotected EJB 1.0 methods have the correct level of protection before you map users to roles.

To view this administrative console page, click **Applications > Install New Application**. While running the Install New Application Wizard, prompts appear to help you determine that all unprotected EJB 1.0 methods have the correct level of protection.

EJB Module:

Specifies the enterprise bean module name.

Data Type:	String
Units:	EJB module name

Module URI:

Specifies the Java archive (JAR) file name.

Data Type:	String
Units:	JAR file name

Method protection:

Specifies the level of protection assigned to the EJB module.

A selected box means to *Deny All* and that the method is completely protected.

Data Type:	Check box
Default:	Cleared
Range:	Yes or No

RunAs roles to users mapping

Use this page to map RunAs roles to users. You can change the RunAs settings after an application deploys.

To view this administrative console page, click **Applications > Install New Application**. While running the application installation wizard, prompts appear to help you map RunAs roles to users. You can change the RunAs roles to users mappings for deployed applications. Click **Applications >** *application_name* **> Map RunAs roles to users** in the Additional Properties section.

The enterprise beans you are installing contain predefined RunAs roles. RunAs roles are used by enterprise beans that need to run as a particular role for recognition while interacting with another enterprise bean.

User name:

Specifies a user name for the RunAs role user.

This user already maps to the role specified in the Mapping users and groups to roles panel. You can map the user to its appropriate role by either mapping the user to that role directly or mapping a group that contains the user to that role.

Data type: String

Password:

Specifies the password for the RunAs user.

Data type: String

Confirm password:

Specifies the confirmed password of the administrative user.

Data type String

Role:

Specifies administrative user roles.

A number of administrative roles have been defined to provide degrees of authority needed to perform certain WebSphere administrative functions from either the web based administrative console or the system management scripting interface. The authorization policy is only enforced when global security is enabled. The following roles are valid:

- **Monitor**--least privileged that basically allows a user to view the WebSphere configuration and current state
- **Configurator**--monitor privilege plus the ability to change the WebSphere configuration
- **Operator**--monitor privilege plus the ability to change runtime state, such as starting or stopping services for example
- **Administrator**--operator plus configurator privilege

Updating and redeploying secured applications

Before you perform this task, secure Web applications, secure EJB applications, and deploy them in WebSphere Application Server. This section addresses the way to update existing applications.

1. Use the administrative console to modify the existing users and groups mapping to roles. The task titled Assigning users and groups to roles details the required steps.
2. Use the administrative console to modify the users for the RunAs roles. The task entitled, Assigning users to RunAs roles details the required steps.
3. Complete the changes and save them.
4. Stop and restart the application for the changes to become effective.
5. Use the Assembly Toolkit to update any other security related information.
6. Use the Assembly Toolkit to modify roles, method permissions, auth-constraints, data-constraints and so on.
7. Save the Enterprise Archive (EAR) file, uninstall the old application, deploy the modified application and start the application to make the changes effective.

The applications are modified and redeployed.

This step is required to modify existing secured applications.

If information about roles is modified make sure you update the user and group information using the administrative console. Once the secured applications are modified and either restarted or redeployed, make sure that the changes are effective by accessing the resources in the application.

Testing security

After configuring global security and restarting all of your servers in a secure mode, it is best to validate that security is properly enabled. There are basic tests that show that the fundamental security components are working properly. Complete the following steps to validate your security configuration:

1. Test the Web-based form login by bringing up the administrative console: `http://hostname.domain:9090/admin`. A form-based login page appears. If a login page does not appear, try accessing the administrative console by typing `https://myhost.domain:9043/admin`. Type in the server user ID and password used for the LocalOS registry. When the authentication mechanism is set as Lightweight Third Party Authentication (LTPA), represent the host name as a fully qualified host name (that is, `myhost.mycompany.com:9090` rather than just `myhost:9090`).
2. Thoroughly test all of your applications in secure mode.
3. After enabling security, verify that your system comes up in secure mode.
4. If all tests pass, proceed with more rigorous testing of your secured applications. If you have any problems, review the output logs in the WebSphere Application Server `/logs/`*`nodeagent`* or WebSphere Application Server `/logs/`*`server_name`* directories, respectively. Then check the security troubleshooting article to see if it references any common problems.

The results of these tests, if successful, indicate that security is fully enabled and working properly.

Managing security

Administering secure applications requires access to the WebSphere Application Server administrative console. Otherwise, log in with a valid user ID and password that have administrative access. To administer security, complete these steps:

1. Configure global security. For more information, see “Configuring global security.”
2. Assign users to administrative roles. For more information, see “Assigning users to administrator roles” on page 176.
3. Assign users to naming roles. For more information, see “Assigning users to naming roles” on page 181.
4. Configure authentication mechanisms. For more information, see “Configuring authentication mechanisms” on page 184.
5. Configure Lightweight Third Party Authentication. For more information, see “Configuring Lightweight Third Party Authentication” on page 186.
6. Configure trust association interceptors. For more information, see “Configuring trust association interceptors” on page 194.
7. Configure single signon. For more information, see “Configuring single signon” on page 198.
8. Configure user registries. For more information, see “Configuring user registries” on page 227.
   a. Configure local operating system user registries. For more information, see “Configuring local operating system user registries” on page 231.
   b. Configure Lightweight Directory Access Protocol user registries. For more information, see tsec_ldap.ditaae-base ae-qos zos wbifz ee-prog.
   c. Configure custom user registries. For more information, see “Configuring custom user registries” on page 248.
9. Configure Java Authentication and Authorization Service login. For more information, see “Configuring application logins for Java Authentication and Authorization Service” on page 277.
10. Configure the Common Secure Interoperability Version 2 and Security Authentication Service authentication protocols. For more information, see “Configuring Common Secure Interoperability Version 2 and Security Authentication Service authentication protocols” on page 295.
11. Configure Secure Sockets Layer. For more information, see “Configuring Secure Sockets Layer” on page 321.
12. Configure Java 2 Security Manager. For more information, see “Configuring Java 2 security” on page 353.
13. Optional: Configure security attribute propagation. For more information, see Security attribute propagation.

Configuring global security

It is helpful to understand security from an infrastructure standpoint so that you know the advantages of different authentication mechanisms, user registries, authentication protocols, and so on. Picking the right security components to meet your needs is a part of configuring global security. The following sections help you make these decisions. Read the following articles before continuing with the security configuration.

- “Global security and server security” on page 167
- Chapter 1, “Welcome to Security,” on page 1

After you understand the security components, you can proceed to configure global security in WebSphere Application Server.

Attention: There are some security customization tasks required to enable security on WebSphere Application Server for z/OS that require updates to the security server (such as Resource Access Control Facility (RACF)) running on your system. You might need to include your security administrator in this process. Refer to "Security customization dialog settings" on page 42 for details on customization procedures.

1. Start the WebSphere Application Server administrative console by typing `http://yourhost.domain:9090/admin` after the WebSphere Application Server deployment manager has been started. If security is currently disabled, log in with any user ID. If security is currently enabled, log in with a predefined administrative user ID and password.
2. Click **Security** on the navigation menu. Configure the authentication mechanism, user registry, and so on. The configuration order is not important. However, select the **Enabled** flag in the Global Security panel after you have completed all of these tasks. When you first click **Apply** or **OK** and the **Enabled** flag is set, a verification occurs to see if the administrative user ID and password can be authenticated to the configured user registry. If the user registry is not configured, the validation fails.
3. Configure a user registry. For more information, see "Configuring user registries" on page 227. Configure a LocalOS, LDAP, or custom user registry and then specify the details about that registry. One of these details common to all user registries is the user ID used for the server. This ID is a member of the chosen user registry, but also has special privileges in WebSphere Application Server. The privileges for this ID and the privileges associated with the administrative role ID are the same. The user ID used for the server can access all protected administrative methods. When you use the LocalOS user registry on WebSphere Application Server for z/OS, the user ID for the server is not set using the administrative console, but is set through the started profile in z/OS.
4. Configure the authentication mechanism. You can choose either Lightweight Third Party Authentication (LTPA), Integrated Cryptographic Services Facility (ICSF), or Simple WebSphere Authentication Mechanism (SWAM). To get details about configuring LTPA, refer to "Configuring Lightweight Third Party Authentication" on page 186. To get details about configuring ICSF, refer to "Integrated Cryptographic Services Facility settings" on page 203. LTPA and ICSF credentials are forwardable to other machines and, for security reasons, these credentials do expire. This expiration time is configurable.

   Refer to "Configuring single signon" on page 198 if you want single signon (SSO) support, which provides the ability for browsers to visit different product servers without having to authenticate multiple times. For form-based login, you must configure SSO when using LTPA or ICSF.
5. Configure the authentication protocol for special security requirements for Remote Method Invocation over the Internet Inter-ORB Protocol (RMI/IIOP) method invocations from Java clients or from server to server.

   Choose either the Common Secure Interoperability Version 2 (CSIv2) or Security Authentication Service (zSAS) protocol.

   The CSIv2 protocol is new to WebSphere Application Server Version 5 and has new features.

   The z/SAS protocol still provides backward compatibility to previous product releases.

   For details on configuring CSIv2 or z/SAS protocols, refer to the "Configuring Common Secure Interoperability Version 2 and Security Authentication Service authentication protocols" on page 295 article.

6. Verify the SSL repertoires to be used by WebSphere Application Server. The sample customization jobs generated by the WebSphere Application Server for z/OS customization dialogs create jobs that create SSL key rings that are usable if RACF is your security server. These jobs create a unique RACF certificate authority certificate for your installation with a set of server certificates signed by this certificate authority. The Application Server controller user ID has a SAF key ring that includes these certificates. (Similarly in a Network Deployment environment, RACF key rings owned by the deployment manager user ID and the node agent user IDs are created.)

   Note: A RACF key ring is uniquely identified by both the key ring name in the repertoire and the MVS user ID of the server controller process. If different WebSphere Application Server controller processes have unique MVS user IDs, you must be sure that a RACF key ring and a private key are generated even if they share the same repertoire.

   There are two kinds of configurable SSL repertoires:
   - The System SSL repertoire is used for HTTPS and IIOP communication. If you want to use the administrative console after security is enabled you must define a System SSL type repertoire for HTTP and select it. You must define a System SSL repertoire and select if IIOP security requires or supports SSL transport, or if a secure RMI connector is selected for administrative requests.
   - The Java Secure Socket Extension (JSSE) repertoire is used for administrative requests if the SOAP and HTTP connector is specified (or default) and a JSSE repertoire is also required if LDAP is the selected user registry and it uses SSL for communications.

   Users must configure a System SSL repertoire to use HTTP or IIOP protocols and a JMX connector must be configured to use SSL. If the SOAP HTTP connector (default) is chosen, a JSSE repertoire must be selected for the administrative subsystem. In a Network Deployment environment, click **System Administration > Deployment Manager > Administration Services > JMX Connectors > SOAP Connector > Custom Properties > sslConfig**.

   A set of SSL repertoires are set up by the z/OS installation dialogs. These dialogs are configured to refer to SAF key rings and to files that are populated by the customization process when generating RACF commands.

Repertoire name	Type	Default use
DefaultSSLSettings	JSSE	SOAP JMX connector, SOAP client
DefaultHTTPS	SSSL	Web container HTTP transport
DefaultIIOPSSL	SSSL	z/SAS and CSIV2
RACFJSSESettings	SSSL	None
RACFJSSESettings	JSSE	None

   No additional action is required if these settings are sufficient for your needs. If your want to create or modify these settings, you must ensure that the keystores to which they refer are created.

   For System SSL repertoires, the same key ring must be used in every System SSL repertoire used by the server.

   If you do create a new alias for your new keystore and truststore files, change every location that references the SSL configuration alias DefaultSSLConfig. The following list provides these locations:

- **Security** > **Authentication Protocol** > **CSIv2 Inbound Transport**
- **Security** > **Authentication Protocol** > **CSIv2 Outbound Transport**
- **Security** > **Authentication Protocol** > **zSAS Transport**
- **Servers** > **Application Servers** > *app_server_name* > **Web Container** > **HTTP transports** > *host_link*
- **Servers** > **Application Servers** > *app_server_name* > **Server Level Security** > **CSIv2 Inbound Transport**
- **Servers** > **Application Servers** > *app_server_name* > **Server Security** > **CSIv2 OutboundTransport**
- **Servers** > **Application Servers** > *app_server_name* > **Server Security** > **zSAS Inbound Transport**> **ssl settings**
- **Servers** > **Application Servers** > *app_server_name* > **Server Security** > **zSAS Outbound Transport** > **ssl settings**

7. Click **Security > Global Security** to configure the rest of the security settings and to enable security.

   This panel performs a final validation of the security configuration. When you click **OK** or **Apply** from this panel, the security validation routine is performed and any problems are reported at the top of the page. When you complete all of the fields, click **OK** or **Apply** to accept the selected settings. Click **Save** (at the top of the panel) to persist these settings out to a file. If you see any informational messages in red text color, then a problem exists with the security validation. Typically, the message indicates the problem. So, review your configuration to verify that the user registry settings are accurate and that the correct registry is selected. In some cases, the LTPA configuration might not be fully specified. See the "Global security and server security" on page 167 article for detailed information.

   Enabled
   This flag enables or disables global security. See the "Global security and server security" on page 167 article to learn more about global security. When enabled, security for the entire product domain is enabled. You can change some security attributes at a server-specific level.

   Enforce Java 2 Security
   This flag enables or disables Java 2 security access control. See "Configuring Java 2 security" on page 353 for details on Java 2 security in WebSphere Application Server, Version 5.

   Use Domain Qualified User IDs
   This flag determines if user IDs returned by the J2EE APIs such as getUserPrincipal() and getCallerPrincipal() are qualified within the security domain in which they reside.

   Cache Timeout
   The flag is the timeout value of the WebSphere Application Server authentication and validation cache. This value is used to determine when to flush a credential from the cache. Any time that the credential is reused, the cache timeout for that credential is reset to this value. Currently, no way is available to flush the cache or purge specific users from the cache.

   Issue Permission Warning
   When you enable this flag, a warning is issued during application installation if an application requires a Java 2 security permission that normally is not granted to an application. WebSphere Application Server provides support for policy file management. A number of policy files exist in WebSphere Application Server; some of the policy files are static and some of them are dynamic. *Dynamic policy* is a template of permissions for a particular type of resource. No code base

is defined and no related code base is used in the dynamic policy template. The real code base is dynamically created from the configuration and run-time data. The `filter.policy` file contains a list of permissions that an application should not have according to the J2EE 1.3 specification. For more information on permissions, see the "Java 2 security policy files" on page 357 (Dynamic Policy) article.

Active Protocol
This flag selects the active authentication protocol for the object request broker (ORB). RMI/IIOP requests use this protocol to gather security information in a format that both client and server understands. In step 5 , you already might have configured one or both of these authentication protocols. Select **BOTH**, if you need to communicate with WebSphere Application Server Version 5 and previous versions. Select **CSI**, if you only need to communicate with WebSphere Application Server Version 5 servers.

Active Authentication Mechanism
WebSphere Application Server for z/OS, Version 5 supports the following authentication mechanisms: Simple WebSphere Authentication Mechanism (SWAM), Lightweight Third Party Authentication (LTPA), and Integrated Cryptographic Services Facility (ICSF).

Active User Registry
This flag indicates the user registry you that chose in step 3. The "Configuring user registries" on page 227 article provides the necessary steps to configure the user registry.

8. Store the configuration for the deployment manager to use after the WebSphere Application Server is restarted, if you have selected **OK** or **Apply** on the **Security** > **Global Security** panel, and no validation problems occurred.

   "Enabling and disabling global security" differs from a stand-alone base application server. In the Network Deployment environment, the configuration is stored temporarily in the deployment manager until it is synchronized with all of the node agents. To save the configuration, click **Save** in the menu bar at the top of the panel.

   Verify that all of the node agents are up and running in the domain. It is recommended that you stop all application servers during this process. If any of the node agents are down, run a manual file synchronization utility from the node agent machine to synchronize the security configuration from the deployment manager. Otherwise, the malfunctioning node agent does not communicate with the deployment manager after security is enabled on the deployment manager.

   Important: If security is enabled on a WebSphere Application Server 5.x environment and the deployment manager is upgraded to the next cumulative level (but the base node is not), synchronization fails because the default SSL Keys in ND and Base do not match. You should create your own trust stores and key stores for production systems (default ones are suggested only for testing purposes).

   a. Copy `..\DeploymentManager\etc\Dummy*File.jks` (there are four of them) to `..\AppServer\etc`. Make sure you save the original ones before the copy.
   b. Recycle the Network Deployment (ND) server and perform the sync operation again.

Enabling and disabling global security

You can decide whether to enable IBM WebSphere Application Server security. You must enable security for all other security settings to function.

1. Enable global security in the WebSphere Application Server. For more information, see "Configuring global security" on page 145. It is important to click **Security > Global Security** and set the **Enabled** flag to `on` and to save the configuration has been saved to the repository. Verify that the validation that occurs after you click **OK** in the **Security > Global Security** panel is successful before continuing. If the validation is not successful and you continue with these steps, you risk the server not starting. Reconfigure the security settings until validation is successful.
2. Push a copy of the new configuration to all of the running node agents using the administrative console. If a node agent fails to get the security-enabled configuration, communication with the deployment manager fails due to a lack of access (the node agent will not be security enabled). To force synchronize a specific node, complete the following steps from the administrative console:
   a. Go to **System Administration > Nodes** and select the option next to all the nodes (you do not need to select the deployment manager node).
   b. Click **Full Resynchronize** to verify that the file synchronization has occurred. The message might indicate that the nodes already are synchronized. This message is OK. When synchronization is initiated, verify that the Synchronized status displays for all nodes.
3. Stop the deployment manager. Manually restart the deployment manager from the command line or service. To stop the deployment manager, complete the following step:
   a. Go to **System Administration > Deployment Manager** and click **Stop**. This action logs you out of the administrative console and stops the deployment manager process.
4. Restart the deployment Mmanager process. To restart the deployment manager process, locate the *install_root*`/bin` directory and type the following code:

   ```
   START dmgr_proc_name,JOBNAME=server_short_name,
         ENV=cell_short_name.node_short_name.server_short_name
   ```

   Note: You must enter the previous command on a single line. It is split here for display purposes.

   After the deployment manager initialization is complete, go back into the administrative console to complete this task. Remember that security now is enabled in only the deployment manager. If you enabled single signon (SSO), specify the fully qualified domain name of your Web address, for example, `http://myhost.domain:9090/admin`. When you are prompted for a user ID and password, type the one that you entered as the administrator ID in the configured user registry.
5. If the deployment manager does not start after enabling security, disable security using a script and restart. Disable security by issuing the following command from the `DeploymentManager/bin` directory: `wsadmin -c`.
6. Restart all node agents to make them security enabled. You must have restarted the deployment manager in a previous step before completing this step. If the node agent is security-enabled before the deployment manager is security-enabled, then the deployment manager cannot query the node agent for status or give the node agent commands. To stop all node agents, complete the following steps:

a. Go to **System Administration > Node Agents** and select the option beside all node agents. Click **Restart**. A message similar to the following example is displayed at the top of the panel: `The node agent on node NODE NAME was restarted successfully`.

b. Alternatively, if you previously did not stop your application servers, restart all of the servers within any given node by clicking **System Administration > Node Agents** and by clicking the node agents where you want to restart all the servers. Then, click **Restart all Servers on Node**. This action restarts the node agent and any started application servers.

7. If any node agent fails to restart, perform a manual resynchronization of the configuration. This step consists of going to the physical node and running the client `syncNode` command. This client logs into the deployment manager and copies all of the configuration files to the node agent. This action ensures that the configuration is security-enabled. To resynchronize, complete the following steps:
8. Restart all of the application servers on each node agent. If you have not already stopped your application servers before performing these steps, restart them now. To restart application servers on a node agent (they must already be started), go to **System Administration > Node Agents**. Click a node agent and select **Restart all Servers on Node**. If all servers are already stopped, start the servers by going to **Servers > Application Servers** and selecting the servers that you want to start. Click **Start**.
9. If you click **System Management > Nodes** and the status of the node is `Unknown`, go to that node and physically stop and restart the node agent. To stop the node agent, issue the following command:

   ```
   STOP nodeagent_proc_name,JOBNAME=server_short_name,
          ENV=cell_short_name.node_short_name.server_short_name
   ```

   To start the node agent, issue the following command:

   ```
   START nodeagent_proc_name,JOBNAME=server_short_name,
          ENV=cell_short_name.node_short_name.server_short_name
   ```

10. If you have any problems restarting the node agents or application servers, review the output logs in the `WAS/logs/nodeagent` or `WAS /logs/server_name` directory, respectively. Then, check the security troubleshooting section to see if any common problems are referenced.

Disabling global security:

1. Click **Security > Global Security** and set the **Enabled** flag to `off` so that security gets disabled upon a server restart.
2. Before restarting the server, log off of the administrative console. You can log out by clicking **Log off** at the top menu bar.
3. Stop the server by going to the command line, accessing the WebSphere Application Server `/bin` directory, and issuing the following command on one continuous line:

   ```
   STOP appserver_proc_name,JOBNAME=server_short_name,
          ENV=cell_short_name.node_short_name.server_short_name
   ```

4. Issue the following command to restart the server in secure mode:

   ```
   START appserver_proc_name,JOBNAME=server_short_name,
          ENV=cell_short_name.node_short_name.server_short_name
   ```

5. If you have any problems restarting the server, review the output logs in the *install_root*`/logs/server_name` directory.
6. Set the Enabled global security flag to `off` (click **Security** > **Global Security**) and verify that the configuration is saved to the repository.

7. Issue a **force file sync** command from the administrative console to push a copy of the new configuration to all of the running node agents. Failure for a node agent to receive the security-enabled configuration causes the node agent to fail to communicate with the deployment manager because of a lack of access (security is not enabled). To force a file synchronization on any specific node, issue the following command from the administrative console:
   a. Go to **System Administration > Nodes** and select the option beside all of the nodes. You do not need to select the deployment manager node. Click **Full Resynchronize** to ensure that the file synchronization has occurred. The status might indicate that the nodes already are synchronized. After a synchronization is initiated, continue refreshing the view until the status displays as Synchronized for all nodes.
8. Stop all processes including the deployment manager, node agents, and application servers.
   a. Stop the application servers by clicking **Servers > Application Servers** and selecting the option next to each application server process. Click **Stop**.
   b. Stop the node agents by clicking **System Administration > Node Agents** and selecting the option next to each node agent process. Click **Stop**.
   c. Stop the deployment manager by clicking **System Administration > Deployment Manager** and clicking **Stop**.
9. When all of the processes are stopped, manually restart the deployment manager and all node agents from the command line or service.
   a. Restart the deployment manager process. You start this process again by going to the deployment manager installation `/bin` directory and issuing the following command:

      ```
      START dmgr_proc_name,JOBNAME=server_short_name,
            ENV=cell_short_name.node_short_name.server_short_name
      ```

   b. Restart all of the node agent processes by going to the node agent installation `/bin` directory and by issuing the following command:

      ```
      START nodeagent_proc_name,JOBNAME=server_short_name,
            ENV=cell_short_name.node_short_name.server_short_name
      ```

10. If any node agent fails to restart, manually resynchronize the configuration by going to the physical node and by running the client **nodeSync** command. This client logs into the deployment manager and copies all of the configuration files to the node agent. This action ensures that the configuration is security enabled. To perform the manual resynchronization, complete the following steps:
    a. If the node agent is started, but is not communicating with the deployment manager, stop the node agent by issuing a **STOP *appserver_proc_name*** command. If security is enabled on this node agent, issue the following command:

       ```
       STOP nodeagent_proc_name,JOBNAME=server_short_name,
            ENV=cell_short_name.node_short_name.server_short_name
       ```

    b. Issue the command: `syncNode CELL_HOST 8879 -username administrative_user_name -password administrative_password`. `CELL_HOST` is the host name where the deployment manager resides. The **8879** port is the default Simple Object Access Protocol (SOAP) connector port. If that port number is changed, specify the changed port.
    c. Restart the node agent by issuing the following command:

       ```
       START nodeagent_proc_name,JOBNAME=server_short_name,
            ENV=cell_short_name.node_short_name.server_short_name
       ```

11. Restart all of the application servers on each node agent. Start the servers by accessing the Administrative Console and clicking **Servers > Application Servers**. Select the servers that you want to start and click **Start**.
12. If you click **System Management > Nodes** and the status of the node is Unknown, go to that node, manually stop the node agent, perform a configuration synchronization, and restart the node agent. To stop the node agent, issue the `stopNode -username` *`administrative_user_name`* `-password` *`administrative_password`* command. Perform a configuration synchronization, by issuing the `syncNode CELL_HOST 8879 -username` *`administrative_user_name`* `-password` *`administrative_password`*. The `CELL_HOST` is the host name where the deployment manager resides. Port **8879** is the default SOAP connector port. If the post number is changed, specify the changed port. The *administrative_user_name* is the administrative user configured for the user registry. To start the node agent, issue the **startNode** command.
13. If you have any problems restarting the node agents or the application servers, review the output logs in the product `/logs/nodeagent` or the product `/logs/server_name` directory, respectively. Check the "Troubleshooting security configurations" on page 389 article to see common problems that are referenced.

This scenario is specifically for a Network Deployment setup where multiple nodes and or application servers are installed. You must install a deployment manager to manage all of the nodes. Lightweight Third Party Authentication (LTPA) is the configured authentication mechanism because distributed security tokens are required.

After restarting all of the node agents and application servers in secure mode, complete the following steps to verify that most facets of security are functioning.
1. Test the Java client by running *`install_root`*`\bin\dumpNameSpace.sh`. A login panel is displayed. Type in any valid user ID and password from your configured user registry. If the login panel does not appear, a problem exists.
2. Test form login. Bring up the administrative console by typing `http://hostname.domain:9090/admin`. A form-based login page is displayed. Type in the administrative user ID and password that you used for configuring your user registry. If the login panel does not appear, a problem exists.

   LDAP users: When the authentication mechanism is set as LTPA, provide a fully qualified host name (for example, `myhost.mycompany.com:9090`, rather than `myhost:9090`).

Global security settings:

Use this page to configure security. When you enable security, you are enabling security settings on a global level.

To view this administrative console page, click **Security** > **Global Security**.

If you are configuring security for the first time, complete the steps in "Configuring server security" on page 168 to avoid problems. When security is configured, validate any changes to the registry or authentication mechanism panels. Click **Apply** to validate the user registry settings. An attempt is made to authenticate the server ID to the configured user registry. Validating the user registry settings after enabling global security can avoid problems when you restart the server for the first time.

Enabled:

Specifies for the server to enable security subsystems.

This flag is commonly referred to as the *global security flag* in WebSphere Application Server information. When enabling security, set the authentication mechanism configuration and specify a valid user ID and password in the selected user registry configuration.

If you have problems such as the server not starting after enabling security within the security domain, then you should resynchronize all of the files from the cell to this node. To resynchronize files, run the following command from the node: `syncNode -username your_userid -password your_password`. This command connects to the deployment manager and resynchronize all of the files.

If your server does not restart after you enable global security, you can disable security. Go to your `$install_root\bin` directory and run the **`wsadmin -conntype NONE`** command. At the `wsadmin>` prompt, enter `securityoff` and then type `exit` to return to a command prompt. Restart the server with security disabled to check any incorrect settings through the administrative console.

Service Access Facility registry users: When you choose the Service Access Facility (SAF) registry as the active local operating system user registry, you do not need to supply a password in the user registry configuration.

Data type:	Boolean
Default:	Disable

Enforce Java 2 Security:

Specifies whether to enable or disable Java 2 security permission checking. By default, Java 2 security is disabled. However, enabling global security, automatically enables Java 2 security. You can choose to disable Java 2 security, even when global security is enabled.

When Java 2 security is enabled and if an application requires more Java 2 security permissions than are granted in the default policy, then the application might fail to run properly until the required permissions are granted in either the `app.policy` file or the `was.policy` file of the application. AccessControl exceptions are generated by applications that do have all the required permissions. Consult the WebSphere Application Server documentation and review the Java 2 Security and Dynamic Policy sections if you are unfamiliar with Java 2 security.

Data type:	Boolean
Default:	Disabled
Range:	Enabled or Disabled

Use Domain Qualified User Names:

Enable or disable qualifying user names with the security domain ID.

Data type:	Boolean
Default:	Disabled
Range:	Enable or Disable

When you specify **Use Domain Qualified User Names** from the **Security > Global Security** configuration panel, the run-time call to the getCallerPrincipal() API from an enterprise bean returns the qualified name with the realm prepended twice. For example, the format return is realm/realm/user. You can strip the first realm from the returned value when making API calls. The servlet API getUserPrincipal() works correctly.

Cache Timeout:

Specifies the timeout value in seconds for security cache. This value is a relative timeout.

If WebSphere Application Server security is enabled, the security cache timeout can influence performance. The timeout setting specifies how often to refresh the security-related caches.

When the cache timeout expires, all cached information becomes invalid.

Data type:	Integer
Units:	Seconds
Default:	600
Range:	Greater than 30 seconds

Issue Permission Warning:

Specifies that when the Issue permission warning option is enabled, during application deployment and application start, the security run time emits a warning if applications are granted any custom permissions. Custom permissions are permissions defined by the user applications, not Java API permissions. Java API permissions are permissions in `package java.*` and `javax.*`.

The WebSphere product provides support for policy file management. A number of policy files are available in this product, some of them are static and some of them are dynamic. Dynamic policy is a template of permissions for a particular type of resource. There is no code base defined or relative code base used in the dynamic policy template. The real code base is dynamically created from the configuration and run-time data. The `filter.policy` file contains a list of permissions that an application should not have according to the J2EE 1.3 specification. For more information on permissions, see "Java 2 security policy files" on page 357.

Data type:	Boolean
Default:	Disabled
Range:	Enable or Disable

Active Protocol:

Specifies the active authentication protocol for Remote Method Invocation over the Internet Inter-ORB Protocol (RMI IIOP) requests when security is enabled. In previous releases the Security Authentication Service (SAS) platform (or z/OS Security Authentication Service on the z/OS platform) was the only available protocol.

An Object Management Group (OMG) protocol called Common Secure Interoperability Version 2 (CSIv2) supports increased vendor interoperability and additional features. If all of the servers in your security domain are Version 5 servers, specify `CSI` as your protocol.

If some servers are 4.x servers, specify `CSI and z/SAS`

Data type:	String
Default:	BOTH
Range:	CSI and zSAS, CSI

Active Authentication Mechanism:

Specifies the active authentication mechanism when security is enabled.

WebSphere Application Server for z/OS, Version 5 supports the following authentication mechanisms: Simple WebSphere Authentication Mechanism (SWAM), Lightweight Third Party Authentication (LTPA), and Integrated Cryptographic Services Facility (ICSF). Only ICSF and LTPA are configurable on WebSphere Application Server for z/OS, Version 5. SWAM is not configurable.

Data type:	String
Default:	SWAM
Range:	SWAM, LTPA, ICSF

Active User Registry:

Specifies the active user registry, when security is enabled. LDAP or a custom user registry is required when running as a UNIX non-root user or in a multi-node environment.

You can configure settings for one of the following user registries:

- Local operating system.

  Specify this setting if you want your configured Resource Access Control Facility (RACF) (or Security Authorization Facility (SAF)-compliant) security server to be used as the WebSphere registry.
- LDAP user registry. The LDAP user registry settings are used when users and groups reside in an external LDAP directory. When security is enabled and any of these properties change, go to the Global Security panel and click **Apply** or **OK** to validate the changes.
- Custom user registry

Data type:	String
Default:	Local OS
Range:	Local OS, LDAP, Custom

Custom Properties: For an existing configuration, there are a number of profiles that you must modify. To modify the profiles, go into the administrative console and click **Security > Global Security > Custom Properties**:

```
"security.zOS.domainName" value="TESTSYS"
```

You can modify the following global security custom properties:

- `security.zOS.domainType` specifies if there is a security domain used to qualify security definitions. In WebSphere Application Server for z/OS, the values can

be specified as *none*, which indicates that Service Access Facility (SAF) security definitions are of the global sysplex scope or *cellQualified* . This indicates that WebSphere Runtime uses the domain name specified in the property `security.zOS.domainName` to qualify SAF security definitions. If the property is not defined, or a value is not set, *none* is assumed. For example: `"security.zOS.domainType" value="cellQualified"`.

- `security.zOS.domainName` is specified if `"security.zOS.domainType" value="cellQualified"`. The value for `security.zOS.domainName` must be an upper case string from 1 to 8 characters in length, which is used to qualify SAF profiles checked for authorization for the server. If a value is specified here and *cellQualified* is selected, the name is also used to identify the application name used in the APPL and Passticket profiles. If a value for `security.zOS.domainName` is not specified, the default value is *CBS390*.

The following profiles are affected by this definition are:

- EJBROLE (if SAF authorization)
- CBIND
- APPL
- PASSTICKET

The customization dialog sets up appropriate SAF profiles during customization if the security domain is defined there. Changing the value of the domainType of domainName requires the customer to make appropriate changes in their SAF profile setup, otherwise runtime errors occur. Refer to "Summary of controls" on page 31 for more information on the specific profile updates required for security domainName related customization and the security domain customization panels.

Synchronizing a Java thread identity and an operating system thread identity

Determine if your application depends on the Java thread identity and the OS thread identity being synchronized to the same value. **Important**: Application Synch to OS Thread Allowed support is only supported if your WebSphere Application Server is configured to use local OS registry. For more information on why you would use this function, refer to:

- "Understanding application Synch to OS Thread Allowed" on page 161
- "Understanding Connection Manager RunAs Identity Enabled and operating system security" on page 162
- "When to use application Synch to OS Thread Allowed" on page 163
- "When to use Connection Manager RunAs Identity Enabled" on page 164

Enabling and Disabling Operating System Thread Synchronization: The WebSphere Application Server for z/OS server provides a global switch controlled by the administrator to enable or disable any association (or synchronization) of Java thread identities and OS thread identities. The default settings disable the ability to synchronize the operating system thread identity to the WebSphere Application Server for z/OS identity regardless of the values specified in the installed applications. Refer to "WebSphere Application Server for z/OS global security options" on page 160 for more information.

Note: Exercise caution when enabling this support because it can cause general z/OS system resources (such as files and sockets) to run using identities established by other WebSphere Application Server for z/OS applications.

Thread identity and access control: When setting the OS thread identity, you must consider the roles of the different identities involved thread identity synchronization. For more information, refer to "Understanding Java 2 Platform, Enterprise Edition identities and operating system thread identities" on page 164.

Security migration considerations: When setting thread identity, use application Synch to OS Thread Allowed support to obtain the required compatible behavior between WebSphere Application Server for z/OS Version 3.5 and WebSphere Application Server for z/OS Version 5. WebSphere Application Server for z/OS Version 3.5 always made the Java thread identity and the OS thread identity the same. WebSphere Application Server for z/OS Version 5 does not and runs with servant identity on the OS thread by default. This means that if you are migrating servlets or Java Server Pages from WebSphere Application Server for z/OS Version 3.5 to WebSphere Application Server for z/OS Version 5, use the WebSphere application Server Synch to OS Thread Allowed option to synchronize your identities so the application functions correctly between versions.

Refer to "Deploying secured applications" on page 134 and "Developing secured applications" on page 70 for details on WebSphere role-based security.

Application events that modify the Java thread identity: Use application Synch to OS Thread Allowed to synchronize the Java thread identity with the OS thread identity for the duration of the current Java 2 Platform, Enterprise Edition (J2EE) application request. Application or system events that modify the Java thread identity and OS thread identity values include:

Initial value when the first method is set
By default, invocations of servlets and EJBs implicitly run as caller (RunAsCaller) unless the RunAs attribute specifies otherwise. This sets the Java thread identity to the same value as the caller's identity. For Web applications, if no security constraints are specified the application runs under the user ID configured as the unauthenticated user ID. For more information refer to Session security support.

Method delegation changes to the J2EE identity (RunAs Specified)
Delegation involves security identity propagation from a caller to a called object. Servlets and EJBs can propagate either the client identity or another specified identity (as indicated in the corresponding deployment descriptor) when invoking EJBs . Three types of delegations are supported for EJBs:

- Delegate Client Identity (RunAs Caller)
- Delegate Specified Identity (RunAs Role)
- Delegate System Identity (RunAs Server)

One type of delegations is supported for Web applications:

- Servlet RunAs

When `RunAs Caller` is specified, both the identity of the called object and the identity of the thread object are unchanged. Specifying `RunAs System` and `RunAs Specified` can change the WebSphere security identity. When Synch to OS Thread Allowed is enabled, specifying `RunAs System` and `RunAs Caller` modifies the OS thread identity.

WSSubject.doAs()
The WSSubject class provides WebSphere extensions to Java Authentication and Authorization Services (JAAS). An application developer can use the WSSubject.doAs method to establish a JAAS subject (authenticated by a

JAAS login module) as the active security identity for WebSphere runtime to use while performing a specified action. This identity is set on the operating system thread for the scope of the action when used in conjunction with the application Synch to OS Thread Allowed option. Refer to Overriding the RunAs Subject on the Thread for more information.

Programming considerations when using application Synch to OS Thread Allowed: Programming considerations when using Synch to OS Thread Allowed exist because your security configuration establishes access control to application files, logs, binaries, and Hierarchical File System (HFS) files only for the servant identity. Using Synch to OS Thread Allowed support might require other identities to request access to these resources as well. All resource usage by applications other than those specifically described above require you to specifically grant access to all identities that might require access. This includes:

- Application configuration files, logs and additional binaries stored in the HFS, which includes `.gif` and `.jpeg` formats
- Application access to resources not managed by WebSphere Application Server connection management

Synch to OS Thread Allowed support lets you use a consistent user identity to manage J2EE application access control to native system resources (such as the application configuration files, logs, binaries, and the HFS file system) and J2EE-protected resources (J2EE methods, Java Naming and Directory Interface (JNDI) or COSNaming name space, and WebSphere administrative operations).

When application users have to manipulate HFS files, you can control access to these files in two ways:

- Update the file permissions to permit universal read (read-other) access to specific application resources when the client user ID is on the thread
- Use a shared library to store all the application resources accessible to all client users. The directory used by the shared library can be owned by a SAF group and set up so all group members have read and execute permission. Access is then granted by connecting valid application client and server user IDs to this group.

Considerations for setting Synch to OS Thread Allowed using WebSphere Studio Application Developer: With the Synch to OS Thread Allowed support:

1. The application developer or assembler requests behavior by setting the special application environment entry `env-entry` in the deployment descriptor: `com.ibm.websphere.security.SyncToOSThread = true | false`.
2. The system administrator grants the request made by the application developer or assembler using an application server configuration setting.

This article discusses the first of the two tasks above.

You can set the Synch to OS Thread Allowed option at development time or at assembly time:

- At development time, use WebSphere Studio Application Developer (WSAD) to add an environment entry (environment variable) to the Enterprise JavaBean (EJB) component or Web application module. **Important**: Environment entries (environment variables) can be defined on individual EJB components but cannot be set on individual Web components. A J2EE standard deployment descriptor can be defined for each EJB component and for each Web application module. Note that a Web component is either a servlet or JSP. For Web

components, environment entries (environment variables) can only be set on a Web application module. A Web application module contains servlets and JavaServer Pages (JSP).

- At assembly time, you can add or change environment entries (environment variables) using the WebSphere application assembly tool .

WebSphere Application Server for z/OS global security options:

Use this page to determine which global security options to specify for WebSphere Application Server for z/OS.

To view this administrative console page, click **Security** > **Global Security** > **z/OS security options**. Under Additional Properties, click **z/OS Security Options**.

If you are configuring security for the first time, complete the steps in "Configuring global security" on page 145 in the documentation prior to making changes. Once security is configured, validate any changes to the user registry or authentication mechanism panels. Click **Apply** to validate the user registry settings. An attempt is made to authenticate the server ID to the configured user registry (note that for registries other than Local OS the server user ID and password are validated).

Note: There has been a change in the option names on this page along with their function. Previously, the Connection Manager Synch to OS Thread support had been enabled by the Synch to OS Thread Allowed checkbox. The Connection Manager Synch to OS Thread support is now enabled by the new Connection Manager RunAs Identity Enabled checkbox. The Synch to OS Thread Allowed checkbox now enables the application Synch to OS Thread support and not the Connection Manager Synch to OS Thread support.

Remote identity:

SAF user ID associated with unauthenticated clients making requests of this server from another system.

Specifies which SAF identity is used when a remote RMI/IIOP request is received with no authentication information.

Local identity:

SAF user ID associated with unauthenticated clients making requests of this server from the same system.

Specifies which SAF identity is used when an RMI/IIOP request is received with no authentication information from a server on the same system.

Synch to OS Thread Allowed:

When checked, this option specifies that application servers are allowed to process the Synch to OS Thread Allowed option for application components that specify it. Refer to the note at the top of this article regarding the history of this option's name and the recent changes in this area.

Specifies whether or not application Synch to OS Thread Allowed is permitted. When this global security option is enabled, the application-specified Sync to OS

Thread Allowed is honored and subsequently carried out by the EJB and Web containers as indicated by EJB and Web application Synch to OS Thread Allowed specification. The default is disabled.

Important: TThis permits the application server to alter the OS thread identity in a potentially unauthorized environment (which can be an integrity breach).

Connection Manager RunAs Identity Enabled:

When checked, specifies that the connection manager sync the current J2EE identity to the OS thread when using operating system thread security for connector authorization. Refer to the note at the top of this article regarding the history of this option's name and the recent changes in this area.

When you enable this option, the method processes a request that modifies the operating system identity to reflect the J2EE identity. This function is required if you wish to use one of the Java Message Service (JMS), Java database connectivity (JDBC), or Java Connector Architecture (JCA) connector configurations that use operating system thread security. For more information, refer to:

- "Synchronizing a Java thread identity and an operating system thread identity" on page 157
- "Understanding Connection Manager RunAs Identity Enabled and operating system security" on page 162
- "Understanding application Synch to OS Thread Allowed"
- Using thread identity support
- Connection thread identity

Important: This permits the application server to alter the OS thread identity in a potentially unauthorized environment (which can be an integrity breach).

Understanding application Synch to OS Thread Allowed: Use application Synch to OS Thread Allowed to synchronize a Java thread identity (or JAAS subject) with the OS thread identity for the duration of the current Java 2 Platform, Enterprise Edition (J2EE) application request. If you do not choose this option the OS thread identity value is the same as the servant region identity value. Refer to"Synchronizing a Java thread identity and an operating system thread identity" on page 157 for more information.

Application Synch to OS Thread Allowed requires configuration in both the application and the application server:

1. The WebSphere Application Server developer must configure the application to declare that it wants to execute with application Synch to OS Thread Allowed
2. The WebSphere Application Server administrator must configure the application server to enable application Synch to OS Thread Allowed

The J2EE application developer configures the application for individual Enterprise JavaBeans (EJB) or Web applications by setting a special `env-entry` in the deployment descriptor `com.ibm.websphere.security.SyncToOSThread = true | false`. The default case in which this deployment descriptor is not specified is equivalent to defining it with a value of `false`.

When an EJB or Web application that requests Synch to OS Thread Allowed is dispatched, the application server (at the request of the EJB Container or the Web Container) synchronizes the OS thread identity associated with the current Java

thread identity so the Java thread identity is current on the native thread. This synchronization is effective as long as the EJB or Web application is running the current request. When the EJB or Web completes processing, the native thread is restored to its former state.

If the application requests Synch to OS Thread Allowed but Synch to OS Thread Allowed is not enabled in the application server, when the application attempts to run a no permission exception is issued. If the application does not request Synch to OS Thread Allowed but Synch to OS Thread Allowed is enabled in the application server, no synchronization occurs and the current OS thread identity remains the same as the servant process identity. Note that the Synch to OS Thread Allowed option is ignored unless global security is enabled and the active configured registry is localOS.

Refer to “Understanding Java 2 Platform, Enterprise Edition identities and operating system thread identities” on page 164 for more information about the identities discussed above.

Understanding Connection Manager RunAs Identity Enabled and operating system security: Operating system thread security: Under certain configurations of J2EE Connector Architecture (JCA), Java Message Service (JMS), or Java database connectivity (JDBC) connectors on WebSphere Application Server for z/OS, the OS thread identity is the identity used to create the enterprise information systems (EIS) connection. Refer to Connection thread identity for more information on which configurations support OS thread security.

We introduce a new term when saying that these connector configurations ″use OS thread security″. By enabling Connection Manager Synch to OS Thread support, the J2EE identity (the RunAs identity, for example) can be used to obtain the EIS connection for connector configurations that use OS thread security. The Connection Manager Synch to OS Thread support is enabled by selecting the Connection Manager RunAs Identity Enabled checkbox. If the Connection Manager RunAs Identity Enabled setting is not enabled, the connection to a resource manager under a connector configuration that uses OS thread security is obtained using the server identity if the thread identity is REQUIRED (which serves as a default in this case). If the thread identity is not REQUIRED, the container-managed or application-managed alias can be used to establish the identity. See “WebSphere Application Server for z/OS global security options” on page 160 for more information.

The WebSphere Connection Manager performs the operating system thread security-related functions. The Connection Manager synchronizes the Java thread identity with the OS thread identity (this Java thread identity corresponds to the J2EE identity) before obtaining the EIS connection.

Refer to “Synchronizing a Java thread identity and an operating system thread identity” on page 157 for more information.

After the Connection Manager performs the synchronization, the OS thread identity is temporarily replaced with the Java thread identity, and the Java thread identity is the identity used to obtain the EIS connection. This means that Connection Manager Synch to OS Thread support provides a way to obtain an EIS connection using the Java thread identity (the RunAs identity, for example). After obtaining the connection the Connection Manager restores the previous OS thread identity.

Note:

- The application Synch to OS Thread Allowed setting is not relevant to determining which identity is used to create a connection under a connector configuration that supports OS thread security. Using thread identity support explains which identity is used to create a connection in which the configuration is unchanged by the application Synch to OS Thread Allowed support. In particular, for connector configurations that use OS thread security (but in which Connection Manager RunAs Identity Enabled is disabled), the servant process identity is used to create the connection regardless of the application Synch to OS Thread Allowed setting or the current RunAs identity.
- Connection Manager Synch to OS Thread support is only relevant to obtaining EIS Connections managed by WebSphere Connection Management. For example Connection Manager Synch to OS Thread support might be relevant to Java database connectivity (JDBC) Connections obtained from application requests on DataSource objects configured via WAS Admin and then looked up in Java Naming and Directory Interface (JNDI). (This would depend on whether or not a specific DataSource instance under a specific JDBC provider used OS thread security or not). However, Connection Manager Synch to OS Thread support would not be pertinent for JDBC Connections obtained using the unmanaged `DriverManager.getConnection(...)` API. Access to such unmanaged resources for which the authorization is performed against the OS thread identity might be affected by the application Synch to OS Thread Allowed support, however.
- Connection Manager Synch to OS Thread support is used (or not used) for connection requests made by user-written code (such as JMS or JDBC calls from a stateless session bean), connection requests made by certain components of the WebSphere Application Server (such as the Message Driven Beans (MDB) Listener), or connection requests made by tooling-generated code (such as container-managed persistence (CMP) beans).
- Some (but not all) connector configurations that use the J2EE identity also use OS Thread Security. Connector configurations such as the Customer Information Control System (CICS) CTG Connector in local mode allow use of the J2EE identity using a different Connection Manager mechanism to create the EIS connection. This configuration does not use operating system thread security.

Refer to Connection thread identity for information for details of connector configurations that use operating system thread security. You can also refer to Using thread identity support.

Refer to “Understanding Java 2 Platform, Enterprise Edition identities and operating system thread identities” on page 164 for more information about the identities discussed above.

When to use application Synch to OS Thread Allowed: Application Synch to OS Thread Allowed uses the Java thread identity (or WSPrincipal currently associated with the thread) to access the non-WebSphere-managed resources accessed by your application. As a result of exploiting the application Synch to OS Thread Allowed support, access control privileges associated with the current Java thread identity (not the access control privileges for the servant process identity) are applied when accessing these resources. (An example of a non-WebSphere-managed resource is the file system.)

Use application Synch to OS Thread Allowed to control non-WebSphere-managed resource access based on the Java thread identity. The default Java thread identity is the client identity, which is the user who invoked the application. The Java 2 Platform, Enterprise Edition (J2EE) RunAS role deployment descriptor settings can override this default to choose from other choices. These choices include the server identity or the specified role, such as a user ID (chosen by the application server) configured to be in the specified role. By running with the Java thread identity and specifying Synch to OS Thread Allowed, all non-WebSphere-managed resource access control decisions are based on the access privileges of the Java thread identity. Refer to "Deploying secured applications" on page 134 and "Developing secured applications" on page 70 for details on WebSphere role-based security.

Application Synch to OS Thread Allowed is not relevant for container managed persistence (CMP) entity beans but Connection Management RunAs Identity Enabled might be relevant, depending on the JDBC Provider.

Refer to "Understanding Connection Manager RunAs Identity Enabled and operating system security" on page 162 for more information for CMP entity beans.

Refer to Understanding Java 2 Platform, Enterprise Edition identities and operating system thread identities for more information about the identities discussed previously

When to use Connection Manager RunAs Identity Enabled: Specifying Connection Manager RunAs Identity Enabled allows you to use your resource manager's security policy to govern access control decisions made when Java 2 Platform, Enterprise Edition (J2EE) clients invoke a WebSphere application accessing the resource managed by that resource manager.

For example, if you have a preexisting Database 2 (DB2) for z/OS security policy that controls which users have access to which tables, you want to have that policy enforced when users access WebSphere applications that also access DB2 for z/OS. The J2EE identity (the client identity by default) rather than the operating system identity (server identity) is used to establish connections to DB2 for z/OS when Connection Manager RunAs Identity Enabled is selected. DB2 for z/OS table access for the application is determined using your preexisting DB2 for z/OS security policy based the application invocation.

Refer to "Understanding Java 2 Platform, Enterprise Edition identities and operating system thread identities" for more information about the identities discussed above.

Understanding Java 2 Platform, Enterprise Edition identities and operating system thread identities: Understanding the different types of identities: A WebSphere Application Server user is identified using an identity that must be authenticated by WebSphere Application Server in order to access a WebSphere Application Server application in a secure environment. The WebSphere Application Server authenticates the user identity and represents the user with a Java Authentication and Authorization Service (JAAS) subject. A subject contains one or more principals (which are technology-dependent representations of the authenticated user identity). More detail follows:

User identities

J2EE identity
The user identity authenticated by WebSphere and used for access

control decisions made by the WebSphere Application Server at Java 2 Platform, Enterprise Edition (J2EE) runtime (such as the user identity associated with a J2EE application request and used in EJB method permission access control decisions).

Operating system (OS) identity
The user identity authenticated by the underlying operating system and used for access control decisions made by the OS and its subsystems (such as the user identity associated with a WebSphere Application Server for z/OS servant region by the SAF STARTED class facility and used by the file system for access control decisions when the server attempts to access files).

Thread identity

Java thread identity
The J2EE identity currently associated with a Java thread managed by the WebSphere J2EE runtime (a Java thread is the JVM's representation of a thread). The Java thread identity is associated with an operating system (OS) thread, but the Java virtual machine (JVM) manages the user identity on the Java representation of the thread - separate from the user identity that the operating system manages on the operating system thread. The J2EE identity is current on the Java thread for the life of the a given application request.

OS thread identity
The operating system identity currently associated with the operating system thread. The OS thread identity is typically the user identity assigned to servant region and is normally not the same as the Java thread identity. Note that J2EE maintains a J2EE identity that corresponds to the OS thread identity assigned to the servant region. This J2EE identity can be used as a RunAs identity.

RunAs identity
The J2EE identity chosen as the Java thread identity for a given J2EE application request (based on the RunAs deployment descriptor policy on an EJB invoked within the J2EE application request). The J2EE identity is normally the identity of the authenticated user who has made the J2EE application request. WebSphere Application Server RunAs policy allows three choices in assigning the Java thread identity for the current request:

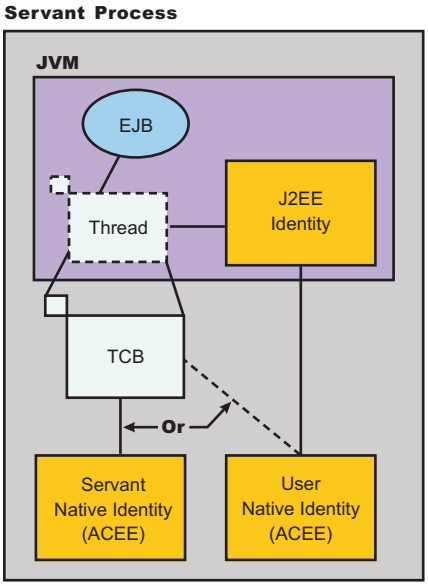
1. Assign the client (for example, user) J2EE identity - also referred to as selecting RunAs of ″Caller″
2. Assign the server's J2EE identity
3. Assign the J2EE identity that is in the specified role

Web Application J2EE identity
A Web application can run with a J2EE identity. For example, in a Web application using Basic Authentication or Form-based authentication the J2EE identity is the user identity used in basic authentication or form-based authentication logon. In certain contexts, this J2EE identity is used with Web applications in the same ways as the RunAs identity is used with EJBs, (such as together with connector thread identity support).

When security is enabled, each WebSphere Application Server for z/OS request that invokes a J2EE component is authenticated to ensure that an authorized user is requesting access. A user is represented by a J2EE identity (also called a JAAS subject). This J2EE identity contains one or more principals, and each principal

corresponds to a specific user identity. This association is managed by the WebSphere Application Server. The J2EE identity and operating system OS thread identity are associated with each other because they have the same name and represent the same user.

WebSphere Application Server for z/OS dispatches component requests in one of its available servant processes. Within the servant process the component request is dispatched on a Java thread. A Java thread is then mapped internally by the Java Virtual Machine (JVM) to a z/OS task control block (TCB). A TCB is an operating system thread and is considered part of the native process infrastructure. A servant process has a OS identity assigned to it when it starts. The z/OS security policy uses the SAF STARTED class facility to assign the identity.



J2EE authorization decisions including role authorization and permission checking are determined using the J2EE identity. Through a configuration setting, role authorization checking can be delegated to the underlying operating system security manager (such as System Authorization Facility (SAF)), in which case the associated operating system OS identity is used in the role authorization decision.

Some resource managers on z/OS use the OS thread identity to make authorization decisions. For example, file system access control is determined entirely based on which OS thread identity is currently on the TCB when the file is accessed. Similarly, local Java database connectivity (JDBC) connections to Database 2 (DB2) for z/OS use the TCB OS thread identity as the authorization identity under certain configurations. For resource managers that use the OS thread identity such as DB2 for z/OS (and unlike the file system) that applications access through Java Message Service (JMS), JDBC, or J2EE Connector Architecture (JCA) connectors managed by the WebSphere Application Server for z/OS connection management, we say that the connectors to these z/OS resource managers "use operating system thread security". For more information, refer to:

- "Synchronizing a Java thread identity and an operating system thread identity" on page 157
- "Understanding Connection Manager RunAs Identity Enabled and operating system security" on page 162

- "Understanding application Synch to OS Thread Allowed" on page 161
- Connection thread identity
- Using thread identity support

Global security and server security

The term *global security* refers to the security configuration that is effective for the WebSphere Application Server cell.

In some cases, the realm can be the machine name of a LocalOS user registry. For WebSphere Application Server for z/OS, a Local OS registry refers to the Resource Access Control Facility (RACF) (or Service Access Facility (SAF) compliant) security service configured for the sysplex. Selecting the Local OS registry as the active registry in WebSphere Application Server for z/OS enables you to take advantage of a number security server functions:
- Share identities with many other z/OS connector services
- Ability to use SAF authorization
- Use of SAF authorization, which minimizes the need to store user IDs and passwords in many locations in the configuration
- Additional audit capabilities

When a local OS registry is chosen on a z/OS platform, the realm name is actually the daemon IP name registered for the sysplex.

Configuration of global security for a security domain consists of configuring the common user registry, the authentication mechanism, and other security information that defines the behavior of a security domain. The other security information that is configured includes Java 2 Security Manager, Java Authentication and Authorization Service (JAAS), Java 2 Connector authentication data entries, Common Secure Interoperability Version 2 (CSIv2)/Security Authentication Service (zSAS) authentication protocol (Remote Method Invocation over the Internet Inter-ORB Protocol (RMI/IIOP) security), and other miscellaneous attributes. The global security configuration usually applies to every server within the security domain.

In a Network Deployment environment, where multiple nodes and multiple servers within a node are possible, you can configure certain attributes at a server level. The attributes that are configurable at a server level include security enablement for the server, Java 2 Security Manager enablement, and CSIv2/zSAS authentication protocol (RMI/IIOP security). You can disable security on individual application servers while global security is enabled, however, you cannot enable security on an individual application server while global security is disabled.

While application server security is disabled for user requests, administrative and naming security is still enabled for that application server so that the administrative and naming infrastructure remains secure. If cell security is enabled, but security for individual servers is disabled, J2EE applications are not authenticated or authorized. However, naming and administrative security is still enforced. Consequently, because Naming Services can be called from user applications you need to grant Everyone access to the naming functions that are required so that these functions accept unauthenticated requests. User code does not directly access administrative security except through the supported scripting tools.

Configuring server security

You can customize security to some extent at the application server level. You can disable user security on an application server (administrative security remains enabled when global security is enabled).

You can also modify Java 2 Security Manager, CSIv2 or z/OS Secure Authentication Services (z/SAS), and some of the other security attributes that are found on the global security (also called *cell-level* security) panel.

You cannot configure a different authentication mechanism or user registry on an individual server basis. This feature is limited to cell-level configuration only. Also, when global security is disabled, you cannot enable application server security.

By default, server security inherits all of the values that are configured in global security (cell-level security). To override the security configuration at the server level, click **Servers > Application Servers >** *server name*. Under Additional Properties, click **Server Security** and click any of the following panels: **Server Level Security, CSI Authentication > Inbound, CSI Authentication > Outbound, CSI Transport > Inbound, CSI Transport > Outbound, zSAS Transport > Inbound, and z/SAS Transport > Outbound**. After modifying the configuration in any of these panels and clicking **OK** or **Apply**, the security configuration for that panel or set of panels now overrides cell-level security. Other panels that are not overridden continue to be inherited at the cell-level. However, you can always revert back to the cell-level configuration at any time. On the Server Security panel, click **Use Cell Security**, **Use Cell CSI**, and **Use Cell z/SAS** to revert back to the global security configuration on these panels.

A number of additional z/SAS attributes that can be considered for security at a server level, such as:
- Local identity
- Remote identity
- Sync to thread allowed

Some of the z/SAS attributes are on global properties:
- com_ibm_SAF_authorization
- com_ibm_SAF_delegation
- com_ibm_SAF_unauthenticated
- control_region_enable_trusted_applications

For more information, review "Global security and server security" on page 167.

1. Start the administrative console for the deployment manager. To get to the administrative console, go to `http://host.domain:9090/admin`. If security is disabled, you can enter any ID. If security is enabled, you must enter a valid user ID and password, which is either the administrative ID (configured for the user registry) or a user ID entered as an administrative user. To add a user ID as an administrative user, click **System Administration > Console Users**.
2. Configure global security if you have not already done so. Read the "Configuring global security" on page 145 article for detailed steps. After global security is configured, configure server-level security.
3. To configure server-level security, click **Servers > Application Servers >** *server name*. Under Additional Properties, click **Server Security**. The status of the security level that is in use for this application server is displayed.

By default, you can see that global security, CSI, and z/SAS have not been overridden at the server level. CSI and z/SAS are authentication protocols for RMI/IIOP requests.

The Server Level Security panel lists attributes that are on the Global Security panel and can be overridden at the server level. Not all of the attributes on the Global Security panel can be overridden at the server level, including Active Authentication Mechanism and Active User Registry.

4. To disable security for this application server, go to the Server Level Security panel, clear the **Enabled** flag and click **OK** or **Apply**. Click **Save**. By modifying the Server Level Security panel, you can see that this flag overrides the cell-level security.
5. To configure CSI at the server level, you can change any panel that starts with CSI. By doing so, all panels that start with CSI will override the CSI settings specified at the Cell-level. This includes all authentication and transport panels for CSI. See the "Configuring Common Secure Interoperability Version 2 and Security Authentication Service authentication protocols" on page 295 article for more detailed steps regarding configuring CSI authentication protocol.

Typically server-level security is used to disable user security for a specific application server. However, this can also be used to disable (or enable) the Java 2 Security Manager, and configure the authentication requirements for RMI/IIOP requests both incoming and outgoing from this application server.

Once you have modified the configuration for a particular application server, you must restart the application server for the changes to become effective. To restart the application server, go to **Servers > Application Servers** and click the server name that you recently modified. Then, click the **Stop** button and then the **Start** button.

If you disabled security for the application server, you can typically test a URL which is protected when security is enabled.

Server security settings

Use this page to configure server security and override the global security settings. If you need to revert to the global security defaults, deselect the appropriate check box in the administrative console.

To view this administrative console page, click **Servers** > **Application servers** > *server_name* > **Server Security**. Note that these settings only apply to Network Deployment.

You can disable security on individual application servers while global security is enabled. However, you cannot enable security on an individual application server while global security is disabled. While application server security is disabled for user requests, administrative and naming security is still enabled for that application server so that the administrative and naming infrastructure remains secure. To avoid problems, verify that the naming security has **Everyone** access to the naming function that you use within your user code. You do not need to configure administrative security, because user code does not directly access administrative functions. User code accesses administrative functions through the supported scripting tools.

Server Level Security:

Specifies whether the server overrides cell defaults for security.

To revert to the call defaults for Server Level Security, click **Use Cell Security**. Click **Apply** and then select **Save** to validate the changes at the server level.

Default False

CSI:

Specifies whether the server overrides cell defaults for the CSI protocol.

Default False

SAS or z/SAS:

Specifies whether the server overrides cell defaults for the Secure Authentication Service (SAS) or z/OS Secure Authentication Services (zSAS) protocol.

To revert back to the cell defaults for the SAS protocol, click **Use Cell z/SAS**. Click **Apply** and then select **Save** to validate the changes at the server level.

Default False

Server-level security settings

Use this page to enable server level security and specify other server level security configurations.

To view this administrative console page, click **Servers > Application Servers >** *server_name* **> Server Security > Server Level Security**.

Enabled:

Use this flag to disable or enable security again for this application server while global security is enabled. Server security is enabled by default when global security is enabled. You cannot enable security on an application server while global security is disabled. Administrative (administrative console and wsadmin) and naming security remain enabled while global security is enabled, regardless of the status of this flag.

Data type Boolean
Default Disable

Enforce Java 2 Security:

Specifies that the server enforces Java 2 Security permission checking at the server level. When cleared, the Java 2 server-level security manager is not installed and all of the Java 2 Security permission checking is disabled at the server level.

If your application policy file is not set up correctly, see "Configuring the was.policy file" on page 368 for information on how to configure an application policy file.

Data type Boolean
Default Disabled
Range Enabled or Disabled

Use Domain Qualified User IDs:

Specifies whether user IDs returned by getUserPrincipal()-like calls are qualified with the server level security domain within which they reside.

Data type	Boolean
Default	Disabled
Range	Enable or Disable

Cache Timeout:

Specifies the timeout value for server level security cache in seconds.

Data type	Integer
Units	Seconds
Default	600
Range	Greater than 30 seconds. Avoid setting cache timeout value to 30 seconds or less.

Issue Permission Warning:

Specifies whether a warning is issued during application installation when an application requires a Java 2 permission that is normally not granted to an application.

WebSphere Application Server provides support for policy file management. A number of policy files are included in WebSphere Application Server. Some of these policy files are static and some of them are dynamic. Dynamic policy is a template of permissions for a particular type of resource. In dynamic policy files, the code bases are evaluated at run time using configuration data. You can add or remove permissions, as needed, for each code base. However, do not add, remove, or modify the existing code bases. The real code base is dynamically created from the configuration and run-time data. The `filter.policy` file contains a list of permissions that an application does not have, according to the J2EE 1.3 Specification. For more information on permissions, see "Java 2 security policy files" on page 357.

Data type	Boolean
Default	Enabled
Range	Enable or Disable

Active Protocol:

Specifies the active server level security authentication protocol when server level security is enabled.

You can use an Object Management Group (OMG) protocol called Common Secure Interoperability Version 2 (CSIv2) for more vendor interoperability and additional features. If all of the servers in your entire security domain are Version 5.0 servers, it is best to specify **CSI** as your protocol.

If some servers are Version 3.x or Version 4.x servers, it is best to specify **CSI and z/SAS**.

Data type	String
Default	CSI and z/SAS
Range	CSI, CSI and z/SAS

RACF server class profiles

The Resource Access Control Facility (RACF) server class profiles are used to control dynamic application environments. Dynamic application environments are displayed and controlled separately from static application environments.

Set up both the three-part and four-part RACF server class profiles for the application server or cluster for your dynamic application environment. The user ID for the servant region must be given read access to both of the profiles.

Three-part profile

The existing three-part profile has the form:

<subsystem_type>.<subsystem_name>.<application_environment_name>

where:

- *<subsystem_type>* is **CB**
- <subsystem_name> is the application server short name.
- *<application_environment_name>* is the application server generic short name, as specified in the WebSphere Application Server variables. If the server resides in a cluster, the name specified here must match the cluster short name. If the server does not reside in a cluster, the name must match the name specified on the ClusterTransitionName custom property for the server .

Four-part profile

The four-part profile adds the cell name to avoid ambiguities with existing profile names. The four-part profile has the form:

<subystem_type>.<subsystem_name>.<application_environment_name>.<cell_name>

where:

- <cell_name> is the short name of the cell containing this application server.

Examples of profile names

Three-part profile names:

- CB.T5SRV1.T5CL1 (the application server with the short name T5SRV1 and generic short name T5CL1)
- CB.*.T5CL1 (all application servers in the generic short name of T5CL1)
- CB.*.* (any application server in the sysplex)

Four-part profile names:

- CB.T5SRV1.T5CL1.T5CELL (the application server with the short name T5SRV1, and generic short name T5CL1 that resides in the cell T5CELL)
- CB.*.T5CL1.T5CELL (all servers in the generic short name of T5CL1 in the T5CELL)
- CB.*.*.T5CELL (any server in the cell named T5CELL)

If you do not want to discriminate between any of the application servers, you can eliminate all the specified profiles and use a generic form to cover the three and four-part names for all the servers in the sysplex:

- CB.*.T5*
- CB.*.T5*.*

Administrative console and naming service authorization

WebSphere Application Server extends the Java 2 Platform, Enterprise Edition (J2EE) security role-based access control to protect the product administrative and naming subsystems.

Administrative console

Four administrative roles are defined to provide degrees of authority needed to perform certain WebSphere Application Server administrative functions from either the administrative console or the system management scripting interface. The authorization policy is only enforced when global security is enabled. The four administrative security roles are defined in the following table:

administrative roles

Role	Description
monitor	Least privileged where a user can view the WebSphere Application Server configuration and current state.
configurator	Monitor privilege plus the ability to change the WebSphere Application Server configuration.
operator	Monitor privilege plus the ability to change the run-time state, such as starting or stopping services.
administrator	Operator plus configuration privilege and the permission required to access sensitive data including the server password, LTPA password, LTPA, keys, and so on.

When WebSphere Application Server global security is enabled, the administrative subsystem role-based access control is enforced. The administrative subsystem includes security server, user registry, and all the Java Management Extensions (JMX) MBeans. When security is enabled, both the administrative console and the administrative scripting tool require users to provide the required authentication data. Moreover, the administrative console is designed so the control functions that display on the pages are adjusted according to the security roles that a user has. For example, a user who has only the monitor role can see only the non-sensitive configuration data. A user with the operator role can change the system state.

When WebSphere Application Server for z/OS global security is enabled, the administrative subsystem role-based access control is enforced. The administrative subsystem includes security server, user registry, and all the Java Management Extensions (JMX) MBeans. When security is enabled, both the administrative console and the administrative scripting tool require users to provide the required authentication data. Moreover, the administrative console is designed so the control functions that display on the pages are adjusted according to the security roles that

a user has. For example, a user who has only the monitor role can see only the non-sensitive configuration data. A user with the operator role can change the system state.

WebSphere Application Server for z/OS security customization dialogs prime the administrative subsystem to accept the MVS identities of all started WebSphere system tasks (controllers, servants, and so on) as WebSphere administrators and to accept the configured WebSphere administrator identity.

Local OS as the configured user registry

If you choose local OS as the configured user registry, the value of the `com.ibm.security.SAF.authentication` setting controls whether SAF EJBROLE profiles or the console settings are used to control access to administration profiles rather than the console users. If you choose SAF authentication, any values in the console users and console groups are ignored.

When local OS is the configured user registry, WebSphere Application Server for z/OS servers in the cell do not have to use the same security name (enabled with PQ81586). Instead, all WebSphere Application Server for z/OS processes (as well as the default administrative user IDs) are configured to a WebSphere configuration group as part of customization. This customization process grants the Console Group administrative role to this WebSphere configuration group.

(When SAF authorization is chosen, no server restart is needed to authorize additional users or groups.)

Local OS is not the configured user registry

If you choose another registry (LDAP or Custom User Registry) other than local OS, WebSphere Application Server for z/OS automatically maps the server identity specified when enabling global security to the administrative role. Also, when global security is enabled, WebSphere Application Servers on z/OS run under the server identity that is defined under the active configured user registry configuration. Although it is not shown on the administrative console and in other tools, a special Server subject is mapped to the administrator role. This is why the WebSphere Application Server run-time code, which runs under the server identity, requires authorization to execute run-time operations. If no other user is assigned administrative roles, you can log into the administrative console or to the wsadmin scripting tool using the server identity to perform administrative operations and to assign other users or groups to administrative roles.

A special configuration is not required to enable the server identity (as specified) when enabling global security for administrative use because the server identity is automatically mapped to the administrator role (enabled with PQ81586)

You can add or remove users and groups to or from the administrative roles from the WebSphere Application Server administrative console. However, a server restart is required for the changes to take effect. A best practice is to map a group, rather than specific users, to administrative roles because it is more flexible and easier to administer. By mapping a group to an administrative role, adding or removing users to or from the group occurs outside of WebSphere Application Server and does not require a server restart for the change to take effect.

Administrative roles

In addition to mapping users or groups, you can map a *special-subject* to the administrative roles. A special-subject is a generalization of a particular class of users. The AllAuthenticated special subject means that the access check of the administrative role ensures that the user making the request has at least been authenticated. The Everyone special subject means that anyone, authenticated or not, can perform the action, as if security is not enabled.

When enabling security, you can assign one or more users and groups to administrative roles. For more information, see Assigning users to naming roles. However, before assigning users to naming roles, configure the active user registry. User and group validation depends on the active user registry. For more information, see Configuring user registries.

Naming service authorization

CosNaming security offers increased granularity of security control over CosNaming functions. CosNaming functions are available on CosNaming servers such as the WebSphere Application Server. They affect the content of the WebSphere Application Server name space. There are generally two ways in which client programs result in CosNaming calls. The first is through the JNDI interfaces. The second is with CORBA clients invoking CosNaming methods directly.

Four security roles are introduced :

- CosNamingRead
- CosNamingWrite
- CosNamingCreate
- CosNamingDelete

The roles now have authority levels from low to high:

CosNamingRead
: Users can query of the WebSphere Application Server name space, using, for example, the JNDI lookup method. The special-subject Everyone is the default policy for this role.

CosNamingWrite
: Users can perform write operations such as JNDI **bind**, **rebind**, or **unbind**, and CosNamingRead operations. The special-subject AllAuthenticated is the default policy for this role.

CosNamingCreate
: Users can create new objects in the name space through such operations as JNDI createSubcontext and CosNamingWrite operations. The special subject AllAuthenticated is the default policy for this role.

CosNamingDelete
: Users can destroy objects in the name space, for example using the JNDI destroySubcontext method and CosNamingCreate operations. The special-subject AllAuthenticated is the default policy for this role.

When you configure a local OS user registry to user with WebSphere Application Server for z/OS, there are some additional considerations. Refer to Configuring user registries and Steps for selecting a local OS registry for more information. If you specify an LDAP or a custom registry, you must remove local OS customization by deleting the pre-configured WebSphere configuration group and administrator identity from the console group. Then delete the console users.

Additionally, a Server special-subject is assigned to all the four CosNaming roles by default. The Server special-subject provides a WebSphere Application Server

server process, which runs under the server identity, access to all the CosNaming operations. Note that the Server special-subject does not display and cannot be modified through the administrative console or other administrative tools.

No special configuration is required to enable the server identity (as specified) when enabling global security for administrative use because the server identity is automatically mapped to the administrator role (enabled with PQ81586) .

Users, groups, or the special subjects AllAuthenticated and Everyone can be added or removed to or from the naming roles from the WebSphere Application Server administrative console at any time. However, a server restart is required for the changes to take effect. (Note that when SAF Authorization is chosen, no server restart is needed to authorize additional users or groups.) A best practice is to map groups or one of the special-subjects, rather than specific users, to naming roles because it is more flexible and easier to administer in the long run. By mapping a group to a naming role, adding or removing users to or from the group occurs outside of WebSphere Application Server and does not require a server restart for the change to take effect.

Note that when System Authorization Facility (SAF) authorization is selected, you do not need to restart the server to authorize additional users or groups (enabled with PQ81586).

The CosNaming authorization policy is only enforced when global security is enabled. When global security is enabled, attempts to do CosNaming operations without the proper role assignment result in an `org.omg.CORBA.NO_PERMISSION` exception from the CosNaming Server.

Although the ability exists to greatly restrict access to the name space by changing the default policy, unexpected `org.omg.CORBA.NO_PERMISSION` exceptions can occur at run time. Typically, J2EE applications access the name space and the identity they use is that of the user that authenticated to WebSphere Application Server when they access the J2EE application. Unless the J2EE application provider clearly communicates the expected Naming roles, use caution when changing the default naming authorization policy.

Assigning users to administrator roles

You must determine if Service Access Facility (SAF) authorization is used for server authorization. SAF authorization is in the local OS registry custom properties: com.ibm.security.SAF.Authorization. If you are not using a local OS registry or this value of this authorization property is `false`, complete the steps in this article. However, you are SAF authorization or the property value is `true`, do not follow the steps for assigning users to administrator roles. Instead, for SAF authorization, any user who is connected to the default WebSphere Application Server configuration group is assigned administrator authority for the configured security domain. However, for more specific administration functions, you can selectively grant authorization EJBROLE profiles, as appropriate. The syntax for this action is:

```
Permit [optional_securitydomain_id.]rolename EJBROLE
```

For example, if you wanted to give the MVS user BOB and the group MANAGERS the access to the operator role for servers in the TESTSYS domain, a Resource Access Control Facility (RACF) administrator can issue the following RACF (or equivalent) command:

```
PERMIT TESTSYS.operator CLASS(EJBROLE) ID(BOB MANAGERS) ACCESS(READ)
```

The following steps are needed to assign users to administrative roles.

In the administrative console, expand the **System Administration** folder and click **Console Users** or **Console Groups**.

1. To add a user or a group, click **Add** on the **Console users** or **Console groups** panel.
2. To add a new administrative user, enter a user identity in the User field, highlight **Administrator**, and click **OK**. If there is no validation error, the specified user is displayed with the assigned security role.
3. To add a new administrative group, either enter a group name in the **Specify group** field or select EVERYONE or ALL AUTHENTICATED from the Select from special subject menu, and click **OK**. If no validation error exists, the specified group or special subject displays with the assigned security role.
4. To remove a user or group assignment, click **Remove** on the Console Users or the Console Groups panel. On the Console Users or the Console Groups panel, select the check box of the user or group to remove and click **OK**.
5. To manage the set of users or groups to display, expand the **filter** folder on the right panel and modify the filter. For example, setting the filter to `user*` only displays users with the `user` prefix.
6. After the modifications are complete, click **Save** to save the mappings.
7. Restart the server for changes to take effect.

The task of assigning users and groups to administrative roles is performed to identify users for performing WebSphere Application Server administrative functions. There are four roles: administrator, configurator, operator and monitor. Users and groups assigned to the administrator role can perform all administrative operations and can set up both J2EE role-based and Java 2 security policy. Users assigned to the configurator role can perform all day-to-day configuration tasks including installing and uninstalling applications, assigning users and groups to role mapping for applications, setting run-as configurations, setting up Java 2 security permissions for applications, and customizing Common Secure Interoperability Version 2 (CSIv2), z/OS Security Authentication Service (zSAS), and Secure Sockets Layer (SSL) configurations. Users assigned to the operator role can view the WebSphere Application Server configuration and its current state, but also can change the run-time state such as stopping and starting services. Users assigned the monitor state can view the WebSphere Application server configuration and its current state only.

Before you assign users to administrative roles (administrator, configurator, operator, and monitor), you must set up your user registry, which can be LDAP, local OS, or a custom registry. You can set up your user registries without enabling security. Once you assign users to administrative roles, you must restart the server for the new roles to take effect. However, the administrative resources are not protected until you enable security.

If you use SAF authorization, you do not need to restart the server for new definitions to take affect. However, after you add the new definitions, you must issue the RACF or equivalent `SETROPTS RACLIST(EJBROLE) REFRESH` command to refresh the EJBROLE data seen by the security server.

Console users settings and CORBA naming service user settings

Use the Console users settings page to give users specific authority to administer WebSphere Application Server using tools such as the administrative console or wsadmin scripting. The authority requirements are only effective when global security is enabled. Use the common object request broker architecture (CORBA) naming service users settings page to manage CORBA naming service users settings.

To view the Console users administrative console page, click **System Administration > Console Users**.

To view the CORBA naming service users administrative console page, click **Environment > Naming > CORBA Naming Service users**.

User (Console users):

Specifies users.

The users entered must exist in the configured active user registry.

Data type: String

User (CORBA naming service users):

Specifies CORBA naming service users.

The users entered must exist in the configured active user registry.

Data type: String

Role (Console users):

Specifies user roles.

The following administrative roles provide different degrees of authority needed to perform certain WebSphere Application Server administrative functions:

Administrator
The administrator role has operator permissions, configurator permissions, and the permission required to access sensitive data including server password, Lightweight Third Party Authentication (LTPA) password and keys, and so on.

Configurator
The configurator role has monitor permissions and can change the WebSphere Application Server configuration.

Operator
The operator role has monitor permissions and can change the run-time state. For example, the operator can start or stop services.

Monitor
The monitor role has the least permissions. This role primarily confines the user to viewing the WebSphere Application Server configuration and current state.

Data type: String
Range: Administrator, Configurator, Operator, and Monitor

Role (CORBA naming service users):

Specifies naming service user roles.

A number of naming roles are defined to provide degrees of authority needed to perform certain WebSphere naming service functions. The authorization policy is only enforced when global security is enabled. The following roles are valid: CosNamingRead, CosNamingWrite, CosNamingCreate, and CosNamingDelete.

The names of the four roles are the same with WebSphere Application Server, Advanced Edition Version 4.0.2. However, the roles now have authority levels from low to high:

CosNamingRead
Users can query the WebSphere name space using, for example, the Java Naming and Directory Interface (JNDI) lookup method. The special-subject EVERYONE is the default policy for this role.

CosNamingWrite
Users can perform write operations such as JNDI bind, rebind, or unbind, plus CosNamingRead operations. The special-subject ALL AUTHENTICATED is the default policy for this role.

CosNamingCreate
Users can create new objects in the name space through operations such as JNDI createSubcontext and CosNamingWrite operations. The special-subject ALL AUTHENTICATED is the default policy for this role.

CosNamingDelete
Users can destroy objects in the name space, for example using the JNDI destroySubcontext method and CosNamingCreate operations. The special-subject ALL AUTHENTICATED is the default policy for this role.

Data type:	String
Range:	CosNamingRead, CosNamingWrite, CosNamingCreate and CosNamingDelete

Console groups and CORBA naming service groups

Use the Console Groups page to give groups specific authority to administer the WebSphere Application Server using tools such as the administrative console or wsadmin scripting. The authority requirements are only effective when global security is enabled. Use the CORBA naming service groups page to manage CORBA Naming Service groups settings.

To view the Console Groups administrative console page, click **System Administration > Console Groups**.

To view the CORBA naming service groups administrative console page, click **Environment > Naming > CORBA Naming Service Groups**.

Group (Console groups):

Specifies groups.

The ALL_AUTHENTICATED and the EVERYONE groups can have the following role privileges: Administrator, Configurator, Operator, and Monitor.

Data type: String
Range: ALL_AUTHENTICATED, EVERYONE

Group (CORBA naming service groups):

Identifies CORBA naming service groups.

The ALL_AUTHENTICATED group has the following role privileges: CosNamingRead, CosNamingWrite, CosNamingCreate, and CosNamingDelete. The EVERYONE group indicates that the users in this group have CosNamingRead privileges only.

Data type: String
Range: ALL_AUTHENTICATED, EVERYONE

Role (Console group):

Specifies user roles.

The following administrative roles provide different degrees of authority needed to perform certain WebSphere Application Server administrative functions:

Administrator
The administrator role has operator permissions, configurator permissions, and the permission required to access sensitive data including server password, LTPA password and keys, and so on.

Configurator
The configurator role has monitor permissions and can change the WebSphere Application Server configuration.

Operator
The operator role has monitor permissions and can change the run-time state. For example, the operator can start or stop services.

Monitor
The monitor role has the least permissions. This role primarily confines the user to viewing the WebSphere Application Server configuration and current state.

Data type: String
Range: Administrator, Configurator, Operator, and Monitor

Role (CORBA naming service groups):

Identifies naming service group roles.

A number of naming roles are defined to provide degrees of authority needed to perform certain WebSphere naming service functions. The authorization policy is only enforced when global security is enabled.

Four name space security roles are available: CosNamingRead, CosNamingWrite, CosNamingCreate, and CosNamingDelete. The names of the four roles are the same with WebSphere Advanced Edition, Version 4.0.2. However, the roles now have authority levels from low to high:

CosNamingRead
Users can query the WebSphere name space using, for example, the Java

Naming and Directory Interface (JNDI) lookup method. The special-subject EVERYONE is the default policy for this role.

CosNamingWrite
Users can perform write operations such as JNDI bind, rebind, or unbind, and CosNamingRead operations. The special-subject ALL_AUTHENTICATED is the default policy for this role.

CosNamingCreate
Users can create new objects in the name space through operations such as JNDI createSubcontext and CosNamingWrite operations. The special-subject ALL_AUTHENTICATED is the default policy for this role.

CosNamingDelete
Users can destroy objects in the name space, for example using the JNDI destroySubcontext method and CosNamingCreate operations. The special-subject ALL_AUTHENTICATED is the default policy for this role.

Data type:	String
Range:	CosNamingRead, CosNamingWrite, CosNamingCreate, and CosNamingDelete

Assigning users to naming roles

The following steps are needed to assign users to naming roles. In the administrative console, expand **Environment > Naming**, and click **CORBA Naming Service Users** or **CORBA Naming Service Groups**.

1. Click **Add** on the **CORBA Naming Service Users** or **CORBA Naming Service Groups** panel.
2. To add a new naming service user, enter a user identity in the **User** field, highlight one or more naming roles, and click **OK**. If no validation errors occur, the specified user is displayed with the assigned security role.
3. To add a new naming service group, either select **Specify group** and enter a group name or select **Select from special subject** and then select either **EVERYONE** or **ALL AUTHENTICATED**. Click **OK**. If no validation errors occur, the specified group or special subject is displayed with the assigned security role.
4. To remove a user or group assignment, go to the **CORBA Naming Service Users** or **CORBA Naming Service Groups** panel. Select the check box next to the user or group that you want to remove and click **Remove**.
5. To manage the set of users or groups to display, expand the **Filter** folder on the right panel, and modify the filter text box. For example, setting the filter to `user*` displays only users with the `user` prefix.
6. After modifications are complete, click **Save** to save the mappings. Restart the server for the changes to take effect.

The default naming security policy is to grant all users read access to the CosNaming space and to grant any valid user the privilege to modify the contents of the CosNaming space. You can perform the previously mentioned steps to restrict user access to the CosNaming space. However, use caution when changing the naming security policy. Unless a Java 2 Platform, Enterprise Edition (J2EE) application has clearly specified its naming space access requirements, changing the default policy can result in unexpected org.omg.CORBA.NO_PERMISSION exceptions at run time.

Special considerations for controlling access to naming roles using a Local OS Registry

The user registry and authorization setting for the cell control how you access naming roles. If the user registry is defined as LocalOS (Resource Access Control Facility (RACF)), you can use either Service Access Facility (SAF) authorization (such as, RACF EJBROLE profiles) or WebSphere Authorization (such as CORBA Naming Service Users and CORBA Naming Service Groups as specified on the administrative console).

You can determine your selection by clicking: **GlobalSecurity > UserRegistries > LocalOS > CustomProperties > com.ibm.SAFAuthorization**

Using SAF authorization to control access to CosNaming functions: When SAF authorization is selected during systems customization, EJBROLE profiles for all pf the CosNaming roles are defined by the RACF jobs generated by the Configuration Dialog:

```
RDEFINE EJBROLE (optionalSecurityDomainName.)CosNamingRead UACC(READ)
PERMIT (optionalSecurityDomainName.)CosNamingRead  CLASS(EJBROLE)  ID(WSGUEST) ACCESS(READ)
RDEFINE EJBROLE (optionalSecurityDomainName.)CosNamingWrite  UACC(READ)
RDEFINE EJBROLE (optionalSecurityDomainName.)CosNamingCreate UACC(READ)
RDEFINE EJBROLE (optionalSecurityDomainName.)CosNamingDelete UACC(READ)
```

Subsequently, if SAF authorization is selected, issue the following RACF commands (or equivalent z/OS Security Server commands) to enable your servers and the administrator to administer WebSphere Application Server.

The default access granted by the customization dialog permits all authenticated users to update the names pace. This type of authorizations might be a broader level of authority than you want to provide. Minimally, you must enable the WebSphere Configuration group (servers and administrators) to have READ access to all profiles and permit all WebSphere Application Server for z/OS clients to have READ access to the CosNamingRead profile.

If additional users require access to CosNaming roles, you can permit a user to any of the previous roles as indicated by issuing the following RACF command: `PERMIT (optionalSecurityDomainName.)rolename CLASS(EJBROLE) ID(mvsid) ACCESS(READ)`

LocalOS Considerations when using WebSphere authorization to control access to CosNaming roles: The server identities that use WebSphere Application Servers within a given cell are unlikely to be the same, therefore you cannot rely on the use of the Server special subject, which by default has access to all CosNaming roles. Instead, give the WebSphere Configuration group be given `CosNaming Delete` authority.

For a discussion of the CosNaming roles, see Administrative console and naming service authorization. You can also refer to Assigning users to naming roles.

Authentication mechanisms

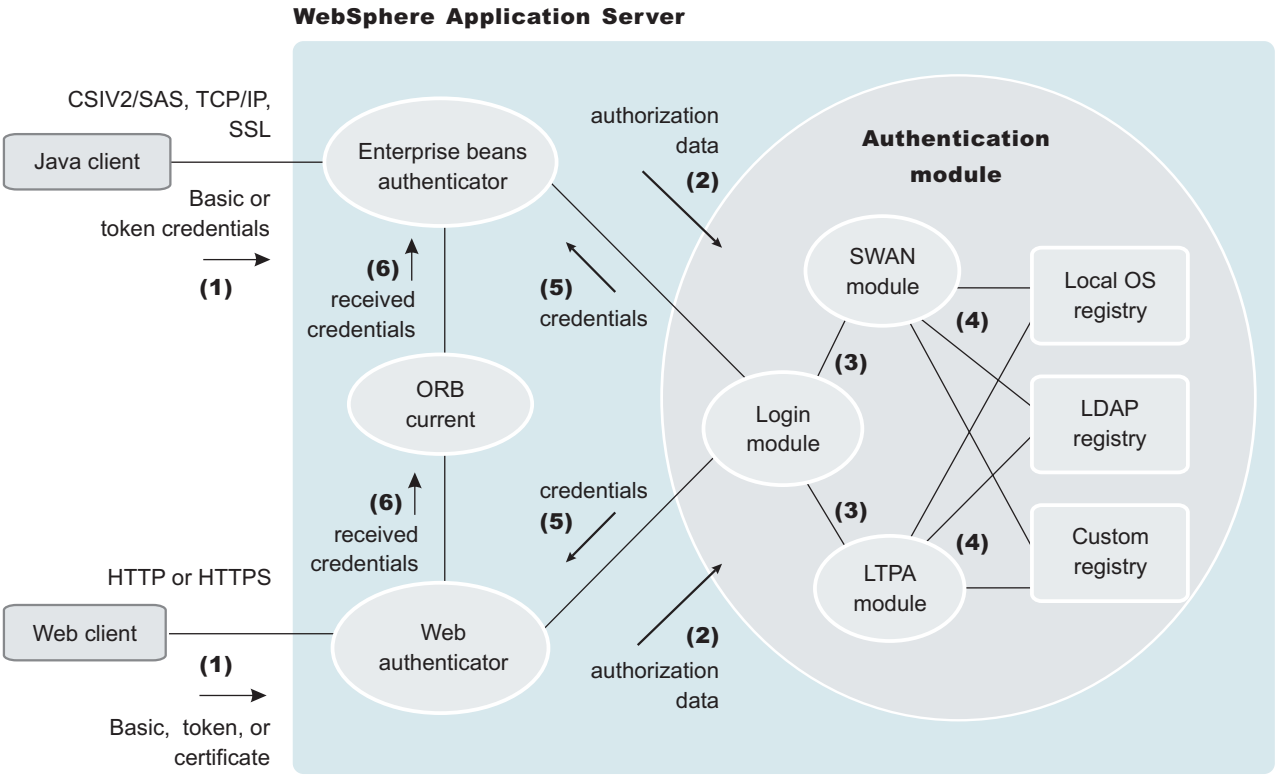
An *authentication mechanism* defines rules about security information (for example, whether a credential is forwardable to another Java process), and the format of how security information is stored in both credentials and tokens.

Authentication is the process of establishing whether a client is valid in a particular context. A client can be either an end user, a machine, or an application.

An authentication mechanism in WebSphere Application Server typically collaborates closely with a *user registry*. The user registry is the user and groups account repository that the authentication mechanism consults with when performing authentication. The authentication mechanism is responsible for creating a *credential*, which is an internal product representation of a successfully authenticated client user. Not all credentials are created equally. The abilities of the credential are determined by the configured authentication mechanism.

Although this product provides several authentication mechanisms, you can only configure a single *active* authentication mechanism at a time. The active authentication mechanism is selected when configuring WebSphere Application Server global security.

Authentication



Authentication Process

The figure demonstrates the authentication process. Basically, authentication is required for enterprise bean clients and Web clients when they access protected resources. Enterprise bean clients (a servlet or other enterprise beans or a pure client) send the authentication information to a Web application server using the Common Secure Interoperability Version 2 (CSIv2) or the z/OS Security Authentication Service (z/SAS) protocol. Web clients use the HTTP or HTTPS protocol to send the authentication information as shown in the previous figure. The authentication information can be BasicAuth (user ID and password), credential token (in case of Lightweight Third Party Authentication (LTPA) or Integrated Cryptographic Services Facility (ICSF)), or client certificate. The Web authentication is performed by the Web Authentication module and the enterprise bean authentication is performed by the Enterprise JavaBean (EJB) authentication module, which resides in the CSIv2 and z/SAS layer.

The authentication module is implemented using the Java Authentication and Authorization Service (JAAS) login module. The Web authenticator and the EJB authenticator pass the authentication data to the login module (2), which can be Lightweight Third Party Authentication (LTPA), Simple WebSphere Authentication Mechanism (SWAM), or Integrated Cryptographic Service Facility (ICSF).

Note: 5.1 + In future releases, IBM intends to deprecate the ICSF authentication mechanism. It is recommended that you migrate to LTPA. For more information on LTPA, see Lightweight Third Party Authentication.

The authentication module uses the registry that is configured on the system to perform the authentication (4). Three types of registries are supported: LocalOS, Lightweight Directory Access Protocol (LDAP), and custom registry. External registry implementation following the registry interface specified by IBM can replace either the LocalOS or the LDAP registry.

The login module creates a JAAS subject after authentication and stores the Common Object Request Broker Architecture (CORBA) credential derived from the authentication data in the public credentials list of the subject. The credential is returned to the Web authenticator or EJB authenticator (5).

The Web authenticator and the EJB authenticator store the received credentials for the authorization service to use in performing further access control checks.

WebSphere Application Server provides the following authentication mechanisms: SWAM, LTPA, and ICSF. These authentication mechanisms differ primarily in the distributed security features that each supports.

Configuring authentication mechanisms

Configure authentication mechanisms by clicking **Authentication Mechanisms** under **Security** in the administrative console.

- If you are using Simple WebSphere Authentication Mechanism (SWAM), no setup is needed. Follow the instructions in "Configuring Lightweight Third Party Authentication" on page 186 to set up Lightweight Third Party Authentication (LTPA).
- For LTPA, follow the steps in "Configuring single signon" on page 198 for most situations. If trust association is required, follow the steps in "Configuring trust association interceptors" on page 194.

Simple WebSphere authentication mechanism

The Simple WebSphere authentication mechanism (SWAM) is intended for simple, non-distributed, single application server run-time environments. The single application server restriction is due to the fact that SWAM does not support *forwardable* credentials. If a servlet or enterprise bean in application server process 1, invokes a remote method on an enterprise bean living in another application server process 2, the identity of the caller identity in process 1 is not transmitted to server process 2. What is transmitted is an unauthenticated credential, which, depending on the security permissions configured on the EJB methods, can cause authorization failures.

Since SWAM is intended for a single application server process, single signon (SSO) is not supported.

The SWAM authentication mechanism is suitable for simple environments, software development environments, or other environments that do not require a distributed security solution.

Lightweight Third Party Authentication

Lightweight Third Party Authentication (LTPA) is intended for distributed, multiple application server and machine environments. It supports forwardable credentials and single signon (SSO). LTPA can support security in a distributed environment through cryptography. This supports permits LTPA to encrypt, digitally sign, and securely transmit authentication-related data, and later decrypt and verify the signature.

The Lightweight Third Party Authentication (LTPA) protocol enables the WebSphere Application Server to provide security in a distributed environment using cryptography. Application servers distributed in multiple nodes and cells can securely communicate using this protocol. It also provides the single signon (SSO) feature wherein a user is required to authenticate only once in a domain name system (DNS) domain and can access resources in other WebSphere Application Server cells without getting prompted. This protocol uses cryptographic keys (LTPA keys) to encrypt and decrypt user data that passes between the servers. These keys need to be shared between the different cells for the resources in one cell to access resources in other cells (assuming that all the cells involved use the same LDAP or custom registry).

When using LTPA, a token is created with the user information and an expiration time and is signed by the keys. The LTPA token is time sensitive. All product servers participating in a protection domain must have their time, date, and time zone synchronized. If not, LTPA tokens appear prematurely expired and cause authentication or validation failures. This token passes to other servers, in the same cell or in a different cell, either through cookies (for Web resources when SSO is enabled). If the receiving servers share the same keys as the originating server, the token can be decrypted to obtain the user information, which then is validated to make sure it has not expired and the user information in the token is valid in its registry. On successful validation, the resources in the receiving servers are accessible after the authorization check.

All the WebSphere Application Server processes in a cell (cell, nodes, application servers) share the same set of keys. If key sharing is required between different cells, export them from one cell and import them to the other. For security purposes, the exported keys are encrypted with a user-defined password. This same password is needed when importing the keys into another cell.

In the base version of WebSphere Application Server, LTPA, ICSF, and the Simple WebSphere Authentication Mechanism (SWAM) protocols are supported. When security is enabled for the first time in WebSphere Application Server Network Deployment with LTPA, configuring LTPA is normally the initial step performed.

LTPA requires that the configured user registry be a centrally shared repository such as LDAP or a Windows domain type registry so that users and groups are the same regardless of the machine.

The following table summarizes the authentication mechanism capabilities and user registries with which LTPA can work.

	Forwardable Credentials	SSO	LocalOS User Registry	LDAP User Registry	Custom User Registry
LTPA	Yes	Yes	Yes	Yes	Yes
ICSF	Yes	Yes	Yes	Yes	Yes

Configuring Lightweight Third Party Authentication

The following steps are needed to configure Lightweight Third Party Authentication (LTPA) when setting up security for the first time:

1. Access the administrative console by typing `http://localhost:9090/admin` in a Web browser.
2. Click **Security** > **Authentication mechanisms** > **LTPA** in the Navigation panel on the left.
3. Enter the password and confirm it in the password fields. This password is used to encrypt and decrypt the LTPA keys during export and import of the keys. Remember this password because you enter it again when the keys from this cell are exported to another cell.
4. Enter a positive integer value in the **Timeout** field. This timeout value refers to how long an LTPA token is valid in minutes. The token contains this expiration time so that any server that receives the token can verify that the token is valid before proceeding further.

   When the token expires, the request is rejected and the user must log in again. An optimal value for this field depends on your configuration. The default value is 30 minutes.
5. Click **Apply** or **OK**. The LTPA configuration is now set. Do not generate the LTPA keys in this step because they are automatically generated later. Proceed with the rest of the steps required to enable security, starting with single signon (SSO) (if SSO is required).
6. Complete the information in the Global Security panel and click OK. The LTPA keys are generated automatically the first time. Do not generate the keys manually.

The previous steps configure LTPA by setting passwords that generate LTPA keys.

After configuring LTPA, complete the following steps to work with your key files:
1. Generate key files.
2. Export key files.
3. Import key files.
4. If you are enabling security, make sure that you complete the remaining steps starting with enabling single signon (SSO).
5. If you generated a new set of keys or imported a new set of keys, verify that the keys are saved by clicking **Save** at the top of the panel. Because LTPA authentication uses time sensitive tokens, verify that the time, date, and time zone are synchronized among all product servers that are participating in the protection domain. If the clock skew is too high between servers, the LTPA token appears prematurely expired and causes authentication or validation failures.

Configuring Lightweight Third Party Authentication keys:

Generating keys:

Lightweight Third Party Authentication (LTPA) keys are automatically generated when a password change is detected. The first time that you set the LTPA password, as part of enabling security, the LTPA keys are automatically generated after **OK** or **Apply** is clicked in the LTPA panel. You do not have to click **Generate Keys** in this situation. Complete the following steps in the administrative console to generate a new set of LTPA keys:

1. Access the administrative console by typing `http://localhost:9090/admin` in a Web browser.
2. Verify that all the WebSphere Application Server processes are running (cell, nodes, and all of the application servers). If any of the servers are down at the time of key generation and then brought back up later, these servers might contain old keys. Copy the new set of keys to these servers to bring them back up.
3. Click **Security > Authentication mechanisms > LTPA** in the navigation panel on the left.
4. Click **Generate Keys** if you want to use the existing password. This action generates a new set of keys that are encrypted with the same password as the old set of keys. Regardless of the password change, a new set of keys is generated when you click **Generate Keys**. This new set of keys is not propagated to the run time unless saved; save the files immediately.
5. Enter the new password and confirm it, to use a new password to generate keys. Click **OK** or **Apply**. A new set of keys is generated. A message indicating that a new set of keys is generated displays on the console. Do not click **Generate Keys**. These new keys are propagated to the run time once you save them.
6. Click **Save** to save the keys. After a new set of keys is generated and saved, the key propagation is dynamic. All of the processes running at that time (cells, node agents, application servers) are updated with the new set of keys. The next sections describe the process of exporting and importing the keys.

Exporting keys:

To support single signon (SSO) in WebSphere Application Server across multiple WebSphere Application Server domains or cells, share the LTPA keys and the password among the domains. Make sure that the time on the domains is similar to prevent the tokens from appearing as expired between the cells. You can use **Export Keys** to export the LTPA keys to other domains or cells. Complete the following steps in the administrative console to export key files for LTPA:

1. Access the administrative console by typing `http://localhost:9090/admin` in a Web browser.
2. Click **Security** > **Authentication mechanisms** > **LTPA** in the navigation panel on the left.
3. In the **Key File Name** field, enter the full path of a file for key storage. This file needs write permissions.
4. Click **Export Keys**. A file is created with the LTPA keys. Exporting keys fails if a new set of keys is generated or imported and not saved prior to exporting. To avoid failure, make sure that you save the new set of keys (if any) prior to exporting them.
5. Click **Save** to save the configuration.

Importing keys:

To support single signon (SSO) in WebSphere Application Server across multiple WebSphere Application Server domains or cells, share the LTPA keys and the password among the domains. You can use **Import Keys** to import the LTPA keys from other domains. Verify that key files are exported from one of the cells involved, into a file. Complete the following steps in the administrative console to import key files for LTPA.

Importing keys is a dynamic operation. All of the servers that are running at this time are updated with the new set of keys. Any back-level tokens signed with the back-level keys fail validation and the user is prompted to log in again.

1. Access the administrative console by typing `http://localhost:9090/admin` in a Web browser.
2. Click **Security** > **Authentication mechanisms** > **LTPA** in the navigation panel on the left.
3. Change the password in the **password** fields to match the password in the cell from which you are importing the keys.
4. Click **Save** to save the new set of keys in the repository. This step is important to complete before importing the keys. If the password and the keys do not match, the servers fail. If the servers fail, turn off security and redo these steps.
5. In the **Key File Name** field, enter the full path of a file for key storage. This file needs read permissions.
6. Click **Import Keys**. The keys are now imported into the system.
7. Click **Save** to save the new set of keys in the repository. It is important to save the new set of keys to match the new password so that no problems are encountered starting the servers later.

Lightweight Third Party Authentication settings:

Use this page to configure Lightweight Third Party Authentication (LTPA) settings.

To view this administrative console page, click **Security > Authentication Mechanisms > LTPA**.

If you are configuring security for the first time, only the password is required. After the password is entered, click **Apply**. Click **Single signon** (SSO) and enter the domain name. Make sure that SSO is enabled. Click **Apply**. In the Global Security panel, click **Custom Properties**. A list of security properties is displayed. Click the **control_region_security_enable_trusted_applications** property. On the new window, change the **Value** field from `false` to `true`, and click **Apply**. To complete the security setup, make sure that the appropriate registry is set up and click **Apply** from the Global Security panel. When security is enabled and any of these properties change, go to the Global Security panel and click **Apply** to validate the changes.

Generate Keys:

Specifies whether the server generates new Lightweight Third Party Authentication (LTPA) keys.

When security is turned on for the first time with LTPA as the authentication mechanism, the LTPA keys are automatically generated with the password entered in the panel. If you need a new set of keys to generate using the previously set password, click **Generate Keys**. If a new password is used, do not click this

option. After the new password is entered and **OK** or **Apply** is clicked, a new set of keys is generated. *A new set of generated keys is not used until you save them.*

Import Keys:

Specifies whether the server imports new LTPA keys.

To support single signon (SSO) in the WebSphere product across multiple WebSphere domains (cells), share the LTPA keys and the password among the domains. You can use the **Import Keys** option to import the LTPA keys from other domains. The LTPA keys are exported from one of the cells to a file. To import a new set of LTPA keys, enter the appropriate password, click **OK** and click **Save**. Then, enter the directory location where the LTPA keys are located prior to clicking **Import keys**. Do not click **OK** or **Apply**, but save the settings.

Export Keys:

Specifies whether the server exports LTPA keys.

To support single signon (SSO) in the WebSphere product across multiple WebSphere Application Server domains (cells), share the LTPA keys and the password among the domains. Use the **Export Keys** option to export the LTPA keys to other domains.

To export the LTPA keys, make sure that the system is running with security enabled and is using LTPA. Enter the file name in the **Key File Name** field and click **Export Keys**. The encrypted keys are stored in the specified file.

Password:

Specifies the password to encrypt and decrypt the LTPA keys. Use this password when importing these keys into other WebSphere Application Server administrative domain configurations (if any) and when configuring SSO for a Lotus Domino server.

After the keys are generated or imported, they are used to encrypt and decrypt the LTPA token. Whenever the password is changed, a new set of LTPA keys are automatically generated when you click **OK** or **Apply**. This new set of keys is used only when you save.

Data type String

Confirm Password:

Specifies the confirmed password used to encrypt and decrypt the LTPA keys.

Use this password when importing these keys into other WebSphere Application Server administrative domain configurations (if any) and when configuring SSO for a Lotus Domino server.

Data type String

Timeout:

Specifies the time period in minutes at which an LTPA token expires. Verify that this time period is longer than the cache timeout configured in the Global Security panel.

Data type	Integer
Units	Minutes
Default	120

Key File Name:

Specifies the name of the file used when importing or exporting keys.

Enter a fully qualified key file name, and click **Import Keys** or **Export Keys**.

Data type	String

Trust Associations

Trust Association enables the integration of IBM WebSphere Application Server security and third-party security servers. More specifically, a reverse proxy server can act as a front-end authentication server while the product applies its own authorization policy onto the resulting credentials passed by the proxy server.

Demand for such an integrated configuration has become more compelling, especially when a single product cannot meet all of the customer needs or when migration is not a viable solution. This article provides a conceptual background behind the approach.

The demand is growing to provide customers with a trust association solution between IBM WebSphere Application Server and other Web authentication servers that act as a reverse proxy security server (IBM Tivoli Access Manager for e-business - WebSEAL, Caching Proxy) as an entry point to all service requests (See the first figure). This implementation design intends to have the proxy server as the only exposed entry point. The proxy server authenticates all requests that come in and provides coarse, granularity junction point authorization.

In this setup, the WebSphere Application Server is used as a back-end server to further exploit its fine-grained access control. The reverse proxy server passes the HTTP request to the WebSphere Application Server that includes the credentials of the authenticated user. WebSphere Application Server then uses these credentials to authorize the request.

Trust association model

The idea that WebSphere Application Server can support trust association implies that the product application security recognizes and processes HTTP requests received from a reverse proxy server. WebSphere Application Server and the proxy server engage in a contract in which the product gives its full trust to the proxy server and the proxy server applies its authentication policies on every Web request that is dispatched to WebSphere Application Server. This trust is validated by the interceptors that reside in the product environment for every request received. The method of validation is agreed upon by the proxy server and the interceptor.

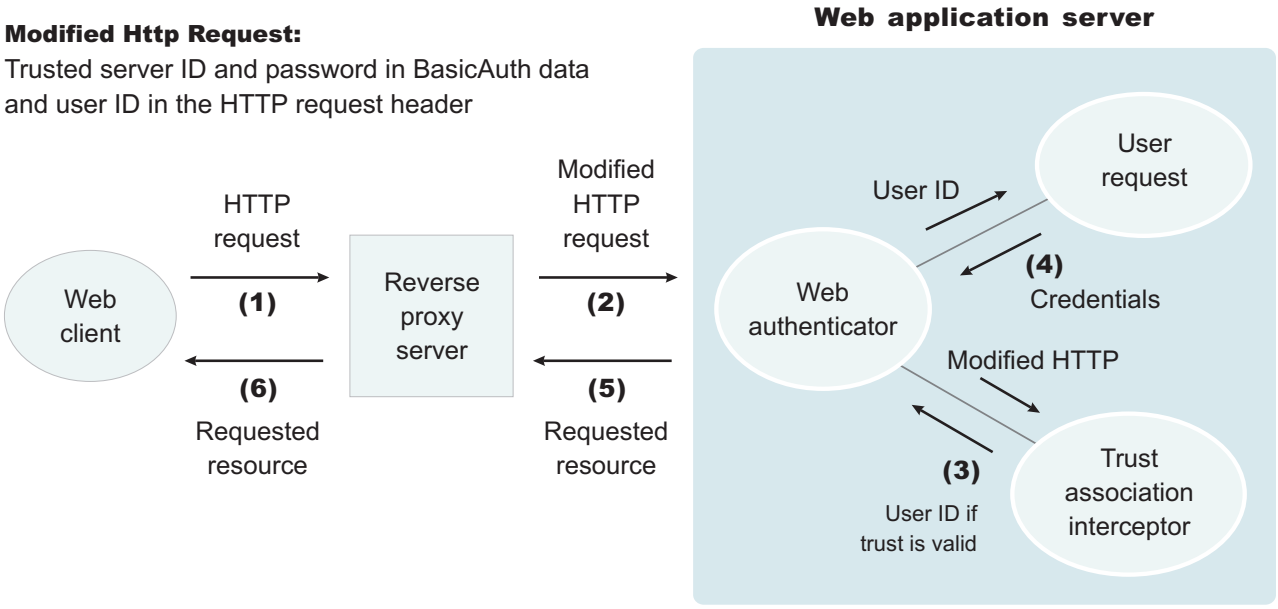
Running in trust association mode does not prohibit WebSphere Application Server from accepting requests that did not pass through the proxy server. In this case, no

interceptor is needed for validating trust. It is possible, however, to configure WebSphere Application Server to strictly require that all HTTP requests go through a reverse proxy server. In this case, all requests that do not come from a proxy server are immediately denied by WebSphere Application Server.

Trust association model

Http Request:
User ID and password in BasicAuth data

Modified Http Request:
Trusted server ID and password in BasicAuth data and user ID in the HTTP request header



IBM WebSphere Application Server--WebSEAL Integration

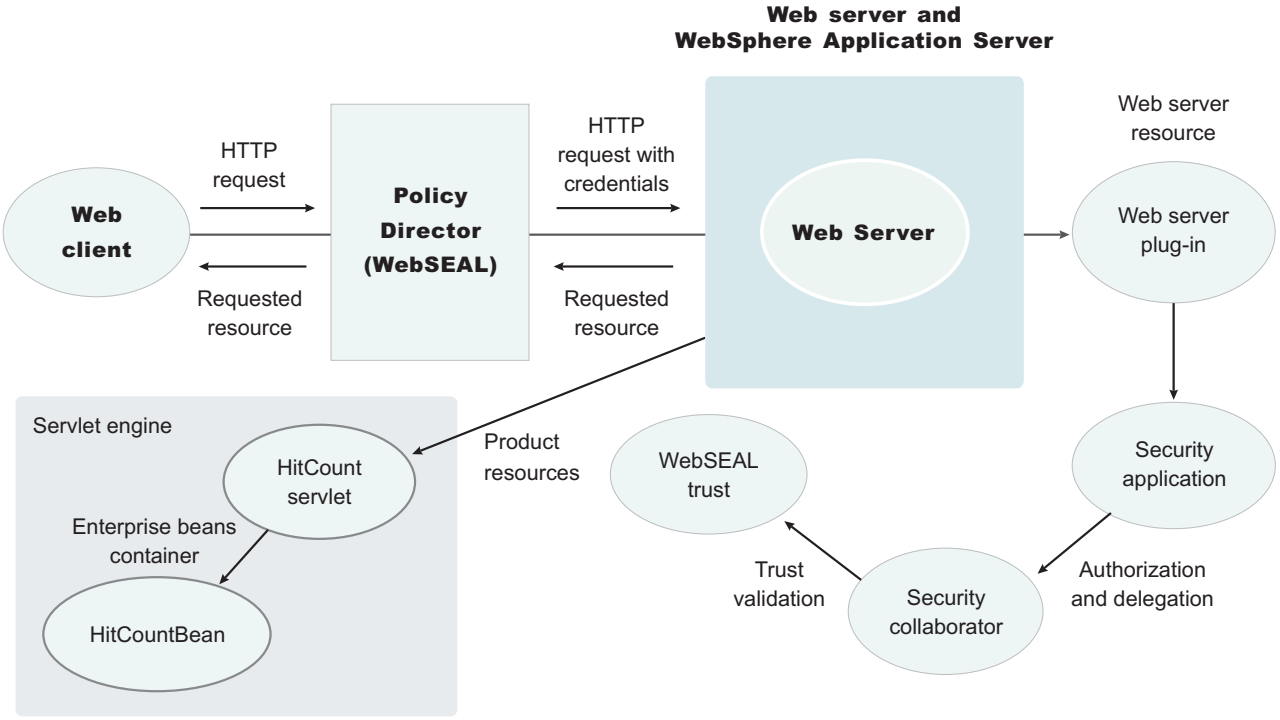
The integration of WebSEAL and WebSphere Application Server security is achieved by placing the WebSEAL server at the front-end as a reverse proxy server. See Figure 2. From a WebSEAL management perspective, a junction is created with WebSEAL on one end, and the product Web server on the other end. A junction is a logical connection created to establish a path from the WebSEAL server to another server.

In this setup, a request for Web resources stored in a protected domain of the product is submitted to the WebSEAL server where it is authenticated against the WebSEAL security realm. If the requesting user has access to the junction, the request is transmitted to the WebSphere Application Server HTTP server through the junction, and then to the application server.

Meanwhile, the WebSphere Application Server validates every request that comes through the junction to ensure that the source is a trusted party. This process is referenced as *validating the trust* and it is performed by a WebSEAL product-designated interceptor. If the validation is successful, the WebSphere Application Server authorizes the request by checking whether the client user has the required permissions to access the Web resource. If so, the Web resource is delivered to the WebSEAL server, through the Web server, which then gives it to the client user.

WebSEAL server

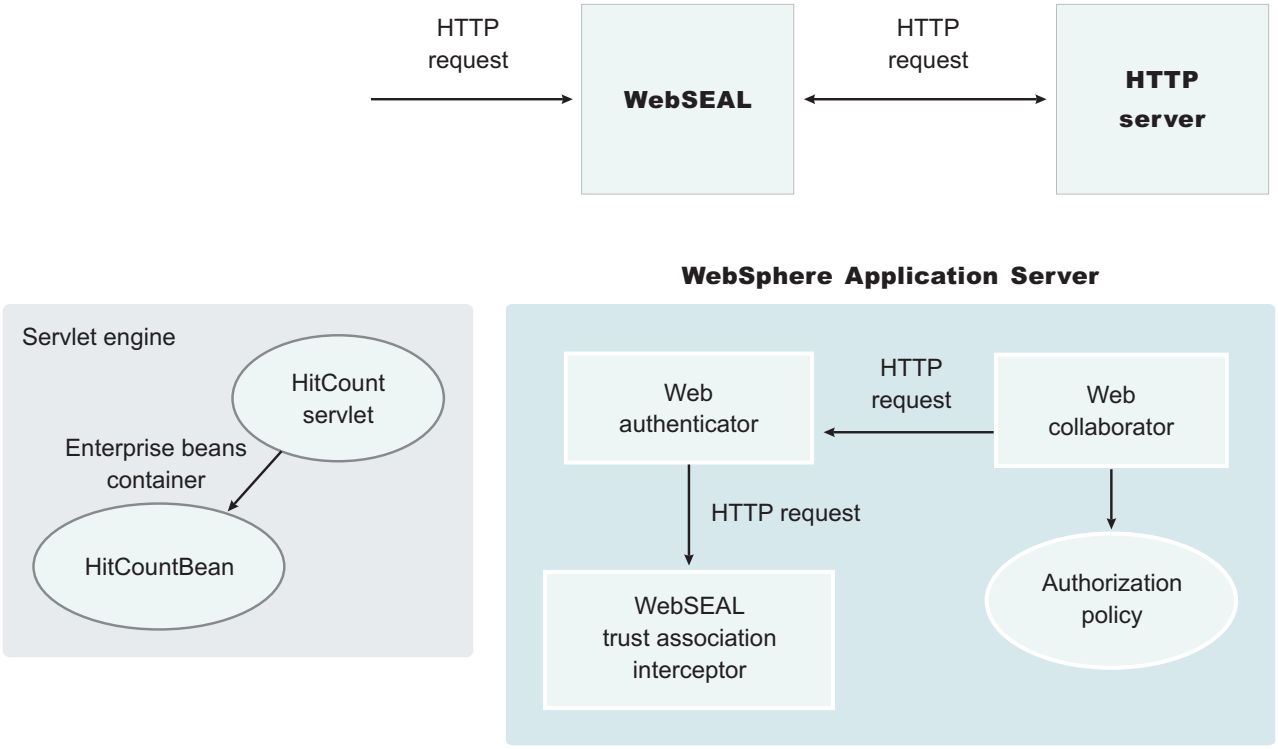
The policy director delegates all of the Web requests to its Web component, the WebSEAL server. One of the major functions of the server is to perform authentication of the requesting user. The WebSEAL server consults a Lightweight Directory Access Protocol (LDAP) directory. It can also map the original user ID to another user ID, such as when global single signon (GSO) is used.



For successful authentication, the server plays the role of a client to WebSphere Application Server when channeling the request. The server needs its own user ID and password to identify itself to WebSphere Application Server. This identity must be valid in the security realm of WebSphere Application Server. The WebSEAL server replaces the basic authentication information in the HTTP request with its own user ID and password. In addition, WebSphere Application Server must determine the credentials of the requesting client so that the application server has an identity to use as a basis for its authorization decisions. This information is transmitted through the HTTP request by creating a header called `iv-creds` with the Tivoli Access Manager user credentials as its value.

HTTP server

The junction created in the WebSEAL server must get to the HTTP server that serves as the product front end. However, the HTTP server is shielded from knowing that trust association is used. As far as it is concerned, the WebSEAL product is just another HTTP client, and as part of its normal routines, it sends the HTTP request to the product. The only requirement on the HTTP server is a Secure Sockets Layer (SSL) configuration using server authentication only. This requirement protects the requests that flow within the junction.



Web collaborator

When trust association is enabled, the Web collaborator manages the interceptors that are configured in the system. It loads and initializes these interceptors when you restart your servers. When a request is passed to WebSphere Application Server by the Web server, the Web collaborator eventually receives the request for a security check. Two actions must take place:

1. The request must be authenticated.
2. The request must be authorized.

The Web authenticator is called to authenticate the request by passing the HTTP request. If successful, a good credential record is returned by the authenticator, which the Web collaborator uses to base its authorization for the requested resource. If the authorization succeeds, the Web collaborator indicates to WebSphere Application Server that the security check has succeeded and that the requested resource can be served.

Web authenticator

The Web authenticator is asked by the Web collaborator to authenticate a given HTTP request. Knowing that trust association is enabled, the task of the Web authenticator is to find the appropriate trust association interceptor to direct the request for processing. The Web authenticator queries every available interceptor. If no target interceptor is found, the Web authenticator processes the request as though trust association is not enabled.

For an HTTP request sent by the WebSEAL server, the WebSEAL trust association interceptor replies with a positive response to the Web authenticator. Subsequently, the interceptor is asked to validate its trust association with the WebSEAL server and retrieve the user ID of the original user client.

Trust association interceptor feature

The intent of the trust association interceptor feature is to have reverse proxy security servers (RPSS) exist as the exposed entry points to perform authentication and coarse-grained authorization, while the WebSphere Application Server enforces further fine-grained access control. Trust associations improve security by reducing the scope and risk of exposure.

In a typical e-business infrastructure, the distributed environment of a company consists of Web application servers, Web servers, legacy systems, and one or more RPSS, such as the Tivoli WebSEAL product. Such reverse proxy servers, front-end security servers, or security plug-ins registered within Web servers, guard the HTTP access requests to the Web servers and the Web application servers. While protecting access to the Uniform Resource Identifiers (URIs), these RPSS perform authentication, coarse-grained authorization, and request routing to the target application server.

Using the trust association interceptor feature

The following points further describe the benefits of the trust association interceptor (TAI) feature:

- RPSS can authenticate WebSphere Application Server users up front and send credential information about the authenticated user to the product so that the product can trust the RPSS to perform authentication and not prompt the end user for authentication data later. The strength of the trust relationship between RPSS and the product is based on the criteria of trust association that is particular to a RPSS and enforced through the TAI implementation. This level of trust might need relaxing based on the environment. Be aware of the vulnerabilities in cases where the RPSS is not trusted, based on a security technology.
- The end user credentials most likely are sent in a special format as part of the Hypertext Transfer Protocol (HTTP) headers as in the case of RPSS authentication. The credentials can be a special header or a cookie. The data that passes is implementation specific, and the TAI feature considers this fact and accommodates the idea. The TAI implementation works with the credential data and returns a string that represents the end user that WebSphere Application Server uses to enforce security policies.

Configuring trust association interceptors

These steps are required to use either a WebSEAL trust association interceptor or your own trust association interceptor with a reverse proxy security server.

1. Access the administrative console by typing `http://localhost:9090/admin` in a Web browser.
2. Click **Security > Authentication mechanisms > LTPA** in the left navigation panel.
3. Click **Trust Association** under Additional Properties.
4. Select the **Trust Association Enabled** check box.
5. Click **Interceptors** under Additional Properties. The default value appears.
6. Click **`com.ibm.ws.security.web.WebSealTrustAssociationInterceptor`** if you are using the WebSEAL interceptor. This interceptor is the default value. To use a different interceptor, complete the following steps:
   a. Click **New**.
   b. Type the name of the interceptor into the **Interceptor Classname** field.

c. Click **OK**.

d. Click the name of the new interceptor.

7. Click **Custom Properties** under Additional Properties.
8. Click **New** to enter the property name and value pairs. The name and value pairs for the WebSEAL server to follow. For a new interceptor, enter the name and value pairs that correspond to your interceptor.

   com.ibm.websphere.security.trustassociation.types
   WebSEAL

   com.ibm.websphere.security.webseal.loginId
   This property contains the ID of the WebSEAL server.

   com.ibm.websphere.security.webseal.id
   The HTTP headers that signify this request come from WebSEAL. Set this property to `iv-creds`, which is a special header field that is sent by the WebSEAL server with the request to WebSphere Application Server.

   com.ibm.websphere.security.webseal.hostnames
   The host names (case sensitive) that are expected in the request header (the VIA header). This request header also includes the proxy host names (if any) unless the `com.ibm.websphere.security.webseal.ignoreProxy` interceptor is set to `true`.

   com.ibm.websphere.security.webseal.ports
   The corresponding port number of the host names that are expected in the request header (the VIA header). This request header also includes the proxy ports (if any) unless the `com.ibm.websphere.security.webseal.ignoreProxy` interceptor is set to `true`.

   com.ibm.websphere.security.webseal.ignoreProxy
   An optional property that if set to `true` or `yes` ignores the proxy host names and ports in the VIA header. By default, this property is set to `false`.

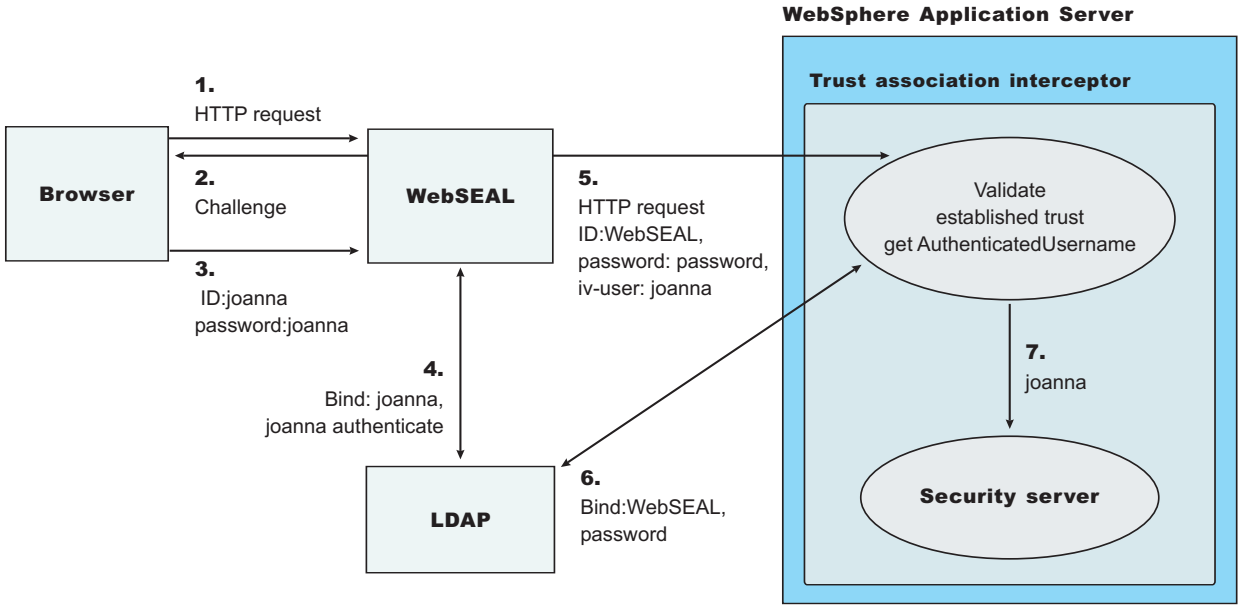
9. Click **OK**.

Enables trust association.

A typical scenario using the trust association interceptor (TAI) includes an environment where IBM Tivoli WebSEAL product is deployed and used with WebSphere Application Server. For the WebSEAL product, an implementation of the TAI is already provided with the product. The following steps outline the typical flow of an HTTP request for a secured WebSphere Application Server resource authenticated by the WebSEAL server through a Web trust association:

1. The browser makes a request for a secured WebSphere resource.
2. The WebSEAL server sends back a challenge, either an HTTP basic authentication or a form-based challenge.
3. A user name and password are supplied.
4. The WebSEAL product authenticates the user to Lightweight Directory Access Protocol (LDAP).
5. The modified request is forwarded by the WebSEAL product to the WebSphere Application Server.
6. The plug-in TAI establishes trust between WebSphere Application Server and the WebSEAL server by using the negotiateAndValidateEstablishedTrust method.
7. The plug-in extracts the end-user credentials from the iv-creds header field and passes it to WebSphere Application Server for authorization.

Web trust association authentication flow



1. If you are enabling security, make sure that you complete the remaining steps for enabling security.
2. Save, stop and restart all of the product servers (cell, nodes, and all of the application servers) for the changes to take effect.

Trust association settings:

Trust association enables the integration of IBM WebSphere Application Server security and third-party security servers. More specifically, a reverse proxy server can act as a front-end authentication server while the product applies its own authorization policy onto the resulting credentials passed by the proxy server. Use this page to configure trust association settings.

To view this administrative console page, click **Security Center > Authentication Mechanisms > LTPA > Trust Association**.

When security is enabled and any of these properties change, go to the **Global Security** panel and click **Apply** to validate the changes.

Enabled:

Specifies whether trust association is enabled.

Data type:	Boolean
Default:	Disable
Range:	Enable or Disable

Trust association interceptor collection:

Use this page to specify trust information for reverse security proxy servers.

To view this administrative console page, click **Security > Authentication Mechanisms > LTPA > Trust Association > Interceptors**.

When security is enabled and any of these properties are changed, go to the Global Security panel and click **Apply** to validate the changes.

Interceptor Class Name:

Specifies the trust association interceptor class name.

Data type
String

Default
`com.ibm.ws.security.web.WebSealTrustAssociationInterceptor`

Single Signon

With single signon (SSO) support, Web users can authenticate once when accessing both WebSphere Application Server resources, such as HTML, JavaServer page (JSP) files, servlets, enterprise beans, and Lotus Domino resources, such as documents in a Domino database, or accessing resources in multiple WebSphere domains.

Web users can authenticate once to a WebSphere Application Server or to a Domino server. Without logging in again, Web users can access any other WebSphere Application Servers or Domino servers in the same Domain Name Service (DNS) domain that are enabled for SSO. This authentication is accomplished by configuring the WebSphere Application Servers and the Domino servers to share authentication information.

Enable SSO among WebSphere Application Servers by configuring SSO for WebSphere Application Server. To enable SSO between WebSphere Application Servers and Domino servers, you must configure SSO for both WebSphere Application Server and for Domino.

Prerequisites and conditions

To take advantage of support for single signon between WebSphere Application Servers or between WebSphere Application Server and a Domino server, applications must meet the following prerequisites and conditions:

- Verify that all servers are configured as part of the same DNS domain. For example, if the DNS domain is specified as `mycompany.com`, then SSO is effective with any Domino server or WebSphere Application Server on a host that is part of the mycompany.com domain, for example, a.mycompany.com and b.mycompany.com.
- Verify that all servers share the same user registry. This registry can be either a supported Lightweight Directory Access Protocol (LDAP) directory server or, if SSO is configured between two WebSphere Application Servers, either a Service Access Facility (SAF) registry or a custom user registry. Domino servers do not support custom registries, but you can use a Domino-supported registry as a custom registry within WebSphere Application Server. For more information on custom registries, see *Introduction to custom registries*.

  You can use a Domino directory (configured for LDAP access) or other LDAP directory for the user registry. The LDAP directory product must have WebSphere Application Server support. Supported products include both Domino and IBM SecureWay LDAP directory servers. Regardless of the choice to

use an LDAP or a custom registry, the SSO configuration is the same. The difference is in the configuration of the registry.
- Define all users in a single LDAP directory. Using LDAP referrals to connect more than one directory together is not supported. Using multiple Domino directory assistance documents to access multiple directories also is not supported.
- Enable HTTP cookies in browsers because the authentication information that is generated by the server is transported to the browser in a cookie. The cookie is then used to propagate the authentication information for the user to other servers, exempting the user from entering the authentication information for every request to a different server.
- For a Domino server:
  - Domino Release 5.0.6a for iSeries 400 or later and Domino Release 5.0.5 or later for other platforms are supported.
  - A Lotus Notes client Release 5.0.5 or later is required for configuring the Domino server for SSO.
  - You can share authentication information across multiple Domino domains.
- For WebSphere Application Server:
  - WebSphere Application Server Version 3.5 or later for all platforms is supported.
  - You can use any HTTP Web server supported by WebSphere Application Server.
  - You can share authentication information across multiple product administrative domains.
  - Basic authentication (user ID and password) using the basic and form-login mechanisms is supported.
  - By default, WebSphere Application Server does a case-sensitive comparison for authorization. This comparison implies that a user who is authenticated by Domino matches the entry exactly (including the base distinguished name) in the WebSphere Application Server authorization table. If case sensitivity is not considered for the authorization, enable the **Ignore Case** property in the LDAP user registry settings.

Configuring single signon

With single signon (SSO) support, Web users can authenticate once when accessing Web resources across multiple WebSphere Application Servers. Form login mechanisms for Web applications require that SSO is enabled.

SSO is supported when either Lightweight Third Party Authentication (LTPA) or Integrated Cryptographic Services Facility (ICSF) is the authentication mechanism. Note that ICSF can only be used with SSO if you are not working within a sysplex. SSO uses HTTP cookies to achieve this functionality.

When SSO is enabled, a cookie is created containing the LTPA token and inserted into the HTTP response. When the user accesses other Web resources in any other WebSphere Application Server process in the same domain name service (DNS) domain, the cookie is sent in the request. The LTPA token is then extracted from the cookie and validated. If the request is between different cells of WebSphere Application Servers, you must share the LTPA keys and the user registry between the cells for SSO to work.

The LTPA authentication mechanism requires that you enable SSO if any of the Web applications have form login as the authentication method.

If you are using single signon between a WebSphere Application Server Version 5.0.x or 5.1 server and a WebSphere Application Server Version 4.0.x application server, you must specify an LDAP server port number in the administrative console by clicking **Security > User registries > LDAP**. You must set the LDAP ports numbers to the same numerical value because for WebSphere Application Server Version 5.0.x or 5.1 the default value is 0 and for WebSphere Application Server Version 4.0.x the default value for the port is not 0.

The following steps are required to configure SSO for the first time.

1. Access the administrative console by typing `http://localhost:9090/admin` in a Web browser.
2. Click **Security** > **Authentication mechanisms > LTPA** in the Navigation panel on the left. Click **Single Signon (SSO)** in the Additional Properties section.
3. Click **Enable** if SSO is disabled. After you click **Enable**, make sure you complete the remaining steps to enable security.
4. Enable the **Requires SSL** field if all of the requests are expected to come over HTTPS.
5. 5.1 Enter the domain name in the Domain name field where SSO is effective. The cookie is sent for all of the servers in this domain only. For example, if the domain is `ibm.com`, SSO works between the domains `austin.ibm.com`, `raleigh.ibm.com` and not `austin.otherCompany.com`.

   The Domain name field is optional, and, if left blank, the Web browser defaults to the domain name of the SSO cookie to the WebSphere Application Server that created it. In this case, SSO is only valid for the server that created the cookie. This behavior might be desirable when multiple virtual hosts are defined and need to have a separate domain specified in the SSO cookie.
6. Click **OK**.

For the changes to take effect, save, stop, and restart all the product servers (cell, nodes and all the WebSphere Application Server systems).

Single signon settings:

Use this page to set the configuration values for single signon (SSO).

To view this administrative console page, click **Security** > **Authentication Mechanisms** > **LTPA** > **Single Signon (SSO)**.

Requires SSL:

Specifies that the single signon function is enabled only when requests are made over HTTPS Secure Sockets Layer (SSL) connections.

Data type:	Boolean
Default:	Disable
Range:	Enable or Disable

Domain Name:

Specifies a fully qualified domain name (.ibm.com, for example) for all single signon hosts.

5.1 If no value is specified, the Web browser of the user defaults to the value of the host name where the Web application is running. This default restricts the HTTP cookie (generated for SSO purposes) only to the originating host. Restricting the HTTP cookie can be undesirable if there is more than one host is participating in the SSO domain. Leaving the domain name attribute empty is only desirable if multiple virtual hosts with different domain names are running on the same physical host. With this field empty, your Web browser can default the domain name to each different virtual host. If a domain name is explicitly specified in this field, then that value is used for all of the virtual hosts and restricts them to a single domain, which can be undesirable in some situations.

5.1 If a domain name is explicitly specified, then all of the Web pages used to access protected Web resources contain the server domain name service (DNS) host name. For example, after global security is configured for LTPA and an explicit SSO domain name is specified, then the administrative console is accessible with the following Web address: `http://yourhost.austin.ibm.com:9090/admin`, where *yourhost.austin.ibm.com* is replaced with your server DNS host name.

Data type: String

Enabled:

Specifies that the single signon function is enabled.

Web applications that use J2EE FormLogin style login pages (such as the WebSphere Application Server administrative console) require single signon (SSO) enablement. Only disable SSO for certain advanced configurations where LTPA SSO-type cookies are not required.

Data type: Boolean
Default: Enabled
Range: Enabled or Disabled

Troubleshooting single signon configurations:

This article describes common problems in configuring single signon (SSO) between a WebSphere Application Server and a Domino server and suggests possible solutions.

- Failure to save the Domino Web SSO configuration document

  The client must be able to find Domino server documents for the participating SSO Domino servers. The Web SSO configuration document is encrypted for the servers that you specify, so the home server indicated by the client location record must point to a server in the Domino domain where the participating servers reside. This pointer ensures that lookups can find the public keys of the servers.

  If you receive a message stating that one or more of the participating Domino servers cannot be found, then those servers cannot decrypt the Web SSO configuration document or perform SSO.

  When the Web SSO configuration document is saved, the status bar indicates how many public keys were used to encrypt the document by finding the listed servers, authors, and administrators on the document.
- Failure of the Domino server console to load the Web SSO configuration document at Domino HTTP server startup

During configuration of SSO, the server document is configured for **Multi-Server** in the **Session Authentication** field. The Domino HTTP server tries to find and load a Web SSO configuration document during startup. The Domino server console reports the following information if a valid document is found and decrypted: `HTTP: Successfully loaded Web SSO Configuration`.

If a server cannot load the Web SSO configuration document, SSO does not work. In this case, a server reports the following message: `HTTP: Error Loading Web SSO configuration`. Reverting to single-server session authentication.

Verify that only one Web SSO Configuration document is in the Web Configurations view of the Domino directory and in the $WebSSOConfigs hidden view. You cannot create more than one document, but you can insert additional documents during replication.

If you can verify only one Web SSO Configuration document, consider another condition. When the public key of the Server document does not match the public key in the ID file, this same error message can display. In this case, attempts to decrypt the Web SSO configuration document fail and the error message is generated.

This situation can occur when the ID file is created multiple times but the Server document is not updated correctly. Usually, an error message is displayed on the Domino server console stating that the public key does not match the server ID. If this situation occurs, then SSO does not work because the document is encrypted with a public key for which the server does not possess the corresponding private key.

To correct a key-mismatch problem:

1. Copy the public key from the server ID file and paste it into the Server document.
2. Create the Web SSO configuration document again.

- Authentication fails when accessing a protected resource.

  If a Web user is repeatedly prompted for a user ID and password, SSO is not working because either the Domino or the WebSphere Application Server security server cannot authenticate the user with the Lightweight Directory Access Protocol (LDAP) server. Check the following possibilities:

  – Verify that the LDAP server is accessible from the Domino server machine. Use the **TCP/IP ping** utility to check TCP/IP connectivity and to verify that the host machine is running.
  – Verify that the LDAP user is defined in the LDAP directory. Use the **ldapsearch** utility to confirm that the user ID exists and that the password is correct. For example, you can run the following command, entered as a single line:

    ```
    % ldapsearch -D "cn=John Doe, ou=Rochester, o=IBM, c=US" -w mypassword
    -h myhost.mycompany.com -p 389
    -b "ou=Rochester, o=IBM, c=US" (objectclass=*)
    ```

    (The percent character (%) indicates the prompt and is not part of the command.) A list of directory entries is expected. Possible error conditions and causes are contained in the following list:

    - No such object: This error indicates that the directory entry referenced by either the user's distinguished name (DN) value, which is specified after the -D option, or the base DN value, which is specified after the -b option, does not exist.
    - Invalid credentials: This error indicates that the password is invalid.
    - Cannot contact the LDAP server: This error indicates that the host name or port specified for the server is invalid or that the LDAP server is not running.

- An empty list means that the base directory specified by the -b option does not contain any directory entries.

– If you are using the user's short name (or user ID) instead of the distinguished name, verify that the directory entry is configured with the short name. For a Domino directory, verify the **Short name/UserID** field of the Person document. For other LDAP directories, verify the userid property of the directory entry.
– If Domino authentication fails when using an LDAP directory other than a Domino directory, verify the configuration settings of the LDAP server in the Directory assistance document in the Directory assistance database. Also verify that the Server document refers to the correct Directory assistance document. The following LDAP values specified in the Directory Assistance document must match the values specified for the user registry in the WebSphere administrative domain:
  - Domain name
  - LDAP host name
  - LDAP port
  - Base DN

  Additionally, the rules defined in the Directory assistance document must refer to the base distinguished name (DN) of the directory containing the directory entries of the users.

  You can trace Domino server requests to the LDAP server by adding the following line to the server `notes.ini` file:

  ```
  webauth_verbose_trace=1
  ```

  After restarting the Domino server, trace messages are displayed in the Domino server console as Web users attempt to authenticate to the Domino server.

• Authorization failure when accessing a protected resource.

  After authenticating successfully, if an authorization error message is displayed, security is not configured correctly. Check the following possibilities:
  – For Domino databases, verify that the user is defined in the access-control settings for the database. Refer to the Domino Administrative documentation for the correct way to specify the user's DN. For example, for the `DN cn=John Doe, ou=Rochester, o=IBM, c=US`, the value on the access-control list must be set as `John Doe/Rochester/IBM/US`.
  – For resources protected by WebSphere Application Server, verify that the security permissions are set correctly.
    - If granting permissions to selected groups, make sure that the user attempting to access the resource is a member of the group. For example, you can verify the members of the groups by using the following Web site to display the directory contents:
      `Ldap://myhost.mycompany.com:389/ou=Rochester, o=IBM, c=US??sub`
    - If you have changed the LDAP configuration information (host, port, and base DN) in a WebSphere Application Server administrative domain since the permissions were set, the existing permissions are probably invalid and need to be recreated.

• SSO failure when accessing protected resources.

  If a Web user is prompted to authenticate with each resource, SSO is not configured correctly. Check the following possibilities:
  1. Configure both the WebSphere Application Server and the Domino server to use the same LDAP directory. The HTTP cookie used for SSO stores the full DN of the user, for example, `cn=John Doe, ou=Rochester, o=IBM, c=US`, and the domain name service (DNS) domain.

2. Define Web users by hierarchical names if the Domino Directory is used. For example, update the **User name** field in the Person document to include names of this format as the first value: `John Doe/Rochester/IBM/US`.
3. Specify the full DNS server name, not just the host name or TCP/IP address for Web sites issued to Domino servers and WebSphere Application Servers configured for SSO. For browsers to send cookies to a group of servers, the DNS domain must be included in the cookie, and the DNS domain in the cookie must match the Web address. (This requirement is why you cannot use cookies across TCP/IP domains.)
4. Configure both Domino and the WebSphere Application Server to use the same DNS domain. Verify that the DNS domain value is exactly the same, including capitalization. The DNS domain value is found on the Configure Global Security Settings panel of the WebSphere Application Server administrative console and in the Web SSO Configuration document of a Domino server. If you make a change to the Domino Web SSO Configuration document, replicate the modified document to all of the Domino servers participating in SSO.
5. Verify that the clustered Domino servers have the host name populated with the full DNS server name in the Server document. By using the full DNS server name, Domino Internet Cluster Manager (ICM) can redirect to cluster members using SSO. If this field is not populated, by default, ICM redirects Web addresses to clustered Web servers by using the host name of the server only. It cannot send the SSO cookie because the DNS domain is not included in the Web address. To correct the problem:
   a. Edit the Server document.
   b. Click **Internet Protocols > HTTP** tab.
   c. Enter the full DNS name of the server in the **Host names** field.
6. If a port value for an LDAP server was specified for a WebSphere Application Server administrative domain, edit the Domino Web SSO configuration document and insert a backslash character (\) into the value of the **LDAP Realm** field before the colon character (:). For example, replace `myhost.mycompany.com:389` with `myhost.mycompany.com\:389`.

Integrated Cryptographic Services Facility settings

Use this page to configure Integrated Cryptographic Services Facility (ICSF) settings.

To view this administrative console page, click **Security** > **Authentication Mechanisms** > **ICSF**.

Timeout:

Specifies the time period in which an ICSF token expires. Verify that this time period is longer than the cache out that is configured in the Global Security panel.

Data type	Integer
Units	Minutes
Default	120

Encryption Cryptographic Key:

Specifies the label of the cryptographic key to use for single signon tokens for Web applications and administrative security when using the Simple Object Access Protocol (SOAP) HTTP connector.

You can create the cryptographic key in a Cryptographic Key Data Set (CKDS) accessible by ICSF. For additional information, see the *z/OS Integrated Cryptographic Services Overview* manual or the *OS/390 Integrated Cryptographic Services Overview* manual

Data type String

Configuring Tivoli Access Manager for WebSphere Application Server

Tivoli Access Manager for WebSphere Application Server provides container-based authorization and centralized policy management for WebSphere Application Server applications. When integrated with WebSphere Application Server, Tivoli Access Manager for WebSphere Application Server is responsible for all role mappings to principals or groups. It also provides a migration utility (`migrateEAR5`), which is used to import role-to-principal or role-to-group mappings from a Java 2 Platform, Enterprise Edition (J2EE) deployment descriptor into a Tivoli Access Manager security schema.

To configure Tivoli Access Manager on one or more host systems in a WebSphere Application Server for z/OS, Version 5.1, environment, follow these steps:

1. Verify that the Tivoli Access Manager policy server, a supported registry server, and an authorization server are set up in your secure domain. For instructions on setting up these Tivoli Access Manager systems, see *IBM Tivoli Access Manager Base Installation Guide, Version 5.1* at http://publib.boulder.ibm.com/tividd/td/IBMAccessManagerfore-business5.1.html
2. Verify that WebSphere Application Server for z/OS, Version 5.1, is installed on your system.
3. If the policy server was configured against an existing registry used by WebSphere Application Server security, import existing application server users and groups from the user registry to the Tivoli Access Manager registry schema. For more information, refer to "Importing existing WebSphere Application Server users and groups to use Tivoli Access Manager" on page 205.
4. Create a Tivoli Access Manager administrative user to perform tasks specific to WebSphere Application Server. For more information, refer to "Creating a Tivoli Access Manager administrative user for WebSphere Application Server" on page 205.
5. Configure the access manager Java Runtime Environment component. For more information, refer to "Configuring the Access Manager Java Runtime Environment component" on page 206.
6. Configure the access manager component for WebSphere Application Server. For more information, refer to "Configuring Tivoli Access Manager to use WebSphere Application Server" on page 206.
7. Enable WebSphere Application Server security. For more information, refer to "Enabling WebSphere Application Server security to use Tivoli Access Manager" on page 209.
8. If your systems have J2EE applications with enterprise archive (EAR) files that specify the security policy, you must migrate application server security settings. For more information, refer to "Migrating WebSphere Application Server security settings for use with Tivoli Access Manager" on page 212.

9. Verify that your configuration is successful. For more information, refer to "Verifying the WebSphere Application Server configuration" on page 214.
10. After migrating the administrative console security definitions, you can grant new users access to the administrative console. For more information, refer to "Granting user access to the WebSphere Application Server administrative console" on page 215.

Importing existing WebSphere Application Server users and groups to use Tivoli Access Manager:

If the Tivoli Access Manager policy server is configured with an existing registry used by WebSphere Application Server security, you must import existing users and groups from the user registry to the Tivoli Access Manager registry schema. Perform this process prior to migrating applications that contain these users and groups.

You can import users and groups into the registry using the Web Portal Manager interface or the **pdadmin** command line utility. For example, enter the following commands from the Tivoli Access Manager server:

```
pdadmin sec_master> user import garyf "cn=Gary Forghetti,o=IBM,c=us,dc=mkt"
pdadmin sec_master> group import engineering "cn=engineering,o=IBM,c=US"
```

1. For information about importing users and groups, refer to the IBM Tivoli Access Manager Base Administration Guide, Version 5.1. 2.
2. If you are using IBM Tivoli Directory Server and have a large number of users and groups, consider using the `bulkload` utility. This Lightweight Directory Access Protocol (LDAP) utility is described in IBM Tivoli Access Manager for e-business Performance Tuning Guide, Version 5.1.

Creating a Tivoli Access Manager administrative user for WebSphere Application Server:

A Tivoli Access Manager user is required by WebSphere Application Serverto perform administrative tasks, such as logging into the console. If you already have security enabled, you must import the WebSphere Application Server administrative user into the Tivoli Access Manager object space as described in Importing WebSphere Application Server existing users and groups to use Tivoli Access Manager. Otherwise, you must create a Tivoli Access Manager administrative user for WebSphere Application Server.

To create a user using the **pdadmin** command, follow these steps:

1. From the Tivoli Access Manager server, log on as the `sec_master` administrative user:

   ```
   pdadmin -a sec_master -p sec_master_password
   ```
2. To create a Tivoli Access Manager user, such as wsuser, enter the following command as one continuous command line:

   ```
   user create wsuser cn=wsuser,o=organization,c=country wsuser wsuser
   myPassword
   ```
3. To enable the wsuser user account to log in, set the account-valid flag to `yes`:

   ```
   user modify wsuser account-valid yes
   ```
4. Display the properties of the `wsuser` user:

   ```
   user show wsuser
   ```

For more information, refer to IBM Tivoli Access Manager Base Administration Guide, Version 5.1. 2.

Configuring the Access Manager Java Runtime Environment component:

The following procedure uses the `pdjrtecfg` utility to configure the Access Manager Java Runtime Environment component for use within the JRE shipped and installed with WebSphere Application Server. This component contains the core classes needed by applications to communicate with the Tivoli Access Manager policy server and authorization servers. Note that you must configure the Access Manager Java Runtime Environment component for each Java Development Kit (JDK) used to run WebSphere Application Server and its applications.

Attention: If you are running in a network deployment (ND) environment, you must repeat these configuration steps for both ND and the base application server. Be sure to select the deploy to all nodes check box when using the administrative console in an ND environment.

To configure the Access Manager Java Runtime Environment component, follow these steps:

1. Open a system command prompt on your z/OS machine where WebSphere Application Server is installed and log on with a user account that has write access to the $WAS_HOME directory.
2. Run the `setupCmdLine` script, located in WAS_HOME\bin to set up the environment.
3. Set the WAS_HOME environment variable by issuing:

   ```
   export WAS_HOME=/WebSphere/V5R0M0/AppServer
   ```

   where WAS_HOME specifies the Tivoli Access Manager for WebSphere Application Server installation directory.

   When configuring the deployment manager, $WAS_HOME is typically /WebSphere/V5R0M0/DeploymentManager.
4. Run the `pdjrtecfg` utility as one continuous command line or, enter keywords on several lines using a trailing continuation character (\) as shown:

   ```
   ${JAVA_HOME}/bin/java -Dfile.encoding=ISO8859-1 \
                  -Dws.output.encoding=CP1047 \
                  -Xnoargsconversion \
                  -Dpd.home=${WAS_HOME}/java/jre/PolicyDirector \
                  -cp ${WAS_HOME}/java/jre/lib/ext/PD.jar \
                   com.tivoli.pd.jcfg.PDJrteCfg \
                  -action config \
                  -cfgfiles_path ${WAS_HOME}/java/jre \
                  -host tivoli_access_manager_server \
                  -was
   ```

   For more information about this utility, refer to "The Tivoli Access Manager com.tivoli.pd.jcfg.PDJrteCfg utility" on page 222.

Configuring Tivoli Access Manager to use WebSphere Application Server:

Complete the instructions in the following sections:

1. Running the SvrSslCfg utility to configure WebSphere Application Server to use Tivoli Access Manager

2. Running the pdwascfg utility to configure WebSphere Application Server to use Tivoli Access Manager

Running the SvrSslCfg utility to configure WebSphere Application Server to use Tivoli Access Manager:

The following procedure uses the SvrSslCfg utility to configure WebSphere Application Server to use Tivoli Access Manager for authentication.

After running the SvrSslCfg utility successfully on WebSphere Application Server, a user account and server entries, representing the WebSphere Application Server, are created in the Tivoli Access Manager user registry. In addition, a configuration file and a Java key store file, which securely store a client certificate, are created locally on the Application Server. This client certificate permits callers to use Tivoli Access Manager authentication services. You can also choose to remove the user and server entries from the user registry and clean up the local configuration and key store files.

Note: You must run SvrSslCfg for each WebSphere Developer Kit, Java Technology Edition installation. For example, in a network deployment setup, if the deployment manager and a node are installed on the same machine, you must run the SvrSslCfg twice - one time for the deployment manager developer kit and again to configure the node developer kit.

To configure the Access Manager for WebSphere Application Server component using the SvrSslCfg utility, follow these steps:

1. Run the setupCmdLine script, located in WAS_HOME\bin to set up the environment.
2. Set the WAS_HOME environment variable by issuing export WAS_HOME=/WebSphere/V5R0M0/AppServer, where WAS_HOME specifies the Tivoli Access Manager for WebSphere installation directory.
3. Run the SvrSslCfg utility as one continuous command line or, enter keywords on several lines using a trailing continuation character (\) as shown:

```
CLASSPATH=${WAS_HOME}/java/jre/lib/ext/PD.jar:${WAS_CLASSPATH}
java \
-cp ${CLASSPATH} \
-Dpd.cfg.home= ${WAS_HOME}/java/jre \
-Dfile.encoding=ISO8859-1 \
-Dws.output.encoding=CP1047 \
-Xnoargsconversion \
 com.tivoli.pd.jcfg.SvrSslCfg \
-action config \
-admin_id sec_master \
-admin_pwd password \
-appsvr_id application_server id \
-policysvr tam_policy_server:7135:1 \
-port 7135 \
-authzsvr tam_authorization_server:7136:1 \
-mode remote \
-cfg_file configuration_file \
-key_file key_file \
-cfg_action create
```

Note: For the `-appsvr_id` option, ensure that you specify the Tivoli Access Manager user ID you created in "Creating a Tivoli Access Manager administrative user for WebSphere Application Server" on page 205. For more information, such as command syntax and option descriptions, refer to "The Tivoli Access Manager com.tivoli.pd.jcfg.SvrSslCfg utility" on page 223.

4. After you run the SvrSslCfg utility, do the following:
   a. Verify that the `-appsvr_id` specified user was created successfully by entering the following command from the Tivoli Access Manager server:

      ```
      pdadmin -a sec_master -p password -m user show was_user_ID
      ```

   a. Verify that the `PdPerm.properties` file was created successfully. This file is located in the path specified for the `CFG_FILE` option when running the `SvrSslCfg` utility. For example:

      ```
      CFG_FILE=${WAS_HOME}/java/jre/PDPerm.properties
      ```

5. After the configuration and key store files are created, make sure that the deployment node and deployment manager control and servant regions have read permission to the files.

Running the pdwascfg utility to configure WebSphere Application Server to use Tivoli Access Manager:

The following procedure uses the `pdwascfg` utility to configure the Access Manager for WebSphere component to the default security authorization provider for WebSphere Application Server. During this process, this component also joins to the Tivoli Access Manager domain.

If you are using deployment manager, you must run the `pdwascfg` utility twice - one time for the deployment manager and again to configure the base application server. The `pdwascfg` utility is located in the bin directory for both the base application server and the deployment manager (typically `/WebSphere/V5R0M0/AppServer` and `/WebSphere/V5R0M0/DeploymentManager/bin`).

To configure the Access Manager for WebSphere Application Server component using the `pdwascfg` utility, follow these steps:

1. Open a system command prompt on your z/OS machine where WebSphere Application Server is installed and log on with a user account that has write access to the $WAS_HOME directory.
2. Run the `setupCmdLine` script, located in `WAS_HOME\bin` to set up the environment.
3. Set the `WAS_HOME`, `PDWAS_HOME`, and `JDK_DIR` environment variables. For example:

   ```
   export WAS_HOME=/WebSphere/V5R0M0/AppServer
   export PDWAS_HOME=$WAS_HOME
   export JDK_DIR=/java/J1.4
   ```

   where:

   WAS_HOME
   Specifies the Tivoli Access Manager for WebSphere installation directory.

   When configuring the deployment manager, `$WAS_HOME` is typically `/WebSphere/V5R0M0/DeploymentManager`.

PDWAS_HOME
Specifies the WebSphere Application Server installation directory.

JDK_DIR
Specifies the Java installation directory.

4. Run the pdwascfg utility as follows:

```
${WAS_HOME}/bin/pdwascfg
\
-action configWAS5
-remote_acl_user remote_acl_user \
-sec_master_pwd password \
-pdmgrd_host tam_policy_server \
-pdacld_host tam_authorization_server \
-embedded true \
-was_home $WAS_HOME\
-amwas_home $PDWAS_HOME \
-action_type local
```

where remote_ACL_user_name corresponds to the user created by the configuration. This user is employed for all communication with the Tivoli Access Manager servers. This is a special user that should not be used for any other purpose.

The pdwascfg utility configures WebSphere Application Server to use Tivoli Access Manager for WebSphere as the authorization vendor.

5. After you run the pdwascfg utility, verify that the remote_acl_user specified user is a member of the remote-acl-users group. To do so, enter the following from the Tivoli Access Manager server:

```
pdadmin -a sec_master -p password -m group show-members remote-acl-users
```

The pdwascfg utility creates the following configuration files:

```
/${PDWAS_HOME}/etc/PDWAS.properties
/${PDWAS_HOME}/config/PD_WAS.prop
```

For more information about this utility, refer to "The Tivoli Access Manager pdwascfg utility" on page 219.

Enabling WebSphere Application Server security to use Tivoli Access Manager:

The steps for enabling security using Tivoli Access Manager are identical to enabling WebSphere Application Server security. Back up the WebSphere Application Server configuration files before enabling security. In the ${WAS_HOME}/bin directory, the backupConfig.sh and restoreConfig.sh scripts are provided.

To enable WebSphere Application Server, Version 5.1 security, follow these steps:

1. Start the WebSphere Application Server if it is not started already.
2. Add a grant codeBase definition statement for the PD.JAR file in the server.policy file. Tivoli Access Manager core classes in the PD.jar file need permissions when Java security is enabled. Edit the ${WAS_HOME}/properties/server.policy file using the viascii editor and append the following statement to the bottom of the file:

```
grant codeBase "file:${was.install.root}/java/jre/lib/ext/PD.jar" {
     permission java.security.AllPermission;
};
```

3. To start the administrative console, enter the following address in your Web browser: http://localhost:9080/admin
4. Log in as any user. If the user ID does not require a password, log in, and skip to step 5. If the user ID requires a password when signing onto the administrative console, you must disable global security and restart the WebSphere Application Server before logging into the console:
   a. In the left navigation pane, click **Security > Global Security**.
   b. From the Global Security page, clear the **Enabled** option and click **OK**. Messages are displayed that indicate a change to your local configuration:

      ```
      Changes have been made to your local configuration. Click Save to apply
      changes to the master configuration.
      ```

      From the Save page, click **Save** to update the master repository with your changes.

      When running in a Network Deployment environment, select the **Deploy to all nodes** option.
   c. Restart the WebSphere Application Server:

      ```
      ./stopServer.sh server_name -username wsadmin -password password -nowait
      ./startServer.sh server_name
      ```
   d. Log into the administrative console. No password is required.
5. Add the `PDDEFAULTCONFIG` and `pd.cfg.home` variables to the Java virtual machine (JVM) configuration for the control process. When running in a Network Deployment environment, set the same variables for the deployment manager.
   a. From the left navigation pane, click **Servers > Application Servers** and then click the name of the server that you want to modify.
   b. From the Server page, click **Process Definition** under Additional Properties.
   c. From the Process Definition page, click the **Control** process type.
   d. From the Control page, click **Java virtual machine** under Additional Properties.
   e. From the Java virtual machine page, click **Custom Properties** under Additional Properties.
   f. From the Custom Properties page, click **New**.
   g. From the New page, in the General Properties table, enter values for the following fields and click **OK**.

      Name Type `PDDEFAULTCONFIG`

      Value Specify the fully qualified file name for the configuration file you that specified when you ran the SvrSslCfg utility. This file name is specified using the `-cfg_file` option. For example: `/WebSphere/V5R0M0/AppServer/java/jre/PdPerm.properties`
   h. From the Server page, click **Custom Properties** under Additional Properties.
   i. From the Custom Properties page, click **New**.
   j. From the New page, in the General Properties table, enter values for the following fields and click **OK**.

      Name Type `pd.cfg.home`

Value Specify the Tivoli Access Manager configuration home directory. For example: `/WebSphere/V5R0M0/AppServer/java/jre`

k. Messages are displayed that indicate a change to your local configuration.

```
Changes have been made to your local configuration. Click Save to
apply changes to the master configuration.
```

From the Save page, click **Save** to update the master repository with your changes.

When running in a Network Deployment environment, be sure to click the **Deploy to all nodes** option.

6. Repeat step 5 from "Configuring the Access Manager Java Runtime Environment component" on page 206 for the servant process, substituting the Servant process type in step 5c.
7. Configure your user registry. For example, for an Lightweight Directory Access Protocol (LDAP) server, perform the following steps:
   a. From the left navigation panel, click **Security > User Registries > LDAP**.
   b. Configure LDAP properties similar to those properties shown in the following table and click **OK**. For Server user ID and Server user password fields, specify the Tivoli Access Manager user ID and password that you created or imported in "Creating a Tivoli Access Manager administrative user for WebSphere Application Server" on page 205.

Table 9. General properties

General Properties	Value
Server user ID	`cn=wsadmin,o=ibm,c=us`
Server user password	*myPassword*
Type	`IBM_Directory_Server`
Host	ldapserver.mydomain.ibm.com
Port	389
Base distinguished name (DN)	`o=ibm,c=us`
Bind distinguished name (DN)	`cn=root`
Search timeout	120
Reuse connection	Select the option
Ignore case	Select the option
SSL-enabled	Clear the option
SSL configuration	`cellname/DefaultSSLSetting`
Use Tivoli Access Manager for account policies	Do not select this option at this time. You enable this function later in step 16 to configure WebSphere Application Server to authenticate through Tivoli Access Manager.

Messages are displayed the indicate that a change to your local configuration.

```
Changes have been made to your local configuration. Click Save to
apply changes to the master configuration.
```

c. From the Save page, click **Save** to update the master repository with your changes.

When running in a Network Deployment environment, be sure to select the **Deploy to all nodes** option.

8. From the left navigation pane, click **Security > Authentication Mechanisms > LTPA**.
9. From the LTPA page, configure Lightweight Third Party Authentication (LTPA) authentication:
   a. Specify a new password to encrypt and decrypt LTPA keys.
   b. Specify the new password again for confirmation.
   c. Click **Apply**.
10. (*Optional*) To enable single signon (SSO), click **Single Signon (SSO)** under Additional Properties. From the Single Signon (SSO) page, click **Enable single signon**, enter the single signon domain name service (DNS), and click **OK**.
11. From the Global Security page in the General Properties table, configure the following properties and then click **OK**. You can leave the other properties unchanged.

Table 10. General properties

General properties	Value
Enabled	Select this option
Enforce Java 2 security	Clear this option
Use domain qualified user IDs	Select this option
Active authentication mechanism	Click **LTPA (Lightweight Third Party Authentication)**
Active user registry	Click **LDAP**

Messages are displayed that indicate a change to your local configuration.

```
Changes have been made to your local configuration. Click Save to
apply changes to the master configuration.
```

12. From the Save page, click **Save** to update the master repository with your changes.

    When running in a Network Deployment environment, select the **Deploy to all nodes** option.
13. Click **Logout** to log out of the WebSphere Application Server administrative console.
14. Open the administrative console and log in again at http://localhost:9090/admin/. The WebSphere Application Server Network Deployment port is 9080.
15. From the left navigation pane, click **Security > User Registries > LDAP**.
16. Select the **Use Tivoli Access Manager for Account Policies** option and click **OK**. Messages are displayed that indicate a change to your local configuration.

    ```
    Changes have been made to your local configuration. Click Save to
    apply changes to the master configuration.
    ```
17. From the Save page, click **Save** to update the master repository with your changes.

    When running in a Network Deployment environment, be sure to select the **Deploy to all nodes** option.
18. Click **Logout** to log out of the WebSphere Application Server administrative console.

Migrating WebSphere Application Server security settings for use with Tivoli Access Manager:

After enabling WebSphere Application Server security to use Tivoli Access Manager, you must migrate the WebSphere Application Server security definitions to Tivoli Access Manager. Tivoli Access Manager for WebSphere provides the migrateEAR5 utility to convert security role definitions to Tivoli Access Manager protected objects.

The migrateEAR5 utility is run against the following policy definition files to migrate WebSphere Application Server security settings. You must also run this utility against any other WebSphere application enterprise archive files (`.ear` files) that you want to protect using Tivoli Access Manager.

- The `adminconsole.ear` file contains the `application.xml file`, which includes the administrative console Web address (resource to protect) and the administrative roles required to use the administrative console.
- The `admin-authz.xml` file contains users and their assigned administrative roles.
- The `naming-authz.xml` file contains roles to control access to the WebSphere name space.

To migrate application server security settings, follow these steps:

1. Make sure that the *WAS_HOME* environment variable is set to the WebSphere Application Server installation directory.
2. Change to the directory where the migrateEAR5 utility is located: `${WAS_HOME}/bin/`
3. Run the migrateEAR5 utility to migrate the data contained in the `adminconsole.ear` file: Use parameter descriptions listed in The Tivoli Access Manager migrateEAR5 utility. The -e option is required for migration of the `adminconsole.ear` file because the WebSphere Application Server renames this application during deployment.

   ```
   /WebSphere/V5R0M0/AppServer/bin/migrateEAR5 \
   -j /WebSphere/V5R0M0/AppServer/installedApps/SY1/adminconsole.ear \
   -e adminconsole \
   -a sec_master \
   -p password \
   -w wsadmin \
   -d o=ibm,c=us \
   -c file:/WebSphere/V5R0M0/AppServer/java/jre/PdPerm.properties
   ```

4. Run the migrateEAR5 utility to migrate the data contained in the `admin-authz.xml` file: The default `admin-authz.xml` file has an entry for the cbcfg1group. You get an error message when you run the migrateEAR5 utility for the group if it is not pre-defined to Tivoli Access Manager. From the Tivoli Access Manager server, use the **pdadmin** command to create the group. For example:

   ```
   pdadmin -a sec_master -p password -m group create cbcfg1
    cn=cbcfg1,o=ibm,c=us cbcfg1
   /WebSphere/V5R0M0/AppServer/bin/migrateEAR5 \
   -j /WebSphere/V5R0M0/AppServer/config/cells/SY1/admin-authz.xml \
   -a sec_master \
   -p password \
   -w wsadmin \
   -d o=ibm,c=us \
   -c file:/WebSphere/V5R0M0/AppServer/java/jre/PdPerm.properties
   ```

5. Run the migrateEAR5 utility to migrate the data contained in the `naming-authz.xml` file:

```
/WebSphere/V5R0M0/AppServer/bin/migrateEAR5 \
-j /WebSphere/V5R0M0/AppServer/config/cells/SY1/naming-authz.xml \
-a sec_master \
-p password \
-w wsadmin \
-d o=ibm,c=us \
-c file:/WebSphere/V5R0M0/AppServer/java/jre/PdPerm.properties
```

A status message is displayed when the migration completes. Output of the utility is logged to the `pdwas_migrate.log` file, which is created in the directory where the utility is run. Check the log file after each migration. If the log file displays errors, check the last recorded transaction, correct the source of the error, and rerun the migration utility. If the migration is unsuccessful, verify that you supplied the correct values for the `-c` and `-j` options.

The migration utility requires access to the `adminconsole.ear` file. By default, the assembly toolkit contains URL references to the location of the document type definitions (DTD) standard. Lookups for the deployment descriptors of the DTD require a connection to the Internet. If the host computer is not connected to the Internet, use a local copy of the DTD. In this case, update the deployment descriptors to point to the local DTD.

After configuring the initial installation, you can configure additional Tivoli Access Manager installations into a secure domain.

6. Restart the WebSphere Application Server:

```
./stopServer.sh server_name -username wsadmin -password password -nowait
./startServer.sh server_name
```

Verifying the WebSphere Application Server configuration:

1. Make sure that WebSphere Application Server is started and open the administrative console: `http://localhost:9090/admin`
2. Log in to the administrative console. Security is enabled and you need to specify the Tivoli Access Manager `wsuser` user account password.
3. On the Introduction page, view WebSphere Status to verify that the configuration is successful. Verify that the total configuration problems value is 0. To review configuration progress, you can also browse the WebSphere Application Server system log file on the mainframe using the System Display and Search Facility (SDSF). For example, the following configuration message indicates that WebSphere Application Server is configured to use Tivoli Access Manager for authentication and authorization:

   ```
   BBOO0222I SECJ0157I: Loaded Vendor AuthorizationTable:
   com.tivoli.pdwas.websphere.PDWASAuthzManager
   ```

   If you cannot log in or your configuration results in errors, consider taking the following actions to determine the problem:

   a. Use the System Display and Search Facility (SDSF) to browse the WebSphere Application Server system log file for possible errors. For example, the following error message indicates a role-related problem during configuration:

      ```
      ...
      BBOO0220E SECJ0161E: Error returned from Vendor AuthorizationTable.
      pdwas.websphere.PDWASAuthzManager.isGrantedAnyRole(PDWASAuthzManager.java:334)
      pdwas.websphere.PDWASAuthzManager.isEveryoneGranted(PDWASAuthzManager.java:116)
      security.core.WSAccessManager.isEveryoneGranted(WSAccessManager.java:728)
      security.web.WebCollaborator.authorize(WebCollaborator.java:488)
      ```

```
security.web.EJSWebCollaborator.preInvoke(EJSWebCollaborator.java:230)
webcontainer.webapp.WebAppSecurityCollaborator.preInvoke(WebAppSecurityCollabora
webcontainer.webapp.WebAppRequestDispatcher.dispatch(WebAppRequestDispatcher.jav
webcontainer.webapp.WebAppRequestDispatcher.forward(WebAppRequestDispatcher.java
webcontainer.srt.WebAppInvoker.doForward(WebAppInvoker.java:119)
```

b. Turn on WebSphere Application Server security Java tracing.

c. To explore the possibility that the problem might exist on the Tivoli Access Manager server, turn on Tivoli Access Manager tracing. For instructions, refer to IBM Tivoli Access Manager for e-business Problem Determination Guide, Version 5.1.

d. Turn on logging for the Access Manager Java Runtime Environment. For example, use the `viascii` editor to edit the `PDJLog.properties` file and change the following statement to `true`:

```
baseGroup.PDJTraceLogger.isLogging=true
```

e. Turn on tracing and logging for the SrvSslCfg utility.

Granting user access to the WebSphere Application Server administrative console:

After migrating the administrative console security definitions, you eventually want to grant new users access to the administrative console. Use either the Web Portal Manager interface or the pdadmin utility:

1. Create a user account:
   a. From the Tivoli Access Manager server, log on as the `sec_master` administrative user: `pdadmin -a sec_master -p sec_master_password`
   b. To create a Tivoli Access Manager user, such as `admin1`, enter the following command on one line: `pdadmin sec_master> user create admin1 cn=admin1,o=organization,c=country wsuser wsuser myPassword` For example: `pdadmin sec_master> user create admin1 cn=admin1,o=ibm,c=us wsuser wsuser password`
   c. To enable the `admin1` user account to log in, set the account-valid flag to yes as follows: `pdadmin sec_master> user modify admin1 account-valid yes`
   d. Display the properties of the `admin1` user: `pdadmin sec_master> user show admin1`
2. Add the user to the `pdwas-admin` group: `pdadmin sec_master> -m group modify pdwas-admin add admin1`
3. Attach the user to the appropriate `admin-authz` access control list (ACL): `pdadmin sec_master> -m acl / modify _WebAppServer_deployedResources_administrator_admin-authz_ACL / set user admin1 T[WebAppServer]i` Additional WebSphere Application Server administrative console authorization roles are provided in the following table:

Role	ACL
Administrator	`_WebAppServer_deployedResources_administrator_admin-authz_ACL`
Configurator	`_WebAppServer_deployedResources_configurator_admin-authz_ACL`
Monitor	`_WebAppServer_deployedResources_monitor_admin-authz_ACL`
Operator	`_WebAppServer_deployedResources_operator_admin-authz_ACL`

Configuring WebSphere Application Server to use your original security settings

To configure WebSphere Application Server so that it does not use Tivoli Access Manager for authentication and authorization, follow these steps:

1. Log in to the WebSphere Application Server administrative console and revert back to your original security settings.
2. Run the `pdwascfg -action unconfigWAS5` utility to reconfigure the access manager for WebSphere Application Server. For more information, refer to "The Tivoli Access Manager pdwascfg utility" on page 219.
3. Run the SvrSslCfgutility to reconfigure the access manager for WebSphere Application Server component. For more information, refer to "The Tivoli Access Manager com.tivoli.pd.jcfg.SvrSslCfg utility" on page 223.
4. Run the PDJrteCfg utility to reconfigure the access manager Java Runtime Environment component. For more information, refer to "The Tivoli Access Manager com.tivoli.pd.jcfg.PDJrteCfg utility" on page 222.

Using the Tivoli Access Manager utilities

Use the Tivoli Access Manager to help configure WebSphere Application Server security.

The Tivoli Access Manager migrateEAR5 utility:
Purpose

Migrates security policy information from deployment descriptors (enterprise archive files) to Tivoli Access Manager for WebSphere Application Server, Version 5.1.

Syntax

```
migrateEAR5
-j path
-c URI
-a admin_ID
-p admin_pwd
-w Websphere_admin_user
-d user_registry_domain_suffix
[-r root_objectspace_name]
[-t ssl_timeout]
[-e enterprise_application_name]
```

Parameters

-a admin_ID
Specifies the administrative user identifier. The administrative user must have the privileges required to create users, objects, and access control lists (ACLs). For example, `-a sec_master`.

This parameter is optional. When the parameter is not specified, the user is prompted to supply the administrative user name at run time.

-c URI
Specifies the Uniform Resource Indicator (URI) location of the `PdPerm.properties` file that is configured by the pdwascfg utility. When WebSphere Application Server is installed in the default location, the URI is: `file:/WebSphere/V5R0M0/AppServer/java/jre/PdPerm.properties`

-d user_registry_domain_suffix
Specifies the domain suffix for the user registry to use. For example, for Lightweight Directory Access Protocol (LDAP) user registries, this value is the domain suffix, such as: "o=ibm,c=us" Notes:

Windows platforms require that the domain suffix is enclosed within quotes.

You can use the **pdadmin user show** command to display the distinguished name (DN) for a user.

-e enterprise_application_name
Specifies the application name so that installed applications that have a different display name from their installed name, are migrated correctly. If this option is not specified, the utility attempts to figure out the application name by using either the `.ear` file or the `.xml` file.

You can change an application name at application deployment or later through the administrative console. This change is reflected in the enterprise archive (EAR) file. When the EAR file is not modified to reflect the new name, the wrong protected objects are created. Use the -e option to specify the name of the application as it is displayed on the WebSphere Application Server administrative console.

-j path
Specifies the fully qualified path and file name of the Java 2 Platform, Enterprise Edition application archive file. Optionally, this path can also be a directory of an expanded enterprise application. When WebSphere Application Server is installed in the default location, the paths to data files to migrate include:

```
/WebSphere/V5R0M0/AppServer/installedApps/cellname/adminconsole.ear
/WebSphere/V5R0M0/AppServer/config/cells/cellname/admin-authz.xml
/WebSphere/V5R0M0/AppServer/config/cells/cellname/naming-authz.xml
```

-p admin_pwd
Specifies the password for the Tivoli Access Manager administrative user. The administrative user must have the privileges required to create users, objects, and access control lists (ACLs). For example, you can specify the password for the `-a sec_master` administrative user as `-p myPassword`.

This parameter is optional. When it is not specified, the user is prompted to supply the password for the administrative user name.

-r root_objectspace_name
Specifies the space name of the root object. The value is the name of the root of the protected object namespace hierarchy that is created for WebSphere Application Server. This parameter is optional.

The default value for the root object space is `WebAppServer`. If a name other than the default is used, then change the `PDWAS.properties` file to access the correct object space.

The action group name matches the space name of the root object. The action group name is automatically set when this value is specified.

-t ssl_timeout
Specifies the number of minutes for the Secure Sockets Layer (SSL) timeout. This parameter is used to disconnect and reconnect the SSL context between the Tivoli Access Manager authorization server and policy server before the default connection times out.

The default is 60 minutes. The minimum is 10 minutes. The maximum value cannot exceed the Tivoli Access Manager ssl-v3-timeout value. The default value for ssl-v3-timeout is 120 minutes.

This parameter is optional. If you are not familiar with the administration of this value, you can safely use the default value.

-w WebSphere_admin_user
Specifies the user name that is configured in the WebSphere Application Server security user registry field as the administrator. This value matches the account that you created or imported in Creating a Tivoli Access Manager administrative user for WebSphere Application Server. Access permission for this user is needed to create or update the Tivoli Access Manager protected object space.

When the WebSphere Application Server administrative user does not already exist in the protected object space, it is created or imported. In this case, a random password is generated for the user and the account is set to `not valid`. Change this password to a known value and set the account to `valid`.

A protected object and access control list (ACL) are created. The administrative user is added to the `pdwas-admin` group with the following ACL attributes:

T Traverse permission

i Invoke permission

WebAppServer
Specifies the action group name. `WebAppServer` is the default name. This action group name (and the matching root object space) can be overwritten when the migration utility is run with the -r option.

Comments

This utility migrates security policy information from deployment descriptors (enterprise archive files) to Tivoli Access Manager for WebSphere Application Server. The script calls the Java class: com.tivoli.pdwas.migrate.Migrate.

The script is dependent on finding the correct environment variables for the location of prerequisite software. The script calls Java code with the following options:

-Dpdwas.lang.home
The directory containing the native language support libraries that are provided with Tivoli Access Manager for WebSphere Application Server. These libraries are located in a subdirectory under the Tivoli Access Manager for WebSphere Application Server installation directory. For example: `-Dpdwas.lang.home=%PDWAS_HOME%\java\nls`

-cp %CLASSPATH% com.tivoli.pdwas.migrate.Migrate
The CLASSPATH variable must be set correctly for your Java installation.

On Windows platforms, both the -j option and the -c option can reference the %WAS_HOME% variable to determine where WebSphere Application Server is installed. This information is used to:

- Build the full path name of the enterprise archive file.
- Build the full URI path name to the location of the `PdPerm.properties` file.

Return codes

The following exit status codes can be returned:

0 The command completed successfully.

1 The command failed.

When the command fails, an error message is displayed. Refer to the IBM Tivoli Access Manager for e-business Error Message Reference for a more detailed description of the problem.

The Tivoli Access Manager pdwascfg utility:
Purpose

Configures or reconfigures the Tivoli Access Manager for WebSphere Application Server. Note that this utility only supports domains with the `sec_master` administrative user.

Syntax

```
pdwascfg -action configWAS5 -remote_acl_user user -sec_master_pwd password
-was_home was_home_dir -pdmgrd_host policy_server_hostname
-pdacld_host authorization_server_hostname[-amwas_home amwas_install_path]
[-pdmgrd_port policy_server_port] [-pdacld_port authorization_server_port]
[-embedded {true|false}] [-action_type {all|local|remote}] [-am_domain was_domain]
[-cfg_url pdjrte_config_file_URL] [-key_url pdjrte_keystore_URL ]
[-verbose {true|false}]

pdwascfg -action unconfigWAS5 -remote_acl_user user
-sec_master_pwd password -was_home
was_install path -pdmgrd_host policy_server_hostname
-pdacld_host authorization_server_hostname

pdwascfg -help [options]
```

Parameters

-action configWAS5
Specifies the action for this command to perform. Configures the Tivoli Access Manager for WebSphere Application Server.

-action unconfigWAS5
Specifies the action for this command to perform. Reconfigures the Tivoli Access Manager for WebSphere Application Server.

-action_type {all | local | remote}
Specifies the level of configuration required. Possible values are: `all`, `local`, or `remote`. The local option performs only configuration changes required on the local machine (meaning no `SvrSslCfg`). The remote option performs only configuration changes required on the remote machine (meaning `SvrSslCfg`). The command defaults to `all`.

-am_domain was_domain
Specifies the Tivoli Access Manager domain to use with WebSphere Application Server. The Tivoli Access Manager authentication server (`pdacld`) must be in the domain, and the domain must exist in the Tivoli Access Manager protected object space.

-amwas_home amwas_install_path
Specifies the location of the Tivoli Access Manager installation when Tivoli Access Manager is not installed in the default location. Use this parameter with the `-action configWAS5` or `-action unconfigWAS5` options.

You do not need to specify the `-amwas_home` option as part of the `pdwascfg` command when Tivoli Access Manager is installed in the default location.

-cfg_url pdjrte_config_file_url
Specifies the location of the `PDJrte` properties file. This file is created during configuration and removed during reconfiguration if the option `-action_type` remote or `-action_type all` option is also specified.

-embedded {true | false}
Specifies that this product is packaged with WebSphere Application Server when set to `true`. The default value is `false`.

-help [options]
Lists the command option name and a short description.

-key_url pdjrte_keystore_url
Specifies the location of the PDJrte key store file. This file is created during configuration and removed during reconfiguration if the -action_type remote option or -action_type all option is also specified.

-pdacld_host authorization_server_hostname
Contains the host name of the Tivoli Access Manager authorization server. Use this parameter with the -action configWAS5 option or the -action unconfigWAS5 option.

-pdacld_port authorization_server_port
Specifies the port number of the Tivoli Access Manager authorization server only if it is configure differently from the standard port. Use this parameter with the -action configWAS5 option or the -action unconfigWAS5 optios. Note that the `pdmgrd_port` value also must be specified if this option is used.

-pdmgrd_host policy_server_hostname
Contains the host name of the Tivoli Access Manager policy server. Use this parameter with the -action configWAS5 option or the -action unconfigWAS5 option.

-pdmgrd_port policy_server_port
Specifies the port number of the Tivoli Access Manager policy server only if it is configured differently from the standard port. Use this parameter with the -action configWAS5 option or the -action unconfigWAS5 option.

-remote_acl_user user
Specifies the principal that is created for communication with the authorization server. This parameter is used for the Secure Sockets Layer (SSL) connection with the Tivoli Access Manager authorization server. The user does not exist in the registry. Use this parameter with the-action configWAS5 option or the -action unconfigWAS5 option.

For example: `-remote_acl_user pdpermadmin`

-sec_master_pwd password
Specifies the password of the administrative user (normally sec_master). Use this parameter with the -action configWAS5 option or the -action unconfigWAS5 option.

-verbose {true | false}
Enables verbose output when set to `true`; otherwise, disables verbose output. The default value is `false`.

-was_home was_home_dir
Specifies the fully qualified path to the home directory of the WebSphere Application Server installation. Use this parameter with the -action configWAS5 option or the -action unconfigWAS5 option.

For example: `/WebSphere/V50M0/AppServer`

Comments

The pdwascfg utility is implemented as a shell script on Linux and UNIX systems and as a batch file on Windows systems. When invoked with the action config, option, the utility completes the following tasks:

- Configures WebSphere Application Server to use Tivoli Access Manager.
- Calls the com.tivoli.mts.SvrSslCfg Java class to configure Secure Sockets Layer (SSL) communication between the authorization component of the Tivoli Access Manager and both the policy server and the authorization server.
- Creates a user identity for the Tivoli Access Manager classes on the host system.

The script is dependent on finding the correct environment variables for the location of prerequisite software. Set the `%WAS_HOME%` environment variable to the WebSphere Application Server installation directory. Set the `%PDWAS_HOME%` variable to the directory location of the Tivoli Access Manager installation directory. The **pdwascfg** command file uses Java code with the following options:

-Dpdwas.lang.home
The directory containing the native language support libraries that are provided with Tivoli Access Manager. These libraries are located in a subdirectory under the Tivoli Access Manager installation directory. For example: `-Dpdwas.lang.home=%PDWAS_HOME%\java\nls`

-Dpdwas.home
The home (installation) directory for Tivoli Access Manager. For example: `-Dpdwas.home=%PDWAS_HOME%`

This environment variable is set only when a new command window is opened after installing Tivoli Access Manager.

-Dwas.home
The home (installation) directory for WebSphere Application Server. For example:

```
-Dwas.home=%WAS_HOME%
/WebSphere/V5R0M0/AppServer/bin/pdwascfg
-action unconfigWAS5 \
-remote_acl_user pdpermadmin \
-sec_master_pwd myPassword \
-was_home /WebSphere/V5R0M0/AppServer \
-amwas_home /WebSphere/V5R0M0/AppServer \
-pdmgrd_host pdmgrserver.mysubnet.ibm.com \
-pdacld_host pdacldserver.mysubnet.ibm.com \
-action_type local \
-embedded true \
```

Return codes

The following exit status codes can be returned:

0 The command completed successfully.

1 The command failed.

When the command fails, an error message is displayed. Refer to the IBM Tivoli Access Manager for e-business Error Message Reference for a more detailed description of the problem.

The Tivoli Access Manager com.tivoli.pd.jcfg.PDJrteCfg utility: Purpose

Configures and reconfigures the Access Manager Java Runtime Environment component. The Access Manager Java Runtime Environment component enables Java applications to manage and use Tivoli Access Manager security.

Syntax

```
java com.tivoli.pd.jcfg.PDJrteCfg -action {config | unconfig} -cfgfiles_path
configuration_file_path -host policy_server_host -was [-java_home jre_path]
```

Parameters

-action {config|unconfig}
Specifies the action to be performed. Actions include:

config Use to configure the Access Manager Java Runtime Environment component.

unconfig
Use to reconfigure the Access Manager Java Runtime Environment component.

-host policy_server_host
Specifies the policy server host name.

Valid values for *host_name* include any valid IP host name.

Examples include:

```
host = libra
host = libra.dallas.ibm.com
```

-java_home jre_path
Specifies the fully-qualified path to the JDK to be configured or reconfigured. If `-java_home` is not specified, the current (default) JDK is used.

For example: `-java_home /usr/lpp/java/J1.3`

-was
Specifies to configure in a WebSphere Application Server environment (as opposed to a Tivoli Access Manager environment).

The following examples demonstrate correct syntax. *Node1* is the name by which the node that contains the administrative server is administered.

Import operation

```
XMLConfig -adminNodeName Node1 -import import.xml
```

Full export operation

```
XMLConfig -adminNodeName Node1 -export export.xml
```

Partial export operation

```
XMLConfig -adminNodeName Node1 -export export.xml -partial imput.xml
```

Comments

This command copies Tivoli Access Manager Java libraries to a library extensions directory that exists for a Java runtime that has already been installed on the system.

Using this command does not overwrite JAR files that already exist in the `jre_home\lib\ext` directory, except the `PD.jar` file, which is overwritten if the file exists.

You can install more than one JRE on a given machine. The `pdjrtecfg` command can be used to configure the Access Manager Java Runtime Environment component independently to each of the JREs.

```
${JAVA_HOME}/bin/java
-Dfile.encoding=ISO8859-1 \
-Dws.output.encoding=CP1047 \
-Xnoargsconversion \
-Dpd.home=${WAS_HOME}/java/jre/PolicyDirector \
-cp ${WAS_HOME}/java/jre/lib/ext/PD.jar \
 com.tivoli.pd.jcfg.PDJrteCfg \
-action config \
          -cfgfiles_path ${WAS_HOME}/java/jre \
          -host gary.us.ibm.com \
-was
```

The Tivoli Access Manager com.tivoli.pd.jcfg.SvrSslCfg utility: Purpose

Configures and reconfigures configuration information associated with a Tivoli Access Manager Java application server.

Syntax

```
java com.tivoli.pd.jcfg.SvrSslCfg
-action {config | unconfig} -admin_id admin_user_ID
-admin_pwd admin_password -appsvr_id application_server_name
-appsvr_pwd application_server_password -mode{local|remote}
-host host_name_of_application_server
-policysvr policy_server_name:port:rank [,...]
-authzsvr authorization_server_name:port:rank [,...]
-cfg_file fully_qualified_name_of_configuration_file
-domain Tivoli_Acccess_Manager_domain
-key_file fully_qualified_name_of_keystore_file
-cfg_action {create|replace}
```

Parameters

-action {config | unconfig}

Configures or reconfigures an application server. Options are as follows:

-action config
Configuring a server creates user and server information in the user registry and creates local configuration and key store files on the application server. Use the `-action unconfig` option to reverse this operation.

-action unconfig
Reconfigures an application server to remove the user and server information from the user registry, delete the local key store file, and remove information for this application from the configuration file (without deleting the configuration file). The reconfiguration operation fails only if the caller is unauthorized or the policy server cannot be contacted.

This action can succeed when there is no configuration file. When the configuration file does not exist, it is created and used as a temporary file to hold configuration information during the operation, and then the file is deleted completely.

-admin_id admin_user_ID
Specifies the Tivoli Access Manager administrator name. If this option is not specified, `sec_master` is the default.

A valid administrative ID is an alphanumeric, case-sensitive string. String values are expected to be characters that are part of the local code set. You cannot use a space in the administrative ID.

For example, for U.S. English the valid characters are the letters `a-Z`, the numbers `0-9`, a period (`.`), an underscore (_), a plus sign (+), a hyphen (-), an at sign (`@`), an ampersand (`&`), and an asterisk (`*`). The minimum and maximum lengths of the administrative ID, if there are limits, are imposed by the underlying registry.

-admin_password admin_password

Specifies the name of the Tivoli Access Manager administrator user. The default administrative user is sec_master.

-appsvr_id application_server_name
Specifies the name of the application server. The name is combined with the host name to create unique names for Tivoli Access Manager objects created for your application. The following names are reserved for Tivoli Access Manager applications: `ivacld`, `secmgrd`, `ivnet`, and `ivweb`.

-appsvr_pwd application_server_password
Specifies the password of the application server. This option is required. A password is created by the system and the configuration file is updated with the password created by the system.

If this option is not specified, the server password will be read from standard input.

-authzsvr authorization_server_name
Specifies the name of the authorization server.

-cfg_action {create | replace}
Options are as follows:

create Specifies to create the configuration and key store files during server configuration. Configuration fails if either of these files already exists.

replace
Specifies to replace the configuration and key store files during server configuration. Configuration deletes any existing files and replaces them with new ones.

-cfg_file fully_qualified_name_of_configuration_file
Specifies the configuration file path and name.

A file name should be an absolute file name (fully qualified file name) to be valid.

-domain Tivoli_Access_Manager_domain
Specifies the domain name for the domain to which this server is configured. This domain must exist and an the administrator ID and password must be valid for this domain.

If not specified, the local domain that was specified during Tivoli Access Manager runtime configuration will be used. The local domain value will be retrieved from the configuration file.

A valid domain name is an alphanumeric, case-sensitive string. String values are expected to be characters that are part of the local code set. You cannot use a space in the domain name.

For example, for U.S. English the valid characters for domain names are the letters a-Z, the numbers 0-9, a period (.), an underscore (_), a plus sign (+), a hyphen (-), an at sign (@), an ampersand (&), and an asterisk (*). The minimum and maximum lengths of the domain name, if there are limits, are imposed by the underlying registry.

-host host_name_of_application_server
Specifies the TCP host name used by the Tivoli Access Manager policy server to contact this server. This name is saved in the configuration file using the azn-app-host key.

The default is the local host name returned by the operating system. Valid values for host_name include any valid IP host name.

Examples:

```
host = libra
host = libra.dallas.ibm.com
```

-key_file fully_qualified_name_of_keystore_file
Specifies the directory that is to contain the key files for the server. A valid directory name is determined by the operating system. Do not use relative directory names.

Make sure that server user (for example, `ivmgr`) or all users have permission to access the `.kdb` file and the folder that contains the `.kdb` file.

-mode server_mode
Specifies the mode in which the application operates. This value must be either `local` or `remote`.

-policysvr policy_server_name
Specifies the name of the policy server.

Comments

After the successful configuration of a Tivoli Access Manager Java application server, `SvrSslCfg` creates a user account and server entries representing the Java

application server in the Tivoli Access Manager user registry. In addition, SvrSslCfg creates a configuration file and a Java key store file, which securely stores a client certificate, locally on the application server. This client certificate permits callers to make authenticated use of Tivoli Access Manager services. Conversely, reconfiguration removes the user and server entries from the user registry and cleans up the local configuration and keystore files.

The contents of an existing configuration file can be modified by using the SvrSslCfg utility. The configuration file and the key store file must already exist when calling SvrSslCfg with all options other than -action config or -action unconfig.

The following options are parsed and processed into the configuration file, but are otherwise ignored in this version of Tivoli Access Manager:

The host name is used to build a unique name (identity) for the application. The pdadmin user list command displays the application identity name in the following format:

server_name/host_name

Note that the pdadmin server list command displays the server name in a slightly different format:

server_name-host_name

```
CLASSPATH=${WAS_HOME}/java/jre/lib/ext/PD.jar:${WAS_CLASSPATH}
java \
-cp ${CLASSPATH} \
-Dpd.cfg.home= ${WAS_HOME}/java/jre \
-Dfile.encoding=ISO8859-1 \
-Dws.output.encoding=CP1047 \
-Xnoargsconversion \
 com.tivoli.pd.jcfg.SvrSslCfg \
-action config \
-admin_id sec_master \
-admin_pwd $TAM_PASSWORD \
-appsvr_id $APPSVR_ID \
-policysvr ${TAM_HOST}:7135:1 \
-port 7135 \
-authzsvr ${TAM_HOST}:7136:1 \
-mode remote \
-cfg_file ${CFG_FILE} \
-key_file ${KEY_FILE} \
-cfg_action create
```

User registries

Information about users and groups reside in a user registry. With WebSphere Application Server, a user registry authenticates a user and retrieves information about users and groups to perform security-related functions, including authentication and authorization.

WebSphere Application Server for z/OS provides several implementations to support multiple types of operating system base user registries. You can use the custom LDAP feature to support any LDAP server by setting up the correct

configuration (user and group filters). However, support is not extended to these custom LDAP servers because there are many configuration possibilities.

In addition to Local operating system (OS) and LDAP registries, WebSphere Application Server for z/OS also provides a plug-in that supports any registry by using the custom registry feature (also referred to as a custom user registry). The custom registry feature supports any user registry that is not implemented by WebSphere Application Server. You can use any registry used in the product environment by implementing the *UserRegistry interface* interface.

The UserRegistry interface is very helpful in situations where the current user and group information exists in some other format (for example, a database) and cannot move to Local OS or LDAP. In such a case, implement the UserRegistry interface so that WebSphere Application Server for z/OS can use the existing registry for all of the security-related operations. Using a custom registry is a software implementation effort, it is expected that the implementation does not depend on other WebSphere Application Server for z/OS resources, for example, data sources, for its operation.

Although WebSphere Application Server supports different types of user registries, only one user registry can be active. This active registry is shared by all of the product server processes. If the product processes in one node or cell need to communicate with other product processes in other nodes or cells using Integrated Cryptographic Service Facility (ICSF) or Lightweight Third Party Authentication (LTPA), all of the nodes and cells share the same user registry.

Note:

- (PQ81586) Local OS registries such as System Authorization Facility (SAF) registries provide certificate-to-user mapping, authorization, and delegation functions. However, you need an underlying SAF user identity to issue authenticated requests across servers. Interoperability between Common Secure Interoperability Version 2 (CSIv2) compliant servers on other platforms and a WebSphere Application Server for z/OS using a local OS registry occurs if the originating identity can be mapped to a local OS identity on z/OS. This can be done if using X509 certificates, SSL client certificates, or identity assertion using a distinguished name (DN) that is mapped to a SAF user identity.
- If you are planning to configure your Web Application Server for z/OS to use a registry other than a local OS Registry, (such as an LDAP or a custom registry), the RMI connector cannot be configured to process administrative requests.

Configuring user registries

Before configuring the user registry, decide which registry to use. Though different types of registries are supported, all of the processes in WebSphere Application Server can use one active registry. Configuring the correct registry is a prerequisite to assigning users and groups to roles for applications. When no registry is configured, the LocalOS registry is used by default. So, if your choice of registry is not Local OS you need to first configure the registry, which is normally done as part of enabling security, restart the servers, and then assign users and groups to roles for all your applications.

After the applications are assigned users and groups, and you need to change the registries (for example from Lightweight Directory Access Protocol (LDAP) to

Custom), delete all the users and groups (including any RunAs role) from the applications, and reassign them after changing the registry through the administrative console or by using wsadmin scripting. The following wsadmin command removes all of the users and groups (including the RunAs role) from any application:

```
$AdminApp deleteUserAndGroupEntries yourAppName
```

where *yourAppName* is the name of the application. Backing up the old application is advised before performing this operation. However, if both of the following conditions are true, you might be able to switch the registries without having to delete the users and groups information:

- All of the user and group names (including the password for the RunAs role users) in all of the applications match in both registries.
- The application bindings file does not contain the `accessIDs`, which are unique for each registry even for the same user or group name.

By default, an application does not contain `accessIDs` in the bindings file (these IDs are generated when the applications start). However, if you migrated an existing application from an earlier release, or if you used the wsadmin script to add accessIDs for the applications to improve performance you have to remove the existing user and group information and add the information after configuring the new registry.

For more information on updating accessIDs, see updateAccessIDs in the AdminApp object for scripted administration article.

Complete one of the following steps to configure your user registry:

- Configure the local operating system user registry.
- Configure the LDAP user registry.
- Configure the custom user registry.

This step is required as part of enabling security in WebSphere Application Server.

1. If you are enabling security, make sure that you complete the remaining steps. Verify that the Active User Registry field in the **Global Security** panel is set to the appropriate registry. As the final step, validate the user ID and the password by clicking **OK** or **Apply** in the Global Security panel. Save, stop and start all the WebSphere Application Servers.
2. For any changes in user registry panels to be effective, you must validate the changes by clicking **OK** or **Apply** in the Global Security panel. After validation, save the configuration, stop and start all of the WebSphere Application Servers (cells, nodes and all the application servers). To avoid inconsistencies between the WebSphere Application Server processes, make sure that any changes to the registry are done when all of the processes are running. If any of the processes are down, force synchronization to make sure that the process can start later.
3. If the server or servers start without any problems, the setup is correct.

Local operating system user registries

With the local operating system, or Local OS, user registry implementation, the WebSphere authentication mechanism can use the user accounts database of the local operating system.

WebSphere Application Server for z/OS uses the System Authorization Facility (SAF) interfaces. SAF interfaces are defined by MVS to enable applications to use system authorization services or user registries to control access to resources such

as data sets and MVS commands. SAF either processes security authorization requests directly or works with RACF, or other security products, to process the requests.

A Local OS user registry is not a centralized user registry like LDAP, but it is a centralized registry within a sysplex.

Do not use a Local OS user registry in a WebSphere Application Server environment, where application servers are dispersed across more than one machine because each machine has its own user registry.

Because these IDs are typically unique identifiers, they vary from machine to machine, even if the exact users and passwords exist on each machine.

Web client certificate authentication is supported when using the local operating system user registry. Digital certificates can be mapped to MVS identities by both Web and Java clients when you select Local OS. A certificate name filter can be used to simplify the mapping. If you are using RACF as the security server, the **RACDCERT MAP** command creates a resource profile that maps multiple user identities to a digital certificate in order to simplify administration of certificates, conserve storage space in the RACF database, maintain accountability, or maintain access control granularity.

Using both the domain registry and the local registry

When the machine hosting the WebSphere Application Server process is a member of a domain, both the local and the domain registries are used by default. The following section describes more on this topic and recommends some best practices to avoid undesirable consequences.

- **Best Practices**

  In general, if the local and the domain registries do not contain common users or groups, it is simpler to administer and it eliminates undesirable side effects. So if possible, give users and groups access to unique security roles (including the server ID and administrative roles). In this situation, select the users and groups from either the local registry or the domain registry to map to the roles.

  In cases where the same users or groups exist in both the local registry and the domain registry, it is recommended that at least the server ID and the users and groups that are mapped to the administrative roles be unique in the registries (exist only on the domain).

  If a common set of users exists, set a different password to make sure that the appropriate user is authenticated.
- **How it works**

  When a machine is part of a domain, the domain user registry takes precedence over the local user registry. For example, when a user logs into the system, the domain registry tries to authenticate the user first. If the authentication fails the local registry is used. When a user or a group is mapped to a role, the user and group information is first obtained from the domain registry. In case of failure, the local registry is tried. However, when a fully qualified user or a group name (one that has a domain or host name attached to it) is mapped to a role, then only that registry is used to get the information. Use the administrative console or scripts to get the fully qualified user and group names and is the recommended way to map users and groups to roles.

Note: A user **Bob** on one machine (the local registry, for example) is not the same as the user **Bob** on another machine (say the domain registry) because the `uniqueID` of **Bob** (the security identifier [SID], in this case) is different in different registries.

- **Examples**

  The machine `MyMachine` is part of the domain `MyDomain`. `MyMachine` contains the following users and groups:
  - MyMachine\user2
  - MyMachine\user3
  - MyMachine\group2

  MyDomain contains the following users and groups:
  - MyDomain\user1
  - MyDomain\user2
  - MyDomain\group1
  - MyDomain\group2

  Here are some scenarios that assume the previous set of users and groups.
  1. When `user2` logs into the system, the domain registry is used for authentication. If the authentication fails (the password is different) the local registry is used.
  2. If the user `MyMachine\user2` is mapped to a role, only the `user2` in `MyMachine` has access. So if the `user2` password is the same on both the local and the domain registries, `user2` cannot access the resource, because `user2` is always authenticated using the domain registry. Hence, if both registries have common users, it is recommended that the password be different.
  3. If the `group2` is mapped to a role, only the users who are members of the `MyDomain\group2` can access the resource because `group2` information is first obtained from the domain registry.
  4. If the group `MyMachine\group2` is mapped to a role, only the users who are members of the `MyMachine\group2` can access the resource. A specific group is mapped to the role (`MyMachine\group2` instead of just `group2`).
  5. Use either `user3` or `MyMachine\user3` to map to a role, because `user3` is unique; it exists in one registry only.

  Authorizing with the domain user registry first can cause problems if a user exists in both the domain and local user registries with the same password. Role-based authorization can fail in this situation because the user is first authenticated within the domain user registry. This authentication produces a unique domain security ID that is used in WebSphere Application Server during the authorization check. However, the local user registry is used for role assignment. The domain security ID does not match the unique security ID associated with the role. To avoid this problem, map security roles to domain users instead of local users.

Using either the local or the domain registry. If you want to access users and groups from either the local registry or the domain registry, instead of both, set the property `com.ibm.websphere.registry.UseRegistry`. This property can be set to either **local** or **domain**. When this property is set to **local** (case insensitive) only the local registry is used. When this property is set to **domain** (case insensitive) only the domain registry is used. Set this property by clicking **Custom Properties** in the **Security** > **User Registries** > **Local OS** panel in the administrative console or by using scripts. When the property is set, the privilege requirement for the user who is running the product process does not change. For example, if this property is set to **local**, the user running the process requires the same privilege, as if the property was not set.

Remote registries

By default, the registry is local to all of the product processes. The performance is higher, (no need for remote calls) and the registry also increases availability. Any process failing does not effect other processes. When using LocalOS as the registry, every product process must run with privilege access. If this process is not practical in some situations, you can use a remote registry from the node (or in very rare situations from the cell). Using a remote registry affects performance and creates a single point of failure. **Use remote registries only in rare situations.**

The node and the cell processes are meant for manipulating configuration information and using them to host the registry for all the application servers creates traffic and can cause problems. Using a node agent (instead of the cell) to host the remote registry is preferable because since the cell process is not designed to be highly available. Also, using a node to host the remote registry indicates that only the application servers in that node are using it. Because the Node Agent does not contain any application code, giving it the access required, privilege is not a concern.

You can set up a remote registry by setting the WAS_UseRemoteRegistry property in the Global Security panel using the **Custom Properties** link at the bottom of the administrative console panel. Use either the **Cell** or the **Node** (case insensitive) value. If the value is `Cell`, the cell registry is used by all of the product processes including the node agent and all of the application servers. If the cell process is down for any reason, restart all of the processes after the cell is restarted. If the node agent registry needs is used for the remote registry, set the value, `WAS_UseRemoteRegistry`, to `node`. In this case, all the application server processes use the node agent registry. In this case, if the node agent fails and does not start automatically, then depending on that node agent, you might need to restart all the application servers, after the node agent is started.

Configuring local operating system user registries

When a Local OS Registry is chosen for z/OS, the started task identity is chosen as the server identity. Thus, a user ID and password is not required to configure the server.

Important: Each started task, (for example, controller, servant, node agent, and so on) might have a different identity.

For all servers in a given cell to have the authority needed by the administrative subsystem, they must be part of a common configuration group. This customization is generally provided by the configuration dialogs when WebSphere Application Server for z/OS is initially customized.

The following steps are needed to perform this task initially when setting up security for the first time.

1. Click **Security** > **User Registries** > **LocalOS** in the left navigation panel of the administrative console.
2. Under Additional Properties, click **Custom Properties**. Under **Custom Properties**, you can set the following properties:

   `com.ibm.security.SAF.unauthenticated`
   This property indicates the MVS user ID that is used to represent unprotected servlet requests and is used for the following functions:
   - Authorization if an unprotected servlet invokes an entity bean.

- Identification of an unprotected servlet for invoking a z/OS connector (Customer Information Control System (CICS), Information Management System (IMS)) that uses a current identity when `res-auth=container`.

`com.ibm.security.SAF.authorization`
This property can be set to `true` or `false`. When this property is set to `true`, SAF EJBROLE profiles are used for user to role authorization for both J2EE applications and the Role-based authorization requests (naming and administration) associated with the WebSphere Application Server run time.

`com.ibm.security.SAF.delegation`
This property specifies that SAF EJBROLE definitions are to assign which MVS user ID becomes the active identity when you select the RunAs specified role.

com.ibm.security.SAF.EJBROLE.Audit.Messages.Suppress
This property is located in the Administrative Console under: **Global Security > User Registry > LocalOS > Custom Properties > com.ibm.security.SAF.EJBROLE.Audit.Messages.Suppress** and allows you to turn ICH408I messages on or off. The default value for this property is *false*, which does not suppress messages. You can set this value to *true* to suppress the ICH408I messages.

SMF records access violations no matter what value is specified for this new property. This property affects access violation message generation for both application-defined roles and for WebSphere runtime-defined roles for the naming and administrative subsystems. EJBROLE profile checks are done for both declarative (deployment descriptors) and programmatic checks:

- Declarative checks are coded as SecurityConstraints in Web applications, and Deployment Descriptors are coded as SecurityConstraints in EJB files. This property is not used to control messages in this case. Instead, there are a set of roles permitted, and if an access violation occurs an ICH408I access violation message indicates a failure for one of the roles. SMF then logs a single access violation (for that role).
- Program logic checks (or access checks) are performed using the programmatic isCallerinRole(x) for EJB or isUserInRole(x) for Web applications. The com.ibm.security.SAF.EJBROLE.Audit.Messages.Suppress property controls the messages generated by this call.

For more information on SAF authorization, refer to“Controlling access to console users when using a Local OS Registry” on page 30Local OS Registry. For more information on administrative roles, refer to “Admin roles” on page 130.

For more information on SAF authorization, see “Controlling access to console users when using a Local OS Registry” on page 30

If your changes are not validated, the server might not restart.

The Local OS user registry has been configured.

1. If you are enabling security, complete the remaining steps. As the final step, ensure that you validate the user and password by clicking **OK** or **Apply** in the Global Security panel. Save, stop, and start all the product servers.

2. For any changes in this panel to be effective, you need to save, stop and start all the product servers (cell, nodes and all the application servers).
3. If the server comes up without any problems the setup is correct.

Local operating system user registry settings:

Use this page to configure local operating system user registry settings.

To view this administrative console page, click **Security** > **User Registries** > **Local OS**.

Local OS Type:

The local operating system (OS) type is set as the Service Access Facility (SAF).

SAF, which is the local operating system on WebSphere Application Server for z/OS, is automatically specified as the local operating system type. Configure SAF by clicking **Custom Properties** in the Additional Properties section. You can configure the following custom properties:

Property	Data type	Valid values
com.ibm.security.SAF.authorization	Boolean	true or false
com.ibm.security.delegation	Boolean	true or false
com.ibm.security.SAF.EJBROLE.Audit.Messages.Suppress	Boolean	true or false
com.ibm.security.SAF.unauthenticated	String	A valid MVS user ID. The default value is WSGUEST.

Ignore Case:

When this option is set to true, a case insensitive authorization check is performed.

SAF user IDs are usually in uppercase letters. Enabling this option is necessary only when your registry is case insensitive and does not provide a consistent case when queried for users and groups.

Lightweight Directory Access Protocol

Lightweight Directory Access Protocol (LDAP) is a user registry in which authentication is performed using an LDAP binding.

WebSphere Application Server security provides and supports implementation of most major LDAP directory servers, which can act as the repository for user and group information. These LDAP servers are called by the product processes (servers) for authenticating a user and other security-related tasks (for example, getting user or group information). This support is provided by using different user and group filters to obtain the user and group information. These filters have default values that you can modify to fit your needs. The custom LDAP feature enables you to use any other LDAP server (which is not in the product supported list of LDAP servers) for its user registry by using the appropriate filters.

To use LDAP as the user registry, you need to know a valid user name (ID), the user password, the server host and port, the base distinguished name (DN) and if necessary the bind DN and the bind password. You can choose any valid user in the registry that is searchable. In some LDAP servers, the administrative users are

not searchable and cannot be used (for example, `cn=root` in SecureWay). This user is referred to as WebSphere Application Server security server ID, server ID, or server user ID in the documentation. Being a server ID means a user has special privileges when calling some protected internal methods. Normally, this ID and password are used to log into the administrative console after security is turned on. You can use other users to log in if those users are part of the administrative roles.

When security is enabled in the product, this server ID and password are authenticated with the registry during the product startup. If authentication fails, the server does not start. Choosing an ID and password that do not expire or change often is important. If the product server user ID or password need to change in the registry, make sure that the changes are performed when all the product servers are up and running.

When the changes are done in the registry, use the steps described in Configuring LDAP user registries. Change the ID, password, and other configuration information, save, stop, and restart all the servers so that the new ID or password is used by the product. If any problems occur starting the product when security is enabled, disable security before the server can start up (to avoid these problems, make sure that any changes in this panel are validated in the Global Security panel). When the server is up, you can change the ID, password and other configuration information and then enable security.

Supported directory services:

WebSphere Application Server security supports several different LDAP servers.

For a list of supported LDAP servers, refer to the **Supported hardware, software and APIs** prerequisite Web site in the "Security: Resources for learning" on page 407 article. *The z/OS Security Server LDAP is supported when the DB2 TDBM backend is used. Use the SecureWay Directory Server filters to connect to the z/os LDAP*.

It is expected that other LDAP servers follow the LDAP specification function. Support is limited to these specific directory servers only. You can use any other directory server by using the custom directory type in the list and by filling in the filters required for that directory.

To improve performance for LDAP searches, the default filters for IBM Directory Server, iPlanet Directory Server, and Active Directory are defined such that when you search for a user, the result contains all the relevant information about the user (user ID, groups, and so on). As a result, the product does not call the LDAP server multiple times. This definition is possible only in these directory types, which support searches where the complete user information is obtained.

If you use the IBM Directory Server, enable the Ignore case flag. This flag is required because when the group information is obtained from the user object attributes, the case is not the same as when you get the group information directly. For the authorization to work in this case, perform a case insensitive check and verify the requirement for the Ignore case flag.

Lightweight Directory Access Protocol settings:

Use this page to configure Lightweight Directory Access Protocol (LDAP) settings when users and groups reside in an external LDAP directory.

To view this administrative console page, click **Security** > **User Registries** > **LDAP**.

When security is enabled and any of these properties change, go to the Global Security panel and click **Apply** to validate the changes.

Server User ID:

Specifies the user ID under which the server runs, for security purposes.

Although this ID is not the LDAP administrator user ID, specify a valid entry in the LDAP directory located under the Base Distinguished Name.

Server User Password:

Specifies the password corresponding to the security server ID.

Type:

Specifies the type of LDAP server to which you connect.

The type is used to preload default LDAP properties. IBM Directory Server users can choose either IBM_Directory_Server or SecureWay as the directory type. Use the IBM_Directory_server directory type for better performance. Users of the iPlanet Directory Server can choose either iPlanet Directory Server or NetScape as the directory type. Use the iPlanet Directory Server directory type for better performance after configuring iPlanet to use `role (nsRole)` as the grouping method.

5.1 + IBM SecureWay Directory Server is supported by WebSphere Application Server for z/OS

For a list of supported LDAP servers, see ″Supported directory services.″ in the documentation.

Host:

Specifies the host ID (IP address or domain name service (DNS) name) of the LDAP server.

Port:

Specifies the host port of the LDAP server.

If multiple WebSphere Application Servers are installed and configured to run in the same single signon domain, or if the WebSphere Application Server interoperates with a previous version of the WebSphere Application Server, then it is important that the port number match all configurations. For example, if the LDAP port is explicitly specified as 389 in a Version 4.0.x configuration, and a WebSphere Application Server at Version 5 is going to interoperate with the Version 4.0.x server, then verify that port 389 is specified explicitly for the Version 5 server.

Default: 389

Base Distinguished Name:

Specifies the base distinguished name of the directory service, indicating the starting point for LDAP searches of the directory service.

For example, for a user with a distinguished name (DN) of `cn=John Doe, ou=Rochester, o=IBM, c=US`, you can specify the base DN as (assuming a suffix of `c=us`): `ou=Rochester,o=IBM,c=us` or `o=IBM,c=us`. For authorization purposes, this field is case sensitive. This specification implies that if a token is received (for example, from another cell or Domino) the base DN in the server must match the base DN from the other cell or Domino server exactly. If case sensitivity is not a consideration for authorization, enable the **Ignore Case** field.

If you need to interoperate between WebSphere Application Server Version 5 and a Version 5.0.1 or later server, you must enter a normalized base distinguished name. A normalized base distinguished name does not contain spaces before or after commas and equal symbols. An example of a non-normalized base distinguished name is `o = ibm, c = us` or `o=ibm, c=us`. An example of a normalized base distinguished name is `o=ibm,c=us`. In WebSphere Application Server, Version 5.0.1 or later, the normalization occurs automatically at the run time

This field is required for all Lightweight Directory Access Protocol (LDAP) directories except for the Domino Directory, where this field is optional.

Bind Distinguished Name:

Specifies the distinguished name for the application server to use when binding to the directory service.

If no name is specified, the application server binds anonymously. See the Base Distinguished Name field description for examples of distinguished names.

Bind Password:

Specifies the password for the application server to use when binding to the directory service.

Search Timeout:

Specifies the timeout value in seconds for an Lightweight Directory Access Protocol (LDAP) server to respond before aborting a request.

Default: 120

Reuse connection:

Specifies whether the server reuses the Lightweight Directory Access Protocol (LDAP) connection. Clear this option only in rare situations where a router is used to spray requests to multiple LDAP servers and when the router does not support affinity.

Default: Enabled
Range: Enabled or Disabled

Ignore Case:

Specifies that a case insensitive authorization check is performed.

This field is required when IBM Directory Server is selected as the LDAP directory server.

5.1 + This field is required when Sun ONE Directory Server is selected as the LDAP directory server. For more information, see ″Using specific directory servers as the LDAP server″ in the documentation.

Otherwise, this field is optional and can be enabled when a case-sensitive authorization check is required. For example, use this field when the certificates and the certificate contents do not match the case used for the entry in the LDAP server. You can enable the **Ignore Case** field when using single signon (SSO) between WebSphere Application Server and Lotus Domino.

Default: Disabled
Range: Enabled or Disabled

SSL Enabled:

Specifies whether secure socket communication is enabled to the Lightweight Directory Access Protocol (LDAP) server. When enabled, the LDAP Secure Sockets Layer (SSL) settings are used, if specified.

SSL Configuration:

Specifies the Secure Sockets Layer configuration to use for the Lightweight Directory Access Protocol (LDAP) connection. This configuration is used only when SSL is enabled for LDAP.

Default: DefaultSSLSettings

Use Tivoli Access Manager for Account Policies:

Select this option to indicate that the Tivoli Access Manager is used for authentication to honor password and account policies. This option requires that you have previously installed the Tivoli Access Manager.

Do not select this option unless you have a Tivoli Access Manager Server installed and configured to be used by WebSphere Application Server. The Lightweight Directory Access Protocol (LDAP) directory server used by the Tivoli Access Manager must be the same LDAP directory server that is used by WebSphere Application Server.

Important: When you select this option, IBM SecureWay Directory Server is not supported as an LDAP directory server.

Lightweight Directory Access Protocol advanced settings:

Use this page to configure advanced Lightweight Directory Access Protocol (LDAP) user registry settings when users and groups reside in an external LDAP directory.

To view this administrative page, click **Security** > **User Registries** > **LDAP** **Advanced LDAP settings**.

Default values for all the user and group related filters are already completed in the appropriate fields. You can change these values depending on your requirements. These default values are based on the type of LDAP server selected in the **LDAP settings** panel. If this type changes (for example from Netscape to Secureway) the default filters automatically change. When the default filter values change, the LDAP server type changes to `Custom` to indicate that custom filters are used. When security is enabled and any of these properties change, go to the **Global Security** panel and click **Apply** or **OK** to validate the changes.

User Filter:

Specifies the LDAP user filter that searches the registry for users.

This option is typically used for Security Role to User assignments. It specifies the property by which to look up users in the directory service. For example, to look up users based on their user IDs, specify `(&(uid=%v)(objectclass=inetOrgPerson))`. For more information about this syntax, see the LDAP directory service documentation.

Data type: String

Group Filter:

Specifies the LDAP group filter that searches the user registry for groups

This option is typically used for Security Role to Group assignments. It specifies the property by which to look up groups in the directory service. For more information about this syntax, see the LDAP directory service documentation.

Data type: String

User ID Map:

Specifies the LDAP filter that maps the short name of a user to an LDAP entry.

Specifies the piece of information that represents users when users appear. For example, to display entries of the type `object class = inetOrgPerson` by their IDs, specify `inetOrgPerson:uid`. This field takes multiple objectclass:property pairs delimited by a semicolon (;).

Data type: String

Group ID Map:

Specifies the LDAP filter that maps the short name of a group to an LDAP entry.

Specifies the piece of information that represents groups when groups appear. For example, to display groups by their names, specify `*:cn`. The asterisk (`*`) is a wildcard character that searches on any object class in this case. This field takes multiple `objectclass:property` pairs delimited by a semicolon (;).

Data type: String

Group Member ID Map:

Specifies the LDAP filter which identifies user to group relationships.

For directory types SecureWay, Netscape, and Domino, this field takes multiple objectclass:property pairs, delimited by a semicolon (;). In an objectclass:property pair, the objectclass value is the same objectclass defined in Group Filter, and the property is the member attribute. If the objectclass value does not match the objectclass in Group Filter, authorization might fail if groups are mapped to security roles. For more information about this syntax, see your LDAP directory service documentation.

For IBM Directory Server, iPlanet Directory Server and Active Directory, this field takes multiple (`group attribute:member attribute`) pairs delimited by a semicolon (;). They are used to find the group memberships of a user by enumerating all the group attributes possessed by a given user. For example, attribute pair (`memberof:member`) is used by Active Directory, and (ibm-allGroup:member) is used by IBM Directory Server . This field also specifies which property of an objectclass stores the list of members belonging to the group represented by the objectclass. For supported LDAP directory servers, see ″Supported directory services″.

Data type: String

Certificate Map Mode:

Specifies whether to map X.509 certificates into an LDAP directory by EXACT_DN or CERTIFICATE_FILTER. Specify CERTIFICATE_FILTER to use the specified certificate filter for the mapping.

Data type: String

Certificate Filter:

Specifies whether to use the filter certificate mapping property to specify the LDAP filter, which is used to map attributes in the client certificate to entries in the LDAP registry.

To enable this field, click **CERTIFICATE_FILTER** for the certificate mapping. If more than one LDAP entry matches the filter specification at run time, then authentication fails because it results in an ambiguous match. The syntax or structure of this filter is: `LDAP attribute=${Client certificate attribute}` (for example, `uid=${SubjectCN}`). The left side of the filter specification is an LDAP attribute that depends on the schema that your LDAP server is configured to use. The right side of the filter specification is one of the public attributes in your client certificate. The right side must begin with a dollar sign ($) and open bracket ({) and end with a close bracket (}). You can use the following certificate attribute values on the right side of the filter specification. The case of the strings is important:

- `${UniqueKey}`
- `${PublicKey}`
- `${PublicKey}`
- `${Issuer}`
- `${NotAfter}`
- `${NotBefore}`
- `${SerialNumber}`
- `${SigAlgName}`
- `${SigAlgOID}`

- ${SigAlgParams}
- ${SubjectCN}
- ${Version}

Data type: String

Using specific directory servers as the LDAP server:

For *Using MS Active Directory server as the LDAP server* below, note that to use Microsoft Active Directory as the LDAP server for authentication with WebSphere Application Server you must take specific steps. By default, Microsoft Active Directory does not permit anonymous LDAP queries. To create LDAP queries or to browse the directory, an LDAP client must bind to the LDAP server using the distinguished name (DN) of an account that belongs to the administrator group of the Windows system. A group membership search in the Active Directory is done by enumerating the memberof attribute possessed by a given user entry, rather than browsing through the member list in each group. If you change this default behavior to browse each group, you can change the **Group Member ID Map** field from `memberof:member` to `group:member`.

5.1+ Using Tivoli Directory Server as the LDAP server

You can choose the directory type of either **IBM Directory Server** or **SecureWay** for the IBM Directory Server.

For supported directory servers, refer to the article, Supported directory services. The difference between these two types is group membership lookup. It is recommended that you choose the IBM Directory Server for optimum performance during run time. In the IBM Directory Server, the group membership is an operational attribute. With this attribute, a group membership lookup is done by enumerating the ibm-allGroups attribute for the entry, rather than selecting a group and browsing through the members list. To utilize this attribute in a security authorization application, use a case-insensitive match so that attribute values returned by the ibm-allGroups attribute are all in uppercase.

Important: 5.1+ It is recommended that you do not install Tivoli Directory Server Version 5.2 on the same machine that you install WebSphere Application Server, Version 5.1.x. Tivoli Directory Server, Version 5.2 includes WebSphere Application Server Express, Version 5.0.2, which the directory server uses for its administrative console. Install the Web Administration tool Version 5.2 and WebSphere Application Server Express, Version 5.0.2, which are both bundled with Tivoli Directory Server, Version 5.2, on a different machine from WebSphere Application Server, Version 5.1.x. You cannot use WebSphere Application Server, Version 5.1.x as the administrative console for Tivoli Directory Server. If Tivoli Directory Server, Version 5.2 and WebSphere Application Server, Version 5.1.x are installed on the same machine, you might encounter port conflicts.

5.1+ If you must install Tivoli Directory Server Version 5.2 and WebSphere Application Server Version 5.1.x on the same machine, consider the following information:

- During the Tivoli Directory Server installation process, you must select both the **Web Administration tool** and **WebSphere Application Server Express, Version 5.0.2**.
- Install WebSphere Application Server, Version 5.1.x.
- When you install WebSphere Application Server, Version 5.1.x, change the port number for the application server. For more information, see Changing HTTP transport ports.
- You might need to adjust the WebSphere Application Server environment variables on the version 5.1.x application server for *WAS_HOME* and *WAS_INSTALL_ROOT*. To change the variables using the administrative console, click **Environment > Manage WebSphere Variables**.

Using a Lotus Domino Server as the LDAP server

If you choose the Lotus Domino LDAP server Version 6 and the attribute short name is not defined in the schema, you can take either of the following actions:
- Change the schema to add the short name attribute.
- Change the user ID map filter to replace the short name with any other defined attribute (preferably to UID). For example, change `person:shortname` to `person:uid`.

5.1 + The userID map filter has been changed to use the **uid** attribute instead of the **shortname** attribute as the current version of Lotus Domino does not create the **shortname** attribute by default. If you want to use the **shortname** attribute, define the attribute in the schema and change the userID map filter to the following:

```
User ID Map :    person:shortname
```

Roles unify entries. Roles are designed to be more efficient and easier to use for applications. For example, an application can locate the role of an entry by enumerating all the roles possessed by a given entry, rather than selecting a group and browsing through the members list. With the iPlanet Directory Server directory, WebSphere Application Server security supports groups defined by *nsRole* only. If you plan to use traditional grouping methods to group entries in the iPlanet Directory Server, select **Netscape** as the directory type.

5.1 + Using Sun ONE Directory Server as the LDAP server

5.1 + You can choose **Sun ONE Directory Server** for your Sun ONE Directory Server system. For supported directory servers, refer to the article, Supported directory services. In Sun ONE Directory Server, the default object class is `groupOfUniqueName` when you create a group. For better performance, WebSphere Application Server uses the user object to locate the user group membership from the *nsRole* attribute. Thus, create the group from the role. If you want to use `groupOfUniqueName` to search groups, specify your own filter setting. Roles unify entries. Roles are designed to be more efficient and easier to use for applications. For example, an application can locate the role of an entry by enumerating all the roles possessed by a given entry, rather than selecting a group and browsing through the members list.

Using Microsoft Active Directory server as the LDAP server

To set up Microsoft Active Directory as your LDAP server, complete the following steps.

1. Determine the full DN and password of an account in the **administrators** group.
2. Determine the short name and password of any account in the Microsoft Active Directory. This password does not have to be the same account that is used in the previous step.
3. Use the WebSphere Application Server administrative console to set up the information needed to use Microsoft Active Directory:
   a. Start the administrative server for the domain, if necessary.
   b. On the administrative console, click **Security** on the left navigation panel.
   c. Click the **Authentication mechanisms** tabbed page. Select **Lightweight Third Party Authentication** (LTPA) as the authentication mechanism.
   d. Enter the following information in the LDAP settings fields:
      - **Security Server ID**: The short name of the account chosen in 2
      - **Security Server Password**: The password of the account chosen in step 2
      - **Directory Type**: Active Directory
      - **Host**: The domain name service (DNS) name of the machine running Microsoft Active Directory
      - **Base Distinguished Name**: The domain components of the DN of the account chosen in step 1. For example: `dc=ibm, dc=com Bind`
      - **Distinguished Name**: The full DN of the account chosen in step 1. For example: `cn=<adminUsername>, cn=users, dc=ibm, dc=com`
      - **Bind Password**: The password of the account chosen in step 1
   e. Click **OK** to save the changes.
   f. Stop and restart the administrative server so that the changes take effect.

Configuring Lightweight Directory Access Protocol user registries

Review the article on Lightweight Directory Access Protocol (LDAP) before beginning this task.

1. In the administrative console, click **Security** > **User Registries** > **LDAP** in the left navigation panel.
2. Enter a valid user name in the **Server User ID** field. You can either enter the complete distinguished name (DN) of the user or the short name of the user as defined by the User Filter in the Advanced LDAP settings panel. For example, enter the user ID for Netscape.
3. Enter the password of the user in the Server User Password field.
4. Select the type of LDAP server that is used from the **Type** list. The type of LDAP server determines the default filters that are used by the WebSphere Application Server. These default filters change the **Type** field to **Custom**, which indicates that custom filters are used. This action occurs after you click **OK** or **Apply** in the Advanced LDAP settings panel. Choose the **Custom** type from the list and modify the user and group filters to use other LDAP servers, if required. If either the IBM Directory Server or the iPlanet Directory Server is selected, also select the **Ignore Case** field.
5. Enter the fully qualified host name of the LDAP server in the **Host** field.
6. Enter the LDAP server port number in the **Port** field. The host name and the port number represent the realm for this LDAP server in the WebSphere Application Server cell. So, if servers in different cells are communicating with each other using Lightweight Third Party Authentication (LTPA) tokens, these

realms must match exactly in all the cells. **Important**: If you are using single signon between a WebSphere Application Server Version 5.0.x or 5.1 server and a WebSphere Application Server Version 4.0.x application server, you must specify an LDAP server port number in the administrative console by clicking **Security > User registries > LDAP**. You must set the LDAP ports numbers to the same numerical value because for WebSphere Application Server Version 5.0.x or 5.1 the default value is 0 and for WebSphere Application Server Version 4.0.x the default value for the port is not 0.

7. Enter the Base distinguished name (DN) in the **Base Distinguished Name** field. The Base DN indicates the starting point for searches in this LDAP directory server. For example, for a user with a DN of `cn=John Doe, ou=Rochester, o=IBM, c=US`, specify the Base DN as any of the following options (assuming a suffix of `c=us`): `ou=Rochester, o=IBM, c=us` or `o=IBM c=us` or `c=us`. This field can be case sensitive. Match the case in your directory server. This field is required for all LDAP directories except the Domino Directory. The Base DN field is optional for the Domino server.
8. Enter the Bind DN name in the **Bind Distinguished Name** field, if necessary. The Bind DN is required if anonymous binds are not possible on the LDAP server to obtain user and group information. If the LDAP server is set up to use anonymous binds, leave this field blank.
9. Enter the password corresponding to the Bind DN in the **Bind password** field, if necessary.
10. Modify the **Search Time Out** value if required. This timeout value is the maximum amount of time that the LDAP server waits to send a response to the product client before aborting the request. The default is 120 seconds.
11. Disable the **Reuse Connection** field only if you use routers to send requests to multiple LDAP servers, and if the routers do not support affinity. Leave this field enabled for all other situations.
12. Enable the **Ignore Case** flag, if required. When this flag is enabled, the authorization check is case insensitive. Normally, an authorization check involves checking the complete DN of a user, which is unique in the LDAP server and is case sensitive. However, when using either the IBM Directory Server or the iPlanet Directory Server LDAP servers, this flag needs enabling because the group information obtained from the LDAP servers is not consistent in case. This inconsistency only effects the authorization check.
13. Enable Secure Sockets Layer (SSL) if the communication to the LDAP server is through SSL. For more information on setting up LDAP for SSL, refer to Configuring SSL for LDAP clients.
14. If SSL is enabled, select the appropriate SSL alias configuration from the list in the **SSL configuration** field.
15. Click **OK**. The validation of the user, password, and the setup do not take place in this panel. Validation is only done when you click **OK** or **Apply** in the **Global Security** panel. If you are enabling security for the first time, complete the remaining steps and go to the **Global Security** panel. Select **LDAP** as the Active User Registry. If security is already enabled, but information on this panel changes, go to the **Global Security** panel and click **OK** or **Apply** to validate your changes. If your changes are not validated, the server might not come up.

Sets the LDAP registry configuration.

This step is required to set up the LDAP registry. This step is required as part of enabling security in the WebSphere Application Server.

1. If you are enabling security, complete the remaining steps. As the final step, validate this setup by clicking **OK** or **Apply** in the Global Security panel.
2. Save, stop, and restart all the product servers (cell, nodes and all the application servers) for changes in this panel to take effect.
3. If the server comes up without any problems the setup is correct.

Configuring Lightweight Directory Access Protocol search filters:

The WebSphere Application Server uses Lightweight Directory Access Protocol (LDAP) filters to search and obtain information about users and groups from an LDAP directory server. A default set of filters is provided for each LDAP server that the product supports. You can modify these filters to fit your LDAP configuration. After the filters are modified (and **OK** or **Apply** is clicked) the directory type in the **LDAP Registry** panel changes to `custom`, which indicates that custom filters are used. Also, you can develop filters to support any additional type of LDAP server. The effort to support additional LDAP directories is optional and other LDAP directory types are not supported.

1. In the administrative console, click **Security > User Registries > LDAP** in the left navigation panel. Click **Advanced LDAP Setting** in Additional Properties.
2. Modify the **User** filter, if necessary. The user filter is used for searching the registry for users and is typically used for the security role to user assignment. Also, the filter is used to authenticate a user using the attribute specified in the filter. The filter specifies the property used to look up users in the directory service. In the following example, the property that is assigned to `%v`, which is the short name of the user, must be a unique key. Two LDAP entries with the same object class cannot have the same short name. To look up users based on their user IDs (uid) and to use the inetOrgPerson object class, specify the following syntax:

   ```
   (&(uid=%v)(objectclass=inetOrgPerson)
   ```

   For more information about this syntax, see the LDAP directory service documentation.
3. Modify the **Group** filter, if necessary. The group filter is used in searching the registry for groups and is typically used for the security role to group assignment. Also, the filter is used to specify the property by which to look up groups in the directory service. In the following example, the property that is assigned to `%v`, which is the short name of the group, must be a unique key. Two LDAP entries with the same object class cannot have the same short name. To look up groups based on their common names (CN) and to use either the groupOfNames or the groupOfUniqueNames object class, specify the following syntax:

   ```
   (&(cn=%v)(|(objectclass=groupOfNames)(objectclass=groupOfUniqueNames)))
   ```

   For more information about this syntax, see the LDAP directory service documentation.
4. Modify the **User ID map** filter, if necessary. This filter maps the short name of a user to an LDAP entry. It specifies the piece of information that represents users when these users are displayed with their short names. For example, to display entries of the type object class = inetOrgPerson by their IDs, specify `inetOrgPerson:uid`. This field takes multiple objectclass:property pairs delimited by a semicolon (;). To provide a consistent value for methods like getCallerPrincipal( ), getUserPrincipal() the short name obtained by using this filter is used. For example, the user `CN=Bob Smith, ou=austin.ibm.com, o=IBM, c=US` can log in using any attributes that are defined (for example, e-mail

address, social security number, and so on) but when these methods are called, the user ID **bob** is returned no matter how the user logs in.

5. Modify the **Group ID Map** filter, if necessary. This filter maps the short name of a group to an LDAP entry. It specifies the piece of information that represents groups when groups display. For example, to display groups by their names, specify `*:cn`. The (*) is a wildcard character that searches on any object class in this case. This field takes multiple objectclass:property pairs delimited by a semicolon (;).
6. Modify the **Group Member ID Map** filter, if necessary. This filter identifies user to group memberships. For SecureWay, Netscape, and Domino directory types, this field is used to query all the groups that match the specified object classes to find if the user is contained in the attribute specified. For example, to get all the users belonging to groups with the groupOfNames object class and the users contained in the member attributes, specify `groupOfNames:member`. This syntax which property of an objectclass stores the list of members belonging to the group represented by the objectclass. This field takes multiple objectclass:property pairs delimited by a semicolon (;). For more information about this syntax, see the LDAP directory service documentation.

   For the IBM Directory Server, iPlanet Directory Server, and Active Directory, this field is used to query all users in a group by using the information stored in the user object (instead of querying all the groups individually to find if the user exists in that group). For example, the memberof:member filter (for Active Directory) is used to get the memberof attribute of the user object to get all the groups to which the user belongs. The member attribute is used to get all the users in a group using the group object. Using the user object to obtain the group information is expected to improve performance.
7. Modify the **Certificate Map Mode**, if necessary. You can use the X.590 certificates for user authentication when LDAP is selected as the user registry. This field is used to indicate whether to map the X.509 certificates into an LDAP directory user by **EXACT_DN** or **CERTIFICATE_FILTER**. If **EXACT_DN** is selected, the DN in the certificate must exactly match the user entry in the LDAP server (including case and spaces). Use the **Ignore Case** field in the LDAP settings to make the authorization case insensitive. If you select **CERTIFICATE_FILTER**, fill in the appropriate certificate filter (in the next field) to use for mapping the certificate to a user in LDAP.
8. If you specify the filter certificate mapping in step 7, use this property to specify the LDAP filter for mapping attributes in the client certificate to entries in LDAP. If more than one LDAP entry matches the filter specification at run time, authentication fails because an ambiguous match results. The syntax or structure of this filter is: `LDAP attribute=${Client certificate attribute}` (for example, `uid=${SubjectCN}`). The left side of the filter specification is an LDAP attribute that depends on the schema that your LDAP server is configured to use. The right side of the filter specification is one of the public attributes in your client certificate. Note that the right side must begin with a dollar sign ($), open bracket ({), and end with a close bracket ({). Use the following certificate attribute values on the right side of the filter specification. The case of the strings is important.
   - ${UniqueKey}
   - ${PublicKey}
   - ${Issuer}
   - ${NotAfter}
   - ${NotBefore}
   - ${SerialNumber}
   - ${SigAlgName}
   - ${SigAlgOID}

- ${SigAlgParams}
- ${SubjectDN}
- ${Version}

To enable this field, select **CERTIFICATE_FILTER** for the certificate mapping.

9. Click **Apply**.

   When any LDAP user or group filter is modified in the Advanced LDAP Settings panel click **Apply**. Clicking **OK** navigates you to the LDAP User Registry panel, which contains the previous LDAP directory type, rather than the custom LDAP directory type. Clicking **OK** or **Apply** in the LDAP User Registry panel saves the back-level LDAP directory type and the default filters of that directory. This action overwrites any changes to the filters that you made. To avoid overwriting changes, you can take either of the following actions:
   - Click **Apply** in the Advanced LDAP Settings panel. To proceed to another panel, use the left navigation. Using the navigation to access the LDAP User Registry panel changes the directory type to `Custom`.
   - Choose **Custom** type from the LDAP User Registry panel. Click **Apply** and then change the filters by clicking the **Advanced LDAP Settings** panel. After you complete your changes, click **Apply** or **OK**.

   The validation of the changes (if any) does not take place in this panel. Validation is done when you click **OK** or **Apply** in the Global Security panel. If you are in the process of enabling security for the first time, complete the remaining steps and go to the Global Security panel. Select **LDAP** as the Active User Registry. If security already is enabled and any information on this panel changes, go to the Global Security panel and click **OK** or **Apply** to validate your changes. If your changes are not validated, the server might not come up.

Sets the LDAP search filters.

This step is required to modify existing user and group filters for a particular LDAP directory type. It is also used to set up certificate filters to map certificates to entries in the LDAP server.

1. If you are enabling security, complete the remaining steps. As the final step make sure that you validate this setup by clicking **OK** or **Apply** in the Global Security panel.
2. Save, stop, and start all the product servers (cell, nodes and all the application servers) for any changes in this panel to become effective.
3. After the server comes up, go through all the security-related tasks (getting users, getting groups and so on) to verify that the changes to the filters function.

Custom user registries

A *custom user registry* is a customer-implemented user registry, which implements the UserRegistry Java interface as provided by the product. A custom-implemented user registry can support virtually any type of an account repository from a relational database, flat file, and so on. The custom user registry provides considerable flexibility in adapting product security to various environments where some form of a user registry, other than Lightweight Directory Access Protocol (LDAP) or Local Operating System (LocalOS), already exists in the operational environment.

WebSphere Application Server security provides an implementation that uses various local operating system-based registries (Windows, AIX, Solaris, Linux) and various Lightweight Directory Access Protocol (LDAP)-based registries. However, situations can exist where your user and group data resides in other repositories or

custom registries (a database, for example) and moving this information to either a LocalOS or an LDAP registry implementation might not be feasible. For these situations WebSphere Application Server security provides a service provider interface (SPI) that you can implement to interact with your current registry. The SPI is the UserRegistry interface. This interface has a set of methods to implement for the product security to interact with your registries for all security-related tasks. The LocalOS and LDAP registry implementations that are provided also implement this interface. Custom user registries are sometimes called the *pluggable user registries* or *custom registries* for short. Your custom user registry implementation is expected to be thread-safe.

The *UserRegistry interface* is a collection of methods required to authenticate individual users using either password or certificates and to collect information about the user (privilege attributes) for authorization purposes. This interface also includes methods that obtain user and group information so that they can be given access to resources. When implementing the methods in the interface, you must decide how to map the information manipulated by the UserRegistry interface to the information in your registry.

Make sure that your implementation of the custom registry does not depend on any WebSphere Application Server components such as data sources, enterprise beans, and so on. Do not have this dependency because security is initialized and enabled prior to most of the other WebSphere Application Server components during startup. If your previous implementation used these components, make a change that eliminates the dependency. For example, if your previous implementation used data sources to connect to a database, use Java database connectivity (JDBC) to connect to the database.

The methods in the UserRegistry interface operate on the following information for users:

User Security Name
: The user name, which is similar to the user name in the Windows systems and the UNIX systems Local OS registries. This name is used to log in when prompted by a secured application. By default, the Enterprise JavaBean (EJB) method getCallerPrincipal and the servlet methods getRemoteUser and getUserPrincipal return this name. The user security name is also referred to as *userSecurityName*, *userName* or *user name*.

Unique ID
: This ID represents a unique identifier for the user. The UserRegistry interface requires this identifier to be unique. The unique ID similar to the system ID (SID) in Windows systems, Unique ID (UID) in UNIX systems, distinguished name (DN) in Lightweight Directory Authentication Protocol (LDAP). This ID is also referred to as *uniqueUserId*. The unique ID is used to make the authorization decisions for protected resources.

Display name
: This name is an optional string that describes a user, and it is similar to the *FullName* attribute in Windows operating systems. The implementation can use display names for informational purposes only; these names are not required to exist or to be unique. The user interface can use the display name to present more information about the user.

Group Security name
: This name, which represents the security group, is also referred to as *groupSecurityName*, *groupName* and *group name*.

Unique ID
: The unique ID is the identifier for a group. This name is also referred to as *uniqueGroupId*.

Display name
The display name is an optional string that describes a group.

The article on UserRegistry interface describes each of the methods in the UserRegistry interface that need implementing. An explanation of each of the methods and their usage in the Sample and any changes from the Version 4 interface are provided. The Related references section provides links to all other custom user registries documentation, including a file-based registry Sample. The Sample provided is very simple and is intended to familiarize you with this feature. Do not use this sample in an actual production environment.

Configuring custom user registries

Before you begin this task, implement and build the UserRegistry interface. For more information on developing custom user registries refer to the article, "Developing custom user registries" on page 108. The following steps are required to configure custom user registries through the administrative console.

1. In the administrative console, click **Security > User Registries > Custom** in the left navigation panel.
2. Enter a valid user name in the **Server User ID** field.
3. Enter the password of the user in the **Server User Password** field.
4. Enter the full name of the location of the implementation class file in the **Custom Registry Classname** field a dot-separated file name. For the sample, this file name is `com.ibm.websphere.security.FileRegistrySample`. The file exists in the WebSphere Application Server class path (preferably in the *`install_root`*`/lib/ext` directory). This file exists in all the product processes. So, if you are operating in a Network Deployment environment, this file exists in the cell class path and in all of the node class paths.
5. Select the **Ignore Case** option for the authorization to perform a case insensitive check. Enabling this option is necessary only when your registry is case insensitive and does not provide a consistent case when queried for users and groups.
6. Click **Apply** if you have any other additional properties to enter for the registry initialization. Otherwise click **OK** and complete the steps required to turn on security.
7. If you need to enter additional properties to initialize your implementation, click **Custom Properties** at the bottom of the panel. Click **New**. Enter the property name and value. Click **OK**. Repeat this step to add other additional properties. For the sample, enter the following two properties: (assuming that the `users.props` and the `groups.props` file are in the `myDir` directory under the product installation directory).

Property name	Property value
usersFile	`${USER_INSTALL_ROOT}/myDir/users.props`
groupsFile	`${USER_INSTALL_ROOT}/myDir/groups.props`

The Description, Required, and Validation Expression fields are not used and you can leave them blank.

Note: In a Network Deployment environment where multiple WebSphere Application Server processes exist (cell and multiple nodes in different machines), these properties are available for each process. Use the relative name `${USER_INSTALL_ROOT}` to locate any files, as this name

expands to the product installation directory. If this name is not used, ensure that the files exist in the same location in all the nodes.

This step is required to set up the custom user registry and to enable security in WebSphere Application Server.

1. Complete the remaining steps, if you are enabling security.
2. After security is turned on, save, stop, and start all the product servers (cell, nodes and all the application servers) for any changes in this panel to take effect.
3. If the server comes up without any problems, the setup is correct.
4. Validate the user and password by clicking **OK** or **Apply** in the Global Security panel. Save, synchronize (in the cell environment), stop and start all the product servers.

UserRegistry.java files:

```
// 5639-D57, 5630-A36, 5630-A37, 5724-D18
// (C) COPYRIGHT International Business Machines Corp. 1997, 2003
// All Rights Reserved * Licensed Materials - Property of IBM
//
// DESCRIPTION:
//
//    This file is the UserRegistry interface that custom registries in WebSphere
//    Application Server implement to enable WebSphere security to use the custom
//    registry.
//package com.ibm.websphere.security;

import java.util.*;
import java.rmi.*;
import java.security.cert.X509Certificate;
import com.ibm.websphere.security.cred.WSCredential;/**
 * Implementing this interface enables WebSphere Application Server Security
 * to use custom registries. This interface extends java.rmi.Remote because the
 * registry can be in a remote process.
 *
 * Implementation of this interface must provide implementations for:
*
* initialize(java.util.Properties)
* checkPassword(String,String)
* mapCertificate(X509Certificate[])
* getRealm
* getUsers(String,int)
* getUserDisplayName(String)
* getUniqueUserId(String)
* getUserSecurityName(String)
* isValidUser(String)
* getGroups(String,int)
* getGroupDisplayName(String)
* getUniqueGroupId(String)
* getUniqueGroupIds(String)
* getGroupSecurityName(String)
* isValidGroup(String)
* getGroupsForUser(String)
* getUsersForGroup(String,int)
* createCredential(String)
**/

public interface UserRegistry extends java.rmi.Remote
{

  /**
   * Initializes the registry. This method is called when creating the
   * registry.
   *
   * @param props the registry-specific properties with which to
```

```
*              initialize the  custom registry
* @exception CustomRegistryException
*                   if there is any registry specific problem
* @exception RemoteException
*    as this extends java.rmi.Remote
**/
public void initialize(java.util.Properties props)
   throws CustomRegistryException,
          RemoteException;  /**
* Checks the password of the user. This method is called to authenticate a
* user when the user's name and password are given.
*
* @param userSecurityName the name of user
* @param password the password of the user
* @return a valid userSecurityName. Normally this is
*   the name of same user whose password was checked but if the
*  implementation wants to return any other valid
*  userSecurityName in the registry it can do so
* @exception CheckPasswordFailedException if userSecurityName/
*  password combination does not exist in the registry
* @exception CustomRegistryException if there is any registry specific
*            problem
* @exception RemoteException as this extends java.rmi.Remote
**/
public String checkPassword(String userSecurityName, String password)
   throws PasswordCheckFailedException,
          CustomRegistryException,
          RemoteException;  /**
* Maps a certificate (of X509 format) to a valid user in the registry.
* This is used to map the name in the certificate supplied by a browser
* to a valid userSecurityName in the registry
*
* @param cert the X509 certificate chain
* @return the mapped name of the user userSecurityName
* @exception CertificateMapNotSupportedException if the particular
*            certificate is not supported.
* @exception CertificateMapFailedException if the mapping of the
*            certificate fails.
* @exception CustomRegistryException if there is any registry specific
*            problem
* @exception RemoteException as this extends java.rmi.Remote
**/
public String mapCertificate(X509Certificate[] cert)
   throws CertificateMapNotSupportedException,
          CertificateMapFailedException,
          CustomRegistryException,
          RemoteException;  /**
* Returns the realm of the registry.
*
* @return the realm. The realm is a registry-specific string indicating
*            the realm or domain for which this registry
*            applies.  For example, for OS400 or AIX this would be the
*            host name of the system whose user registry this object
*            represents.
*            If null is returned by this method realm defaults to the
*            value of "customRealm". It is recommended that you use
*            your own value for realm.
* @exception CustomRegistryException if there is any registry specific
*            problem
* @exception RemoteException as this extends java.rmi.Remote
**/
public String getRealm()
   throws CustomRegistryException,
          RemoteException;  /**
* Gets a list of users that match a pattern in the registry.
* The maximum number of users returned is defined by the limit
* argument.
```

```
* This method is called by administrative console and by scripting (command
* line) to make available the users in the registry for adding them (users)
* to roles.
*
* @parameter pattern the pattern to match. (For example., a* will match all
*   userSecurityNames starting with a)
* @parameter limit the maximum number of users that should be returned.
*  This is very useful in situations where there are thousands of
*            users in the registry and getting all of them at once is not
*            practical. A value of 0 implies get all the users and hence
*            must be used with care.
* @return a Result object that contains the list of users
*   requested and a flag to indicate if more users exist.
* @exception CustomRegistryException if there is any registry specific
*            problem
* @exception RemoteException as this extends java.rmi.Remote
**/
public Result getUsers(String pattern, int limit)
   throws CustomRegistryException,
          RemoteException;  /**
* Returns the display name for the user specified by userSecurityName.
*
* This method is called only when the user information displays
* (information purposes only, for example, in the administrative console) and not used
* in the actual authentication or authorization purposes. If there are no
* display names in the registry return null or empty string.
*
* In WebSphere Application Server Version 4.0 custom registry, if you had a display
* name for the user and  if it was different from the security name, the display name
* was returned for the EJB methods getCallerPrincipal() and the servlet methods
* getUserPrincipal() and  getRemoteUser().
* In WebSphere Application Server Version 5.0 for the same methods the security
* name is returned by default. This is the recommended way as the display name
* is not unique and might create security holes.
* However, for backward compatibility if one needs the display name to
* be returned set the property WAS_UseDisplayName to true.
*
* See the documentation for more information.
*
* @parameter userSecurityName the name of the user.
* @return the display name for the user. The display name
*   is a registry-specific string that represents a descriptive, not
*  necessarily unique, name for a user. If a display name does
*            not exist return null or empty string.
* @exception EntryNotFoundException if userSecurityName does not exist.
* @exception CustomRegistryException if there is any registry specific
*            problem
* @exception RemoteException as this extends java.rmi.Remote
**/
public String getUserDisplayName(String userSecurityName)
   throws EntryNotFoundException,
          CustomRegistryException,
          RemoteException;  /**
* Returns the unique ID for a userSecurityName. This method is called when
* creating a credential for a user.
*
* @parameter userSecurityName the name of the user.
* @return the unique ID of the user. The unique ID for an user is
*   the stringified form of some unique, registry-specific, data
*  that serves to represent the user.  For example, for the UNIX
*  user registry, the unique ID for a user can be the UID.
* @exception EntryNotFoundException if userSecurityName does not exist.
* @exception CustomRegistryException if there is any registry specific
*            problem
* @exception RemoteException as this extends java.rmi.Remote
**/
public String getUniqueUserId(String userSecurityName)
```

```
   throws EntryNotFoundException,
          CustomRegistryException,
          RemoteException;  /**
 * Returns the name for a user given its unique ID.
 *
 * @parameter uniqueUserId the unique ID of the user.
 * @return the userSecurityName of the user.
 * @exception EntryNotFoundException if the uniqueUserID does not exist.
 * @exception CustomRegistryException if there is any registry specific
 *            problem
 * @exception RemoteException as this extends java.rmi.Remote
 **/
 public String getUserSecurityName(String uniqueUserId)
   throws EntryNotFoundException,
          CustomRegistryException,
          RemoteException;

/**
 * Determines if the userSecurityName exists in the registry
 *
 * @parameter userSecurityName the name of the user
 * @return true if the user is valid. false otherwise
 * @exception CustomRegistryException if there is any registry specific
 *            problem
 * @exception RemoteException as this extends java.rmi.Remote
 **/
 public boolean isValidUser(String userSecurityName)
   throws CustomRegistryException,
          RemoteException;

/**
 * Gets a list of groups that match a pattern in the registy.
 * The maximum number of groups returned is defined by the limit
 * argument.
 * This method is called by the administrative console and scripting
 * (command line) to make available the groups in the registry for adding
 * them (groups) to roles.
 *
 * @parameter pattern the pattern to match. (For e.g., a* will match all
 *   groupSecurityNames starting with a)
 * @parameter limit the maximum number of groups to return.
 *  This is very useful in situations where there are thousands of
 *            groups in the registry and getting all of them at once is not
 *            practical. A value of 0 implies get all the groups and hence
 *            must be used with care.
 * @return a Result object that contains the list of groups
 *   requested and a flag to indicate if more groups exist.
 * @exception CustomRegistryException if there is any registry-specific
 *            problem
 * @exception RemoteException as this extends java.rmi.Remote
 **/
 public Result getGroups(String pattern, int limit)
   throws CustomRegistryException,
          RemoteException;

/**
 * Returns the display name for the group specified by groupSecurityName.
 *
 * This method may be called only when the group information displayed
 * (for example, the administrative console) and not used in the actual
 * authentication or authorization purposes. If there are no display names
 * in the registry return null or empty string.
 *
 * @parameter groupSecurityName the name of the group.
 * @return the display name for the group. The display name
 *   is a registry-specific string that represents a descriptive, not
 *  necessarily unique, name for a group. If a display name does
```

```
 *            not exist return null or empty string.
 * @exception EntryNotFoundException if groupSecurityName does not exist.
 * @exception CustomRegistryException if there is any registry specific
 *            problem
 * @exception RemoteException as this extends java.rmi.Remote
 **/
 public String getGroupDisplayName(String groupSecurityName)
    throws EntryNotFoundException,
           CustomRegistryException,
           RemoteException;

/**
 * Returns the unique ID for a group.

 * @parameter groupSecurityName the name of the group.
 * @return the unique ID of the group. The unique ID for
 *   a group is the stringified form of some unique,
 *   registry-specific, data that serves to represent the group.
 *            For example, for the UNIX user registry, the unique IDd could
 *  be the GID.
 * @exception EntryNotFoundException if groupSecurityName does not exist.
 * @exception CustomRegistryException if there is any registry specific
 *            problem
 * @exception RemoteException as this extends java.rmi.Remote
 **/
 public String getUniqueGroupId(String groupSecurityName)
    throws EntryNotFoundException,
           CustomRegistryException,
           RemoteException;


/**
 * Returns the unique IDs for all the groups that contain the unique ID of
 * a user.
 * Called during creation of a user's credential.
 *
 * @parameter uniqueUserId the unique ID of the user.
 * @return a list of all the group unique IDs that the unique user ID
 *   belongs to. The unique ID for an entry is the stringified
 *  form of some unique, registry-specific, data that serves
 *  to represent the entry.  For example, for the
 *   UNIX user registry, the unique ID for a group could be the GID
 *  and the unique ID for the user could be the UID.
 * @exception EntryNotFoundException if unique user ID does not exist.
 * @exception CustomRegistryException if there is any registry specific
 *            problem
 * @exception RemoteException as this extends java.rmi.Remote
 **/
 public List getUniqueGroupIds(String uniqueUserId)
    throws EntryNotFoundException,
           CustomRegistryException,
           RemoteException;

/**
 * Returns the name for a group given its unique ID.
 *
 * @parameter uniqueGroupId the unique ID of the group.
 * @return the name of the group.
 * @exception EntryNotFoundException if the uniqueGroupId does not exist.
 * @exception CustomRegistryException if there is any registry-specific
 *            problem
 * @exception RemoteException as this extends java.rmi.Remote
 **/
 public String getGroupSecurityName(String uniqueGroupId)
    throws EntryNotFoundException,
           CustomRegistryException,
           RemoteException;
```

```
/**
 * Determines if the groupSecurityName exists in the registry
 *
 * @parameter groupSecurityName the name of the group
 * @return true if the groups exists, false otherwise
 * @exception CustomRegistryException if there is any registry specific
 *            problem
 * @exception RemoteException as this extends java.rmi.Remote
 **/
 public boolean isValidGroup(String groupSecurityName)
    throws CustomRegistryException,
           RemoteException;

/**
 * Returns the securityNames of all the groups that contain the user
 *
 * This method is called by administrative console and scripting
 * (command line) to verify the user entered for RunAsRole mapping belongs
 * to that role  in the roles to user mapping. Initially, the check is done
 * to see if the role contains the user. If the role does not contain the user
 * explicitly, this method is called to get the groups that this user
 * belongs to so that checks are made on the groups that the role contains.
 *
 * @parameter userSecurityName the name of the user
 * @return a List of all the group securityNames that the user
 *   belongs to.
 * @exception EntryNotFoundException if user does not exist.
 * @exception CustomRegistryException if there is any registry specific
 *            problem
 * @exception RemoteException as this extends java.rmi.Remote
 **/
 public List getGroupsForUser(String userSecurityName)
    throws EntryNotFoundException,
           CustomRegistryException,
           RemoteException;

/**
 * Gets a list of users in a group.
 *
 * The maximum number of users returned is defined by the limit
 * argument.
 *

 * This method is used by the process choreographer when staff
 * assignments are modeled using groups.
 *
 * In rare situations if you are working with a registry where getting all of
 * the users from any of your groups is not practical (for example if
 * a large number of users exist) you can throw the NotImplementedException
 * for that particular groups. Make sure that if the Process Choreographer
 * is installed (or if installed later) that are not modeled using these
 * particular groups. If no concern exists about the staff assignments
 * returning the users from groups in the registry it is recommended that
 * this method be implemented without throwing the NotImplemented exception.
 *
 * @parameter groupSecurityName that represents the name of the group
 * @parameter limit the maximum number of users to return.
 *            This option is very useful in situations where lots of
 *            users are in the registry and getting all of them at
 *            once is not practical. A value of 0 means  get all of
 *            the users and must be used with care.
 * @return    a Result object that contains the list of users
 *            requested and a flag to indicate if more users exist.
 * @deprecated This method will be deprecated in the future.
 * @exception NotImplementedException throw this exception in rare situations
 *            if it is not practical to get this information for any of the
```

```
   *            groups from the registry.
   * @exception EntryNotFoundException if the group does not exist in
   *            the registry
   * @exception CustomRegistryException if any registry-specific
   *            problem occurs
   * @exception RemoteException as this extends java.rmi.Remote interface
   **/
   public Result getUsersForGroup(String groupSecurityName, int limit)
      throws NotImplementedException,
             EntryNotFoundException,
             CustomRegistryException,
             RemoteException;

  /**
   * This method is implemented internally by the WebSphere Application Server
   * code in this release. This method is not called for the custom registry
   * implementations for this release. Return null in the implementation.
   *
   * Note that because this method is not called you can also return the
   * NotImplementedException as the previous documentation says.
   *
   **/
   public com.ibm.websphere.security.cred.WSCredential
                                createCredential(String userSecurityName)
      throws NotImplementedException,
      EntryNotFoundException,
             CustomRegistryException,
             RemoteException;
}
```

FileRegistrySample.java file for WebSphere Application Server: The user and group information required by this sample is contained in the users.props and groups.props files.

The contents of the `FileRegistrySample.java` file:

```
//
// 5639-D57, 5630-A36, 5630-A37, 5724-D18
// (C) COPYRIGHT International Business Machines Corp. 1997, 2003
// All Rights Reserved * Licensed Materials - Property of IBM
////--------------------------------------------------------------------------
// This program may be used, executed, copied, modified and distributed
// without royalty for the purpose of developing, using, marketing, or
// distributing.
//--------------------------------------------------------------------------
//

// This sample is for the custom user registry feature in WebSphere
// Application Server.

import java.util.*;
import java.io.*;
import java.security.cert.X509Certificate;
import com.ibm.websphere.security.*;
/**
 *  The main purpose of this sample is to demonstrate the use of the
 *  custom user registry feature available in WebSphere Application Server. This
 *  sample is a file-based registry sample where the users and the groups
 *  information is listed in files (users.props and groups.props). As such
 *  simplicity and not the performance was a major factor behind this. This
 *  sample should be used only to get familiarized with this feature. An
 *  actual implementation of a realistic registry should consider various
 *  factors like performance, scalability, thread safety, and so on.
 **/
public class FileRegistrySample implements UserRegistry {

   private static String USERFILENAME = null;
```

```
 private static String GROUPFILENAME = null;

 /** Default Constructor **/
 public FileRegistrySample() throws java.rmi.RemoteException {
 }

/**
 * Initializes the registry. This method is called when creating the
 * registry.
 *
 * @param     props - The registry-specific properties with which to
 *                    initialize the custom registry
 * @exception CustomRegistryException
 *                    if there is any registry-specific problem
 **/
public void initialize(java.util.Properties props)
       throws CustomRegistryException {
    try {
       /* try getting the USERFILENAME and the GROUPFILENAME from
        * properties that are passed in (For example, from the
        * administrative console). Set these values in the administrative
        * console. Go to the special custom settings in the custom
        * user registry section of the Authentication panel.
        * For example:
        * usersFile   c:/temp/users.props
        * groupsFile  c:/temp/groups.props
        */
        if (props != null) {
           USERFILENAME = props.getProperty("usersFile");
           GROUPFILENAME = props.getProperty("groupsFile");
        }

    } catch(Exception ex) {
       throw new CustomRegistryException(ex.getMessage(),ex);
    }

    if (USERFILENAME == null || GROUPFILENAME == null) {
       throw new CustomRegistryException("users/groups information missing");
    }

 }  /**
 * Checks the password of the user. This method is called to authenticate
 * a user when the user's name and password are given.
 *
 * @param  userSecurityName the name of user
 * @param  password the password of the user
 * @return a valid userSecurityName. Normally this is
 *         the name of same user whose password was checked
 *         but if the implementation wants to return any other
 *         valid userSecurityName in the registry it can do so
 * @exception CheckPasswordFailedException if userSecurityName/
 *            password combination does not exist
 *            in the registry
 * @exception CustomRegistryException if there is any registry-
 *            specific problem
 **/
 public String checkPassword(String userSecurityName, String passwd)
    throws PasswordCheckFailedException,
           CustomRegistryException {
    String s,userName = null;
    BufferedReader in = null;

    try {
       in = fileOpen(USERFILENAME);
       while ((s=in.readLine())!=null)
       {
          if (!(s.startsWith("#") || s.trim().length() <=0 )) {
```

```
            int index = s.indexOf(":");
            int index1 = s.indexOf(":",index+1);
            // check if the userSecurityName:passwd combination exists
            if ((s.substring(0,index)).equals(userSecurityName) &&
                    s.substring(index+1,index1).equals(passwd)) {
               // Authentication successful, return the userId.
               userName = userSecurityName;
               break;
            }
         }
      }
   } catch(Exception ex) {
      throw new CustomRegistryException(ex.getMessage(),ex);
   } finally {
      fileClose(in);
   }


   if (userName == null) {
      throw new PasswordCheckFailedException("Password check failed for user: "
      + userSecurityName);
   }

   return userName;
}  /**
* Maps a X.509 format certificate to a valid user in the registry.
* This is used to map the name in the certificate supplied by a browser
* to a valid userSecurityName in the registry
*
* @param     cert the X509 certificate chain
* @return    The mapped name of the user userSecurityName
* @exception CertificateMapNotSupportedException if the
*            particular certificate is not supported.
* @exception CertificateMapFailedException if the mapping of
*            the certificate fails.
* @exception CustomRegistryException if there is any registry
*            -specific problem
**/
public String mapCertificate(X509Certificate[] cert)
   throws CertificateMapNotSupportedException,
          CertificateMapFailedException,
          CustomRegistryException {
   String name=null;
   X509Certificate cert1 = cert[0];
   try {
      // map the SubjectDN in the certificate to a userID.
      name = cert1.getSubjectDN().getName();
   } catch(Exception ex) {
      throw new CertificateMapNotSupportedException(ex.getMessage(),ex);
   }

   if(!isValidUser(name)) {
      throw new CertificateMapFailedException("user: " + name
      + " is not valid");
   }
   return name;
}  /**
* Returns the realm of the registry.
*
* @return the realm. The realm is a registry-specific string
* indicating the realm or domain for which this registry
* applies. For example, for OS/400 or AIX this would be
* the host name of the system whose user registry this
* object represents. If null is returned by this method,
* realm defaults to the value of "customRealm". It is
* recommended that you use your own value for realm.
*
```

```
* @exception CustomRegistryException if there is any registry-
* specific problem
**/
public String getRealm()
   throws CustomRegistryException {
   String name = "customRealm";
   return name;
}  /**
* Gets a list of users that match a pattern in the registry.
* The maximum number of users returned is defined by the limit
* argument.
* This method is called by the administrative console and scripting
* (command line) to make the users in the registry available for
* adding them (users) to roles.
*
* @param      pattern the pattern to match. (For example, a* will
*             match  all userSecurityNames starting with a)
* @param      limit the maximum number of users that should be
*             returned. This is very useful in situations where
*             there are thousands of users in the registry and
*             getting all of them at once is not practical. The
*             default is 100. A value of 0 implies get all the
*             users and hence must be used with care.
* @return     a Result object that contains the list of users
*             requested and a flag to indicate if  more users
*             exist.
* @exception  CustomRegistryException if there is any registry-
*             specificproblem
**/
public Result getUsers(String pattern, int limit)
   throws CustomRegistryException {
   String s;
   BufferedReader in = null;
   List allUsers = new ArrayList();
   Result result = new Result();
   int count = 0;
   int newLimit = limit+1;
   try {
      in = fileOpen(USERFILENAME);
      while ((s=in.readLine())!=null)
      {
         if (!(s.startsWith("#") || s.trim().length() <=0 )) {
            int index = s.indexOf(":");
            String user = s.substring(0,index);
            if (match(user,pattern)) {
               allUsers.add(user);
               if (limit !=0 && ++count == newLimit) {
                  allUsers.remove(user);
                  result.setHasMore();
                  break;
               }
            }
         }
      }
   } catch (Exception ex) {
      throw new CustomRegistryException(ex.getMessage(),ex);
   } finally {
      fileClose(in);
   }

   result.setList(allUsers);
   return result;
}  /**
* Returns the display name for the user specified by
*  userSecurityName.
*
* This method may be called only when the user information
```

```
 * is displayed (information purposes only, for example, in
 * the administrative console) and hence not used in the actual
 * authentication or authorization purposes. If there are no
 * display names in the registry return null or empty string.
 *
 * In WebSphere Application Server 4 custom registry, if you
 * had a display name for the user and if it was different from the
 * security name, the display name was returned for the EJB
 * methods getCallerPrincipal() and the servlet methods
 * getUserPrincipal() and  getRemoteUser().
 * In WebSphere Application Server Version 5, for the same
 * methods, the security name will be returned by default. This
 * is the recommended way as the display name is not unique
 * and might create security holes. However, for backward
 * compatibility if one needs the display name to be returned
 * set the property WAS_UseDisplayName to true.
 *
 *See the InfoCenter documentation for more information.
 *
 * @param     userSecurityName the name of the user.
 * @return    the display name for the user. The display
 *            name is a registry-specific string that
 *            represents a descriptive, not necessarily
 *            unique, name for a user. If a display name
 *            does not exist return null or empty string.
 * @exception EntryNotFoundException if userSecurityName
 *            does not exist.
 * @exception CustomRegistryException if there is any registry-
  *           specific problem
 **/
 public String getUserDisplayName(String userSecurityName)
    throws CustomRegistryException,
           EntryNotFoundException {

    String s,displayName = null;
    BufferedReader in = null;

    if(!isValidUser(userSecurityName)) {
       EntryNotFoundException nsee = new EntryNotFoundException("user: "
       + userSecurityName + " is not valid");
       throw nsee;
    }

    try {
       in = fileOpen(USERFILENAME);
       while ((s=in.readLine())!=null)
       {
          if (!(s.startsWith("#") || s.trim().length() <=0 )) {
             int index = s.indexOf(":");
             int index1 = s.lastIndexOf(":");
             if ((s.substring(0,index)).equals(userSecurityName)) {
                displayName = s.substring(index1+1);
                break;
             }
          }
       }
    } catch(Exception ex) {
       throw new CustomRegistryException(ex.getMessage(), ex);
    } finally {
       fileClose(in);
    }

    return displayName;
 }

/**
 * Returns the unique ID for a userSecurityName. This method is called
```

```
* when creating a credential for a user.
*
* @param    userSecurityName - The name of the user.
* @return   The unique ID of the user. The unique ID for an user
*           is the stringified form of some unique, registry-specific,
*           data that serves to represent the user. For example, for
*           the UNIX user registry, the unique ID for a user can be
*           the UID.
* @exception EntryNotFoundException if userSecurityName does not
*            exist.
* @exception CustomRegistryException if there is any registry-
*            specific problem
**/
public String getUniqueUserId(String userSecurityName)
   throws CustomRegistryException,
          EntryNotFoundException {

   String s,uniqueUsrId = null;
   BufferedReader in = null;
   try {
      in = fileOpen(USERFILENAME);
      while ((s=in.readLine())!=null)
      {
         if (!(s.startsWith("#") || s.trim().length() <=0 )) {
            int index = s.indexOf(":");
            int index1 = s.indexOf(":", index+1);
            if ((s.substring(0,index)).equals(userSecurityName)) {
               int index2 = s.indexOf(":", index1+1);
               uniqueUsrId = s.substring(index1+1,index2);
               break;
            }
         }
      }
   } catch(Exception ex) {
      throw new CustomRegistryException(ex.getMessage(),ex);
   } finally {
      fileClose(in);
   }

   if (uniqueUsrId == null) {
      EntryNotFoundException nsee =
      new EntryNotFoundException("Cannot obtain uniqueId for user: "
      + userSecurityName);
      throw nsee;
   }

   return uniqueUsrId;
}  /**
* Returns the name for a user given its uniqueId.
*
* @param      uniqueUserId  - The unique ID of the user.
* @return     The userSecurityName of the user.
* @exception  EntryNotFoundException if the unique user ID does not exist.
* @exception  CustomRegistryException if there is any registry-specific
*             problem
**/
public String getUserSecurityName(String uniqueUserId)
   throws CustomRegistryException,
          EntryNotFoundException {
   String s,usrSecName = null;
   BufferedReader in = null;
   try {
      in = fileOpen(USERFILENAME);
      while ((s=in.readLine())!=null)
      {
         if (!(s.startsWith("#") || s.trim().length() <=0 )) {
            int index = s.indexOf(":");
```

```
            int index1 = s.indexOf(":", index+1);
            int index2 = s.indexOf(":", index1+1);
            if ((s.substring(index1+1,index2)).equals(uniqueUserId)) {
               usrSecName = s.substring(0,index);
               break;
            }
         }
      }
   } catch (Exception ex) {
      throw new CustomRegistryException(ex.getMessage(), ex);
   } finally {
      fileClose(in);
   }

   if (usrSecName == null) {
      EntryNotFoundException ex =
         new EntryNotFoundException("Cannot obtain the
         user securityName for " + uniqueUserId);
      throw ex;
   }

   return usrSecName;

}  /**
* Determines if the userSecurityName exists in the registry
*
* @param     userSecurityName - The name of the user
* @return    True if the user is valid; otherwise false
* @exception CustomRegistryException if there is any registry-
*            specific problem
* @exception RemoteException as this extends java.rmi.Remote
*            interface
**/
public boolean isValidUser(String userSecurityName)
   throws CustomRegistryException {
   String s;
   boolean isValid = false;
   BufferedReader in = null;
   try {
      in = fileOpen(USERFILENAME);
      while ((s=in.readLine())!=null)
      {
         if (!(s.startsWith("#") || s.trim().length() <=0 )) {
            int index = s.indexOf(":");
            if ((s.substring(0,index)).equals(userSecurityName)) {
               isValid=true;
               break;
            }
         }
      }
   } catch (Exception ex) {
      throw new CustomRegistryException(ex.getMessage(), ex);
   } finally {
      fileClose(in);
   }

   return isValid;
}  /**
* Gets a list of groups that match a pattern in the registry
* The maximum number of groups returned is defined by the
* limit argument. This method is called by administrative console
* and scripting (command line) to make available the groups in
* the registry for adding them (groups) to roles.
*
* @param       pattern the pattern to match. (For example, a* matches
*              all groupSecurityNames starting with a)
* @param       Limits the maximum number of groups to return
```

```
 *              This is very useful in situations where there
 *              are thousands of groups in the registry and getting all
 *              of them at once is not practical. The default is 100.
 *              A value of 0 implies get all the groups and hence must
 *              be used with care.
 * @return      A Result object that contains the list of groups
 *              requested and a flag to indicate if more groups exist.
 * @exception CustomRegistryException if there is any registry-specific
 *              problem
 **/
 public Result getGroups(String pattern, int limit)
    throws CustomRegistryException {
    String s;
    BufferedReader in = null;
    List allGroups = new ArrayList();      Result result = new Result();
    int count = 0;
    int newLimit = limit+1;
    try {
       in = fileOpen(GROUPFILENAME);
       while ((s=in.readLine())!=null)
       {
          if (!(s.startsWith("#") || s.trim().length() <=0 )) {
             int index = s.indexOf(":");
             String group = s.substring(0,index);
             if (match(group,pattern)) {
                allGroups.add(group);
                if (limit !=0 && ++count == newLimit) {
                   allGroups.remove(group);
                   result.setHasMore();
                   break;
                }
             }
          }
       }
    } catch (Exception ex) {
       throw new CustomRegistryException(ex.getMessage(),ex);
    } finally {
       fileClose(in);
    }

    result.setList(allGroups);
    return result;
 }

/**
 * Returns the display name for the group specified by groupSecurityName.
 * For this version of WebSphere Application Server, the only usage of
 * this method is by the clients (administrative console and scripting)
 * to present a descriptive name of the user if it exists.
 *
 * @param groupSecurityName the name of the group.
 * @return  the display name for the group. The display name
 *          is a registry-specific string that represents a
 *          descriptive, not necessarily unique, name for a group.
 *          If a display name does not exist return null or empty
 *          string.
 * @exception EntryNotFoundException if groupSecurityName does
 *          not exist.
 * @exception CustomRegistryException if there is any registry-
 *          specific problem
 **/
 public String getGroupDisplayName(String groupSecurityName)
    throws CustomRegistryException,
           EntryNotFoundException {
    String s,displayName = null;
    BufferedReader in = null;
```

```
    if(!isValidGroup(groupSecurityName)) {
       EntryNotFoundException nsee = new EntryNotFoundException("group: "
       + groupSecurityName + " is not valid");
       throw nsee;
    }

    try {
       in = fileOpen(GROUPFILENAME);
       while ((s=in.readLine())!=null)
       {
          if (!(s.startsWith("#") || s.trim().length() <=0 )) {
             int index = s.indexOf(":");
             int index1 = s.lastIndexOf(":");
             if ((s.substring(0,index)).equals(groupSecurityName)) {
                displayName = s.substring(index1+1);
                break;
             }
          }
       }
    } catch(Exception ex) {
       throw new CustomRegistryException(ex.getMessage(),ex);
    } finally {
       fileClose(in);
    }

    return displayName;
 }

/**
 * Returns the Unique ID for a group.

 * @param     groupSecurityName the name of the group.
 * @return    The unique ID of the group. The unique ID for
 *            a group is the stringified form of some unique,
 *            registry-specific, data that serves to represent
 *            the group. For example, for the UNIX user registry,
 *            the unique ID might be the GID.
 * @exception EntryNotFoundException if groupSecurityName does
 *            not exist.
 * @exception CustomRegistryException if there is any registry-
 *            specific problem
 * @exception RemoteException as this extends java.rmi.Remote
 **/
 public String getUniqueGroupId(String groupSecurityName)
    throws CustomRegistryException,
           EntryNotFoundException {
    String s,uniqueGrpId = null;
    BufferedReader in = null;
    try {
       in = fileOpen(GROUPFILENAME);
       while ((s=in.readLine())!=null)
       {
          if (!(s.startsWith("#") || s.trim().length() <=0 )) {
             int index = s.indexOf(":");
             int index1 = s.indexOf(":", index+1);
             if ((s.substring(0,index)).equals(groupSecurityName)) {
                uniqueGrpId = s.substring(index+1,index1);
                break;
             }
          }
       }
    } catch(Exception ex) {
       throw new CustomRegistryException(ex.getMessage(),ex);
    } finally {
       fileClose(in);
    }
```

```
   if (uniqueGrpId == null) {
      EntryNotFoundException nsee =
      new EntryNotFoundException("Cannot obtain the uniqueId for group: "
      + groupSecurityName);
      throw nsee;
   }

   return uniqueGrpId;
}

/**
 * Returns the Unique IDs for all the groups that contain the UniqueId
 * of a user. Called during creation of a user's credential.
 *
 * @param     uniqueUserId the unique ID of the user.
 * @return    A list of all the group unique IDs that the unique user
 *            ID belongs to. The unique ID for an entry is the
 *            stringified form of some unique, registry-specific, data
 *            that serves to represent the entry.  For example, for the
 *            UNIX user registry, the unique ID for a group might be
 *            the GID and the Unique ID for the user might be the UID.
 * @exception EntryNotFoundException if uniqueUserId does not exist.
 * @exception CustomRegistryException if there is any registry-specific
 *            problem
 **/
public List getUniqueGroupIds(String uniqueUserId)
   throws CustomRegistryException,
          EntryNotFoundException {
   String s,uniqueGrpId = null;
   BufferedReader in = null;
   List uniqueGrpIds=new ArrayList();
   try {
      in = fileOpen(USERFILENAME);
      while ((s=in.readLine())!=null)
      {
         if (!(s.startsWith("#") || s.trim().length() <=0 )) {
            int index = s.indexOf(":");
            int index1 = s.indexOf(":", index+1);
            int index2 = s.indexOf(":", index1+1);
            if ((s.substring(index1+1,index2)).equals(uniqueUserId)) {
               int lastIndex = s.lastIndexOf(":");
               String subs = s.substring(index2+1,lastIndex);
               StringTokenizer st1 = new StringTokenizer(subs, ",");
               while (st1.hasMoreTokens())
                  uniqueGrpIds.add(st1.nextToken());
               break;
            }
         }
      }
   } catch(Exception ex) {
      throw new CustomRegistryException(ex.getMessage(),ex);
   } finally {
      fileClose(in);
   }

   return uniqueGrpIds;
}

/**
 * Returns the name for a group given its uniqueId.
 *
 * @param     uniqueGroupId the unique ID of the group.
 * @return    The name of the group.
 * @exception EntryNotFoundException if the uniqueGroupId does
 *            not exist.
 * @exception CustomRegistryException if there is any registry-
 *            specific problem
```

```
**/
public String getGroupSecurityName(String uniqueGroupId)
   throws CustomRegistryException,
          EntryNotFoundException {
   String s,grpSecName = null;
   BufferedReader in = null;
   try {
      in = fileOpen(GROUPFILENAME);
      while ((s=in.readLine())!=null)
      {
         if (!(s.startsWith("#") || s.trim().length() <=0 )) {
            int index = s.indexOf(":");
            int index1 = s.indexOf(":", index+1);
            if ((s.substring(index+1,index1)).equals(uniqueGroupId)) {
               grpSecName = s.substring(0,index);
               break;
            }
         }
      }
   } catch (Exception ex) {
      throw new CustomRegistryException(ex.getMessage(),ex);
   } finally {
      fileClose(in);
   }

   if (grpSecName == null) {
      EntryNotFoundException ex =
         new EntryNotFoundException("Cannot obtain the group
        security name for: " + uniqueGroupId);
      throw ex;
   }

   return grpSecName;

}

/**
 * Determines if the groupSecurityName exists in the registry
 *
 * @param     groupSecurityName the name of the group
 * @return    True if the groups exists; otherwise false
 * @exception CustomRegistryException if there is any registry-
 *            specific problem
 **/
public boolean isValidGroup(String groupSecurityName)
   throws CustomRegistryException {
   String s;
   boolean isValid = false;
   BufferedReader in = null;
   try {
      in = fileOpen(GROUPFILENAME);
      while ((s=in.readLine())!=null)
      {
         if (!(s.startsWith("#") || s.trim().length() <=0 )) {
            int index = s.indexOf(":");
            if ((s.substring(0,index)).equals(groupSecurityName)) {
               isValid=true;
               break;
            }
         }
      }
   } catch (Exception ex) {
      throw new CustomRegistryException(ex.getMessage(),ex);
   } finally {
      fileClose(in);
   }
```

```
   return isValid;
}

/**
 * Returns the securityNames of all the groups that contain the user
 *
 * This method is called by the administrative console and scripting
 * (command line) to verify the user entered for RunAsRole mapping
 * belongs to that role in the roles to user mapping. Initially, the
 * check is done to see  if the role contains the user. If the role does
 * not contain the user explicitly, this method is called to get the groups
 * that this user belongs to so that check can be made on the groups that
 * the role contains.
 *
 * @param     userSecurityName the name of the user
 * @return    A list of all the group securityNames that the user
 *            belongs to.
 * @exception EntryNotFoundException if user does not exist.
 * @exception CustomRegistryException if there is any registry-
 *            specific problem
 * @exception RemoteException as this extends the java.rmi.Remote
 *            interface
 **/
public List getGroupsForUser(String userName)
   throws CustomRegistryException,
          EntryNotFoundException {
   String s;
   List grpsForUser = new ArrayList();
   BufferedReader in = null;
   try {
      in = fileOpen(GROUPFILENAME);
      while ((s=in.readLine())!=null)
      {
         if (!(s.startsWith("#") || s.trim().length() <=0 )) {
            StringTokenizer st = new StringTokenizer(s, ":");
            for (int i=0; i<2; i++)
               st.nextToken();
            String subs = st.nextToken();
            StringTokenizer st1 = new StringTokenizer(subs, ",");
            while (st1.hasMoreTokens()) {
               if((st1.nextToken()).equals(userName)) {
                  int index = s.indexOf(":");
                  grpsForUser.add(s.substring(0,index));
               }
            }
         }
      }
   } catch (Exception ex) {
      if (!isValidUser(userName)) {
         throw new EntryNotFoundException("user: " + userName
         + " is not valid");
      }
      throw new CustomRegistryException(ex.getMessage(),ex);
   } finally {
      fileClose(in);
   }

   return grpsForUser;
}

/**
 * Gets a list of users in a group.
 *
 * The maximum number of users returned is defined by the
 * limit argument.
 *
```

```
* This method is being used by the process choreographer
* when staff assignments are modeled using groups.
*
* In rare situations, if you are working with a registry where
* getting all the users from any of your groups is not practical
* (for example if there are a large number of users) you can throw
* the NotImplementedException for that particular group. Make sure
* that if the process choreographer is installed (or if installed later)
* the staff assignments are not modeled using these particular groups.
* If there is no concern about returning the users from groups
* in the registry it is recommended that this method be implemented
* without throwing the NotImplemented exception.
* @param         groupSecurityName the name of the group
* @param         Limits the maximum number of users that should be
*                returned. This is very useful in situations where there
*                are lot of users in the registry and getting all of
*                them at once is not practical. A value of 0 implies
*                get all the users and hence must be used with care.
* @return        A result object that contains the list of users
*                requested and a flag to indicate if more users exist.
* @deprecated    This method will be deprecated in future.
* @exception     NotImplementedException throw this exception in rare
*                situations if it is not practical to get this information
*                for any of the group or groups from the registry.
* @exception     EntryNotFoundException if the group does not exist in
*                the registry
* @exception     CustomRegistryException if there is any registry-specific
*                problem
**/
public Result getUsersForGroup(String groupSecurityName, int limit)
   throws NotImplementedException,
          EntryNotFoundException,
          CustomRegistryException {
   String s, user;
   BufferedReader in = null;
   List usrsForGroup = new ArrayList();
   int count = 0;
   int newLimit = limit+1;
   Result result = new Result();

   try {
      in = fileOpen(GROUPFILENAME);
      while ((s=in.readLine())!=null)
      {
         if (!(s.startsWith("#") || s.trim().length() <=0 )) {
            int index = s.indexOf(":");
            if ((s.substring(0,index)).equals(groupSecurityName))
            {
               StringTokenizer st = new StringTokenizer(s, ":");
               for (int i=0; i<2; i++)
                  st.nextToken();
               String subs = st.nextToken();
               StringTokenizer st1 = new StringTokenizer(subs, ",");
               while (st1.hasMoreTokens()) {
                  user = st1.nextToken();
                  usrsForGroup.add(user);
                  if (limit !=0 && ++count == newLimit) {
                     usrsForGroup.remove(user);
                     result.setHasMore();
                     break;
                  }
               }
            }
         }
      }
   } catch (Exception ex) {
      if (!isValidGroup(groupSecurityName)) {
```

```
            throw new EntryNotFoundException("group: "
            + groupSecurityName
            + " is not valid");
         }
         throw new CustomRegistryException(ex.getMessage(),ex);
      } finally {
         fileClose(in);
      }

      result.setList(usrsForGroup);
      return result;
   }

  /**
   * This method is implemented internally by the WebSphere Application
   * Server code in this release. This method is not called for the custom
   * registry implementations for this release. Return null in the
   * implementation.
   *
   **/
   public com.ibm.websphere.security.cred.WSCredential
         createCredential(String userSecurityName)
         throws CustomRegistryException,
                NotImplementedException,
                EntryNotFoundException {

      // This method is not called.
      return null;
   }

   // private methods
   private BufferedReader fileOpen(String fileName)
      throws FileNotFoundException {
      try {
         return new BufferedReader(new FileReader(fileName));
      } catch(FileNotFoundException e) {
         throw e;
      }
   }

   private void fileClose(BufferedReader in) {
      try {
         if (in != null) in.close();
      } catch(Exception e) {
         System.out.println("Error closing file" + e);
      }
   }

   private boolean match(String name, String pattern) {
      RegExpSample regexp = new RegExpSample(pattern);
      boolean matches = false;
      if(regexp.match(name))
          matches = true;
      return matches;
   }
}


//-------------------------------------------------------------------------
// The program provides the Regular Expression implementation
// used in the sample for the custom user registry (FileRegistrySample).
// The pattern matching in the sample uses this program to search for the
// pattern (for users and groups).
//-------------------------------------------------------------------------

class RegExpSample
{
```

```
    private boolean match(String s, int i, int j, int k)
    {
        for(; k < expr.length; k++)
label0:
            {
                Object obj = expr[k];
                if(obj == STAR)
                {
                    if(++k >= expr.length)
                        return true;
                    if(expr[k] instanceof String)
                    {
                        String s1 = (String)expr[k++];
                        int l = s1.length();
                        for(; (i = s.indexOf(s1, i)) >= 0; i++)
                            if(match(s, i + l, j, k))
                                return true;

                        return false;
                    }
                    for(; i < j; i++)
                        if(match(s, i, j, k))
                            return true;

                    return false;
                }
                if(obj == ANY)
                {
                    if(++i > j)
                        return false;
                    break label0;
                }
                if(obj instanceof char[][])
                {
                    if(i >= j)
                        return false;
                    char c = s.charAt(i++);
                    char ac[][] = (char[][])obj;
                    if(ac[0] == NOT)
                    {
                        for(int j1 = 1; j1 < ac.length; j1++)
                            if(ac[j1][0] <= c && c <= ac[j1][1])
                                return false;

                        break label0;
                    }
                    for(int k1 = 0; k1 < ac.length; k1++)
                        if(ac[k1][0] <= c && c <= ac[k1][1])
                            break label0;

                    return false;
                }
                if(obj instanceof String)
                {
                    String s2 = (String)obj;
                    int i1 = s2.length();
                    if(!s.regionMatches(i, s2, 0, i1))
                        return false;
                    i += i1;
                }
            }

        return i == j;
    }

    public boolean match(String s)
```

```
{
    return match(s, 0, s.length(), 0);
}

public boolean match(String s, int i, int j)
{
    return match(s, i, j, 0);
}

public RegExpSample(String s)
{
    Vector vector = new Vector();
    int i = s.length();
    StringBuffer stringbuffer = null;
    Object obj = null;
    for(int j = 0; j < i; j++)
    {
        char c = s.charAt(j);
        switch(c)
        {
        case 63: /* '?' */
            obj = ANY;
            break;

        case 42: /* '*' */
            obj = STAR;
            break;

        case 91: /* '[' */
            int k = ++j;
            Vector vector1 = new Vector();
            for(; j < i; j++)
            {
                c = s.charAt(j);
                if(j == k && c == '^')
                {
                    vector1.addElement(NOT);
                    continue;
                }
                if(c == '\\')
                {
                    if(j + 1 < i)
                        c = s.charAt(++j);
                }
                else
                if(c == ']')
                    break;
                char c1 = c;
                if(j + 2 < i && s.charAt(j + 1) == '-')
                    c1 = s.charAt(j += 2);
                char ac1[] = {
                    c, c1
                };
                vector1.addElement(ac1);
            }

            char ac[][] = new char[vector1.size()][];
            vector1.copyInto(ac);
            obj = ac;
            break;

        case 92: /* '\\' */
            if(j + 1 < i)
                c = s.charAt(++j);
            break;

        }
```

```
            if(obj != null)
            {
                if(stringbuffer != null)
                {
                    vector.addElement(stringbuffer.toString());
                    stringbuffer = null;
                }
                vector.addElement(obj);
                obj = null;
            }
            else
            {
                if(stringbuffer == null)
                    stringbuffer = new StringBuffer();
                stringbuffer.append(c);
            }
        }

        if(stringbuffer != null)
            vector.addElement(stringbuffer.toString());
        expr = new Object[vector.size()];
        vector.copyInto(expr);
    }

    static final char NOT[] = new char[2];
    static final Integer ANY = new Integer(0);
    static final Integer STAR = new Integer(1);
    Object expr[];

}
```

Result.java file: This module is used by user registries in WebSphere Application Server when calling the getUsers and getGroups methods. The user registries use this method to set the list of users and groups and to indicate if there are more users and groups in the registry than requested.

```
//  @(#) 1.20 src/en/ae/rsec_result.xml, WEBSJAVA.INFO.DOCSRC,
//  ASVINFO1 10/17/02 16:43:01 [10/18/02 07:31:30]
//  5639-D57, 5630-A36, 5630-A37, 5724-D18
// (C) COPYRIGHT International Business Machines Corp. 1997, 2003
//  All Rights Reserved * Licensed Materials - Property of IBM
//
package com.ibm.websphere.security;

import java.util.List;

public class Result implements java.io.Serializable {
    /**
      Default constructor
    */
    public Result() {
    }

    /**
       Returns the list of users and groups
       @return the list of users and groups
    */
    public List getList() {
      return list;
    }
```

```
    /**
       indicates if there are more users and groups in the registry
    */
    public boolean hasMore() {
      return more;
    }
    /**
       Set the flag to indicate that there are more users and groups
       in the registry to true
    */
    public void setHasMore() {
      more = true;
    }

    /*
      Set the list of users and groups
      @param list   list of users/groups
    */
    public void setList(List list) {
      this.list = list;
    }

    private boolean more = false;
    private List list;
}
```

Custom user registry settings:

Use this page to configure the custom user registry.

To view this administrative console page, click **Security** > **User Registries** > **Custom**.

After the properties are set in this panel, click **Apply**. Use the Properties panel for additional properties that the custom registry requires. When security is enabled and any of these properties change, go to the Global Security panel and click **Apply** to validate the changes.

Server User ID:

Specifies the user ID under which the server runs, for security purposes.

This server ID represents a valid user in the custom registry.

Data type: String

Server User Password:

Specifies the password corresponding to the security server ID.

Data type: String

Custom Registry Classname:

Specifies a dot-separated class name that implements the com.ibm.websphere.security.UserRegistry interface.

Put the custom registry class name in the class path. A suggested location is the *%install_root%*/lib/ext directory. Although the custom registry implements the com.ibm.websphere.security.UserRegistry interface, for backward compatibility, a user registry can alternately implement the com.ibm.websphere.security.CustomRegistry interface.

Data type:	String
Default:	com.ibm.websphere.security.FileRegistrySample

Ignore Case:

Specifies that a case insensitive authorization check is performed.

Default:	Enabled
Range:	Enabled or Disabled

Use **Custom Properties** to add any additional properties required to initialize the custom registry. The following property is predefined by the product; set this property when required only:

- WAS_UseDisplayName--When set to true, the getCallerPrincipal(), getUserPrincipal(), and getRemoteUser() methods return the display name. By default, the securityName of the user is returned. This default is introduced to support backward compatibility with the Version 4.0 custom registry.

users.props file: Following is the format for the users.props file:

```
# 5639-D57, 5630-A36, 5630-A37, 5724-D18
# (C) COPYRIGHT International Business Machines Corp. 1997, 2003
# All Rights Reserved * Licensed Materials - Property of IBM
#
# Format:
# name:passwd:uid:gids:display name
# where name   = userId/userName of the user
#       passwd = password of the user
#       uid    = uniqueId of the user
#       gid    = groupIds of the groups that the user belongs to
#       display name = a (optional) display name for the user.
bob:bob1:123:567:bob
dave:dave1:234:678:
jay:jay1:345:678,789:Jay-Jay
ted:ted1:456:678:Teddy G
jeff:jeff1:222:789:Jeff
vikas:vikas1:333:789:vikas
bobby:bobby1:444:789:
```

groups.props file: The following example illustrates the format for the groups.props file:

```
# 5639-D57, 5630-A36, 5630-A37, 5724-D18
# (C) COPYRIGHT International Business Machines Corp. 1997, 2003
# All Rights Reserved * Licensed Materials - Property of IBM
#
# Format:
# name:gid:users:display name
# where name   = groupId of the group
#       gid    = uniqueId of the group
#       users  = list of all the userIds that the group contains
```

```
#       display name = a (optional) display name for the group.
admins:567:bob:Administrative group
operators:678:jay,ted,dave:Operators group
users:789:jay,jeff,vikas,bobby:
```

Java Authentication and Authorization Service

The standard Java 2 security API helps enforce access control, based on the location of the code and who signed it. The current principal of the running thread is not considered in the Java 2 security authorization. Instances where authorization is based on the principal, rather than the code base and the signer exist. The Java Authentication and Authorization Service is a standard Java API that supports the Java 2 security authorization to extend the code base on the principal as well as the code base and signers.

The Java Authentication and Authorization Service (JAAS) Version 1.0 extends the Java 2 security architecture of the Java 2 platform with additional support to authenticate and enforce access control with users. It implements a Java version of the standard Pluggable Authentication Module (PAM) framework, and extends the access control architecture of the Java 2 platform in a compatible fashion to support user-based authorization. WebSphere Application Server fully supports the JAAS architecture and extends the access control architecture to support role-based authorization for Java 2 Platform, Enterprise Edition (J2EE) resources including servlets, JavaServer Pages (JSP) files, and Enterprise JavaBeans (EJB) components.

The following sections cover the JAAS implementation and programming model:
- Java Authentication and Authorization Service login configuration
- Programmatic Login
- Java Authentication and Authorization Service authorization

The accompanying product Javadoc contains detailed descriptions of the WebSphere Application Server programming APIs and the JAAS Javadoc also ships with the product. Refer to the ${*install_root*}/web/docs/jaas directory.

Java Authentication and Authorization Service authorization

Java 2 security architecture uses a security policy to specify which access rights are granted to running code. This architecture is *code-centric*. That is, the permissions are granted based on code characteristics including where the code is coming from, whether it is digitally signed, and by whom. Authorization of the Java Authentication and Authorization Service (JAAS) augments the existing code-centric access controls with new user-centric access controls. Permissions are granted based on what code is running and who is running it.

When using JAAS authentication to authenticate a user, a subject is created to represent the authenticated user. A subject is comprised of a set of principals, where each principal represents an identity for that user. You can grant permissions in the policy to specific principals. After the user is authenticated, the application can associate the subject with the current access control context. For each subsequent security-checked operation, the Java run time automatically determines whether the policy grants the required permission to a specific principal only. If so, the operation is supported if the subject associated with the access control context contains the designated principal only.

Associate a subject with the current access control context by calling the static doAs method from the subject class, passing it an authenticated subject and java.security.PrivilegedAction or java.security.PrivilegedExceptionAction. The doAs

method associates the provided subject with the current access control context and then invokes the run method from the action. The run method implementation contains all the code that ran as the specified subject. The action runs as the specified subject.

In the Java 2 Platform, Enterprise Edition (J2EE) programming model, when invoking the EJB method from an enterprise bean or servlet, the method runs under the user identity that is determined by the run-as setting. The J2EE Version 1.3 Specification does not indicate which user identity to use when invoking an enterprise bean from a Subject.doAs action block within either the EJB code or the servlet code. A logical extension is to use the proper identity specified in the subject when invoking the EJB method within the Subject doAs action block.

This simple rule of letting Subject.doAs overwrite the run-as identity setting is an ideal way to integrate the JAAS programming model with the J2EE run-time environment. However, a design oversight was introduced into IBM Developer Kit, Java Technology Edition Version 1.3 when integrating the JAAS Version 1.0 implementation with the Java 2 security architecture. A subject, which is associated with the access control context is cut off by a doPrivileged call when a doPrivileged call occurs within the Subject.doAs action block. Until this problem is corrected, no reliable and run-time efficient way is available to guarantee the correct behavior of Subject.doAs in a J2EE run-time environment.

The problem can be explained better with the following example:

```
Subject.doAs(subject, new java.security.PrivilegedAction() {
   Public Object run() {
       // Subject is associated with the current thread context
       java.security.AccessController.doPrivileged( new
           java.security.PrivilegedAction() {
                        public Object run() {
                        // Subject was cut off from the current
                        // thread context
   return null;
              }
        });
        // Subject is associated with the current thread context
        return null;
   }
});
```

At line three, the subject object is associated with the context of the current thread. As indicated on line 7 within the run method of a doPrivileged action block, the subject object is removed from the thread context. After leaving the doPrivileged block, the subject object is restored to the current thread context. Because doPrivileged blocks can be placed anywhere along the running path and instrumented quite often in a server environment, the run-time behavior of a doAs action block becomes difficult to manage.

The credential is used by the z/OS Security Authentication Service (z/SAS) run time for EJB invocation.

The WSSubject.doAs and WSSubject.doAsPrivileged methods then invoke the corresponding Subject.doAs and Subject.doAsPrivileged methods. The original credential is restored and associated with the running thread upon leaving the WSSubject.doAs and WSSubject.doAsPrivileged methods.

5.1 + To resolve this difficulty, WebSphere Application Server provides a WSSubject helper class to extend the JAAS authorization to a J2EE EJB method invocation as described previously. The WSSubject class provides static doAs and doAsPrivileged methods that have identical signatures to the subject class. The WSSubject.doAs method associates the Subject to the currently running thread.

The credential is used by the z/OS Security Authentication Service (z/SAS) run time for EJB invocation.

The WSSubject.doAs and WSSubject.doAsPrivileged methods then invoke the corresponding Subject.doAs and Subject.doAsPrivileged methods. The original credential is restored and associated with the running thread upon leaving the WSSubject.doAs and WSSubject.doAsPrivileged methods.

Note that the WSSubject class is not a replacement of the subject object, but rather a helper class to ensure consistent run-time behavior as long as an EJB method invocation is a concern.

Note: When using application Sync to OS thread the operating system identity is modified to match the subject identity. Refer to "Understanding application Synch to OS Thread Allowed" on page 161 for more information.

The following example illustrates the run-time behavior of the WSSubject.doAs method: 5.1 +

```
WSSubject.doAs(subject, new java.security.PrivilegedAction() {
   Public Object run() {
       // Subject is associated with the current thread context
       java.security.AccessController.doPrivileged( new
           java.security.PrivilegedAction() {
                      public Object run() {
                         // Subject was cut off from the current thread
                         // context.
   return null;
              }
        });
        // Subject is associated with the current thread context
   return null;
   }
});
```

The Subject.doAs and Subject.doAsPrivileged methods are not integrated with the J2EE run-time environment. EJB methods that are invoked within the Subject.doAs and Subject.doAsPrivileged action blocks run under the identity specified by the run-as setting and not by the subject identity.

- The subject object generated by the WSLoginModuleImpl instance and the WSClientLoginModuleImpl instance contains a principal that implements the WSPrincipal interface. Using the getCredential() method for a WSPrincipal object returns an object that implements the WSCredential interface. You can also find the WSCredential object instance in the PublicCredentials list of the subject instance. Retrieve the WSCredential object from the PublicCredentials list instead of using the getCredential() method.

- The getCallerPrincipal() method for the WSSubject class returns a string representing the caller security identity. The return type differs from the getCallerPrincipal method of the EJBContext interface, which is java.security.Principal.
- The Subject object generated by the J2C DefaultPrincipalMapping module contains a resource principal and a PasswordCredentials list. The resource principal represents the caller.

Note: When using application Sync to OS thread the operating system identity is modified to match the subject identity. Refer to "Understanding application Synch to OS Thread Allowed" on page 161 for more information.

Refer to "Java 2 Connector security" on page 284 for more information

Configuring application logins for Java Authentication and Authorization Service

Java Authentication and Authorization Service (JAAS) is a new feature in WebSphere Application Server. It is a collection of WebSphere Application Server strategic authentication APIs and replaces the Common Object Request Broker Architecture (CORBA) programmatic login APIs.

WebSphere Application Server provides some extensions to JAAS:

- **com.ibm.websphere.security.auth.WSSubject**. Due to a design oversight in the JAAS V1.0, javax.security.auth.Subject.getSubject() method does not return the subject associated with the running thread inside a java.security.AccessController.doPrivileged() code block. This problem presents an inconsistent behavior that is problematic and causes undesirable effort. The com.ibm.websphere.security.auth.WSSubject API provides a workaround to associate the subject to a running thread. The com.ibm.websphere.security.auth.WSSubject API extends the JAAS authorization model to J2EE resources.
- You can configure JAAS login in the administrative console and store this configuration in the WebSphere configuration application programming interface (API). However, WebSphere Application Server still supports the default JAAS login configuration format (plain text file) provided by the JAAS default implementation. If duplicate login configurations are defined in both the WebSphere configuration API and the plain text file format, the one in the WebSphere configuration API takes precedence. Advantages to defining the login configuration in the WebSphere configuration API include:
  - User interface support in defining JAAS login configuration
  - Central management of the JAAS login configuration
  - Distribution of the JAAS login configuration in a Network Deployment product installation
- **Proxy LoginModule**. The default JAAS implementation does not use the thread context class loader to load classes. The LoginModule module cannot load if the LoginModule class file is not in the application class loader or the Java extension class loader class path. Due to this class loader visibility problem, WebSphere Application Server provides a proxy LoginModule module to load the JAAS LoginModule using the thread context class loader. You do not need to place the LoginModule implementation on the application class loader or the Java extension class loader class path with this proxy LoginModule module.

  If you do not want to use the Proxy LoginModule, you can place the LoginModule in the `jre/lib/ext` directory. However, this is not recommended due to the security risks.

Two JAAS login configurations are defined in the WebSphere Configuration API security document for applications to use. In the left navigation pane, click **Security > JAAS Configuration > Application Login >WSLogin** and **ClientContainer**. The following three JAAS login configurations are available:

WSLogin
Defines a login configuration and a LoginModule implementation that applications can use in general.

ClientContainer
Defines a login configuration and a LoginModule implementation that is similar to that of the WSLogin configuration, but enforces the requirements of the WebSphere Application Server client container.

DefaultPrincipalMapping,
Defines a special LoginModule module that is typically used by Java 2 Connector to map an authenticated WebSphere user identity to a set of user authentication data (user ID and password) for the specified back-end enterprise information system (EIS). For more information about Java 2 Connector and the DefaultMappingModule module, refer to the Java 2 security section.

A new JAAS login configuration can be added and modified using the administrative console. The changes are saved in the cell-level security document and are available to all managed application servers. An application server restart is required for the changes to take effect at run time.

Attention: Do not remove or delete the predefined JAAS login configurations (ClientContainer, WSLogin and DefaultPrincipalMapping). Deleting or removing them can cause other enterprise applications to fail.

1. Delete a JAAS login configuration.
   a. Click **Security** in the navigation tree.
   b. Click **JAAS Configuration** > **Application Logins**. The Application Login Configuration panel appears.
   c. Select the check box for the login configurations to delete and click **Delete**.
2. Create a new JAAS login configuration.
   a. Click **Security** in the navigation tree.
   b. Click **JAAS Configuration** > **Application Logins**.
   c. Click **New**. The Application Login Configuration panel appears.
   d. Specify the alias name of the new JAAS login configuration and click **Apply**. This value is the name of the login configuration that you pass in the javax.security.auth.login.LoginContext implementation for creating a new LoginContext.

      Click **Apply** to save changes and to add the extra node name that precedes the original alias name. Clicking **OK** does not save the new changes in the `security.xml` file.
   e. Click **JAAS Login Modules**.
   f. Click **New**.
   g. Specify the Module Classname. Specify WebSphere Proxy LoginModule because of the limitation of the class loader visibility problem.
   h. Specify the LoginModule implementation as the delegate property of the Proxy LoginModule. The WebSphere Proxy LoginModule class name is com.ibm.ws.security.common.auth.module.proxy.WSLoginModuleProxy.
   i. Select **Authentication Strategy** from the list and click **Apply**.

j. Click **Custom Properties**. The **Custom Properties** panel is displayed for the selected LoginModule.

k. Create a new property with the name `delegate` and the value of the real LoginModule implementation. You can specify other properties like `debug` with the value `true`. These properties are passed to the LoginModule class as options to the initialize() method of the LoginModule instance.

l. Click **Save**.

There are several locations within the WebSphere Application Server directory structure where you can place a JAAS login module. The following list provides locations for the JAAS login module in order of recommendation:

- Within an Enterprise Archive (EAR) file for a specific Java 2 Enterprise Edition (J2EE) application.

  If you place the login module within the EAR file, it is accessible to the specific application only.

- In the WebSphere Application Server shared library.

  If you place the login module in the shared library, you must specify which applications can access the module. For more information on shared libraries, see Managing shared libraries.

- In the Java extensions directory (*WAS_HOME*`\jre\lib\ext`)

  If you place the JAAS login module in the Java extensions directory, the login module is available to all applications.

  This location is not recommended for WebSphere Application Server for z/OS

Although the Java extensions directory provides the greatest availability for the login module, it is recommended that you place the login module in an application EAR file. If other applications need to access the same login module, consider using shared libraries.

3. Change the plain text file. WebSphere Application Server supports the default JAAS login configuration format (plain text file) provided by the JAAS default implementation. However, a tool is not provided that edits plain text files in this format. You can define the JAAS login configuration in the plain text file (*install_root*`/properties/wsjaas.conf`). Any syntax errors can cause the incorrect parsing of the plain JAAS login configuration text file. This problem can cause other applications to fail.

   Java client programs that use the Java Authentication and Authorization Service (JAAS) for authentication must invoke with the JAAS configuration file specified. This configuration file is set in the */install_root*`/bin/launchClient.bat` file as `set JAAS_LOGIN_CONFIG=-Djava.security.auth.login.config=%install_root%\properties\wsjaas_client.conf`. If the `launchClient.bat` file is not used to invoke the Java client program, verify that the appropriate JAAS configuration file is passed to the Java virtual machine with the `-Djava.security.auth.login.config` flag.

A new JAAS login configuration is created or an old JAAS login configuration is removed. An enterprise application can use a newly created JAAS login configuration without restarting the application server process.

However, new JAAS login configurations defined in the *install_root*`/properties/wsjaas.conf` file, do not refresh automatically. Restart the application servers to validate changes. These JAAS login configurations are specific to a particular node and are not available for other application servers running on other nodes.

Create new JAAS login configurations used by enterprise applications to perform custom authentication.

Use these newly defined JAAS login configurations to perform programmatic login.

Login configuration for Java Authentication and Authorization Service

Java Authentication and Authorization Service (JAAS) is a new feature in WebSphere Application Server. JAAS is WebSphere strategic APIs for authentication and it will replace of the CORBA programmatic login APIs. WebSphere Application Server provides some extensions to JAAS:

- com.ibm.websphere.security.auth.WSSubject: Due to a design oversight in the JAAS 1.0, javax.security.auth.Subject.getSubject() does not return the Subject associated with the thread of execution inside a java.security.AccessController.doPrivileged() code block. This can present a inconsistent behavior that is problematic and causes undesirable effort. com.ibm.websphere.security.auth.WSSubject provides a work around to associate Subject to thread of execution. com.ibm.websphere.security.auth.WSSubject extends the JAAS authorization model to J2EE resources.

  Note: You can retrieve the subjects in a Subject.doAs() block with the Subject.getSubject() call. However, this procedure does not work if there is an AccessController.doPrivileged() call within the Subject.doAs() block. In the following example, s1 is equal to s, but s2 is null:

  ```
  * AccessController.doPrivileged() not only truncates the Subject propagation,
  * but also reduces the permissions. It does not include the JAAS security
  * policy defined for the principals in the Subject.
  Subject.doAs(s, new PrivilegedAction() {
    public Object run() {
      System.out.println("Within Subject.doAsPrivileged()");
      Subject s1 = Subject.getSubject(AccessController.getContext());
      AccessController.doPrivileged(new PrivilegedAction() {
        public Object run() {
        Subject s2 = Subject.getSubject(AccessController.getContext());
        return null;
      }
    });
    return null;
  }
  });
  ```

- JAAS Login Configuration can be configured in administrative console and stored in the WebSphere configuration application programming interface (API). An application can define new JAAS login configuration in the administrative console and the data is persisted in the configuration repository (stored in the WebSphere configuration API). However, WebSphere still support the default JAAS login configuration format (plan text file) provided by the JAAS default implementation. But if there are duplication login configurations defined in both the WebSphere configuration API and the plan text file format, the one in the WebSphere configuration API takes precedence. There are advantages to define the login configuration in the WebSphere configuration API:
  - UI support in defining JAAS login configuration.
  - The JAAS configuration login configuration can be managed centrally.

  - The JAAS configuration login configuration is distributed in a Network Deployment installation.
- Proxy LoginModule: The default JAAS implementation does not use the thread context class loader to load classes, the LoginModule could not be loaded if the LoginModule class file is not in the application class loader or the Java extension class loader classpath. Due to this class loader visibility problem, WebSphere provides a proxy LoginModule to load JAAS LoginModule using the thread context class loader. The LoginModule implementation does not have to be placed on the application class loader or the Java extension class loader classpath with this proxy LoginModule.

Note: Do not remove or delete the pre-defined JAAS Login Configurations (ClientContainer, WSLogin and DefaultPrincipalMapping). Deleting or removing them could cause other enterprise applications to fail.

A system administrator determines the authentication technologies, or LoginModules, to be used for each application and configures them in a login configuration. The source of the configuration information (for example, a file or a database) is up to the current javax.security.auth.login.Configuration implementation. The WebSphere Application Server implementation permits the login configuration to be defined in both the WebSphere configuration API security document and in a JAAS configuration file where the former takes precedence.

Two JAAS login configurations are defined in the WebSphere configuration API security document for applications to use. They may be found in the left navigation pane at **Security** > **JAAS Configuration** > **Application Login Config**: **WSLogin** and **ClientContainer**. The **WSLogin** defines a login configuration and LoginModule implementation that may be used by applications in general. The **ClientContainer** defines a login configuration and LoginModule implementation that is similar to that of WSLogin but enforces the requirements of the WebSphere Application Server Client Container. The third entry, **DefaultPrincipalMapping**, defines a special LoginModule that is typically used by Java 2 Connector to map an authenticated WebSphere user identity to a set of user authentication data (user ID and password) for the specified back end enterprise information system (EIS). For more information about Java 2 Connector and the DefaultMappingModule please refer to the Java 2 Security section.

New JAAS login configuration may be added and modified using Security Center. The changes are saved in the cell level security document and are available to all managed application servers. An application server restart is required for the changes to take effect at run time.

WebSphere Application Server also reads JAAS Configuration information from the wsjaas.conf file under the properties sub directory of the root directory under which WebSphere Application Server is installed. Changes made to the wsjaas.conf file is used only by the local application server and will take effect after restarting the application server. Note that JAAS configuration in the WebSphere configuration API security document takes precedence over that defined in the `wsjaas.conf` file. In other words, a configuration entry in `wsjaas.conf` will be overridden by an entry of the same alias name in the WebSphere configuration API security document.

Note: The Java Authentication and Authorization Service (JAAS) login configuration entries in the Security Center are propagated to the server run time when they are created, not when the configuration is saved. However,

the deleted JAAS login configuration entries are not removed from the server run time. To remove the entries, save the new configuration, then stop and restart the server.

Configuration entry settings for Java Authentication and Authorization Service

Use this page to specify a list of Java Authentication and Authorization Service (JAAS) login configurations for the application code to use, including enterprise beans, Java ServerPages (JSP) files, servlets and resource adapters.

To view this administrative console page, click **Security** > **JAAS Configuration** > **Application Login Configuration**.

Read the JAAS documentation before you begin defining additional login modules for authenticating to the WebSphere Application Server security run time. You can define additional login configurations for your applications. However, if the WebSphere Application Server LoginModule (`com.ibm.ws.security.common.auth.module.WSLoginModuleImpl`) is not used or the LoginModule does not produce a credential that is recognized by WebSphere Application Server, then the WebSphere Application Server security run time cannot use the authenticated subject from these login configurations for an authorization check for resource access.

Note: You must invoke Java client programs that use Java Authentication and Authorization Service (JAAS) for authentication with a JAAS configuration file specified. The WebSphere product supplies the default JAAS configuration file, wsjaas_client.conf under the *install_root*`/properties` directory. This configuration file is set in the */install_root*`/bin/launchClient.bat` file as: `set JAAS_LOGIN_CONFIG=-Djava.security.auth.login.config=%WAS_HOME%\properties\wsjaas_client.conf`

If `launchClient.bat` file is not used to invoke Java client programs, make sure that the appropriate JAAS configuration file is passed to the Java virtual machine with the *-Djava.security.auth.login.config* flag.

ClientContainer:

Specifies the login configuration used by the client container application, which uses the CallbackHandler API defined in the client container deployment descriptor.

ClientContainer is the default login configuration for the WebSphere Application Server. Do not remove this default, as other applications that use it fail.

Default: ClientContainer

DefaultPrincipalMapping:

Specifies the login configuration used by Java 2 Connectors to map users to principals that are defined in the J2C Authentication Data Entries.

ClientContainer is the default login configuration for the WebSphere Application Server. Do not remove this default, as other applications that use it fail.

Default: ClientContainer

WSLogin:

Specifies whether all applications can use the WSLogin configuration to perform authentication for the WebSphere Application Server security run time.

This login configuration does not honor the CallbackHandler defined in the client container deployment descriptor. To use this functionality, use the ClientContainer login configuration.

The WSLogin configuration is the default login configuration for the WebSphere Application Server. Do not remove this default, as other applications that use it fail. This login configuration authenticates users for the WebSphere Application Server security run time. Use credentials from the authenticated subject returned from this login configurations as an authorization check for access to WebSphere Application Server resources.

Default: ClientContainer

Login module settings for Java Authentication and Authorization Service

Use this page to define the login module for a Java Authentication and Authorization Service (JAAS) login configuration.

5.1 To view this administrative page, click **Security** > **JAAS Configuration** > **Application Logins** > *alias_name* > **JAAS Login Modules**.

Module Class Name:

Specifies the class name of the given login module.

The default login modules defined by the WebSphere product use a proxy LoginModule class, com.ibm.ws.security.common.auth.module.WSLoginModuleProxy. This proxy class loads the WebSphere login module with the thread context class loader and delegates all the operations to the *real* login module implementation. The real login module implementation is specified as the delegate option in the option configuration. The proxy class is needed because the Developer Kit application class loaders do not have visibility of the WebSphere product class loaders.

Data type: String

Authentication Strategy:

Specifies the authentication behavior as authentication proceeds down the list of login modules.

A JAAS authentication provider supplies the authentication strategy. In JAAS, an authentication strategy is implemented through the LoginModule interface.

Data type: String
Default: Required
Range: Required, Requisite, Sufficient and Optional

Specify additional options by clicking **Custom Properties** under Additional Properties. These name and value pairs are passed to the login modules during initialization. This process is one of the mechanisms used to passed information to login modules.

Application login configuration settings for Java Authentication and Authorization Service

Use this page to configure application login configurations.

To view this administrative console page, click **Security** > **JAAS Configuration** > **Application Logins** > *alias_name*.

Click **Apply** to save changes and to add the extra node name that precedes the original alias name. Clicking **OK** does not save the new changes in the `security.xml` file.

Alias:

Specifies the alias name of the application login.

Do not use the forward slash character (/) in the alias name when defining JAAS login configuration entries. The JAAS login configuration parser cannot process the forward slash character.

Data type: String

Java 2 Connector security

Java 2 Connector authentication data entries are used by resource adapters and Java database connectivity (JDBC) data sources. A Java 2 Connector authentication data entry contains authentication data.

The connector architecture defines a standard architecture for connecting the Java 2 Platform, Enterprise Edition (J2EE) to heterogeneous enterprise information systems (EIS). Examples of EIS include Enterprise Resource Planning (ERP), mainframe transaction processing (TP) and database systems.

The connector architecture enables an EIS vendor to provide a standard *resource adapter* for its EIS. A *resource adapter* is a system-level software driver that is used by a Java application to connect to an EIS. The resource adapter plugs into an application server and provides connectivity between the EIS, the application server, and the enterprise application. You must protect information in EIS from unauthorized access. The Java 2 Connector security architecture is designed to extend the end-to-end security model for J2EE-based applications to include integration with EISs. An application server and an EIS collaborate to ensure the proper authentication of a resource principal, which establishes a connection to an underlying EIS. The connector architecture identifies the following mechanisms as the commonly-supported authentication mechanisms:

- BasicPassword: Basic user-password-based authentication mechanism specific to an EIS
- Kerbv5: Kerberos Version 5-based authentication mechanism

WebSphere Application Server implementation of a Java 2 connection supports basic password authentication mechanisms.

The user ID and password for the target EIS is either supplied by applications or by the application server. WebSphere Application Server uses a Java Authentication

and Authorization Service (JAAS) pluggable authentication mechanism to perform principal mapping to convert a WebSphere principal to a resource principal. WebSphere Application Server provides a DefaultPrincipalMapping LoginModule, which basically converts any authenticated principal to the pre-configured EIS resource principal and password. Subsequently, you can plug in a principal mapping LoginModule through the JAAS plug-in mechanism.

J2C mapping module configuration

When a Java 2 connection factory is configured for container-managed signon, WebSphere Application Server uses the configured principal mapping module to create a Subject instance that contains a user ID and a password for the target EIS.

Mapping modules are special JAAS login modules that provide principal and credential mapping functionality. You can define and configure custom mapping modules through the administrative console. Associated with the mapping module configuration is a set of user IDs and passwords that you can define in the security configuration with a specified alias name. The WebSphere Application Server run time passes the user ID, password and a reference of the connection factory manager to the configured mapping module to create a subject.

For more information about mapping module requirements, refer to the Javadoc of the WSDefaultPrincipalMapping class. For more detailed information about developing a mapping module, refer to the Developing your own Java 2 security mapping module article.

J2C mapping module programming reference

You can develop your own mapping module if your application requires more sophisticated mapping functions. You can use the WSSubject.getRunAsSubject() method to retrieve the subject that represents the identity of the current thread of execution. The identity of the current thread of execution is known as the RunAs identity. The RunAs subject typically contains a WSPrincipal in the principal set and a WSCredential in the public credential set. The subject instance that is created by your mapping module contains a Principal instance in the principals set and a PasswordCredential or GenericCredential instance in the set of private credentials.

Managing J2EE Connector Architecture authentication data entries

Java 2 Connector authentication data entries are used by resource adapters and Java database connectivity (JDBC) data sources. A Java 2 Connector authentication data entry contains authentication data, which contains the following information:

Alias An identifier used to identify the authenticated data entry. When configuring resource adapters or Java database connectivity (JDBC) data sources, the administrator can specify which authentication data to choose for the corresponding alias.

User ID
A user identity of the intended security domain. For example, if a particular authentication data entry is used to open a new connection to DB2, this entry contains a DB2 user identity.

Password
The password of the user identity is encoded in the configuration respository.

Description
A short text description.

This task creates and deletes Java 2 Connector (J2C) authentication data entries.

1. Delete a J2C authentication data entry.
   a. Click **Security** in the navigation tree, then click **JAAS Configuration** > **J2C Authentication Data**. The **J2C Authentication Data Entries** panel is displayed.
   b. Select the check boxes for the entries to delete and click **Delete**. Before deleting or removing an authentication data entry, make sure that it is not used or referenced by any resource adapter or JDBC data source. If the deleted authentication data entry is used or referenced by a resource, the application that uses the resource adapter or JDBC data source fails to connect to the resources.
2. Create a new J2C authentication data entry.
   a. Click **Security** in the navigation tree, then click **JAAS Configuration** > **J2C Authentication Data**. The **J2C Authentication Data Entries** panel is displayed.
   b. Click **New**.
   c. Enter a unique alias, a value user ID, a valid password, and a short description (optional).
   d. Click **OK** or **Apply**. No validation for the user ID and password is required.
   e. Click **Save**. For a Network Deployment installation, make sure that a file synchronized operation is performed to propagate the changes to other nodes.

A new J2C authentication data entry is created or an old entry is removed. The newly created entry is visible without restarting the application server process for use in the data source definition. But the entry is only in effect after the server is restarted. Specifically, the authentication data is loaded by an application server when starting an application and is shared among applications in the same application server.

If you create or update a data source that points to a newly created J2C authentication data alias, Test Connection fails to connect until you restart the deployment manager. After you restart the deployment manager, the J2C authentication data is reflected in the run-time configuration. Any changes to the J2C authentication data fields require a deployment manager restart for the changes to take effect.

This step defines authentication data that you can share among resource adapters and JDBC data sources.

Use the authentication data entry defined in the resource adapters or JDBC data sources.

Java 2 Connector authentication data entry settings:

Use this page as a central place for administrators to define authentication data, which includes user identities and passwords. These values can reference authentication data entries by resource adapters, data sources, and other configurations that require authentication data using an alias.

You can display this page directly from the JAAS configuration page or from other pages for resources that use J2C authentication data entries. For example, to view this administrative page, you can click either **Security** > **JAAS Configuration** >

J2C Authentication Data Entries or **Resources** > **WebSphere JMS Provider** > **WebSphere Queue Connection Factories** > *connection_factory* > **J2C Authentication Data Entries**.

Deleting authentication data entries: Be careful when deleting authentication data entries. If the deleted authentication data is used by other configurations, the initializing resources process fails.

Define a new authentication data entry by clicking **New**.

Alias:

Specifies the name of the authentication data entry.

Data type:	String
Units:	String
Default:	None

User ID:

Specifies the user identity.

Data type:	String

Description:

Specifies an optional description of the authentication data entry. For example, this authentication data entry is used to connect to DB2.

Data type:	String

Authentication protocol for EJB security

In WebSphere Application Server Version 5, two authentication protocols are available to choose from: z/OS Secure Authentication Service (z/SAS) and Common Secure Interoperability Version 2 (CSIv2). z/SAS is the authentication protocol used by all previous releases of WebSphere Application Server and is maintained for backwards compatibility. The Object Management Group (OMG) has defined a new authentication protocol, called CSIv2, so that vendors can interoperate securely. CSIv2 is implemented in WebSphere Application Server with more features than z/SAS and is considered the strategic protocol.

Invoking EJB methods in a secure WebSphere Application Server environment requires an authentication protocol to determine the level of security and the type of authentication, which occur between any given client and server for each request. It is the job of the authentication protocol during a method invocation to merge the server authentication requirements (determined by the object Interoperable Object Reference (IOR)) with the client authentication requirements (determined by the client configuration) and come up with an authentication policy specific to that client and server pair.

The authentication policy makes the following decisions, among others, which are all based on the client and server configurations:
- What kind of connection can you make to this server--SSL or TCP/IP?

- If Secure Sockets Layer (SSL) is chosen, how strong is the encryption of the data?
- If SSL is chosen, do you authenticate the client using client certificates?
- Do you authenticate the client with a user ID and password? Does an existing credential exist?
- Do you assert the client identity to downstream servers?
- Given the configuration of the client and server, can a secure request proceed?

You can configure both protocols (z/SAS and CSIv2) to work simultaneously. If a server supports both protocols, it exports an IOR containing tagged components describing the configuration for z/SAS and CSIv2. If a client supports both protocols, it reads tagged components for both CSIv2 and z/SAS. If the client supports both and the server supports both, CSIv2 is used. However, if the server supports z/SAS (for example, it is a previous WebSphere Application Server release) and the client supports both, the client chooses z/SAS for this request, since the z/SAS protocol is what both have in common. CSIv2 is considered enabled on the client with the existence of the com.ibm.CORBA.ConfigURL java property. If the property is not specified or the specified property does not exist, CSIv2 is not enabled.

Common Secure Interoperability Specification, Version 2

The Common Secure Interoperability Specification, Version 2 (CSIv2) defines the Secure Authentication Services (SAS) that enables interoperable authentication, delegation and privileges. The CSIv2 SAS and SAS protocols are entirely different. The CSIv2SAS protocol is a subcomponent of CSIv2 that supports SSL and interoperability with the EJB Specification, Version 2.0.

Security Authentication Services

The Common Secure Interoperability Specification, Version 2 Secure Authentication Services (CSIv2 SAS) protocol is designed to exchange its protocol elements in the service context of a General Inter-ORB Protocol (GIOP) request and reply messages that are communicated over a connection-based transport. The protocol is intended for use in environments where transport layer security, such as that available through Secure Sockets Layer (SSL) and Transport Layer Security (TLS), is used to provide message protection (that is, integrity and or confidentiality) and server-to-client authentication. The protocol provides client authentication, delegation, and privilege functionality that might be applied to overcome corresponding deficiencies in an underlying transport. The CSIv2 SAS protocol facilitates interoperability by serving as the higher-level protocol under which secure transports can be unified.

Connection and request interceptors

The authentication protocols used by WebSphere Application Server are add-on Interoperable Inter-ORB Protocol (IIOP) services. IIOP is a request-and-reply communications protocol used to send messages between two Object Request Brokers (ORBs). For each request made by a client ORB to a server ORB, an associated reply is made by the server ORB back to the client ORB. Prior to any request flowing, a connection between the client ORB and the server ORB must be established over the TCP/IP transport (SSL is a secure version of TCP/IP). The client ORB invokes the authentication protocol client connection interceptor, which is used to read the tagged components in the IOR of the object located on the server. As mentioned previously, this is where the authentication policy is established for the request. Given the authentication policy (a coalescing of the

server configuration with the client configuration), the strength of the connection is returned to the ORB. The ORB makes the appropriate connection, usually over SSL.

After the connection is established, the client ORB invokes the authentication protocol client request interceptor, which is used to send security information other than what is established by the transport. The security information includes the user ID and password token (authenticated by the server), an authentication mechanism-specific token (validated by the server), or an identity assertion token. Identity assertion is a way for one server to trust another server without the need to reauthenticate or revalidate the originating client. However, some work is required for the server to trust the upstream server. This additional security information is sent with the message in a *service context*. A service context has a registered identifier so that the server ORB can identify which protocol is sending the information. The fact that a service context contains a unique identity is another way for WebSphere Application Server to support both z/SAS and CSIv2 simultaneously because both protocols have different service context IDs. After the client request interceptor finishes adding the service context to the message, the message is sent to the server ORB.

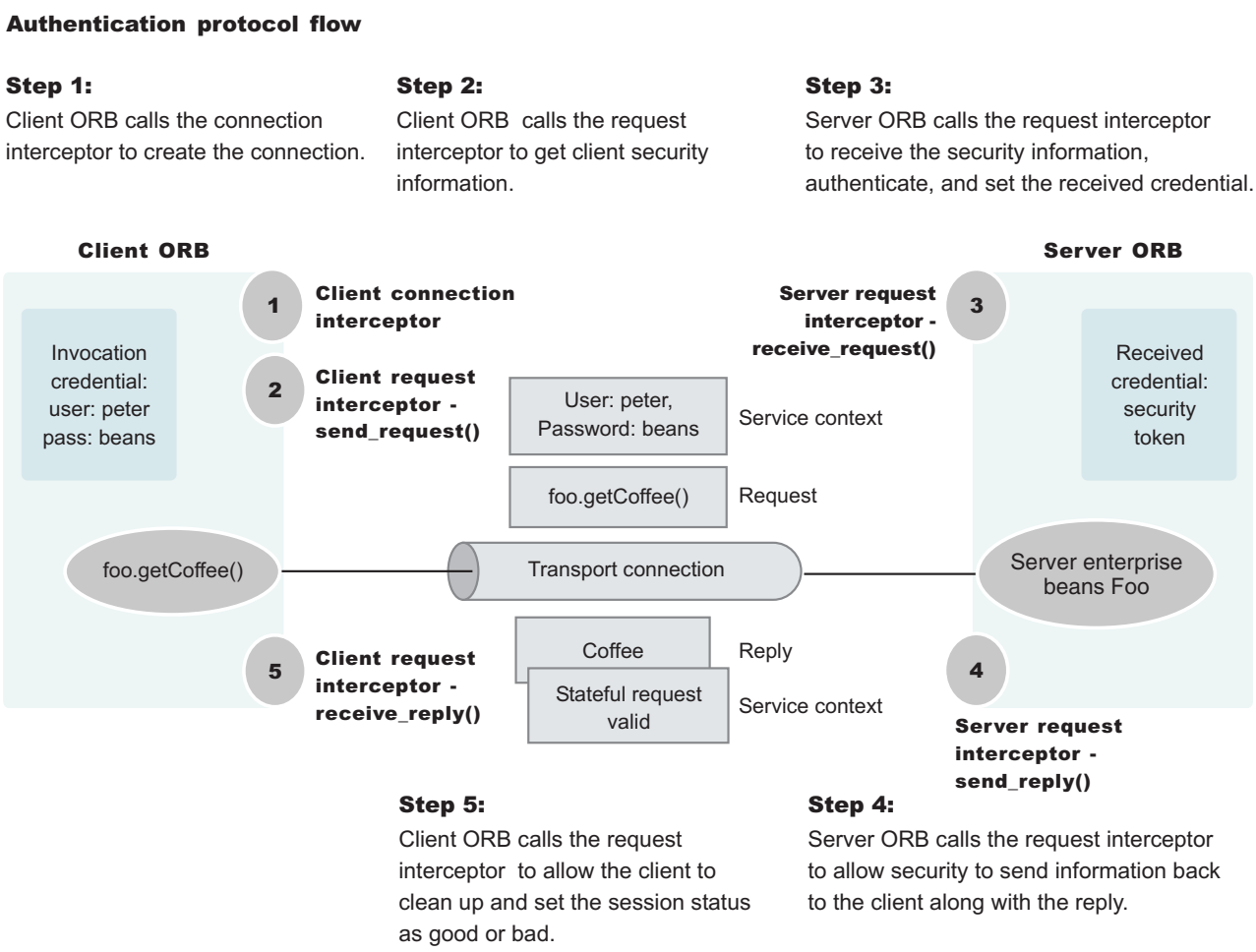
When the message is received by the server ORB, the ORB invokes the authentication protocol server request interceptor. This interceptor looks for the service context ID known by the protocol. When both z/SAS and CSIv2 are supported by a server, two different server request interceptors are invoked and both interceptors look for different service context IDs. However, only one finds a service context for any given request. When the server request interceptor finds a service context, it reads the information in the service context. A method is invoked to the security server to authenticate or validate client identity. The security server either rejects the information or returns a credential. A credential contains additional information about the client, retrieved from the user registry so that authorization can make the appropriate decision. Authorization is the process of determining if the user can invoke the request based on the roles applied to the method and the roles given to the user. If the request is rejected by the security server, a reply is sent back to the client without ever invoking the business method.

If a service context is not found by the CSIv2 server request interceptor, the interceptor then looks at the transport connection to see if a client certificate chain was sent. This is done when SSL client authentication is configured between the client and server. If the user registry is Lightweight Directory Access Protocol (LDAP), the search filters defined in the LDAP registry configuration determine how the certificate maps to an entry in the registry. If registry is local OS, the certificate is mapped to a System Authorization Facility (SAF) user ID. You then can map the user ID, using the issuers name or the subjects name, with the SAF certificate mapping facility. If the certificate does not map, no credential is created and the request is rejected. When invalid security information is presented, the method request is rejected and a NO_PERMISSION exception is sent back with the reply. However, when no security information is presented, an unauthenticated credential is created for the request and the authorization engine determines if the method gets invoked or not. For an unauthenticated credential to invoke an Enterprise JavaBean (EJB) method, either no security roles are defined for the method or a special **Everyone** role is defined for the method.

When the method invocation is completed in the EJB container, the server request interceptor is invoked again to complete server authentication and a new reply service context is created to inform the client request interceptor of the outcome.

This process is typically for making the request *stateful*. When a stateful request is made, only the first request between a client and server requires that security information is sent. All subsequent method requests need to send a unique context ID only so that the server can look up the credential stored in a session table. The context ID is unique within the connection between a client and server.

Finally, the method request cycle is completed by the client request interceptor receiving a reply from the server with a reply service context providing information so the client side stateful context ID can be confirmed and reused. The client and the server support both stateful and stateless sessions and this is not configurable.



. Authentication protocol flow

Authentication policy for each request

The authentication policy of a given request determines the security protection between a client and a server. A client or server authentication protocol configuration can describe required features, supported features and non-supported features. When a client requires a feature, it can only talk to servers that either require or support that feature. When a server requires a feature, it can only talk to clients that either require or support that feature. When a client supports a feature, it can talk to a server that supports or requires that feature, but can also talk to servers that do not support the feature. When a server supports a feature, it can talk to a client that supports or requires the feature, but can also talk to clients that do not support the feature (or chose not to support the feature).

For example, for a client to support client certificate authentication, some setup is required to either generate a self-signed certificate or to get one from a certificate authority (CA). Some clients might not need to complete these actions, therefore, you can configure this feature as `not supported`. By making this decision, the client cannot communicate with a secure server requiring client certificate authentication. Instead, this client can choose to use the user ID and password as the method of authenticating itself to the server.

Typically, supporting a feature is the most common way of configuring features. It is also the most successful during run time because it is more forgiving than requiring a feature. Knowing how secure servers are configured in your domain, you can choose the right combination for the client to ensure successful method invocations and still get the most security. If you know that all of your servers support both client certificate and user ID and password authentication for the client, you might want to require one and not support the other. If both the user ID and password and the client certificate are supported on the client and server, both are performed but user ID and password take precedence at the server. This action is based on the CSIv2 specification requirements.

Common Secure Interoperability Version 2 features

The following Common Secure Interoperability Version 2 (CSIv2) features are available in IBM WebSphere Application Server: SSL client certificate authentication, message layer authentication and identity assertion.

- SSL Client Certificate authentication.

  An additional way to authenticate a client to a server using SSL client authentication.
- Message Layer Authentication.

  Authenticates credential information and sends that information across the network so that a receiving server can interpret it.
- Identity Assertion.

  Supports a downstream server in accepting the client identity established on an upstream server, without having to reauthenticate. The downstream server trusts the upstream server.

Identity assertion

Identity assertion is the invocation credential that is asserted to the downstream server.

When a client authenticates to a server, the received credential is set. When authorization checks the credential to determine whether access is permitted, it also sets the *invocation* credential so that if the EJB method calls another EJB method located on other servers, the invocation credential can be the identity used to invoke the downstream method. Depending on the RunAs mode for the enterprise beans, the invocation credential is set as the originating client identity, the server identity, or a specified different identity. Regardless of the identity that is set, when identity assertion is enabled, it is the invocation credential that is asserted to the downstream server.

The target server validates the authority of the sending server to assert an identity by virtue of the client certificate. The client certificate is mapped to Service Access Facility (SAF) user ID. The user ID must have update authority for the `CBIND.servername` profile. If a client certificate is not sent, the CBIND check is performed against the default user ID.

Evaluation of the identity token consists of the following four identity formats that exist in an identity token:
- Principal name
- Distinguished name
- Certificate chain
- Anonymous identity

The product servers that receive authentication information typically support all four identity types. The sending server decides which one is chosen, based on how the original client authenticated. The existing type depends on how the client originally authenticates to the sending server. For example, if the client uses Secure Sockets Layer (SSL) client authentication to authenticate to the sending server, then the identity token sent to the downstream server contains the certificate chain. This information is important because it permits the receiving server to perform its own certificate chain mapping. It enables more interoperability with other vendors and platforms.

After the identity format is understood and parsed, the identity maps to a credential. For an ITTPrincipal identity token, this identity maps one-to-one with the user ID fields. ITTDistinguishedName identity tokens and ITTCertChain identity tokens are mapped in the same way. Both types of identity tokens use a certificate mapped to a SAF user ID using the RACDCERT (or equivalent) mapping functions. The mapping can be based on the Subject Name or Issuers Name.

Some user registry methods are called to gather additional credential information used by authorization. In a stateful server, this action completes once for the sending server and receiving server pair where the identity tokens are the same. Subsequent requests are made through a session ID.

Identity assertion is available for the local OS registry only.

Message layer authentication

Defines the credential information and sends that information across the network so that a receiving server can interpret it.

When you send authentication information across the network using a token (whether the token is a user ID and password token, that is, Generic Security Services Username Password (GSSUP), or a mechanism-specific format token), the transmission is considered message layer authentication because the data is sent along with the message inside a service context.

A pure Java client uses basic authentication (GSSUP) as the authentication mechanism to establish client identity.

The security token contained in a token-based credential is authentication mechanism-specific. That is, the way the token is interpreted is only known by the authentication mechanism. Therefore, each authentication mechanism has an object ID (OID) representing it. The OID and the client token are sent to the server, so that the server knows which mechanism to use when reading and validating the token. The following list contains the OIDs for each mechanism:

BasicAuth (GSSUP): oid:2.23.130.1.1.1
LTPA: oid:1.3.18.0.2.30.2
SWAM: No OID because it is not forwardable

BasicAuth (GSSUP): oid:2.23.130.1.1.1
SWAM: No OID because it is not forwardable

On the server, the authentication mechanisms can interpret the token and create a credential, or they can authenticate basic authentication data from the client, and create a credential. Either way, the created credential is the *received* credential that the authorization check uses to determine if the user has access to invoke the method. You can specify the authentication mechanism by using the com.ibm.CORBA.authenticationTarget property on the client side. (Basic authentication is currently the only valid value.) You can configure the server through the administrative console.

On the server, the authentication mechanisms can interpret the token and create a credential, or they can authenticate basic authentication data from the client, and create a credential. Either way, the created credential is the *received* credential that the authorization check uses to determine if the user has access to invoke the method. You can specify the authentication mechanism by using the following password on the client side:

```
com.ibm.CSI.performClientAuthenticationtype=SAFUSERIDPASSWORD
```

Basic authentication is currently the only valid value. You can configure the server through the administrative console.

While this property tells you which authentication mechanism to use, you also need to specify whether you want to perform authentication over the message layer (that is, get a `BasicAuth or token-based` credential). To complete this task, specify the com.ibm.CSI.performClientAuthenticationRequired (**True** or **False**) and com.ibm.CSI.performClientAuthenticationSupported (**True** or **False**) properties. Indicating that client authentication is required implies that it must be done for every request. Indicating that the authentication mechanism is supported implies that it might be done but is not required. For some servers, this option is appropriate if no resources are protected. In most cases it is a best practice to indicate that this mechanism is supported so that client authentication is performed if both the client and server support it. Client authentication it is not performed when communicating with certain servers that do not want security, yet the method requests still succeed.

Secure Sockets Layer client certificate authentication

An additional way to authenticate a client to a server is using Secure Sockets Layer (SSL) client authentication.

Using SSL client authentication is another way of authenticating a client to a server. This form of authentication does not occur at the message layer as described previously (using a user ID and password or tokens). This authentication occurs during the connection handshake using SSL certificates. When the client is configured with a personal certificate in the SSL keystore or keyring file, which indicates that SSL client authentication is desired and the server supports SSL client authentication, the following actions occur to establish the identity on the client side.

When a method request is invoked in the client code to a remote enterprise bean, the Object Request Broker (ORB) invokes the client connection interceptor to establish a connection with the server. Because the configuration specifies SSL, and SSL client authentication, the connection type is SSL and the SSL handshake sends the client certificate to the server to validate. If the client certificate does not

validate, the connection is not established and an exception is sent back to the client code where the method is invoked, which indicates the failure. If the client certificate is validated, then a connection opens between the client and the server.

The ORB proceeds to call the client request interceptor, which might be busy.

After the server receives the request, the server-side request interceptor checks for a security context. Because the server does not find a service context, it checks the server socket for a client certificate chain that contains the client identity. In this case, the server finds the certificate chain from the client. The identity in the certificate chain is valid because the connection was made. To create a credential, map the identity from the certificate to the user registry. This action is done differently based on the type of authentication mechanism. Mapping a certificate to a credential is done differently based on the user registry type.

For local OS, the certificate is mapped to a Service Access Facility (SAF) user ID based on the certificate mapping rules defined in the registry.

One benefit of SSL client certificate authentication is that it optimizes authentication performance, because an SSL connection is typically created anyway. The extra overhead of sending the client certificate is minimal. While the client-side request interceptor performs no activity, the server side request interceptor maps the certificate to a credential. One disadvantage to this type of authentication is the complexity of setting up the keystore or key ring file on each client system.

To enable SSL client certificate authentication on the client side, you must enable the properties, such as SSL. This action is completed using the following two properties:
- com.ibm.CSI.performTransportAssocSSLTLSRequired (true or false)
- com.ibm.CSI.performTransportAssocSSLTLSSupported (true or false)

Indicating SSL is required implies that every request must generate an SSL connection key. If a server does not support SSL, then the request fails. After you enable SSL by either supporting it or requiring it, you can enable some of the SSL features.

To enable SSL client authentication, you can specify the following two properties:
- com.ibm.CSI.performTLClientAuthenticationRequired (true or false)
- com.ibm.CSI.performTLClientAuthenticationSupported (true or false)

The TL means *transport layer*. If you indicate that SSL client authentication is required, then you only limit the ability to communicate with servers that support SSL client authentication. For a server to support SSL client authentication, that server must have similarly configured properties through the administrative console, and have an SSL listener port that is open to handle mutual authentication handshakes. Configuration of server properties are done through the administrative console.

Supported IBM protocols: Secure Authentication Service and Common Secure Interoperability Version 2

There are two authentication protocols supported by IBM. Secure Authentication Service (SAS) (z/SAS on the z/OS platform) is the authentication protocol used by all previous releases of the WebSphere Application Server product. Common Secure Interoperability Version 2 (CSIv2) is implemented in WebSphere Application Server, Version 5 and is considered the strategic protocol.

You can configure both protocols to work simultaneously. If a server supports both protocols, it exports an IOR containing tagged components describing the configuration for SAS and CSIv2. If a client supports both protocols, it reads tagged components for both CSIv2 and SAS. If the client and the server support both protocols, CSIv2 is used. However, if the server supports SAS (for example, it is a previous WebSphere Application Server release) and the client supports both protocols, the client chooses SAS for this request. Choose a protocol using the `com.ibm.CSI.protocol` property on the client side and configure this protocol through the GUI on the server side.

You can configure both protocols to work simultaneously. If a server supports both protocols, it exports an IOR containing tagged components describing the configuration for z/SAS and CSIv2. If a client supports both protocols, it reads tagged components for both CSIv2 and z/SAS. If the client and the server support both protocols, CSIv2 is used. However, if the server supports z/SAS (for example, it is a previous WebSphere Application Server release) and the client supports both protocols, the client chooses z/SAS for this request. CSIv2 is considered enabled on the client with the existence of the `com.ibm.CORBA.ConfigURL java` property. If the property is not specified or the property does not exist, CSIv2 is not enabled.

Configuring Common Secure Interoperability Version 2 and Security Authentication Service authentication protocols

1. Determine how to configure security inbound and outbound at each point in your infrastructure.

   For example, you might have a Java client communicating with an Enterprise JavaBean (EJB) application server, which in turn communicates to a downstream EJB application server. A CSIv2 Java client utilizes a configuration file specified by the com.ibm.CORBA.ConfigURL Java property to configure outbound security. The upstream EJB application server configures inbound security to handle the right type of authentication from the Java client. The upstream EJB application server utilizes the outbound security configuration when going to the downstream EJB application server.

   This type of authentication might be different than what you expect from the Java client into the upstream EJB application server. Security might be tighter between the pure client and the first EJB server, depending on your infrastructure. The downstream EJB server utilizes the inbound security configuration to accept requests from the upstream EJB server. These two servers require similar configuration options as well. If the downstream EJB application server communicates to other downstream servers, then the outbound security might require a special configuration.
2. Specify the type of authentication. By default, the server supports authentication using a user ID and password. Both Java client certificate authentication and identity assertion are disabled by default. If you want this type of basic authentication performed at every tier, use the CSIv2 authentication protocol configuration as is. However, if you have any special requirements where some servers authenticate differently from other servers, then consider how to configure CSIv2 to take advantage of its features.
3. Configure clients and servers. Configuring a pure Java client is done through a properties file specified by the com.ibm.CORBA.ConfigURL Java property. Configuring servers is always done from the administrative console, either from the Security navigation for cell-level configurations or from the application server Server security for server-level configurations. If you want some servers

to authenticate differently from others, modify some of the server level configurations. When you modify the server-level configurations, you are overriding the cell-level configurations.

Common Secure Interoperability Version 2 and Security Authentication Service client configuration

A secure Java client requires configuration properties to determine how to perform security with a server. These configuration properties are typically put into a properties file somewhere on the client system and referenced by specifying the following system property on the command line of the Java client. The syntax of this property accepts a valid URL with the protocol type, `file`.

```
-Dcom.ibm.CORBA.ConfigURL=file:/WebSphere/V5R0M0/AppServer/sas.client.props
```

When this file is processed by the object request broker (ORB), security can be enabled between the Java client and the target server. If there are any problems with the client properties file or there is no match with the server security, the Java client examines the server securities for non-Common Secure Interoperability Version 2 (CSIv2) securities that might be available. If there is no match with the old, non-CSIv2 securities either, the Java client attempts a nonsecure connection.

The following properties are used to configure the CSIv2 authentication protocol:
- "Security Authentication Service and Common Secure Interoperability Version 2 authentication protocol common settings for a client configuration"
- "CSIv2 authentication protocol client settings" on page 299

Security Authentication Service and Common Secure Interoperability Version 2 authentication protocol common settings for a client configuration: Use the following settings in the *install_dir*`\properties\sas.client.props` file to configure z/OS Security Authentication Service (z/SAS) and Common Secure Interoperability Version 2 (CSIv2) clients.

com.ibm.CORBA.securityEnabled:

Use to determine if security is enabled for the client process.

Data type:	Boolean
Default:	True
Valid values:	True or False

com.ibm.CORBA.authenticationTarget:

Use to determine the type of authentication mechanism for sending security information from the client to the server.

If basic authentication is specified, the user ID and password are sent to the server. Using the SSL transport with this type of authentication is recommended because otherwise the password is not encrypted. The target server must support the specified authenticationTarget.

If you specify Lightweight Third Party Authentication (LTPA), then LTPA must be the mechanism configured at the server for a method request to proceed securely.

Data type:	String
Default:	BasicAuth

Valid values: BasicAuth, LTPA

com.ibm.CORBA.validateBasicAuth:

Use to determine if the user ID and password get validated immediately after the login data is entered when the authenticationTarget property is set to `BasicAuth`.

In past releases, BasicAuth logins only validated with the initial method request. During the first request, the user ID and password is sent to the server. This is the first time that the client can notice an error, if the user ID or password is incorrect. The validateBasicAuth method is specified and the validation of the user ID and password occurs immediately to the security server.

For performance reasons, you might want to disable this property if it is not desirable to verify the user ID and password immediately. If the client program can wait, it is better to have the initial method request flow to the user ID and password. However, program logic might not be as simple because of error handling considerations.

Data type: Boolean
Default: True
Valid values: True or False

com.ibm.CORBA.authenticationRetryEnabled:

Use to specify that a failed login attempt is retried. This property determines if a retry occurs for other errors, such as stateful sessions that are not found on a server or validation failures at the server because of an expiring credential.

The minor code in the exception that is returned to a client determines which errors are retried. The number of retry attempts is dependent upon the property com.ibm.CORBA.authenticationRetryCount.

Data type: Boolean
Default: True
Valid values: True or False

com.ibm.CORBA.authenticationRetryCount:

Use to specify the number of retries that occur until either a successful authentication occurs or the maximum retry value is reached.

When the maximum retry value is reached, the authentication exception is returned to the client.

Data type: Integer
Default: 3
Range: 1-10

com.ibm.CORBA.loginSource:

Use to specify how the request interceptor attempts to log in if it does not find an invocation credential already set.

This property is only valid if message layer authentication occurs. If only transport layer authentication occurs, this property is ignored. When specifying properties, the following two additional properties need to be defined:

- **com.ibm.CORBA.loginUserid**
- **com.ibm.CORBA.loginPassword**

When performing a programmatic login, it is not necessary to specify `none` as the login source. Unless you want the request to fail, do not set a credential as the invocation credential during a method request.

Data type:	String
Default:	Prompt
Valid values:	prompt, key file, stdin, none, properties

com.ibm.CORBA.loginUserid:

Use to specify the user ID when a properties login is configured and message layer authentication occurs.

This property is only valid when `com.ibm.CORBA.loginSource=properties`. Also, set the `com.ibm.CORBA.loginPassword` property.

Data type:	String
Range:	Any string appropriate for a user ID in the configured user registry of the server.

com.ibm.CORBA.loginPassword:

Use to specify the password when a properties login is configured and message layer authentication occurs.

This property is only valid when `com.ibm.CORBA.loginSource=properties`. Also, set the com.ibm.CORBA.loginUserid property.

Data type:	String
Range:	Any string appropriate for a password in the configured user registry of the server

com.ibm.CORBA.keyFileName:

Use to specify the key file that is used to log in.

A key file is a file that contains a list of realm, user ID, and password combinations that a client uses to log into multiple realms. The realm used is the one found in the Interoperable Object Reference (IOR) for the current method request. The value of this property is used when `com.ibm.CORBA.loginSource=key file` is used.

Data type:	String
Default:	`/WebSphere`
Range:	Any fully qualified path and file name of a WebSphere Application Server key file

com.ibm.CORBA.loginTimeout:

Use to specify the length in time that the login prompt stays available before it is considered a failed login.

Data type:	Integer
Units:	Seconds
Default:	300 (5 minute intervals)
Range:	0 - 600 (10 minute intervals)

CSIv2 authentication protocol client settings:

In addition to the properties that are valid for both Security Authentication Service (SAS) and Common Secure Interoperability Version 2 (CSIv2), this page documents the properties that are valid for the CSIv2 protocol only.

com.ibm.CSI.performClientAuthenticationSupported:

Use to determine if message layer client authentication is supported.

When supported, message layer client authentication is performed when communicating with any server that supports or requires the authentication. Message layer client authentication involves transmitting either a user ID and password or a token from an already authenticated credential. If the authenticationTarget property is BasicAuth, the user ID and password are transmitted to the target server. If the authenticationTarget password is a token-based mechanism such as Lightweight Third Party Authentication (LTPA) or Kerberos, then the credential token is transmitted to the server after authenticating the user ID and password directly to the security server.

Data type:	Boolean
Default:	True
Range:	True or False

com.ibm.CSI.performClientAuthenticationRequired:

Use to determine if message layer client authentication is required.

When required, message layer client authentication must occur when communicating with any server. If transport layer client authentication is also enabled, both authentications are performed, but message layer client authentication takes precedence at the server.

Data type:	Boolean
Default:	True
Range:	True or False

com.ibm.CSI.performTransportAssocSSLTLSSupported:

Use to determine if Secure Sockets Layer (SSL) is supported.

When SSL is supported, this client causes either SSL or TCP/IP to communicate with a server. If SSL is not supported, then the client must communicate over TCP/IP to the server. Supporting SSL is recommended so that any sensitive information is encrypted and digitally signed. When the associated com.ibm.CSI.performTransportAssocSSLTLSRequired property is enabled (set to `true`), this property is ignored. In this case, SSL is always required.

Data type:	Boolean
Default:	True
Range:	True or False

com.ibm.CSI.performTransportAssocSSLTLSRequired:

Use to determine if SSL is required.

When SSL is required, this client must use SSL to communicate to a server. If SSL is not supported by a server, this client does not attempt a connection to that server. When this property is enabled, the associated com.ibm.CSI.performTransportAssocSSLTLSSupported property is ignored.

Data type:	Boolean
Default:	True
Range:	True or False

com.ibm.CSI.performTLClientAuthenticationSupported:

Use to determine if transport layer client authentication is supported.

When performing client authentication using SSL, the client key file must have a personal certificate configured. Without a personal certificate, the client cannot authenticate to the server over SSL. If the personal certificate is a self-signed certificate, the server must contain the public key of the client in the server trust file. If the personal certificate is a Certificate Authority (CA) granted certificate, the server must contain the root public key of the CA in the server trust file. This property is only valid when SSL is supported or required. If the associated com.ibm.CSI.performTLClientAuthenticationRequired property is enabled, this property is ignored.

Data type:	Boolean
Default:	True
Range:	True or False

com.ibm.CSI.performTLClientAuthenticationRequired:

Use to determine if transport layer client authentication is required.

If required, every secure socket opened between a client and server authenticates using SSL mutual authentication. When performing client authentication using SSL, the client key file must have a personal certificate configured. Without a personal certificate, the client cannot authenticate to the server over SSL.

If the personal certificate is a self-signed certificate, the server must contain the public key of the client in the server trust file. If the personal certificate is a certificate authentication (CA) granted certificate, the server must contain the root public key of the CA in the server trust file. When this property is specified, the associated `com.ibm.CSI.performTLClientAuthenticationSupported` property is ignored.

Data type:	Boolean
Default:	True
Range:	True or False

com.ibm.CSI.performMessageConfidentialityRequired:

Use to determine if 128-bit ciphers must be used to make SSL connections.

If a target server does not support 128-bit ciphers, a connection to that server fails. This property is only valid when SSL is enabled. When this property is enabled, the associated `com.ibm.CSI.performMessageConfidentialitySupported` property is ignored.

Data type:	Boolean
Default:	True
Range:	True or False

com.ibm.CSI.performClientAuthenticationtype:

Use to define the type of client authentication.

The only value that is supported is `SAFUSERIDPASSWORD` .

Data type:	String constant
Default:	None
Range:	None

com.ibm.CSI.performSSL.Keyring: Use for providing the name of the Resource Access Control Facility (RACF) keyring used for SSL connections.

Data type:	String
Default:	None
Range:	None

com.ibm.CSI.Rem.Userid: Use to provide the user ID when authenticating with Generic Security Services Username Password (GSSUP) at the target server.

Data type:	String
Default:	None
Range:	None

com.ibm.CSI.Rem.Password: Use to provide the password when authenticating with GSSUP at the target server.

Data type:	String
Default:	None
Range:	None

z/OS Secure Authentication Service transport settings

Use this page to specify authentication settings for requests that are received and sent by a server that uses the z/OS authentication protocol. Use the z/OS Secure Authentication Service (zSAS) protocol to communicate securely to enterprise beans with previous releases of the WebSphere Application Server.

To view this administrative console page, click **Security** > **Authentication Protocol** > **zSAS Transport**.

Basic Authentication:

Specifies that clients to this server can provide a System Authorization Facility (SAF) user ID and password over a Secure Sockets Layer (SSL) connection. This option requires a valid System SSL Repertoire selection on the SSL Settings option.

Data type	Boolean
Default	Disabled
Range	Enabled or Disabled

Client Certificate:

Specifies that clients to this server can authenticate using SSL client certificates. The client certificates must be capable of mapping to a SAF user ID. You must connect the public certificate of the client certificate authority to the server key ring. The client certificate option requires a valid System SSL Repertoire selection on the SSL Settings option.

Data type	Boolean
Default	Disabled
Range	Enabled or Disabled

Kerberos:

Specifies that this security mechanism uses SSL to establish the trust of the client in the server. The client authenticates to the server by using Kerberos. The Kerberos identity must be capable of converting to a SAF identity. This option requires a valid System SSL Repertoire selection on the SSL Settings option.

Data type	Boolean
Default	Disabled
Range	Enabled or Disabled

Userid Password:

Specifies that clients can connect to this server with a SAF user ID and password without requiring a connection sent over an SSL session.

Data type	Boolean
Default	Disabled
Range	Enabled or Disabled

Userid Passticket:

Specifies that clients or other servers on the same sysplex can connect to this server with a one-time user credential that represents the SAF user.

Data type	Boolean
Default	Disabled
Range	Enabled or Disabled

Identity Assertion Inbound:

Specifies that inbound requests using SAF user IDs forwarded by a z/OS Application Server can be accepted.

The immediate downstream server establishes its identity by sending a digital certificate. Identity assertion is available only if client certificates are supported. When you enable this setting, you must select an SSL setting.

Data type	Boolean
Default	Disabled
Range	Enabled or Disabled

Identity Assertion Outbound:

Specifies that outbound requests originating from this server can forward authenticated client user IDs over an SSL connection to another z/OS Application Server in which it has established trust.

This option requires a valid System SSL Repertoire selection on the SSL Settings option.

Data type	Boolean
Default	Disabled
Range	Enabled or Disabled

Allow Unauthenticated Clients:

Specifies that the server accepts Internet Inter-ORB Protocol (IIOP) requests without any authentication information.

If you enable this property, specify the Remote Identity setting to associate a user ID with requests from a remote server.

Data type	Boolean
Default	Disabled
Range	Enabled or Disabled

SSL Settings:

Specifies a predefined list of SSL settings for connections. The selection must be a System SSL repertoire. Configure these settings on the SSL Repertoire panel.

Data type	String
Default	None

Configuring Common Secure Interoperability Version 2 inbound authentication

Inbound authentication refers to the configuration that determines the type of accepted authentication for inbound requests. This authentication is advertised in the Interoperable Object Reference (IOR) that the client retrieves from the name server.

1. Start the administrative console. Click **Security > Authentication Protocol > CSI Inbound Authentication**.
2. Consider the following three layers of security:
   - Identity assertion (attribute layer).

     When selected, this server accepts identity tokens from upstream servers. If the server receives an identity token, the identity is taken from an originating client. For example, the identity is in the same form that the originating client presented to the first server. An upstream server sends the identity of the originating client. The format of the identity can be either a principal name, a distinguished name, or a certificate chain. In some cases, the identity is anonymous. It is important to trust the upstream server that sends the identity token because the identity is authenticating on this server. Trust of the upstream server is established either using Secure Sockets Layer (SSL) client certificate authentication or basic authentication. You must select one of the two layers of authentication in both inbound and outbound authentication when you choose identity assertion. The middle server identity is authorized on the target server with update authority on `CB.BIND.servername`. The middle server identity is sent using an SSL client certificate only. If SSL is not used, the CBIND check is performed against the configured default identity.
   - User ID and password (message layer).

     This type of authentication is the most typical. The user ID and password or authenticated token is sent from a pure client or from an upstream server. However, the upstream server can not be a z/OS server because z/OS does not support a user ID or password from a server acting as a client. When a user ID and password are received at the server, they are authenticated with the user registry.
   - Secure Sockets Layer client certificate authentication (transport layer).

     This type of authentication typically occurs from pure clients using the certificate identity and from servers trusting the upstream server. Usually, when a server delegates an identity to a downstream server, the identity comes from either the message layer (a client authentication token) or the attribute layer (an identity token), not from the transport layer, through the client certificate authentication.

     A client has an SSL client certificate stored in the keystore or keyring file of the client configuration. When SSL client authentication is enabled on this server, the server requests that the client send the SSL client certificate when the connection is established. The certificate chain is available on the socket whenever a request is sent to the server. The server request interceptor gets the certificate chain from the socket and maps this certificate chain to a user in the registry. This type of authentication is optimal for communicating directly from a client to a server. However, when you have to go downstream, the identity typically flows over the message layer or through identity assertion.
3. Consider the following points when deciding what type of authentication to accept:
   - A server can receive multiple layers simultaneously, so an order of precedence rule decides which identity to use. The identity assertion layer has the highest priority, the message layer follows, and the transport layer has the lowest priority. The SSL client certificate authentication is used when it is the only layer provided. If the message layer and the transport layer are provided, the message layer is used to establish the identity for authorization. The identity assertion layer is used to establish precedence when provided.

- Does this server usually receive requests from a client, from a server or both? If the server always receives requests from a client, identity assertion is not needed. You can then choose either the message layer, the transport layer, or both. You also can decide when authentication is required or just supported. To select a layer as required, the sending client must supply this layer, or the request is rejected. However, if the layer is only supported, the layer might not be supplied.
- What kind of client identity is supplied? If the client identity is client certificates authentication and you want the certificate chain to flow downstream so that it maps to the downstream server user registries, then identity assertion is the appropriate choice. Identity assertion preserves the format of the originating client. If the originating client authenticated with a user ID and password, then a principal identity is sent. If authentication is done with a certificate, then the certificate chain is sent.

When you finish configuring this panel, you have configured most of the information that a client coalesces when determining what to send to this server. A client or server outbound configuration with this server inbound configuration, determines the security that is applied. When you know what clients send, the configuration is simple. However, if you have a diverse set of clients with differing security requirements, your server considers various layers of authentication.

Attention: Although the trusted server list and session management appear on the CSI Inbound Authentication panel, these two options are not utilized by WebSphere Application Server for z/OS.

For an enterprise bean server, the authentication choice is usually either identity assertion or message layer because you want the identity of the originating client delegated downstream. You cannot easily delegate a client certificate using an SSL connection. It is acceptable to enable the transport layer because additional server security, as the additional client certificate portion of the SSL handshake, adds some overhead to the overall SSL connection establishment.

After you determine which type of authentication data this server might receive, you can determine what to select for outbound security. Refer to the article, Configuring Common Secure Interoperability Version 2 outbound authentication.

Common Secure Interoperability inbound authentication settings:

Use this page to specify the features that a server supports for a client accessing its resources.

To view this administrative console page, click **Security** > **Authentication Protocol** > **CSI Inbound Authentication**.

Use CSI inbound authentication settings for configuring the type of authentication information contained in an incoming request or transport.

Authentication features include two layers of authentication that you can use simultaneously:
- **Transport layer**. The transport layer, which is the lowest layer, might contain a Secure Sockets Layer (SSL) client certificate as the identity.
- **Attribute layer**. The attribute layer might contain an identity token, which is an identity from an upstream server that already is authenticated. The identity layer has the highest priority, followed by the message layer, and then the transport layer. If a client sends all three, only the identity layer is used. The only way to

use the SSL client certificate as the identity is if it is the only information presented during the request. The client picks up the Interoperable Object Reference (IOR) from the name space and reads the values from the tagged component to determine what the server needs for security.

Basic Authentication:

Specifies that basic authentication occurs over the message layer.

In the message layer, basic authentication (user ID and password) takes place. This type of authentication typically involves sending a user ID and a password from the client to the server for authentication.

If you specify **Basic Authentication** and LTPA is the configured authentication protocol, user name, password, and LTPA tokens are accepted.a

When you select **Basic Authentication**, decide whether it is Required or Supported. Selecting Required, indicates that only clients configured to authenticate to this server through the message layer can invoke requests on the server. Selecting Supported, indicates that this server accepts basic authentication. However, other methods of authentication can occur if configured and anonymous requests are accepted. Select **Never** to indicate that the server is not configured to accept message layer authentication from any client.

Data type: String

Client Certificate Authentication:

Specifies that authentication occurs when the initial connection is made between the client and the server during a method request.

In the transport layer, Secure Sockets Layer (SSL) client certificate authentication takes place. In the message layer, basic authentication (user ID and password) is performed. Client certificate authentication typically performs better than message layer authentication, but requires some additional setup steps. These additional steps involve verifying that the server has the signer certificate of each client to which it is connected. If the client uses a certificate authority (CA) to create its personal certificate, then you only need the CA root certificate in the server signer section of the SSL trust file.

When the certificate is authenticated to a LocalOS user registry, is mapped to the user ID in the registry. The identity from client certificates is used only if no other layer of authentication is presented to the server.

When you select **Client Certificate Authentication**, decide whether it is Required or Supported. When You select **Required**, only clients that are configured to authenticate to this server through SSL client certificates can invoke requests on the server. When you select **Supported**, this server accepts SSL client certificate authentication, however, other methods of authentication can occur (if configured) and anonymous requests are accepted. When you select **Never**, this server is not configured to accept client certificate authentication from any client.

Data type String

Identity Assertion:

Specifies that identity assertion is a way to assert identities from one server to another during a downstream Enterprise JavaBean (EJB) invocation.

Identity assertion is performed in the attribute layer and is only applicable on servers. The principal determined at the server is based on precedence rules. If identity assertion is performed, the identity is always derived from the attribute. If basic authentication is performed without identity assertion, the identity is always derived from the message layer. Finally, if SSL client certificate authentication is performed without either basic authentication, or identity assertion, then the identity is derived from the transport layer.

5.1 + The identity asserted is the invocation credential that is determined by the RunAs mode for the enterprise bean. If the RunAs mode is Client, the identity is the client identity. If the RunAs mode is System, the identity is the server identity. If the RunAs mode is Specified, the identity is the one specified. The receiving server receives the identity in an identity token and also receives the sending server identity in a client authentication token. The receiving server validates the sending server identity as a trusted identity through the Trusted Server IDs entry box. Enter a list of pipe-separated (|) principal names, for example, `serverid1|serverid2|serverid3`.

When authenticating to a LocalOS user registry, all identity token types map to the user ID field of the active user registry. For an ITTPrincipal identity token, this token maps one-to-one with the user ID fields. For an ITTDistinguishedName identity token, the value from the first equal sign is mapped to the user ID field. For an ITTCertChain identity token, the value from the first equal sign of the distinguished name is mapped to the user ID field.

When authenticating to an LDAP user registry, the LDAP filters determine how an identity of type ITTCertChain and ITTDistinguishedName get mapped to the registry. If the token type is ITTPrincipal, then the principal gets mapped to the UID field in the LDAP registry.

Data type: String

Trusted servers:

Specifies a pipe-separated (|) list of trusted server IDs, which are trusted to perform identity assertion to this server. For example, `serverid1|serverid2|serverid3`. WebSphere Application Server supports the comma (,) character as the list delimiter for backwards compatibility. WebSphere Application Server checks the comma character when the pipe character fails to find a valid trusted server ID.

Use this list to quickly decide whether a server is trusted. Even if the server is on the list, the sending server must still authenticate with the receiving server to accept the identity token of the sending server.

Data type String

Stateful:

Specifies stateful sessions that are used mostly for performance improvements.

The first contact between a client and server must fully authenticate. However, all subsequent contacts with valid sessions reuse the security information. The client passes a context ID to the server, and the ID is used to look up the session. The context ID is scoped to the connection, which guarantees uniqueness. Whenever the security session is invalid and the authentication retry is enabled (it is by default), the client-side security interceptor invalidates the client-side session and resubmits the request without user awareness. This situation might occur if the session does not exist on the server (the server failed and resumed operation). When this value is disabled, every method invocation must re-authenticate.

Data type String

Additional Common Secure Interoperability inbound authentication settings:

Use this page to configure additional authentication settings for requests that are received by this server using the Object Management Group (OMG) Common Secure Interoperability authentication protocol.

To view this administrative console page, click **Security** > **Authentication Protocol** > **CSIv2 Inbound Authentication** > **Additional Settings** .

Client Authentication Type:

Specifies the type of client authentication supported for inbound requests.

Data type String
Default SAFUSERIDPASSWORD

SAF Identity Assertion:

Specifies that the server permits a trusted upstream server to assert client identities as System Authorization Facility (SAF) user names.

Data type Boolean
Default Disabled
Options Enabled or Disabled

DN Identity Assertion:

Specifies that the server permits a trusted upstream server to assert client identities as distinguished names.

Data type Boolean
Default Disabled
Options Enabled or Disabled

Certificate Identity Assertion:

Specifies that the server permits a trusted upstream server to assert client identities as X.509 certificates.

Data type Boolean
Default Disabled
Options Enabled or Disabled

Configuring Common Secure Interoperability Version 2 outbound authentication

Outbound authentication refers to the configuration that determines the type of authentication performed for outbound requests to downstream servers. Several *layers* or *methods* of authentication can occur. The downstream server inbound authentication configuration must support at least one choice made in this server outbound authentication configuration. If nothing is supported, the request might go outbound as `unauthenticated`. This situation does not create a security problem because the authorization run time is responsible for preventing access to protected resources. However, if you choose to prevent an unauthenticated credential to go outbound, you might want to designate one of the authentication layers as `required`, rather than `supported`. If a downstream server does not support authentication, then when authentication is required, the method request fails to go outbound.

The following choices are available in the Common Secure Interoperability Version 2 (CSIv2) Outbound Authentication panel. Remember that you are not required to complete these steps in the displayed order. Rather, these steps are provided to help you understand your choices for configuring outbound authentication.

1. Select **Identity Assertion** (attribute layer). When selected, this server submits an identity token to a downstream server, if the downstream server supports identity assertion. When an originating client authenticates to this server, the authentication information supplied is preserved in the outbound identity token. If the client authenticating to this server uses client certificate authentication, then the identity token format is a certificate chain, containing the exact client certificate chain on the socket. The same scenario is true for other mechanisms of authentication. Read theIdentity Assertion article for more information.
2. Select **SSL Client certificate authentication** (transport layer). The main reason to enable outbound Secure Sockets Layer (SSL) client authentication from one server to a downstream server is to create a trusted environment between those servers. For delegating client credentials, use one of the two layers mentioned previously. However, you might want to create SSL personal certificates for all the servers in your domain, and only trust those servers in your SSL truststore file. No other servers or clients can connect to the servers in your domain, except at the tiers where you want them. This process can protect your enterprise bean servers from access by anything other than your servlet servers. Refer to the SSL Client Certificate Authentication article for more information.

   A server can send multiple layers simultaneously, therefore, an order of precedence rule decides which identity to use. The identity assertion layer has the highest priority, the message layer follows, and the transport layer has the lowest priority. SSL client certificates are only used as the identity for invoking method requests, when that is the only layer provided. SSL client certificates are useful for trust purposes, even if the identity is not used for the request. If only the message layer and transport layer are provided, the message layer is used to establish the identity for authorization. If the identity assertion layer is provided (regardless of what is provided), then the identity from the identity token is always used by the authorization engine as the identity for that request.

   Attention: Although user ID and password appear on this panel, they are not available in WebSphere Application Server for z/OS.

Configuring session management:

You can choose either *stateful* or *stateless* security. Performance is optimum when choosing stateful sessions. The first method request between this server and the downstream server is authenticated. All subsequent requests reuse the session information, including the credential. A *unique session entry* is defined as the combination of a unique client authentication token and an identity token, scoped to the connection.

When you finish configuring this panel, you configured the information that this server uses to make decisions about the type of authentication to perform with downstream servers. If the downstream server is configured not to support the outbound configuration of the server, the following exception likely occurs:

```
Exception received: org.omg.CORBA.INITIALIZE:
JSAS1477W: SECURITY CLIENT/SERVER CONFIG MISMATCH:  The client security
configuration (sas.client.props or outbound settings in GUI) does not
support the server security configuration for the following reasons:
ERROR 1: JSAS0607E: The client requires SSL Confidentiality but the server
does not support it.
ERROR 2: JSAS0610E: The server requires SSL Integrity but the client does
not support it.
ERROR 3: JSAS0612E: The client requires client (e.g., userid/password or token),
but the server does not support it.
minor code: 0  completed: No
        at com.ibm.ISecurityLocalObjectBaseL13Impl.SecurityConnectionInterceptor.
getConnectionKey(SecurityConnectionInterceptor.java:1770)
        at com.ibm.ws.orbimpl.transport.WSTransport.getConnection(Unknown Source)
        at com.ibm.rmi.iiop.TransportManager.get(TransportManager.java:79)
        at com.ibm.rmi.iiop.GIOPImpl.locate(GIOPImpl.java:167)
        at com.ibm.CORBA.iiop.ClientDelegate._createRequest(ClientDelegate.java:2088)
        at com.ibm.CORBA.iiop.ClientDelegate.createRequest(ClientDelegate.java:1264)
        at com.ibm.CORBA.iiop.ClientDelegate.createRequest(ClientDelegate.java:1177)
        at com.ibm.CORBA.iiop.ClientDelegate.request(ClientDelegate.java:1726)
        at org.omg.CORBA.portable.ObjectImpl._request(ObjectImpl.java:245)
        at com.ibm.WsnOptimizedNaming._NamingContextStub.get_compatibility_level
(Unknown Source)
        at com.ibm.websphere.naming.DumpNameSpace.getIdlLevel(DumpNameSpace.java:300)
        at com.ibm.websphere.naming.DumpNameSpace.getStartingContext
(DumpNameSpace.java:329)
        at com.ibm.websphere.naming.DumpNameSpace.main(DumpNameSpace.java:268)
        at java.lang.reflect.Method.invoke(Native Method)
        at com.ibm.ws.bootstrap.WSLauncher.main(WSLauncher.java:163)
```

The reasons for the mismatch are explained in the exception. You can make the corrections when you configure the outbound configuration for this server, or when you configure the inbound configuration of the downstream server. If multiple reasons exist for a failure, the reasons are explained as message text in the exception.

Typically, the outbound authentication configuration is for an upstream server to communicate with a downstream server. Most likely, the upstream server is a servlet server and the downstream server is an EJB server. On a servlet server, the client authentication performed to access the servlet can be one of many different types of authentication, including client certificate and basic authentication. When receiving basic authentication data, whether through a prompt login or a form

based login, the basic authentication information is typically authenticated to form a credential of the mechanism type that is supported by the server, such as Lightweight Third Party Authentication (LTPA) or LocalOS. When LTPA is the mechanism, a forwardable token exists in the credential. Choose the message layer (BasicAuth) authentication to propagate the client credentials. If the credential was created using a certificate login and you want to preserve sending the certificate downstream, you might decide to go outbound with identity assertion.

Save the configuration and restart the server for the changes to take effect.

Common Secure Interoperability outbound authentication settings:

Use this page to specify the features that a server supports when acting as a client to another downstream server.

To view this administrative console page, click **Security > Authentication Protocol > CSI Outbound Authentication**.

Authentication features include two layers of authentication that you can use simultaneously. The message layer for z/OS is empty.

Transport layer
The transport layer, the lowest layer, might contain a Secure Sockets Layer (SSL) client certificate as the identity.

Attribute layer
The attribute layer might contain an identity token, which is an identity from an upstream server that is already authenticated. The attribute layer has the highest priority, followed by the message layer and then the transport layer. If this server sends all three, only the attribute layer is used by the downstream server. The only way to use the SSL client certificate as the identity is if it is the only information presented during the outbound request.

Attention: Although basic authentication appears on this panel, this feature is not available in WebSphere Application Server for z/OS.

Client Certificate Authentication:

Specifies whether a client certificate from the configured keystore file is used to authenticate to the server when the SSL connection is made between this server and a downstream server (provided that the downstream server supports client certificate authentication).

Typically, client certificate authentication has a higher performance than message layer authentication, but requires some additional setup steps. These additional steps include verifying that this server has a personal certificate and that the downstream server has the signer certificate of this server.

If you select client certificate authentication, decide whether it is required or supported. Select **Required** to indicate that this server can only connect to downstream servers with client certificate authentication also configured. Select **Supported** to indicate that this server performs client certificate authentication with any downstream server, but might not use client certificate authentication depending on whether it is supported by the downstream server. Select **Never** to indicate that this client does not perform client certificate authentication to any downstream server. This limitation prevents access to any downstream server that requires client certificate authentication.

Data type: String

Identity Assertion:

Specifies whether to assert identities from one server to another during a downstream enterprise bean invocation.

The identity asserted is the client identity. If there are multiple identity types to assert, the identity is asserted in the following order: client certificate, distinguished name (DN), Service Access Facility (SAF) user ID. The receiving server receives the identity in an identity token with an empty client authentication token. The Secure Sockets Layer (SSL) certificate of the server serves as the identity of the server to the receiving server.

Data type: String

Stateful:

This option is ignored. The sending server prefers stateful sessions and uses them if the receiving server supports it.

Configuring inbound transports

Inbound transports refer to the types of listener ports and their attributes that are opened to receive requests for this server. Both Common Secure Interoperability Specification, Version 2 (CSIv2) and z/OS Secure Authentication Service (z/SAS) have the ability to configure the transport.

CSIv2 and z/SAS support most of the same functions. CSIv2 has the advantage of interoperability with other WebSphere Application Server products and any other platforms that support the CSIv2 protocol.

Complete the following steps to configure the Inbound Transport panels in the administrative console:

1. Click **Security** > **Authentication Protocol** > **CSIv2 Inbound Transport** to select the type of transport and the SSL settings. By selecting the type of transport, as noted previously, you choose which listener ports you want to open. In addition, you disable the SSL client certificate authentication feature if you choose TCP/IP as the transport.
2. Select the SSL settings that correspond to an SSL transport. These SSL settings are defined in the **Security** > **SSL** panel and define the SSL configuration including the keyring, security level, ciphers, and so on.
3. Consider fixing the listener ports that you configured.

   You complete this action in a different panel, but this is the time to think about it. Most end points are managed at a single location, which is why they do not appear in the Inbound Transport panels. Managing end points at a single location helps you decrease the number of conflicts in your configuration when you assign the end points. The location for SSL end points is at each server. The following port names are defined in the End Points panel and are used for object request broker (ORB) security:
   - ORB_SSL_LISTENER_ADDRESS - SSL Port
   - ORB_LISTENER_ADDRESS - IIOP port

For an application server, click **Servers** > **Application Servers** > *server_name* > **End Points**.

The Object Request Broker (ORB) on WebSphere Application Server uses a listener port for Remote Method Invocation over the Internet Inter-ORB Protocol (RMI/IIOP) communications, which is generally not specified and selected dynamically during run time. If you are working with a firewall, you must specify a static port for the ORB listener and open that port on the firewall so that communication can pass through the specified port. The endPoint property for setting the ORB listener port is: ORB_LISTENER_ADDRESS.

Complete the following steps using the administrative console to specify the ORB_LISTENER_ADDRESS port or ports.

a. Click **Servers > Application Servers >** *server_name* **> End Points**.
b. Select **ORB_LISTENER_ADDRESS** from the End Point Name field in the Configuration panel.
c. Enter the IP address, the fully qualified DNS host name, or the DNS host name by itself in the Host field. For example, if the host name is `myhost`, the fully qualified DNS name can be `myhost.myco.com` and the IP address can be `155.123.88.201`.
d. Enter the port number in the Port field. The port number specifies the port for which the service is configured to accept client requests. The port value is used in conjunction with the host name. Using the previous example, the port number might be 9000.

4. Click **Security** > **Authentication Protocol** > **z/SAS Inbound** to select the SSL settings used for inbound requests from z/SAS clients.

The inbound transport configuration is complete.

With this configuration, you can configure a different transport for inbound security versus outbound security. For example, if the application server is the first server used by users, the security configuration might be more secure. When requests go to back-end enterprise bean servers, you might lessen the security for performance reasons when you go outbound. With this flexibility you can design the right transport infrastructure to meet your needs.

When you finish configuring security, perform the following steps to save, synchronize, and restart the servers:

1. Click **Save** in the administrative console to save any modifications to the configuration.
2. Stop and restart all servers, when synchronized.

Common Secure Interoperability transport inbound settings:

Use this page to specify which listener ports to open and which Secure Sockets Layer (SSL) settings to use. These specifications determine which transport a client or upstream server uses to communicate with this server for incoming requests.

To view this administrative console page, click **Security** > **Authentication Protocol** > **CSI Inbound Transport**.

Transport:

Specifies whether client processes connect to the server using one of its connected transports.

You can choose to use either Secure Sockets Layer (SSL), TCP/IP or both as the inbound transport that a server supports. If you specify TCP/IP, the server only supports TCP/IP and cannot accept SSL connections. If you specify SSL Supported, this server can support either TCP/IP or SSL connections. If you specify SSL-Required, then any server communicating with this one must use SSL.

If you specify SSL-Supported or SSL-Required, decide which set of SSL configuration settings you want to use for the inbound configuration. This decision determines which key file and trust file are used for inbound connections to this server.

By default, SSL ports for Common Secure Interoperability Version 2 (CSIv2) and Security Authentication Service (SAS) are dynamically generated. In cases where you need to fix the SSL ports on application servers, click **Servers** > **Application Servers** > *server_name* > **End Points**. Configure the following port to be fixed. A zero port number indicates that a dynamic assignment is made at run time.

ORB_SSL_LISTENER_ADDRESS
- **TCP/IP**: Only a TCP/IP listener port is opened and all requests inbound do not have SSL protection.
- **SSL-Supported**: Both a TCP/IP and SSL listener port are opened and most requests come inbound by SSL.
- **SSL-Required**: Only an SSL listener port is opened, and all requests come through SSL connections. If you choose **SSL-Required**, you must also choose **CSI** as the active authentication protocol. If you choose **CSI and SAS**, SAS requires an open TCP/IP socket for some special requests.

Default:	SSL-Supported
Range:	TCP/IP, SSL Required, SSL-Supported

SSL settings:

Specifies a list of predefined SSL settings to choose from for inbound connections. These settings are configured at the SSL Repertoire panel.

Data type:	String
Default:	DefaultSSLSettings
Range:	Any SSL settings configured in the SSL Configuration Repertoire

Configuring outbound transports

Outbound transports refers to the transport used to connect to a downstream server. When you configure the outbound transport, consider the transports that the downstream servers support. If you are considering Secure Sockets Layer (SSL), also consider including the signers of the downstream servers in this server truststore file for the handshake to succeed. When you select an SSL configuration, that configuration points to keystore and truststore keyrings and keystore and truststore files that contain the necessary signers. If you configured client certificate authentication for this server in the **Security** > **Authentication Protocols** > **CSIv2 Outbound Authentication** panel, then the downstream servers contain the signer certificate belonging to the server personal certificate.

Complete the following steps to configure the Outbound Transport panels.

1. Select the type of transport and the SSL settings by clicking **Security** > **Authentication Protocol** > **CSIv2 Outbound Transport** panel. By selecting the type of transport, you are choosing the transport to use when connecting to downstream servers. The downstream servers support the transport that you choose. If you choose **SSL-Supported**, the transport used is negotiated during the connection. If both the client and server support SSL, always choose **SSL-Supported** unless the request is considered a special request that does not require SSL, such as if an object request broker (ORB) is a request.
2. Pick the SSL settings that correspond to an SSL transport. Click **Security** > **SSL**. Verify that the keyring file in the selected SSL configuration contains the signers for any downstream servers. Also, verify that the downstream servers contain the server signer certificates when outbound client certificate authentication is used.

The outbound transport configuration is complete.

With this configuration you can configure a different transport for inbound security versus outbound security. For example, if the application server is the first server used by end users, the security configuration might be more secure. When requests go to back-end enterprise beans servers, you might consider less security for performance reasons when you go outbound. With this flexibility you can design a transport infrastructure that meets your needs.

When you finish configuring security, perform the following steps to save, synchronize, and restart the servers.
- Click **Save** in the administrative console to save any modifications to the configuration.
- Stop and restart all servers, after synchronization.

Common secure interoperability transport outbound settings:

Use this page to specify which transports and Secure Sockets Layer (SSL) settings this server uses when communicating with downstream servers for outbound requests.

To view this administrative console page, click **Security > Authentication Protocol > CSI Outbound Transport**.

Transport:

Specifies whether the client processes connect to the server using one of the server-connected transports.

You can choose to use either SSL, TCP/IP or Both as the outbound transport which a server supports. If you specify **TCP/IP**, the server only supports TCP/IP and cannot initiate SSL connections with downstream servers. If you specify SSL Supported, this server can initiate either TCP/IP or SSL connections. If you specify SSL Required, then this server must use SSL to initiate connections to downstream servers. When you do specify SSL, decide which set of SSL configuration settings you want to use for the outbound configuration.

For example, consider the following options:

TCP/IP
This server opens TCP/IP connections with downstream servers only.

SSL Supported
This server opens SSL connections with any downstream servers that

support them, and TCP/IP connections with any downstream servers that do not support these SSL connections.

SSL Required
This server always opens SSL connections with downstream servers.

Default:	SSL-Supported
Range:	TCP/IP, SSL-Required, SSL-Supported

SSL settings:

Specifies a list of predefined SSL settings for outbound connections. These settings are configured at the SSL Configuration Repertoires panel.

Data type:	String
Default:	DefaultSSLSettings
Range:	Any SSL settings configured in the SSL Configuration Repertoires panel

Secure Sockets Layer

The Secure Sockets Layer (SSL) protocol provides transport layer security: authenticity, integrity, and confidentiality, for a secure connection between a client and server in the WebSphere Application Server. The protocol runs above TCP/IP and below application protocols such as Hypertext Transfer Protocol (HTTP), Lightweight Directory Access Protocol (LDAP), and Internet Inter-ORB Protocol (IIOP), and provides trust and privacy for the transport data.

Depending upon the SSL configurations of both the client and server, various levels of trust, data integrity, and privacy can be established. Understanding the basic operation of SSL is very important to proper configuration and to achieve the desired protection level for both client and application data.

Some of the security features provided by SSL are data encryption to prevent the exposure of sensitive information while data flows across the wire. Data signing prevents unauthorized modification of data while data flows across the wire. Client and server authentication ensures that you talk to the appropriate person or machine. SSL can be effective in securing an enterprise environment.

SSL is used by multiple components within WebSphere Application Server to provide trust and privacy. These components are the built-in HTTP transport, the Object Request Broker (ORB), and the secure LDAP client.

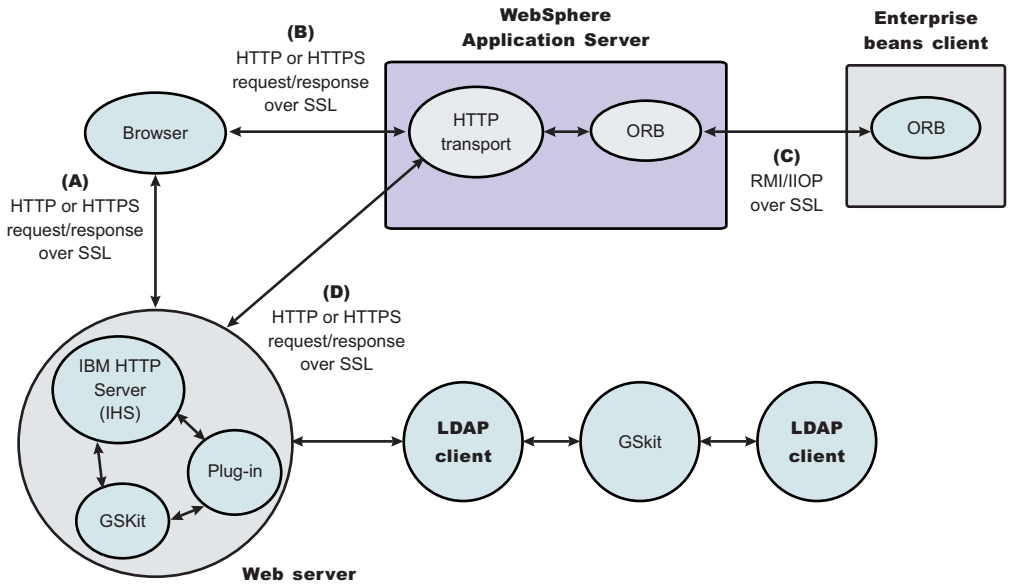


Figure 1. SSL and WebSphere Application Server

In this figure:

- The built-in HTTP transport in a WebSphere Application Server accepts HTTP requests over SSL from a Web client like a browser.
- The Object Request Broker used in WebSphere Application Server can perform Internet Inter-ORB Protocol (IIOP) over SSL to secure the message.
- The secure LDAP client uses LDAP over SSL to securely connect to an LDAP user registry and is present only when LDAP is configured as the user registry.

WebSphere Application Server and the IBMJSSE provider

The SSL implementation used by the WebSphere Application Server is IBM Java Secure Sockets Extension (IBMJSSE) or IBM System SSL. The IBMJSSE provider contains a reference implementation supporting SSL and Transport Layer Security (TLS) protocols and an application programming interface (API) framework. The IBM JSSE provider also comes with a standard provider which supplies RSA support for the signature-related Java Cryptography Architecture (JCA) features of the Java 2 platform, common SSL and TLS cipher suites, X.509-based key and trust managers, and PKCS12 implementation for JCA keystore certificates.

Configuring the JSSE provider is very similar to configuring most other SSL implementations (for example, GSKit); however, a couple of differences are worth noting.

- The JSSE provider support both signer and personal certificate storage in an SSL key file, but it also supports a separate file called a *trust file*. A trust file can contain only signer certificates. You can put all of your personal certificates in an SSL key file and your signer certificates in a trust file. This might be desirable, for example, if you have an inexpensive hardware cryptographic device with only enough memory to hold a personal certificate. In this case, the key file refers to the hardware device and the trust file to a file on disk containing all of the signer certificates.
- The JSSE provider does not recognize the proprietary SSL key file format, which is used by the plug-in (*.kdb* files). Instead, the JSSE provider recognizes standard file formats such as Java Key Store (JKS). SSL key files might not be shared

between the plug-in and application server. Furthermore, a different implementation of the key management utility must be used to manage application server key and trust files.

Certain limitations exist with the Java Secure Socket Extension (JSSE) provider:
- Customer code using JSSE and Java Cryptography Extension (JCE) APIs must reside within a WebSphere Application Server environment. This restriction includes applications deployed in WebSphere Application Server and client applications in the J2EE application client environment.
- Hardware token support is limited to . Java Cryptography Extension V1.2.1, Hardware Cryptography IBMJCE4758.

Tested for SSL clients	Tested for SSL clients or servers
IBM Security Kit Smartcard	IBM 4758-23
GemPlus Smartcards	IBM 4758-23
Rainbow iKey 1000/2000(USB ″Smartcard″ device)	IBM 4758-23

- The SSL protocol of Version 2.0 is not supported. In addition, the JSSE and JCE APIs are not supported with Java applet applications.

Authenticity

Authenticity of client and server identities during a Secure Sockets Layer (SSL) connection is validated by both communicating parties using public key cryptography or asymmetric cryptography, to prove the claimed identity from each other.

Public key cryptography is a cryptographic method that uses public and private keys to encrypt and decrypt messages. The public key is distributed as a public key certificate while the private key is kept private. The public key is also a cryptographic inverse of the private key. Well known public key cryptographic algorithms such as the Rivest Shamir Adleman (RSA) algorithm and Diffie-Hellman (DH) algorithm are supported in the WebSphere Application Server.

Public key certificates are either issued by a trusted organization like a certificate authority (CA) or extracted from a self-signed personal certificate by using the IBM Key Management Tool (iKeyman). A self-signed certificate is less secure and is not recommended for use in a production environment.

The public key certificate includes the following information:
- Issuer of the certificate
- Expiration date
- Subject that the certificate represents
- Public key belonging to the subject
- Signature by the issuer

You can link multiple key certificates into a certificate chain. In a certificate chain, the client is always first, while the certificate for a root CA is last. In between, each certificate belongs to the authority that issued the previous one.

During the Secure Sockets Layer (SSL) connection, a digital signature is also applied to avoid forged keys. The digital signature is an encrypted hash and cannot be reversed. It is very useful for validating the public keys.

SSL supports reciprocal authentication between the client and the server. This process is optional during the handshake. By default, a WebSphere Application Server client always authenticates its server during the SSL connection. For further protection, you can configure a WebSphere Application Server for client authentication.

Refer to the Transport Layer Security (TLS) specification at http://www.ietf.org/rfc/rfc2246.txt for further information.

Confidentiality

Secure Sockets Layer (SSL) uses private or secret key cryptography or symmetric cryptography to support message confidentiality or privacy. After an initial handshake (a negotiation process by message exchange), the client and server decide on a secret key and a cipher suite. Between the communicating parties, each message encryption and decryption using the secret key occurs based on the cipher suite.

Private key cryptography requires the two communicating parties to use the same key for encryption and decryption. Both parties must have the key and keep the key private. Well known secret key cryptographic algorithms include the Data Encryption Standard (DES), triple-strength DES (3DES), and Rivest Cipher 4 (RC4), which are all supported in WebSphere Application Server. These algorithms provide excellent security and quick encryption.

A cryptographic algorithm is a *cipher*, while a set of ciphers is a *cipher suite*. A cipher suite is a combination of cryptographic parameters that define the security algorithms and the key sizes used for authentication, key agreement, encryption strength and integrity protection.

The following IBM JSSE cipher suites are supported in WebSphere Application Server:

- SSL_RSA_WITH_RC4_128_SHA
- SSL_RSA_WITH_RC4_128_MD5
- SSL_RSA_WITH_DES_CBC_SHA
- SSL_RSA_WITH_3DES_EDE_CBC_SHA
- SSL_DHE_DSS_WITH_DES_CBC_SHA
- SSL_DHE_DSS_WITH_3DES_EDE_CBC_SHA
- SSL_RSA_EXPORT_WITH_RC4_40_MD5
- SSL_DHE_DSS_EXPORT_WITH_DES40_CBC_SHA
- SSL_RSA_WITH_NULL_MD5
- SSL_RSA_WITH_NULL_SHA
- SSL_DH_anon_WITH_RC4_128_MD5
- SSL_DH_anon_WITH_DES_CBC_SHA
- SSL_DH_anon_WITH_3DES_EDE_CBC_SHA
- SSL_DH_anon_EXPORT_WITH_RC4_40_MD5
- SSL_DH_anon_EXPORT_WITH_DES40_CBC_SHA

All of the previously mentioned cipher suites provide data integrity protection by using hash algorithms like `MD5` and `SHA-1`. The cipher suite names ending with `_SHA` indicate that the `SHA-1` algorithm is used. SHA-1 is considered a stronger hash, while MD5 provides better performance.

The `SSL_DH_anon_xxx` cipher suites (for example, those cipher suites that begin with `SSL_DH_anon_`, where, `anon` is *anonymous*) are not enabled on the product client side. Because the Java Secure Socket Extension (JSSE) client trust manager does not support anonymous connections, the JSSE client must always establish trust in the

server. However, the SSL_DH_anon_xxx cipher suites are enabled on the server side to support another type of client connection. That client might not require trust in the server. These cipher suites are vulnerable to *man-in-the-middle* attacks and are strongly discouraged. In a *man-in-the-middle* attack, an attacker is able to intercept and potentially modify communications between two parties without either party being cognizant of the attack.

Where:

Name	Description
SSL	Secure Sockets Layer
RSA	• Public key algorithm developed by Rivest, Shamir and Adleman • Requires RSA or DSS key exchange
DH	• Diffie-Hellman public key algorithm • Server certificate contains the Diffie-Hellman parameters signed by the certificate authority (CA)
DHE	• Ephemeral Diffie-Hellman public key algorithm • Diffie-Hellman parameters are signed by a DSS or RSA certificate, which is signed by the certificate authority (CA)
DSS	Digital Signature Standard, using the Digital Signature Algorithm for digital signatures
DES	• Data Encryption Standard, an symmetric encryption algorithm • Block cipher • Performance cost is high when using software without the support of a hardware cryptographic device
3DES	• Triple DES, increasing the security of DES by encrypting three times with different keys • Strongest of the ciphers • Performance cost is very high when using software without the support of a hardware cryptographic device support
RC4	• A stream cipher designed for RSA • Variable key-size stream cipher with key length from 40 bits to 128 bits
EDE	Encrypt-decrypt-encrypt for the triple DES algorithm
CBC	• Cipher block chaining • A mode in which every plain text block encrypted with the block cipher is first exclusive-ORed with the previous ciphertext block
128	128-bit key size
40	40-bit key size
EXPORT	Exportable

Name	Description
MD5	• Secure hashing function that converts an arbitrarily long data stream into a digest of fixed size • Produces 128-bit hash
SHA	• Secure Hash Algorithm, same as SHA-1 • Produces 160-bit hash
anon	For anonymous connections
NULL	No encryption
WITH	The cryptographic algorithm is defined after this key word

Refer to the Transport Layer Security (TLS) specification at http://www.ietf.org/rfc/rfc2246.txt for further information.

Integrity

Secure Sockets Layer (SSL) uses a cryptographic hash function similar to checksum, to ensure data integrity in transit. Use the cryptographic hash function to detect accidental alterations in the data. This function does not require a cryptographic key. After a cryptographic hash is created, the hash is encrypted with a secret key. The private key belonging to the sender encrypts the hash for the digital signature of the message.

When secret key information is included with the cryptographic hash, the resulting hash is known as a *Key-Hashing Message Authentication Code* (HMAC) value. HMAC is a mechanism for message authentication that uses cryptographic hash functions. Use this mechanism with any iterative cryptographic hash function, in combination with a secret shared key.

In the product, both well known *one-way* hash algorithms, MD5 and SHA-1, are supported. One-way hash is an algorithm that converts processing data into a string of bits known as a *hash value* or a *message digest*. *One-way* means that it is extremely difficult to turn the fixed string back into the original data. The following explanation includes both the MD5 and SHA-1 *one-way* hash algorithms:

- MD5 is a hash algorithm designed for a 32-bit machine. It takes a message of arbitrary length as input and produces a 128-bit hash value as output. Although this process is less secure than SHA-1, MD5 provides better performance.
- SHA-1 is a secure hash algorithm specified in the Secure Hash Standard. It is designed to produce a 160-bit hash. Although it is slightly slower than MD5, the larger message digest makes it more secure against attacks like *brute-force collision*.

Refer to the Transport Layer Security (TLS) specification at http://www.ietf.org/rfc/rfc2246.txt for further information.

Configuring Secure Sockets Layer

Secure Sockets Layer (SSL) is used by multiple components within WebSphere Application Server to provide trust and privacy. These components are the built-in HTTP Transport, the Object Request Broker (ORB) (for client and Internet InterORB Protocol (IIOP)) and the secure Lightweight Directory Access Protocol (LDAP) client. Configuring SSL is different between client and server with WebSphere Application Server and for JSSE and System SSL.

1. Configure the client (JSSE). Use the `sas.client.props` file located in the `${install_root}/properties` directory. The `sas.client.props` file is a configuration file that contains lists of property-value pairs, using the syntax *<property> = <value>*. The property names are case sensitive, but the values are not; the values are converted to lowercase when the file is read. By default, the *sas.client.props* file is located in the `properties` directory under the *install_root* of your WebSphere Application Server installation. Specify the following properties for an SSL connection:
   - com.ibm.ssl.protocol
   - com.ibm.ssl.keyStoreType
   - com.ibm.ssl.keyStore
   - com.ibm.ssl.keyStorePassword
   - com.ibm.ssl.trustStoreType
   - com.ibm.ssl.trustStore
   - com.ibm.ssl.trustStorePassword
   - com.ibm.ssl.enabledCipherSuites
   - com.ibm.ssl.contextProvider
   - com.ibm.ssl.keyStoreServerAlias
   - com.ibm.ssl.keyStoreClientAlias
2. Configure the client (System SSL).

   Configurations using System SSL are differentiated by z/OS Secure Authentication Services (z/SAS) and CSIv2 protocols. z/SAS protocols use renamed legacy environment variables provided by z/OS for WebSphere Application Server Version 4.x. The z/SAS protocol can be used by C++ and Java clients. CSIv2 uses a new properties file specified by a Java property and can be used by Java clients only.

   - **z/SAS**:
     a. Create an environment file for the client such as `current.env`. Set the variables in the file as listed.
     b. Specify the SSL key ring through the `security_sslKeyring` variable to a key ring that was created for the client.
     c. Specify a user ID and password if using z/SAS basic authentication through the `client_protocol_user` and the `client_protocol_password` variables.
     d. Point to the environment file using the fully qualified path name through the environment variable `WAS_CONFIG_FILE`. For example, in the test shell script `test.sh`, export `WAS_CONFIG_FILE=/WebSphere/V5R0M0/AppServer/bin/current.env`.
   - **CSIv2**: CSIv2 only supports Java clients and the Java com.ibm.CORBA.ConfigURL property must be specified to point to a properties file in the Hierarchical File System (HFS). You can specify a file only and the Web address must use the file: prefix (see the example below) There is no default. You can also specify individual properties on the Java invocation.
     a. Create or update the CSIv2 properties file with the properties
     b. Specify the SSL key ring using `com.ibm.CSI.performSSL.Keyring`
     c. If using the Generic Security Service username/password (GSSUP) authentication mechanism, specify the user ID and password using the `com.ibm.CSI.Rem.Userid` and `com.ibm.CSI.Rem.Password` property. Specify GSSUP using `com.ibm.CSI.performClientAuthenticationType=SAFUSERIDPASSWORD`, `com.ibm.CSI.performClientAuthenticationRequired`,

com.ibm.CSI.performClientAuthenticationRequired and com.ibm.CSI.performTransportAssocSSLTLSSupported.

d. If client certificate authentication is desired, specify: com.ibm.CSI.performTLClientAuthenticationRequired and com.ibm.CSI.performTLClientAuthenticationSupported.

e. Specify the fully qualified path name of the properties file on the Java invocation. -Dcom.ibm.CORBA.ConfigURL=file:/WebSphere/V5R0M0/AppServer/bin/CSI.properties

3. Configure the server. Use the administrative console to configure an application server that makes SSL connections. To start the administrative console, specify the following Web address: http://*server_hostname*:9090/admin.
4. Create a System SSL or JSSE repertoire. The type of repertoire depends on what function is being configured. In general, you need to create both kinds of repertoires. System SSL repertoires are required to use SSL over HTTP and IIOP. A Java Secure Socket Extension (JSSE) repertoire is used to connect Simple Object Access Protocol (SOAP) connectors.

Configuring Secure Sockets Layer for Web client authentication

To enable client-side certificate-based authentication, you must modify the authentication method defined on the J2EE Web module that you want to manage. The Web module might already be configured to use the basic challenge authentication method. In this case, modify the challenge type to client certificate.

5.1 + This functionality is delivered to the WebSphere Application Server administrator in the Assembly Toolkit. However, developers can use the WebSphere Application Server Studio Application Development environment to achieve the same result.

1. Launch the Assembly Toolkit. This step can be done either before an enterprise application archive .ear file is deployed into the WebSphere Application Server or after deployment into the product. The latter option is discouraged in a production environment because it involves opening the expanded archive correlating to the enterprise application archive, found in the installedApps directory.
2. Locate and expand the Web module package under the application for which you wish to enable the client-side certificate authentication method.
3. Select the appropriate Web application, and switch to the **Advanced** tab. Modify the authentication method to client certificate. The realm name is the scope of the login operation and is the same for all participating resources.
4. Click **OK**, and save the changes you made with Assembly Toolkit.
5. Stop and restart the associated application server containing the resource, so that the security modification is included in the run time. Complete this action if the modification was made to a resource that already is deployed in the WebSphere Application Server.

Now your enterprise application prompts the user for proof of identity with a certificate.

The Web server must also be configured to request a client certificate. If the Web server is external, refer to the appropriate configuration documentation. If the Web

server is the Web container transport (for example, 9043) within WebSphere Application Server, verify that the **client authentication** flag is selected in the referenced SSL configuration.

Configuring Secure Sockets Layer for the Lightweight Directory Access Protocol client

This topic describes how to establish a Secure Sockets Layer (SSL) connection between WebSphere Application Server and a Lightweight Directory Access Protocol (LDAP) server. This page provides an overview. Refer to the linked pages for more details. To understand SSL concepts, refer to "Secure Sockets Layer" on page 316.

Setting up an SSL connection between WebSphere Application Server and an LDAP server requires the following steps:

1. Set up an LDAP server with users. The server configured in this example is IBM Directory Server. Other servers are configured differently. Refer to the documentation of the directory server you are using for details on SSL enablement. For a product-supported LDAP directory server, see the "Supported directory services" on page 234 article.
2. Configure certificates for the LDAP server using the key management utility (iKeyman) that is shipped with the IBM HTTP Server product.
3. Click **Key Database File > New**.
4. Type `LDAPkey.kdb` as the file name and a proper path.
5. Click **Personal Certificates > New Self-Signed Certificate**. The **Create New Self-Signed Certificate** panel is displayed. Type the following information in the fields and click **OK**:
   Key Label
   `LDAP_Cert`
   Common Name
   droplet.austin.ibm.com

   This common name is the host name where the WebSphere Application Server plug-in runs.
   Organization
   `ibm`
   Country
   `US`
6. Return to the Personal Certificates panel and click **Extract Certificate**.
7. Click the **Base64-encoded ASCII data** data type. Type `LDAP_cert.arm` as the file name and a proper path. Click **OK**.
8. Enable SSL on the LDAP server:
   a. Copy the `LDAPkey.kdb`, `LDAPkey.sth`, `LDAPkey.rdb`, and `LDAPkey.crl` files created previously to the LDAP server system, for example, the `\Program Files\IBM\LDAP\ssl\` directory.
   b. Open the LDAP Web administrator from a browser (http://secnt3.austin.ibm.com/ldap, for example). IBM HTTP Server is running on `secnt3`.
   c. Click **SSL properties** to open the SSL Settings window.
   d. Click **SSL On** > **Server Authentication** and type an SSL port (`636`, for example) and a full path to the `LDAPkey.kdb` file.
   e. Click **Apply**, and restart the LDAP server.

9. Manage certificates for WebSphere Application Server using the default SSL key files.
   a. Open the *install_root*\etc\DummyServerTrustFile.jks file using the key management utility that shipped with WebSphere Application Server. The password is WebAS.
   b. Click **Personal Certificates > Import**. The **Import Key** panel is displayed. Specify LDAP_cert.arm for the file name. Complete this step for all the servers including the deployment manager.
10. Establish a connection between the WebSphere Application Server and the LDAP server.
    a. In the administrative console, click **User Registry > LDAP User Registry > LDAP Settings**. Fill in the **Server ID**, **Server Password**, **Type**, **Host**, **Port**, and **Base Distinguished Name** fields. Select the **SSL Enabled** check box. The port is the one that the LDAP server is using for SSL (636, for example). Click **Apply**.
    b. Click **Authentication Mechanisms > LTPA > Single SignOn (SSO)**. Type in a domain name (austin.ibm.com, for example). Click **Apply**.
11. Enable global security.
    a. Click **Security > Global Security**. Select the **Enabled** check box. Choose **LTPA** as the active authentication mechanism and **LDAP** as the active user registry. Click **Apply** and **Save**.

       Note: Verify that the security level for the LDAP server is set to HIGH. The default security level is HIGH (128-bit).
    b. Check the *LDAP_install_root*\etc\slapd32.conf file; verify that the ibm-slapdSSLCipherSpecs parameter has the value, 15360, instead of 12288.
    c. Restart the servers. Restarting the servers ensures that the security settings are synchronized between the deployment manager and the application servers.

You can test the configuration by accessing https://*fully_qualified_host_name*:9443/snoop. You are presented with a login challenge.

This test can be beneficial when using LDAP as your user registry. Sensitive information can flow between the WebSphere Application Server and the LDAP server, including passwords. Using SSL to encrypt the data protects this sensitive information.

1. If you are enabling security, make sure that you complete the remaining steps. As the final step, validate this configuration by clicking **OK** or **Apply** in the Global Security panel. Refer to the "Configuring global security" on page 145 article for detailed steps on enabling global security.
2. For changes in this panel to become effective, save, stop, and start all WebSphere Application Servers (cells, nodes and all the application servers).
3. After the server starts up, go through all the security-related tasks (getting users, getting groups, and so on) to make sure that the changes to the filters are functioning.

Changing the default Secure Sockets Layer repertoire key files

If you modify the default digital certificates in the key rings belonging to the node agent and the deployment managers or application servers, you must verify that the public certificate of the new certificate authority is added as a trust certificate in the key rings of all servers to which it needs to communicate. This action

includes modifying the certificates so they are issued from a different certificate authority (for example, if you use a commercial certificate authority).

Within a given cell, the:

- Deployment manager and node agents must be able communicate
- Node agents must be able to communicate to all servers within the node

If you modify the repertoire definitions, you must update the:

- System SSL repertoire used by HTTP
- System SSL repertoire used for Internet InterORB Protocol (IIOP) communications
- Java Secure Socket Extension (JSSE) repertoire used for the Simple Object Access Protocol (SOAP)/Java Management Extensions (JMX) connector (if applicable)

Configuring Secure Sockets Layer for Java client authentication

WebSphere Application Server supports Java client authentication using a digital certificate when the client attempts to make a Secure Sockets Layer (SSL) connection. The authentication occurs during an SSL handshake. The SSL handshake is a series of messages exchanged over the SSL protocol to negotiate for connection-specific protection. During the handshake, the secure server requests the client to send back a certificate or certificate chain for the authentication.

To configure SSL for Java client authentication, consider the following questions:

- Have you enabled security with your WebSphere Application Server? Refer to Configuring global security for more details.
- Have you configured z/OS Secure Authentication Services (z/SAS) or Common Secure Interoperability (CSI) authentication protocol for your target application server? Refer to "Configuring global security" on page 145 for more details.
- Have you configured your server to support secure transport for the inbound z/SAS or CSI authentication protocol?
- Have you configured your server to support client authentication at the transport layer for the inbound z/SAS or CSI authentication protocol?
- If you are using a self-signed personal certificate, have you exported the public certificate from the Service Access Facility (SAF)?
- If you are using a certificate authority (CA)-signed personal certificate, have you received the root certificate of the CA?
- If you are using a self-signed personal certificate, have you imported the public certificate into SAF as a signer certificate?
- If you are using a CA-signed (certificate authority) personal certificate, have you imported the CA root certificate into your target Java trust store file as a signer certificate?
- Does the common name (CN) specified in your personal certificate name exist in your configured user registry or is there a SAF mapping for the certificate?

If you answer yes to all of these questions, you can configure SSL for Java client authentication.

1. "Configuring Common Secure Interoperability Version 2 for Secure Sockets Layer client authentication" on page 327.
2. "Adding keystore files" on page 328.
3. "Adding truststore files" on page 328.
4. Save changes.
5. Restart the server if you have configured the server.

A secure client connects to a secure Internet InterORB Protocol (IIOP) server that requires client authentication at the transport layer.

If a connection problem occurs, you can set a Java property, `javax.net.debug=true`, before you run your client or your server to generate debugging information. See "Troubleshooting security configurations" on page 389 for further information about how to debug an IBM JSSE problem.

Configuring Common Secure Interoperability Version 2 for Secure Sockets Layer client authentication:

Configure the Secure Sockets Layer (SSL) client authentication using the `sas.client.props` configuration file or the administrative console. To configure a Java client application, use the `sas.client.props` configuration file. By default, the `sas.client.props` file is located in the `properties` directory under the <*install_root*> of your WebSphere Application Server installation.

To configure a WebSphere Application Server, use the administrative console. To start the administrative console, specify URL: `http://<server host_name>:9090/admin`.

To configure a Java client application, complete the following steps, which explain how to edit the `sas.client.props file`.

1. To require SSL client authentication, set property `com.ibm.CSI.performTLClientAuthenticationRequired=true`. Do not set this property unless you know your target server also supports SSL client authentication for the inbound CSI authentication protocol.
2. To support SSL client authentication, set the property `com.ibm.CSI.performTLClientAuthenticationSupported=true`.
3. Specify the com.ibm.CORBA.ConfigURL property with the fully qualified path of your Java property file when you run your application. For example, `file:/WebSphere/V5R0M0/AppServer`

To configure a WebSphere Application Server, complete the following steps

1. Start the administrative console.
2. Expand **Security** > **Authentication Protocol**.
3. Click **CSIv2 Inbound Authentication**.
4. Select **Supported** or **Required** for Client Certificate Authentication.
5. Click **OK**.
6. If you selected **Required** in step 4, configure the CSIv2 outbound authentication as well to support the client certificate authentication. Otherwise, you can skip this step. Click **CSIv2 Outbound Authentication** and select either **Supported** or **Required** for Client Certificate Authentication.
7. Click **CSIv2 Outbound Transport**. Select an SSL setting from the SSLSettings list for keystore, truststore, cryptographic token, SSL protocol, and ciphers use. Create an alias from the SSL Configuration Repertoires panel for an SSL setting. Update the SSL setting selected in CSIv2 Inbound Transport accordingly. (Note that the SSL repertoire chosen must be a system SSL repertoire for both inbound and outbound transport.)
8. Save your configuration.
9. Restart the server for the changes to become effective.

Client authentication using digital certificates is performed during SSL connection.

A secure client connects using SSL to a secure Internet InterORB Protocol (IIOP) server with client authentication at the transport layer.

Adding keystore files:

A keystore file contains both public keys and private keys. Public keys are stored as signer certificates while private keys are stored in the personal certificates. In WebSphere Application Server, adding keystore files to the configuration is different between client and server. For the client, a keystore file is added to a property file like `sas.client.props`. For the server, a keystore file is added through the WebSphere Application Server administrative console.

Before you add the keystore file to your configuration, consider the following questions:
- Is a self-signed or a certificate authority (CA)-signed personal certificate created in the keystore file?
- If you configure client authentication using digital certificates, is the public key of the signed personal certificate imported as a signer certificate into the server truststore file?

1. Add a keystore file into a client configuration by editing the `sas.client.props` file and setting the following properties:
   - **com.ibm.ssl.keyStoreType** for the keystore format. Range: JKS (default), PKCS12KS, JCEK, JCERACFKS.
   - **com.ibm.ssl.keyStore** for a fully qualified path to the keystore file. The keystore file contains private keys and sometimes public keys. For RACF key rings, com.ibm.ssl.keyStore should be set to `safkeyring:///`.
   - **com.ibm.ssl.keyStorePassword** for the password to access the keystore file. For RACF key rings, com.ibm.ssl.keyStorePassword should be set to `password`, and com.ibm.ssl.keyStoreType should be set to JCERACFKS if using a RACF key ring.
2. Add a keystore file into a server configuration:
   a. Start the WebSphere administrative console by specifying: http://*server_hostname*:9090/admin.
   b. Click **Security > SSL Configuration Repertoires**.
   c. Create a new Secure Sockets Layer (SSL) setting alias if one does not exist.
   d. **Click Security > SSL** and select **New JSSE Repertoire**.
   e. Select the alias that you want to add into the keystore file.
   f. Type in the Key File Name for the path of the keystore file. Type `safkeyring:///`*`your_keyring_name`* if you want to use certificates and keys contained in a RACK key ring.
   g. Type in the Key File Password for the password to access the keystore file. Type `password` if you are using a RACF key ring.
   h. Select the **Key File Format** for the keystore type. Range: JKS (default), PKCS12KS, or JCEK.
   i. Click **OK** and **Save** to save the configuration.

The SSL configuration alias now has a valid keystore file for an SSL connection.
- SSL connection for Internet InterORB Protocol (IIOP)
- SSL connection for Lightweight Directory Access Protocol (LDAP)
- SSL connection for Hypertext Transfer Protocol (HTTP)

Adding truststore files:

A *truststore file* is a key database file that contains public keys. The public key is stored as a signer certificate. The keys are used for a variety of purposes, including authentication and data integrity. In WebSphere Application Server, adding truststore files to the configuration is different between client and server. For the client, a truststore file is added to a property file, like `sas.client.props`. For the server, a truststore file is added through the WebSphere Application Server administrative console.

Before you add the truststore file to your configuration, ask the following questions:

- If you configure for client authentication using digital certificate, has the public key of the client personal certificate been imported as a signer certificate into the server truststore file?
- Does the truststore file contain all the required signer certificates with respect to the keystore files of the target servers?

1. Add a truststore file into a client configuration, by editing the `sas.client.props` file and setting the following properties:
   - **com.ibm.ssl.trustStoreType** for the truststore format. Range: JKS (default), PKCS12KS, JCEK, JCERACFKS. Use JCERACFKS if you are using a RACF key ring as the truststore.
   - **com.ibm.ssl.trustStore** for the name of the RACF key ring you want JSSE to use. Specify `safkeyring:///`.
   - **com.ibm.ssl.trustStorePassword** for the password to access the truststore file. The com.ibm.ssl.trustStorePassword property should be set to `password` if you are using a RACF key ring as a trust store.
2. Add a truststore file into a server configuration:
   a. Start the WebSphere administrative console by specifying : http://*server_host_name*:9090/admin.
   b. Click **Security > SSL**.
   c. Click **Security > SSL** and select **New JSSE Repertoire**.
   d. Create a new Secure Sockets Layer (SSL) setting alias if one does not exist.
   e. Select the alias that you want to add into the truststore file.
   f. Type the Trust File Name for the path of the truststore file. Type `safkeyring:///` if you are using a RACF key ring for the trust store.
   g. Type the Trust File Password for the password to access the truststore file. Type `password` if you are using a RACF key ring for the trust store.
   h. Select the Trust File Format for the truststore type. JKS (Default), PKCS12KS, JCEK.
   i. Click **OK** and **Save** to save the configuration.

The SSL configuration alias now contains a valid truststore file for an SSL connection.

- SSL connection for Internet InterORB Protocol (IIOP)
- SSL connection for Lightweight Directory Access Protocol (LDAP)
- SSL connection for Hypertext Transfer Protocol (HTTP)

Secure Sockets Layer configuration repertoire settings

Use this page to define a new Secure Sockets Layer (SSL) alias. Using the SSL configuration repertoire, administrators can define any number of SSL settings to use in configuring the Hypertext Transfer Protocol with SSL (HTTPS), Internet InterORB Protocol with SSL (IIOPS) or Lightweight Directory Access Protocol with SSL (LDAPS) connections. You can pick one of the SSL settings defined here from any location within the administrative console that supports SSL connections. This

flexibility simplifies the SSL configuration process because you can reuse many of these SSL configurations by specifying the alias in multiple places.

To view this administrative console page, click **Security** > **SSL**.

Click **New** to create a new SSL Configuration Repertoire alias.

Click **Delete** to remove an SSL Configuration Repertoire alias. If an SSL configuration alias is referenced in the configuration and is deleted here, then an SSL connection fails when the deleted alias is accessed.

Alias:

Specifies the name of the specific SSL setting.

On the WebSphere Application Server Network Deployment product installation, the default cell SSL alias is used for the HTTPS transport when creating a new server.

Type:

Specifies the type of repertoire configured for the alias listed.

The value is either SSSL for System Secure Sockets Layer repertoire or JSSE for Java Secure Sockets Extension repertoire.

Repertoire settings:

Use this page to configure the repertoire settings for the server.

To view this administrative console page, click **Security > SSL >***alias_name*.

Alias:

Specifies the name of the specific SSL setting

Data type: String

This field is used on the System SSL Repertoire and Java Secure Sockets Extension (JSSE) Repertoire panels.

Key File Name:

Specifies the fully qualified path to the SSL key file that contains public keys and private keys.

For JSSE SSL, the key file specifies the `keystore` file. The key file might also specify the System Authorization Facility (SAF) Key ring that contains certificates and keys. You can create a JSSE SSL keystore file by using the keytool utility found in the WebSphere `bin` directory. The key file contains certificates and keys.

For System SSL or JSSE, you can create an SSL key ring by using the Resource Access Control Facility (RACF) command, RACDCERT. Issue this command in your MVS environment, such as TSO READY or ISPF option 6. The key ring contains the private certificate of this server and certificates of trusted certificate authorities. The certificates for the trusted certificate authorities validate the client

certificates and other server certificates that are exchanged with this server during the SSL handshake. The repertoires that you define for a server require identical key file names.

Data type: String

Key File Password:

Specifies the password for accessing the SSL key file.

Data type: String

This field is used on the JSSE Repertoire panel.

Key File Format:

Specifies the format of the SSL key file.

Data type: String
Default: JKS
Range: JKS, JCEK, PKCS12

This field is used on the JSSE Repertoire panel.

Trust File Name:

Specifies the fully qualified path to a trust file containing the public keys.

You can create a trust file by using the keytool utility located in the WebSphere *bin* directory.

Unlike the SSL key file, no personal certificates are referenced; only signer certificates are retrieved. The default SSL trust files, `DummyClientTrustFile.jks` and `DummyServerTrustFile.jks`, contain multiple test public keys as signer certificates that can expire. The public key for the WebSphere Application Server Version 4.0 test certificates expires on January 15, 2004, and the public key for the WebSphere Application Server Version 5 test certificates and WebSphere Application Server CORBA C++ client expires on March 17, 2005. The test certificate is only intended for use in a test environment.

If a trust file is not specified but the SSL key file is specified, then the SSL key file is used for retrieval of signer certificates as well as personal certificates.

Data type: String

This field is used on the JSSE Repertoire panel.

Trust File Password:

Specifies the password for accessing the SSL trust file.

Data type: String

This field is used on the JSSE Repertoire panel.

Trust File Format:

Specifies the format of the SSL trust file.

Data type:	String
Default:	JKS
Range:	JKS, JCEK, PKCS12

This field is used on the JSSE Repertoire panel.

Client Authentication:

Specifies whether to request a certificate from the client for authentication purposes when making a connection.

When performing client authentication with the Internet InterORB Protocol (IIOP) for EJB requests, click **Security** > **Authentication Protocol** > **CSIv2 Inbound** or **Outbound Authentication** from the left navigation pane of the administrative console. Click **SSL Client Certificate Authentication** to enable it for these requests.

Data type:	Boolean
Default:	Disabled
Range:	Enabled or Disabled

This field is used on the System SSL Repertoire and JSSE Repertoire panels.

Security Level:

Specifies whether the server selects from a preconfigured set of security levels.

Data type:	Valid values include Low, Medium or High. • Low specifies only digital signing ciphers (no encryption) • Medium specifies only 40-bit ciphers (including digital signing) • High specifies only 128-bit ciphers (including digital signing). To specify all ciphers or any particular range, you can set the com.ibm.ssl.enabledCipherSuites property. See the SSL documentation for more information.
Default:	High
Range:	Low, Medium, or High

Note: The SOAP connector does not use security level.

This field is used on the System SSL Repertoire and Java Secure Sockets Extension (JSSE) Repertoire panels.

Cipher Suites:

Specifies a list of supported cipher suites that can be selected during the SSL handshake. If you select cipher suites individually here, you override the cipher suites set in the Security Level field.

Data type:	String
Default:	None

Note: The SOAP connector does not use cipher suites.

This field is used on the Java Secure Sockets Extension (JSSE) Repertoire panel.

Cryptographic Token:

Specifies whether the server enables or disables cryptographic hardware and software support. The SOAP connector does not use hardware cryptography.

Data type:	Boolean
Default:	Disabled
Range:	Enabled or Disabled

This field is used on the Java Secure Sockets Extension (JSSE) Repertoire panel.

V3 Timeout:

Specifies the length of time that a browser can reuse a System SSL Version 3 session ID without renegotiating encryption keys with the server.

The repertoires that you define for a server require the same V3 timeout value.

Data type	integer
Default	100
Range	1 to 86400

This field is used on the System SSL Repertoire panel.

Provider:

Refers to a package that supplies a concrete implementation of a subset of the cryptography aspects of the Java Security API.

If you select the first button, select a provider from the menu.

WebSphere Application Server has the IBMJSSE predefined provider.

Data type	integer
Default	100
Range	1 to 86400

This field is used on the Java Secure Sockets Extension (JSSE) Repertoire panel.

Protocol:

Specifies the SSL protocol that is used.

This field is used on the Java Secure Sockets Extension (JSSE) Repertoire panel.

Secure Sockets Layer settings for custom properties:

Use this page to configure additional Secure Sockets Layer (SSL) settings for a defined alias.

To view this administrative console page, click **Security** > **SSL** > *alias_name* > **Custom properties**.

Custom Properties:

Specifies the name-value pairs that you can use to configure additional SSL settings beyond those available in the `com.ibm.ssl.protocol` administrative interface.

This value is the SSL protocol used (including its version). The possible values are SSL, SSLv2, SSLv3, TLS, or TLSv1. The default value, SSL, is backward-compatible with the other SSL protocols.

com.ibm.ssl.keyStoreProvider
The name of the key store provider to use. Specify one of the security providers listed in your `java.security` file, which has a keystore implementation. The default value is IBMJCE.

com.ibm.ssl.keyManager
The name of the key management algorithm to use. Specify any key management algorithm that is implemented by one of the security providers listed in your `java.security` file. The default value is IbmX509.

com.ibm.ssl.trustStoreProvider
The name of the trust store provider to use. Specify one of the security providers listed in your `java.security` file, which has a truststore implementation. The default value is IBMJCE.

com.ibm.ssl.trustManager
The name of the trust management algorithm to use. Specify any trust management algorithm that is implemented by one of the security providers listed in your `java.security` file. The default value is IbmX509.

com.ibm.ssl.trustStoreType
The type or format of the truststore file. The possible values are JKS, PKCS12, JCEK. The default value is JKS.

com.ibm.ssl.enabledCipherSuites
The list of cipher suites to enable. By default, this is not set and the set of cipher suites used is determined by the value of the security level (high, medium, or low). A cipher suite is a combination of cryptographic algorithms used for an SSL connection. Enter a space-separated list of any of the following cipher suites:

- SSL_RSA_WITH_RC4_128_MD5
- SSL_RSA_WITH_RC4_128_SHA
- SSL_RSA_WITH_DES_CBC_SHA
- SSL_RSA_WITH_3DES_EDE_CBC_SHA
- SSL_DHE_RSA_WITH_DES_CBC_SHA
- SSL_DHE_RSA_WITH_3DES_EDE_CBC_SHA
- SSL_DHE_DSS_WITH_DES_CBC_SHA
- SSL_DHE_DSS_WITH_3DES_EDE_CBC_SHA
- SSL_RSA_EXPORT_WITH_RC4_40_MD5
- SSL_RSA_EXPORT_WITH_DES40_CBC_SHA
- SSL_RSA_EXPORT_WITH_RC2_CBC_40_MD5
- SSL_DHE_RSA_EXPORT_WITH_DES40_CBC_SHA

- SSL_DHE_DSS_EXPORT_WITH_DES40_CBC_SHA
- SSL_RSA_WITH_NULL_MD5
- SSL_RSA_WITH_NULL_SHA
- SSL_DH_anon_WITH_RC4_128_MD5
- SSL_DH_anon_WITH_DES_CBC_SHA
- SSL_DH_anon_WITH_3DES_EDE_CBC_SHA
- SSL_DH_anon_EXPORT_WITH_RC4_40_MD5
- SSL_DH_anon_EXPORT_WITH_DES40_CBC_SHA

Data type: String

Cryptographic token:

Specifies information about the cryptographic tokens related to SSL support.

A cryptographic token is a hardware or software device that has a built-in keystore implementation. Document the exact values for the following fields in the found in the literature of your supported cryptographic device.

Digital certificates

Certificates provide a way of authenticating users. Instead of requiring each participant in an application to authenticate every user, third-party authentication relies on the use of digital certificates.

A digital certificate is equivalent to an electronic ID card. It serves two purposes:
- Establishes the identity of the owner of the certificate
- Distributes the owner's public key

Certificates are issued by trusted parties, called *certificate authorities* (CAs). These authorities can be commercial ventures or they can be local entities, depending on the requirements of your application. Regardless, the CA is trusted to adequately authenticate users before issuing certificates. A CA issues certificates with digital signatures. When a user presents a certificate, the recipient of the certificate validates it by using the digital signature. If the digital signature validates the certificate, the certificate is recognized as intact and authentic. Participants in an application only need to validate certificates; they do not need to authenticate users. The fact that a user can present a valid certificate proves that the CA has authenticated the user. The descriptor, *trusted third-party*, indicates that the system relies on the trustworthiness of the CAs.

Contents of a digital certificate

A certificate contains several pieces of information, including information about the owner of the certificate and the issuing CA. Specifically, a certificate includes:
- The distinguished name (DN) of the owner. A DN is a unique identifier, a fully qualified name including not only the common name (CN) of the owner but the owner's organization and other distinguishing information.
- The public key of the owner.
- The date on which the certificate was issued.
- The date on which the certificate expires.
- The distinguished name of the issuing CA.
- The digital signature of the issuing CA. (The message-digest function is run over all the preceding fields.)

The core idea of a certificate is that a CA takes the owner's public key, signs the public key with its own private key, and returns the information to the owner as a

certificate. When the owner distributes the certificate to another party, it signs the certificate with its private key. The receiver can extract the certificate (containing the CA signature) with the owner's public key. By using the CA public key and the CA signature on the extracted certificate, the receiver can validate the CA signature. If it is valid, the public key used to extract the certificate is recognized as good. The owner signature is then validated, and if the validation succeeds, the owner is successfully authenticated to the receiver.

The additional information in a certificate helps an application decide whether to honor the certificate. With the expiration date, the application can determine if the certificate is still valid. With the name of the issuing CA, the application can check that the CA is considered trustworthy by the site.

A process that uses certificates must provide its personal certificate, the one containing its public key, and the certificate of the CA that signed its certificate, called a *signer certificate*. In cases where chains of trust are established, several signer certificates can be involved.

Requesting certificates

To get a certificate, send a certificate request to the CA. The certificate request includes:
- The distinguished name of the owner (the user for whom the certificate is requested).
- The public key of the owner.
- The digital signature of the owner.

The message-digest function is run over all these fields.

The CA verifies the signature with the public key in the request to ensure that the request is intact and authentic. The CA then authenticates the owner. Exactly what the authentication consists of depends on a prior agreement between the CA and the requesting organization. If the owner in the request is successfully authenticated, the CA issues a certificate for that owner.

Using certificates: Chain of trust and self-signed certificate

To verify the digital signature on a certificate, you must have the public key of the issuing CA. Because public keys are distributed in certificates, you must have a certificate for the issuing CA that is signed by the issuer. One CA can certify other CAs, so a chain of CAs can issue certificates for other CAs, all of whose public keys you need. Eventually, you reach a root CA that issues itself a self-signed certificate. To validate a user's certificate, you need certificates for all intervening participants, back to the root CA. Then you have the public keys you need to validate each certificate, including the user's.

A self-signed certificate contains the public key of the issuer and is signed with the private key. The digital signature is validated like any other, and if the certificate is valid, the public key it contains is used to check the validity of other certificates issued by the CA. However, anyone can generate a self-signed certificate. In fact, you can probably generate self-signed certificates for testing purposes before installing production certificates. The fact that a self-signed certificate contains a valid public key does not mean that the issuer is really a trusted certificate authority. To ensure that self-signed certificates are generated by trusted CAs, such certificates must be distributed by secure means (hand-delivered on floppy disks, downloaded from secure sites, and so on).

Applications that use certificates store these certificates in a *keystore* file. This file typically contains the necessary personal certificates, its signing certificates, and its private key. The private key is used by the application to create digital signatures. Servers always have personal certificates in their keystore files. A client requires a personal certificate only if the client must authenticate to the server when mutual authentication is enabled.

To allow a client to authenticate to a server, a server keystore file contains the private key and the certificate of the server and the certificates of its CA. A client truststore file must contain the signer certificates of the CAs of each server to which the client must authenticate.

If mutual authentication is needed, the client keystore file must contain the client private key and certificate. The server truststore file requires a copy of the certificate of the client CA.

Digital signatures:

A *digital signature* is a number attached to a document. For example, in an authentication system that uses public-key encryption, digital signatures are used to sign certificates.

This signature establishes the following information:
- The integrity of the message: Is the message intact? That is, has the message been modified between the time it was digitally signed and now?
- The identity of the signer of the message: Is the message authentic? That is, was the message actually signed by the user who claims to have signed it?

A digital signature is created in two steps. The first step distills the document into a large number. This number is the *digest code* or *fingerprint*. The digest code is then encrypted, resulting in the digital signature. The digital signature is appended to the document from which the digest code was generated.

Several options are available for generating the digest code. WebSphere Application Server supports the MD5 message digest function and the SHA1 secure hash algorithm, but these procedures reduce a message to a number. This process is not encryption, but a sophisticated checksum. The message cannot regenerate from the resulting digest code. The crucial aspect of distilling the document to a number is that if the message changes, even in a trivial way, a different digest code results. When the recipient gets a message and verifies the digest code by recomputing it, any changes in the document result in a mismatch between the stated and the computed digest codes.

To stop someone from intercepting a message, changing it, recomputing the digest code, and retransmitting the modified message and code, you need a way to verify the digest code as well. To verify the digest code, reverse the use of the public and private keys. For private communication, it makes no sense to encrypt messages with your private key; these keys can be decrypted by anyone with your public key. This technique can be useful for proving that a message came from you. No one can create it because no one else has your private key. If some meaningful message results from decrypting a document by using someone's public key, the decryption process verifies that the holder of the corresponding private key did encrypt the message.

The second step in creating a digital signature takes advantage of this reverse application of public and private keys. After a digest code is computed for a

document, the digest code is encrypted with the sender's private key. The result is the digital signature, which is attached to the end of the message.

When the message is received, the recipient follows these steps to verify the signature:
1. Recomputes the digest code for the message.
2. Decrypts the signature by using the sender's public key. This decryption yields the original digest code for the message.
3. Compares the original and recomputed digest codes. If these codes match, the message is both intact and authentic. If not, something has changed and the message is not to be trusted.

Public key cryptography:

All encryption systems rely on the concept of a key. A key is the basis for a transformation, usually mathematical, of an ordinary message into an unreadable message. For centuries, most encryption systems have relied on what is called private-key encryption. Only within the last 30 years has a challenge to private-key encryption appeared: public-key encryption.

Private key encryption

Private-key encryption systems use a single key that is shared between the sender and the receiver. Both must have the key; the sender encrypts the message by using the key, and the receiver decrypts the message with the same key. Both must keep the key private to keep their communication private. This kind of encryption has characteristics that make it unsuitable for widespread, general use:
- Private key encryption requires a key for every pair of individuals who need to communicate privately. The necessary number of keys rises dramatically as the number of participants increases.
- The fact that keys must be shared between pairs of communicators means the keys must somehow be distributed to the participants. The need to transmit secret keys makes them vulnerable to theft.
- Participants can communicate only by prior arrangement. There is no way to send a usable encrypted message to someone spontaneously. You and the other participant must make arrangements to communicate by sharing keys.

Private-key encryption is also called *symmetric encryption*, because the same key is used to encrypt and decrypt the message.

Public key encryption

Public-key encryption uses a pair of mathematically related keys. A message encrypted with the first key must be decrypted with the second key, and a message encrypted with the second key must be decrypted with the first key.

Each participant in a public-key system has a pair of keys. The private key is kept secret. The other key is distributed to anyone who wants it; this key is the public key.

To send an encrypted message to you, the sender encrypts the message by using your public key. When you receive the message, you decrypt it by using your private key. To send a message to someone, you encrypt the message by using the recipient's public key. The message can be decrypted with the recipient's private key only. This kind of encryption has characteristics that make it very suitable for general use:

- Public-key encryption requires only two keys per participant. The increase in the total number of keys is less dramatic as the number of participants increases, compared to private-key encryption.
- The need for secrecy is more easily met. Only the private key needs to be kept private and because it does not need to be shared, the private key is less vulnerable to theft in transmission than the shared key in a private-key system.
- Public keys can be published, which eliminates the need for prior sharing of a secret key before communication. Anyone who knows your public key can use it to send you a message that only you can read.

Public-key encryption is also called *asymmetric encryption*, because the same key cannot be used to encrypt and decrypt the message. Instead, one key of a pair is used to undo the work of the other. WebSphere Application Server uses the Rivest Shamir Adleman (RSA) public and private key-encryption algorithm.

With private-key encryption, you have to be careful of stolen or intercepted keys. In public-key encryption, where anyone can create a key pair and publish the public key, the challenge is in verifying that the owner of the public key is really the person you think it is. Nothing prevents a user from creating a key pair and publishing the public key under a false name. The listed owner of the public key cannot read messages encrypted with that key because the owner does not have the private key. If the creator of the false public key can intercept these messages, that person can decrypt and read messages intended for someone else. To counteract the potential for forged keys, public-key systems provide mechanisms for validating public keys and other information with digital signatures and digital certificates.

Troubleshooting secure sockets layer interoperability

The Secure Sockets Layer (SSL) protocol provides transport layer security: authenticity, integrity, and confidentiality, for a secure connection between a client and server in the WebSphere Application Server.

The following topics are addressed in this article:

- Interoperability issue might occur between WebSphere Application Server for z/OS and WebSphere Application Server when Secure Sockets Layer is supported, but not required

Interoperability issue might occur between WebSphere Application Server for z/OS and WebSphere Application Server when Secure Sockets Layer is supported, but not required

Symptom

An interoperability issue exists between WebSphere Application Server for z/OS and WebSphere Application Server when Secure Sockets Layer is supported, but not required.

Explanation

WebSphere Application Server sets an integrity required flag for the Common Secure Interoperability Version 2 (CSIv2) inbound configuration to true, by default, because Secure Sockets Layer (SSL) requires integrity at a minimum. However, WebSphere Application Server for z/OS interprets this flag as an SSL requirement.

Recommended response

In the `security.xml` file for WebSphere Application Server (not WebSphere Application Server for z/OS), change the following line from:

```
<CSI xmi:id="IIOPSecurityProtocol_1066667906706">
    <claims xmi:type="orb.securityprotocol:CommonSecureInterop"
    xmi:id="CommonSecureInterop_1066667906706" stateful="true">
            ...
        <requiredQOP xmi:type="orb.securityprotocol:TransportQOP"
        xmi:id="TransportQOP_1066667906706" establishTrustInClient="false"
        enableProtection="false" confidentiality="false" integrity="true"/>
            ...
    </claims>
```

to

```
<CSI xmi:id="IIOPSecurityProtocol_1066667906706">
    <claims xmi:type="orb.securityprotocol:CommonSecureInterop"
    xmi:id="CommonSecureInterop_1066667906706" stateful="true">
            ...
        <requiredQOP xmi:type="orb.securityprotocol:TransportQOP"
        xmi:id="TransportQOP_1066667906706" establishTrustInClient="false"
        enableProtection="false" confidentiality="false" integrity="false"/>
            ...
    </claims>
```

You also can make the previous change using the WebSphere Application Server administrative scripting commands.

Configuring to use cryptographic tokens

You can configure cryptographic token support in both client and server configuration. To configure a Java client application, use the `sas.client.props` configuration file. By default, the `sas.client.props` is located in the `properties` directory under the *<install_root>* of your WebSphere Application Server installation. To configure a WebSphere Application Server, use the administrative console. To start the administrative console, specify URL: `http://<server_hostname>:9090/admin`.

Unzip the *install_root*`/web/docs/jsse/native-support.zip` file and copy the correct libraries, with respect to target operating system, to the appropriate location. Otherwise, link errors might occur at run time, or the key management tool might not work properly with the cryptographic device library.

Follow the documentation that accompanies your device to install your cryptographic device. Installation instructions for IBM cryptographic hardware devices can be found in the Administration section of Resources for learning.

1. To configure a client to use a cryptographic token, edit the `sas.client.props` file and set the following properties. Leave the **KeyStore File Name**, **KeyStore File Password**, **TrustStore File Name**, **TrustStore File Password** fields in a Secure Sockets Layer (SSL) configuration blank, if you want to use only cryptographic tokens as your keystore.

   com.ibm.ssl.tokenType
   Specifies the type of built-in keystore file that is implemented in the cryptographic token. The valid values are: **PKCS\#7**, **PKCS\#12**, and **MSCAPI**.

   com.ibm.ssl.tokenLibraryFile
   Specifies the token file name for **PKCS#7** tokens, **PKCS#12** tokens, and the library name for MSCAPI tokens. Make sure the cryptographic token device is installed and functions properly with a cryptographic

token created. Unzip the `native-support.zip` file from *install_root*`/web/docs/jsse` directory to copy the required libraries with respect to the target operating system.

com.ibm.ssl.tokenPassword
Specifies the password to unlock the cryptographic token.

2. Configure your server to use the cryptographic device. Leave the **KeyStore File Name**, **KeyStore File Password**, **TrustStore File Name**, **TrustStore File Password** fields in an SSL configuration blank, if you want to use only cryptographic tokens as your keystore. You can modify an existing configuration if you click **Security > SSL >** *alias*. You must specify an alias and select the **Cryptographic token** option. If you are using the default cryptographic device, unzip the `native-support.zip` file from *install_root*`/web/docs/jsse` directory to copy the required libraries with respect to the target operating system. The following directions explain how to configure WebSphere Application Server for a new cryptographic device.
   a. Specify `http://`*server_hostname*`:9090/admin` to start the administrative console.
   b. Click **Security > SSL** to open the SSL Configuration Repertoires panel.
   c. Click **New** to create a new SSL setting alias if you do not want to use the default.
   d. Specify an alias name in the **alias** field for the new cryptographic device After you configure the cryptographic device, this alias appears on the **Security > SSL** panel and in the **Authentication protocol > SAS outbound transport** list.
   e. Select **Cryptographic token** and click **OK**. The **SAS outbound transport** panel opens.
   f. Complete the information for **Token Type** to specify the type of built-in keystore file that is implemented in the cryptographic token. The valid values are: **PKCS#7**, **PKCS#12**,or **MSCAPI**.
   g. Complete the information for **Library File** to specify the path to the cryptographic device driver. Make sure the cryptographic token device is installed and functions properly with a new cryptographic token.
   h. Complete the information for **Password** to specify the password for unlocking the cryptographic device.
   i. Click **Apply** and **OK**. WebSphere Application Server displays the **Authentication protocol > SAS outbound transport** list.
   j. Select the appropriate cryptographic device from the SSLSettings menu.

The configuration is enabled to support the specified cryptographic token for and SSL connection.

WebSphere Application Server uses the cryptographic token as a keystore file for and SSL connection.

If the server configuration has changed, restart the configured server.

Using Java Secure Socket Extension and Java Cryptography Extension with Servlets and enterprise bean files

Java Secure Socket Extension

Java Secure Socket Extension (JSSE) provides the transport security for WebSphere Application Server. It provides application programming interface (API) framework

and the implementation of the APIs, for Secure Sockets Layer (SSL) and Transport Layer Security (TLS) protocols, including functionality for data encryption, message integrity and authentication. With the JSSE APIs, other SSL or TLS protocols, and Public Key Infrastructure (PKI), implementations can plug in.

IBM Java Secure Socket Extension

The WebSphere Application Server uses the IBMJSSE provider, which is pre-installed and pre-registered with the Java Cryptography Architecture (JCA) of the Java 2 platform. IBMJSSE supports the following cryptographic services:
- Rivest Shamir Adleman (RSA) public key cryptography support
- SSL and TLS security protocols and common cipher suites
- X.509-based key and trust managers

The IBMJSSE provider is pre-registered in the `java.security` properties file located at *`install_root`*`/java/jre/lib/security` directory. It also supports PKCS#7, and PKCS#12 for cryptographic token support.

Note: The IBM Java Secure Socket Extension (JSSE) is currently not supported within applets. The IBM JSSE is not available on the HP-UX platform. On the HP-UX platform, you must use the Sun JSSE instead.

Customizing Java Secure Socket Extension

Note: Make sure you understand the implication to your application before you begin customizing.

You can customize a number of aspects of JSSE by plugging in different implementations of Cryptography Package Provider, X509Certificate and HTTPS protocols, or specifying different default keystore files, key manager factories and trust manager factories. A provided table summarizes which aspects can be customized, what the defaults are, and which mechanisms are used to provide customization. Some of the key customizable aspects follow:

Customizable item	Default	How to customize
X509Certificate	X509Certificate implementation from IBM	cert.provider.x509v1 security property
HTTPS protocol	Implementation from IBM	java.protocol.handler.pkgs system property
Cryptography Package Provider	IBMJSSE	A security.provider.n= line in security properties file. See description.
Default keystore	None	* javax.net.ssl.keyStore system property
Default truststore	jssecacerts, if it exists. Otherwise, cacerts	* javax.net.ssl.trustStore system property
Default key manager factory	`IbmX509`	ssl.KeyManagerFactory.algorithm security property
Default trust manager factory	`IbmX509`	ssl.TrustManagerFactory.algorithm security property

For aspects that you can customize by setting a system property, statically set the system property by using the `-D` option of the Java command (you can set the system property using the administrative console), or set the system property

dynamically by calling the java.lang.System.setProperty method in your code: System.setProperty(propertyName,"propertyValue").

For aspects that you can customize by setting a Java security property, statically specify a security property value in the java.security properties file located in the *install_root*/java/jre/lib/security directory. The security property is propertyName=propertyValue. Dynamically set the Java security property by calling the java.security.Security.setProperty method in your code.

Application Programming Interface

The JSSE provides a standard application programming interface (API) available in packages of the javax.net file, javax.net.ssl file, and the javax.security.cert file. The APIs cover:

- Sockets and SSL sockets
- Factories to create the sockets and SSL sockets
- Secure socket context that acts as a factory for secure socket factories
- Key and trust manager interfaces
- Secure HTTP UTL connection classes
- Public key certificate API

Samples using Java Secure Socket Extension

The Java Secure Socket Extension (JSSE) also provides samples to demonstrate its functionality. The samples are included in *install_root*/web/docs/jsse/samplejsse.jar. Unzip the file. The following files display:

Files	Description
ClientJsse.java	Demonstrates a simple client and server interaction using JSSE. All enabled cipher suites are used.
ClientJsseProvider.java	Demonstrates a simple client and server interaction using JSSE. All enabled cipher suites are used.
ServerJsse.java ServerJsseProvider.java OldClientJsse.java	Demonstrates a simple client and server interaction using JSSE. All enabled cipher suites are used.
OldServerJsse.java	Back-level samples
ServerPKCS12Jsse.java	Demonstrates a simple client and server interaction using JSSE with the PKCS12 keystore file. All enabled cipher suites are used.
ClientPKCS12Jsse.java	Demonstrates a simple client and server interaction using JSSE with the PKCS12 keystore file. All enabled cipher suites are used.
OldClientPKCS12Jsse.java	Back-level samples
OldServerPKCS12Jsse.java	Back-level samples

Files	Description
`UseHttps.java`	Demonstrates accessing an SSL or non-SSL Web server using the Java protocol handler of the`com.ibm.net.ssl.www.protocol` class. The URL is specified with the `http` or `https` prefix. The HTML returned from this site displays.
`HTTPTest.java`	Demonstrates accessing an SSL or non-SSL Web server using the Java protocol handler of the `com.ibm.net.ssl.www.protocol` class. The URL is specified with the `http` or `https` prefix. The HTML returned from this site is displayed.
`HTTPSPanel.java` `OldHTTPTest.java`	Back-level sample

See more instructions in the source code. Follow these instructions before you run the samples.

Permissions for Java 2 security

You might need the following permissions to run an application with JSSE: (This is a reference list only.)
- java.util.PropertyPermission ″java.protocol.handler.pkgs″, ″write″
- java.lang.RuntimePermission ″writeFileDescriptor″
- java.lang.RuntimePermission ″readFileDescriptor″
- java.lang.RuntimePermission ″accessClassInPackage.sun.security.x509″
- java.io.FilePermission ″${user.install.root}${/}etc${/}.keystore″, ″read″
- java.io.FilePermission ″${user.install.root}${/}etc${/}.truststore″, ″read″

For the IBMJSSE provider:
- java.security.SecurityPermission ″putProviderProperty.IBMJSSE″
- java.security.SecurityPermission ″insertProvider.IBMJSSE″

For the SUNJSSE provider:
- java.security.SecurityPermission ″putProviderProperty.SunJSSE″
- java.security.SecurityPermission ″insertProvider.SunJSSE″

Debugging

By configuring through the `javax.net.debug` system property, JSSE provides the following dynamic debug tracing: `-Djavax.net.debug=true`.

A value of **true** turns on the trace facility. Use the administrative console to set the system property for debugging the application server.

The trace is logged in the `SDSF Active Log` file for the application server or in the file specified by a system property, `DtraceFileName` for a Java client application.

Documentation

See the “Security: Resources for learning” on page 407 article for documentation references to JSSE.

JCE

Java Cryptography Extension (JCE) provides cryptographic, key and hash algorithms for WebSphere Application Server. It provides a framework and implementations for encryption, key generation, key agreement, and Message Authentication Code (MAC) algorithms. Support for encryption includes symmetric, asymmetric, block and stream ciphers.

IBMJCE

The IBM Java Cryptography Extension (JCE) is an implementation of the JCE cryptographic service provider used in WebSphere Application Server. The IBMJCE is similar to SunJCE, except that the IBMJCE offers more algorithms:

- Cipher algorithm
- Signature algorithm
- Message digest algorithm
- Message authentication code
- Key agreement algorithm
- Random number generation algorithm
- Key store

The IBMJCE is also moving `com.sun.crypto.provider.*` packages to `com.ibm.crypto.provider.*` packages.

The IBM JCE is not available on the HP-UX platform. On the HP-UX platform, you must use the Sun JCE instead.

Implementing a Java Cryptography Extension cryptographic service provider

A Cryptographic Service Provider, or *provider*, refers to a package (or a set of packages) that supply a concrete implementation of a subset of the cryptography aspects of the Java Security API. A provider can contain an implementation of one or more digital signature algorithms and one or more cipher algorithms. Complete the following steps to implement and integrate a JCE provider:

1. Write your service implementation code.
2. Give your provider a name.
3. Write your *Master Class*, a subclass of your provider.
4. Compile your code.
5. Prepare for testing.
6. Write and compile test programs.
7. Run your test programs.
8. Document your provider and its supported services.
9. Prepare for production.
10. Run your test programs again.
11. Make your provider software and documentation available to clients.

Application Programming Interface

Java Cryptography Extension (JCE) has a provider-based architecture. Providers can be plugged into the JCE framework by implementing the APIs defined by the JCE. The JCE APIs covers:

- Symmetric bulk encryption, such as DES, RC2, and IDEA
- Symmetric stream encryption, such as RC4

- Asymmetric encryption, such as RSA
- Password-based encryption (PBE)
- Key Agreement
- Message Authentication Codes

Samples using Java Cryptography Extension

There are samples provided in `SampleJCE.jar` file located in the *install_root*`/web/docs/jce` directory. Unzip the file. The following source code displays:

File	Description
`SampleDSASignature.java`	Demonstrates how to generate a pair of DSA keys (a public key and a private key) and use the key to digitally sign a message using the SHA1with DSA algorithm
`SampleMarsCrypto.java`	Demonstrates how to generate a Mars secret key, and how to do Mars encryption and decryption
`SampleMessageDigests.java`	Demonstrates how to use the message digest for MD2 and MD5 algorithms
`SampleRSACrypto.java`	Demonstrates how to generate an RSA key pair, and how to do RSA encryption and decryption
`SampleRSASignatures.java`	Demonstrates how to generate a pair of RSA keys (a public key and a private key) and use the key to digitally sign a message using the SHA1withRSA algorithm
`SampleX509Verification.java`	Demonstrates how to verify X509 Certificates

Documentation

Refer to the "Security: Resources for learning" on page 407 for documentation on JCE.

Java 2 security

Java 2 security provides a policy-based, fine-grain access control mechanism that increases overall system integrity by checking for permissions before allowing access to certain protected system resources. Java 2 security guards access to system resources such as file I/O, sockets, and properties. J2EE security guards access to Web resources such as servlets, JavaServer pages (JSPs) and EJB methods. WebSphere global security includes J2EE role-based authorization, the Common Secure Interoperability Version 2 (CSIv2) authentication protocol, and Secure Sockets Layer (SSL) configuration. Java 2 security is enabled by default. When the security manager detects unauthorized attempts to access system resources, `java.security.AccessControlException` Java 2 security exceptions are thrown and logged in the `SystemOut.log` file.

Since Java 2 security is relatively new, many existing or even new applications might not be prepared for the very fine-grain access control programming model that Java 2 security is capable of enforcing. Administrators should understand the

possible consequences of enabling Java 2 security if applications are not prepared for Java 2 security. Java 2 security places some new requirements on application developers and administrators.

Java 2 security for deployers and administrators

Although Java 2 security is supported in WebSphere Application Server Version 5, it is disabled by default. However, it is enabled automatically if you also enable global security when configuring security. Although it becomes enabled automatically when you enable WebSphere global security, you can choose to disable it. You can configure Java 2 security and global security independently of one another. Disabling global security does not disable Java 2 security automatically. You need to explicitly disable it.

If your applications, or third-party libraries are not ready, having Java 2 security enabled causes problems. You can identify these problems as Java 2 security AccessControlExceptions in the `SystemOut.log` file, `SystemError.log` file, or the trace log files. If you are unsure about the Java 2 security readiness of your applications, disable Java 2 security initially to get your application installed and verify that it is working properly.

There are implications if Java 2 Security is enabled; deployers or administrators are required to make sure that all the applications are granted the required permissions, otherwise, applications might fail to run. By default, applications are granted the permissions recommended in the J2EE 1.3 Specification. For details of default permissions granted to applications in the product, refer to the following policy files:

- *install_root*`/java/jre/lib/security/java.policy`
- *install_root*`/properties/server.policy`
- *install_root*`/config/cells/`*<cell name>*`/nodes/`*<node_name>*`/app.policy`

Note: This policy embodied by these policy files cannot be made more restrictive because the product might not have the necessary Java 2 security doPrivileged APIs in place. The restrictive policy is the default policy. You can grant additional permissions, but you cannot make the default more restrictive because AccessControlExceptions is generated from within WebSphere Application Server. The product does not support a more restrictive policy than the default defined in the policy files previously mentioned.

There are several policy files used to define the security policy for the Java process. These policy files are static (code base is defined in the policy file) and they are in the default policy format provided by the IBM Developer Kit, Java Technology Edition. For enterprise application resources and utility libraries, WebSphere Application Server provides dynamic policy support. The code base is dynamically calculated based on deployment information and permissions are granted based on template policy files during run time. Refer to the section of Java 2 security policy management.

Note: Syntax errors in the policy files cause the application server process to fail. Edit these policy files carefully using the Policy Tool provided by the IBM Developer Kit, Java Technology Edition for editing the policy files (*install_root*`/java/jre/bin/policytool`).

If an application is not prepared for Java 2 security, if the application provider does not provide a `was.policy` file as part of the application, or if the application

provider does not communicate the expected permissions the application is likely to cause Java 2 security access control exceptions at run time. It might not be obvious that an application is not prepared for Java 2 security. Several run-time debugging aids help troubleshoot applications that might have access control exceptions. See the Java 2 security debugging aids for more details. See Handling applications that are not Java 2 security ready for information and strategies for dealing with such applications.

It is important to note that when Java 2 Security is enabled in the Global Security settings, the installed SecurityManager does not currently check modifyThread and modifyThreadGroup permissions for non-system threads.Allowing Web and EJB application code to create or modify a thread can have a negative impact on other components of the container and can affect the capability of the container to manage enterprise bean life cycles and transactions.

Java 2 security for application developers

Application developers must understand the permissions granted in the default WebSphere policy and the permission requirements of the SDK APIs that their application calls to know whether additional permissions are required. The ″Permissions in the Java 2 SDK″ reference in the resources section describes which APIs require which permission.

Application providers can assume that applications have the permissions granted in the default policy previously mentioned. Applications that access resources not covered by the default WebSphere policy are required to grant the additional Java 2 security permissions to the application.

While it is possible to grant the application additional permissions in one of the other dynamic WebSphere policy files or in one of the more traditional static policy files, such as `java.policy`, the `was.policy` (which is embedded in the EAR file) ensures the additional permissions are scoped to the exact application that requires them. Scoping the permission beyond the application code that requires it can permit code that normally does not have permission to access particular resources.

If an application component is being developed, like a library that might actually be included in more than one `.ear` file, then the library developer should document the required Java 2 permissions needed by the application assembler. There is no `was.policy` file for library type components. The developer must communicate the required permissions through Javadoc or some other external documentation.

If the component library is shared by multiple enterprise applications, the permissions can be granted to all enterprise applications on the node in the `app.policy` file.

If the permission is only used internally by the component library and the application should never be granted access to resources protected by the permission, then it might be necessary to mark the code as **privileged** (inserting doPrivileged). Refer to the article, AccessControlException, for more details. However, improperly inserting a doPrivileged might open up security holes. Understand the implication of doPrivileged to make a correct judgement whether a doPrivileged should be inserted or not.

The section on Dynamic Policy describes how the permissions in the `was.policy` files are granted at run time.

Developing an application with Java 2 security in mind might be a new skill and impose a security awareness not previously required of application developers. Describing the Java 2 security model and the implications on application development is beyond the scope of this section. The following URL can help you get started: `http://java.sun.com/j2se/1.3/docs/guide/security/index.html`.

Debugging Aids

There are two primary aids, the WebSphere `SystemOut.log` file and the com.ibm.websphere.java2secman.norethrow property.

The WebSphere SystemOut.log File

The AccessControl exception logged in the `SystemOut.log` file contains the permission violation that causes the exception, the exception call stack, and the permissions granted to each stack frame. This information is usually enough to determine the missing permission and the code requiring the permission.

The com.ibm.websphere.java2secman.norethrow Property

When Java 2 security is enabled in WebSphere Application Server, the security manager component throws a java.security.AccessControl exception when a permission violation occurs. This exception, if not handled, often causes a run-time failure. This exception is also logged in the `SystemOut.log` file.

However, when the JVM com.ibm.websphere.java2secman.norethrow property is set and has a value of **true**, the security manager does not throw the AccessControl exception. This information is logged.

To set the `com.ibm.websphere.java2secman.norethrow` property for the server, go to the WebSphere Application Server administrative console and click **Servers > Application Servers**. Under Additional Properties, click **Process Definition > Java Virtual Machine > Custom Properties > New**. In the Name field, type **com.ibm.websphere.java2secman.norethrow**. In the Value field, type **true**.

To set the `com.ibm.websphere.java2secman.norethrow` property for the node agent, go to the WebSphere Application Server administrative console and click **System Administration > Node Agents**. Under Additional Properties, click **Process Definition > Java Virtual Machine > Custom Properties > New**. In the Name field, type **com.ibm.websphere.java2secman.norethrow**. In the Value field, type **true**.

To set the `com.ibm.websphere.java2secman.norethrow` property for the deployment manager, go to the WebSphere Application Server administrative console and click **System Administration > Deployment Manager**. Under Additional Properties, click **Process Definition > Java Virtual Machine > Custom Properties > New**. In the Name field, type **com.ibm.websphere.java2secman.norethrow**. In the Value field, type **true**.

Note: This property is intended for a sandbox or debug environment because it instructs the security manager not to throw the AccessControl exception. Java 2 security is not enforced. This property should not be used in a production environment where a relaxed Java 2 security environment weakens the integrity that Java 2 security is intended to produce.

This property is valuable in a sandbox or test environment where the application can be thoroughly tested and the where the SystemOut.log file can be inspected for AccessControl exceptions. Since this property does not throw the AccessControl exception , it does not propagate the call stack and does not cause a failure. Without this property, you have to find and fix AccessControl exceptions one at a time.

Handling applications that are not Java 2 security ready

If the increased system integrity that Java 2 security provides is important, then contact the application provider to have the application support Java 2 security or at least communicate the required additional permissions beyond the default WebSphere policy that must be granted.

The easiest way to deal with such applications is to disable Java 2 security in WebSphere Application Server. The downside is that this solution applies to the entire system and the integrity of the system is not as strong as it might be. Disabling Java 2 security might not be acceptable depending on the organization security policies or risk tolerances.

Another approach is to leave Java 2 security enabled, but to grant either just enough additional permissions or grant all permissions to just the problematic application. Granting permissions however, might not be a trivial thing to do. If the application provider has not communicated the required permissions in some way, there is no easy way to determine what the required permissions are and granting all permissions might be the only choice. You minimize this risk by locating this application on a different node, which might help isolate it from certain resources. Grant the java.security.AllPermission permission in the was.policy file embedded in the application's .ear file, for example:

```
grant codeBase "file:${application}" {
            permission java.security.AllPermission;
        };
```

install_root/**properties/server.policy**

This policy defines the policy for the WebSphere classes. At present, all the server processes on the same installation share the same server.policy file. However, you can configure this file so that each server process can have a separate server.policy file. Define the desired policy file as the value of the Java system properties java.security.policy. For details of how to define Java system properties, Refer to the Process definition section of the Manage application servers file.

The server.policy file is not a configuration file managed by the repository and the file replication service. Changes to this file are local and do not get replicated to other machines. Use the server.policy file to define Java 2 security policy for server resources. Use the app.policy file (per node) or was.policy file (per enterprise application) to define Java 2 security policy for enterprise application resources.

WAS_HOME/**java/jre/lib/security/java.policy**

The file represents the default permissions granted to all classes. The policy of this file applies to all the processes launched by the WebSphere Application Server JVM.

Troubleshooting

Symptom:

`Error message SECJ0314E`: Current Java 2 security policy reported a potential violation of Java 2 security permission. Refer to Problem Determination Guide for further information.{0}Permission\:{1}Code\:{2}{3}Stack Trace\:{4}Code Base Location\:{5} Current Java 2 security policy reported a potential violation of Java 2 Security Permission. Refer to Problem Determination Guide for further information.{0}Permission\:{1}Code\:{2}{3}Stack Trace\:{4}Code Base Location\:{5}

Problem:

The Java security manager checkPermission() reported a SecurityException on the subject permission with debugging information. The reported information can be different with respect to the system configuration. This report is enabled by either configuring RAS trace into debug mode or specifying a Java property. Specify the following property in the JVM Settings panel from the administrative console: **java.security.debug**. Valid values include:

access Print all debug information including: required permission, code, stack, and code base location.

stack Print debug information including: required permission, code, and stack.

failure
Print debug information including: required permission and code.

Recommended response:

The reported exception might be critical to the secure system. Turn on security trace to determine the potential code that might have violated the security policy. Once the violating code is determined, verify if the attempted operation is permitted with respect to Java 2 security, by examining all applicable Java 2 security policy files and the application code.

Note: If the application is running with Java Mail, this message might be benign. User can update the `was.policy` file to grant the following permissions to the application.

```
permission java.io.FilePermission "${user.home}${/}.mailcap", "read";
permission java.io.FilePermission "${user.home}${/}.mime.types", "read";
permission java.io.FilePermission "${java.home}${/}lib${/}mailcap", "read";
permission java.io.FilePermission "${java.home}${/}lib${/}mime.types", "read";
```

Messages

Message:	`SECJ0313E`: Java 2 security manager debug message flags are initialized\: TrDebug: {0}, Access: {1}, Stack: {2}, Failure: {3}
Problem:	Configured values of the valid debug message flags for security manager.
Recommended response:	None.

Message:	`SECJ0307E`: Unexpected exception is caught when trying to determine the code base location. Exception: {0}

Problem:	An unexpected exception is caught when the code base location is determined.
Recommended response:	Contact an IBM representative.

AccessControlException

The Java 2 security behavior is specified by its *security policy*. The security policy is an access-control matrix that specifies which system resources certain code bases can access and who must sign them. The Java 2 Security policy is declarative and it is enforced by the java.security.AccessController.checkPermission() method.

The following example depicts the algorithm for the *java.security.AccessController.checkPermission()* method. For the complete algorithm, refer to the Java 2 security check permission algorithm in Resources for learning.

```
i = m;
while (i > 0) {
 if (caller i's domain does not have the permission)
  throw AccessControlException;
 else if (caller i is marked as privileged)
  return;
 i = i - 1;
};
```

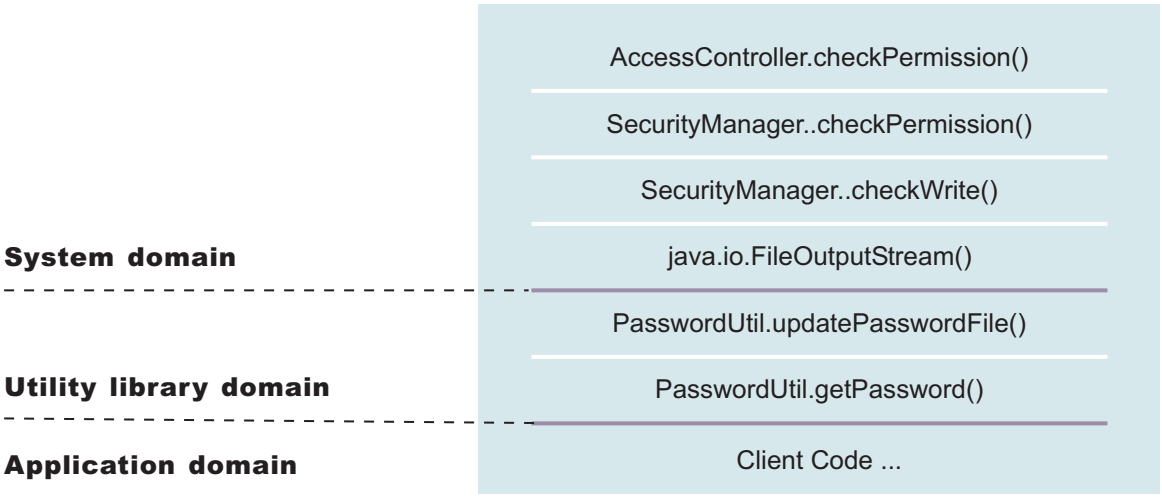
The algorithm requires that all the classes or callers on the call stack have the permissions when a java.security.AccessController.checkPermission() is performed or the request is denied (a java.security.AccessControlException is thrown). However, if the caller is marked as *privileged* and the class (caller) is granted the said permissions, the algorithm returns and does not walk the entire call stack. Subsequent classes (callers) do not need the required permission granted.

A java.security.AccessControlException exception is thrown as a result of certain classes on the call stack missing the required permissions during a java.security.AccessController.checkPermission() method. Two possible resolutions to the java.security.AccessControlException exception:

- If the application is calling a Java 2 security-protected API, then grant the required permission to the application Java 2 Security policy. If the application is not calling a Java 2 security-protected API directly and the required permission is because of the side-effect of the third-party APIs accessing Java 2 security-protected resources.
- If the application is granted the required permission, it gains more access than it should. In this case, it is likely that the third party code that accesses the Java 2 Security protected resource is not properly mark as *privileged*.

Example call stack

This example of a call stack indicates where application code is using a third-party API utility library to update the password. The following is only an example to illustrate the point. The decision as to where to mark the code as *privileged* is application-specific and is unique in every situation. This decision requires great depth of domain knowledge and security expertise to make the correct judgement. There are a number of well written publications and books on this topic. Referencing these materials for more detailed information is recommended.



You can use the `PasswordUtil` utility to change the password of a user. The types in the old password and the new password twice to ensure that the correct password is entered. If the old password matches the one stored in the password file, the new password is stored and the password file updates. Assume that none of the stack frame is marked as *privileged*. According to the `java.security.AccessController.checkPermission()` algorithm, the application fails unless all the classes on the call stack are granted *write* permission to the password file. The client application should not have permission to write to the password file directly and update the password file at will.

However, if the `PasswordUtil.updatePasswordFile()` method marks the code that accesses the password file as *privileged*, then the check permission algorithm does not check for the required permission from classes that call the `PasswordUtil.updatePasswordFile()` method for the required permission as long as the `PasswordUtil` class is granted the permission. Then the client application can successfully update a password without granting the permission to write to the password file.

The ability to mark code *privileged* is very flexible and powerful. If this ability is used incorrectly, the overall security of the system can be compromised and security holes can be exposed. Use the ability to mark code `privileged` carefully.

Resolution to java.security.AccessControlException

As described previously, there are two possibilities to resolve a `java.security.AccessControlException` exception. Judge these exceptions individually to decide which of the following resolutions is best:
1. Grant the missing permission to the application.
2. Mark some code as *privileged* (considering the concerns and risks).

Configuring Java 2 security

Java 2 security is a new feature in WebSphere Application Server Version 5. It is a new programming model that is very pervasive and has a huge impact on application development. It is disabled by default, but is enabled automatically when global security is enabled. However, Java 2 security is orthogonal to J2EE role-based security; you can disable or enable it independently of Global Security.

However, it does provide an extra level of access control protection on top of the J2EE role-based authorization. It particularly addresses the protection of system resources and APIs. Administrators should need to consider the benefits against the risks of disabling Java 2 Security.

The following recommendations are provided to help enable Java 2 security in a test or production environment:

1. Make sure the application is developed with the Java 2 security programming model in mind. Developers have to know whether or not the APIs used in the applications are protected by Java 2 security. It is very important that the required permissions for the APIs used are declared in the policy file (*was.policy*), or the application fails to run when Java 2 security is enabled. Developers can reference the Web site for Development Kit APIs that are protected by Java 2 security. See the Programming model and decisions section of the "Security: Resources for learning" on page 407 article to visit this Web site.
2. Make sure that migrated applications from previous releases are given the required permissions. Since Java 2 security is not supported or partially supported in previous WebSphere Application Server releases, applications developed prior to Version 5 most likely are not using the Java 2 security programming model. There is no easy way to find out all the required permissions for the application. Following are activities you can perform to determine the extra permissions required by an application:
   - Code review and code inspection
   - Application documentation review
   - Sandbox testing of migrated enterprise applications with Java 2 security enabled in a pre-production environment. Enable tracing in WebSphere Java 2 security manager to help determine the missing permissions in the application policy file. The trace specification is `com.ibm.ws.security.core.SecurityManager=all=enabled`.
   - Use the `com.ibm.websphere.java2secman.norethrow` system property to aid debuggging. This property should not be used in a production environment. Refer to "Java 2 security" on page 346.

Note: The default permission set for applications is the recommended permission set defined in the J2EE 1.3 Specification. The default is declared in the `config/cells/<cell_name>/nodes/<node_name>/app.policy` policy file with permissions defined in the Development Kit (`${JAVA_HOME}/lib/security/java.policy`) policy file that grant permissions to everyone. However, applications are denied permissions declared in the `config/cells/cell_name/filter.policy` filter policy file. Permissions declared in the *filter.policy* file are filtered for applications during the permission check.

Note: Define the required permissions for an application in a `was.policy` file and embed the `was.policy` file in the application enterprise archive (EAR) file as *YOURAPP.ear/META-INF/was.policy* (see "Configuring Java 2 security policy files" on page 362 for details).

Enable or disable Java 2 Security for the cell

1. Click **Security > Global Security** in the navigation tree. The Global Security page appears.
2. Enable Java 2 Security by selecting the check box labeled **Enforce Java 2 Security** (clear the check box to disable Java 2 Security). This enables Java 2 Security for the cell.

3. Click **OK** or **Apply** on the Global Security page.
4. Save the changes and make sure a file sync is performed before restarting the servers.
5. For the changes to take effect, restart all the servers, which include the Network Deployment Manager, all Node Agents, and all application servers.

Enable or disable Java 2 Security for an application server

1. Click **Server > Application Servers** in the navigation tree. The Application Servers page appears.
2. Click the **application server name** in the **Name** column of the Application Server collection table. The configuration panel of the application server selected appears.
3. Click **Server Security** in the Additional Properties section. The Server Security panel of the application server appears.
4. Click **Server Level Security** in the Additional Properties section. The Server Level Security panel of the application server appears.
5. Enable Java 2 Security by selecting the option labeled **Enforce Java 2 Security** (clear the check box to disable Java 2 Security). This enables Java 2 Security for the selected application server.
6. Click **OK** or **Apply** on the Server Level Security page.
7. Save the changes and make sure a file sync is performed before restarting the application server.
8. Restart the application server for the changes to take effect.

Java 2 Security is enabled and enforced for the servers. Java 2 Security permission is checked when a Java 2 Security protected API is called.

When to use Java 2 Security

1. To enable protection on system resources. For example, when opening or listening to a socket connection, reading or writing to operating system file systems, reading or writing Java Virtual Machine system properties, and so on.
2. To prevent application code calling destructive APIs. For example, calling *System.exit()* brings down the application server.
3. To prevent application code obtaining privileged information (passwords) or gaining extra privileges (obtaining Server Credentials).

The WebSphere Java 2 Security Manager is enhanced to dump the Java 2 Security permissions granted to all classes on the call stack when an application is denied access to a resource (the `java.security.AccessControlException` exception is thrown). The trace information is dumped to the configured server log files. Check the server log files to access debugging information when an AccessControlException is thrown. In addition, the product Java 2 Security Manager trace can be enabled with the trace string, `com.ibm.ws.security.core.SecurityManager=all=enabled`. When the exception is thrown, the trace dump provides hints to determine whether the application is missing permissions or the product run time code or third party libraries used are not properly marked as *privileged* when accessing Java 2 protected resources. See the Security Problem Determination Guide for details.

Using PolicyTool to edit policy files

Java 2 security uses several policy files to determine the granted permission for each Java program. See Dynamic policy for the list of available policy files. The Java Development Kit provides *policytool* to edit these policy files. This tool is

recommended for editing any policy file to verify the syntax of its contents. Syntax errors in the policy file cause an *AccessControlException* during application execution, including the server start. Identifying the cause of this exception is not easy because the user might not be familiar with the resource that has an access violation. Be careful when you edit these policy files.

To use the policytool with WebSphere Application Server for z/OS, choose one of the following two options:

- Move the policy files to another platform such as Microsoft Windows and modify the files. To use this option, you must issue the FTP command to transfer the files to the other platform, invoke the policytool, and transfer the updated files back to z/OS in binary mode.
- Invoke the policytool on z/OS that is supplied with the Software Development Kit (SDK) installed on your z/OS system. For more information on this option, complete the following steps:

1. Export the display to an Xwindows-enabled device. For example, in Open MVS (OMVS), type `export DISPLAY=<IP_address_of_the_Xwindows_device>:0.0`
2. Enable the z/OS system to access the display of the Xwindows-enabled device. For example, on AIX, type `xhost + <address_of_the_MVS_system>`.
3. Convert the policy file to the Extended Binary Coded Decimal Interchange Code (EBCDIC) format.
4. Invoke the policytool on OMVS by typing `<$JAVA_HOME>/policytool`. <$*JAVA_HOME*> is the directory in which the SDK is installed.
5. Click **File** > **Open**.
6. Navigate the directory tree in the **Open** window to pick up the policy file that you need to update. After selecting the policy file, click **Open**. The code base entries are listed in the window.
7. Create or modify the code base entry.
   a. Modify the existing code base entry by double-clicking the code base, or click the code base and click **Edit Policy Entry**. The Policy Entry window opens with the permission list defined for the selected code base.
   b. Create a new code base entry by clicking **Add Policy Entry**. The Policy Entry window opens. At the code base column, enter the code base information as a URL format, for example, `/WebSphere/AppServer/InstalledApps/testcase.ear`.
8. Modify or add the permission specification
   a. Modify the permission specification by double-clicking the entry you want to modify, or by selecting the permission and clicking **Edit Permission**. The Permissions window opens with the selected permission information.
   b. Add a new permission by clicking **Add Permission**. The Permissions window opens. In the Permissions, window there are four rows for **Permission**, **Target Name**, **Actions**, and **Signed By**.
9. Select the permission from the Permission list. The selected permission displays. After a permission is selected, the **Target Name**, **Actions**, and **Signed By** fields automatically show the valid choices or they enable text input in the right text input area.
   a. Select **Target Name** from the list, or enter the target name in the right text input area.
   b. Select **Actions** from the list.
   c. Input **Signed By** if it is needed.

Important: The Signed By keyword is not supported in the following policy files: `app.policy`, `spi.policy`, `library.policy`, `was.policy`, and `filter.policy` files. However, the Signed By keyword is supported in the following policy files:`java.policy`, `server.policy`, and `client.policy` files. The Java Authentication and Authorization Service (JAAS) is not supported in the `app.policy`, `spi.policy`, `library.policy`, `was.policy`, and `filter.policy` files. However, the JAAS principal keyword is supported in a JAAS policy file when it is specified by the Java Virtual Machine (JVM) system property, `java.security.auth.policy`.

10. Click **OK** to close the Permissions window. Modified permission entries of the specified code base display.
11. Click **Done** to close the window. Modified code base entries are listed. Repeat steps 4 through 8 until you complete editing.
12. Click **File** > **Save** after you finish editing the file.
13. Convert the policy file back from the EBCDIC format to the ASCII format.

A policy file is updated. If any policy files need editing, use the policytool. Do not edit the policy file manually. Syntax errors in the policy files can potentially cause application servers or enterprise applications to not start or function incorrectly. For the changes in the updated policy file to take effect, restart the Java processes.

Java 2 security policy files:

The J2EE 1.3 specification has a well-defined programming model of responsibilities between the container providers and the application code. Using Java 2 security manager to help enforce this programming model is recommended. There are certain operations that are not allowed in the application code because such operations interfere with the behavior and operation of the containers. The Java 2 security manager is used in the product to enforce responsibilities of the container and the application code.

This product provides support for policy file management. There are a number of policy files in the product, which are either static or dynamic. *Dynamic policy* is a template of permissions for a particular type of resource. There is no relative codebase defined in the dynamic policy template. The codebase is dynamically calculated from the deployment and run-time data.

Static policy files

Policy file	Location
java.policy	*install_root*`/java/jre/lib/security/java.policy`. Default permissions granted to all classes. The policy of this file applies to all the processes launched by the WebSphere Application Server.
server.policy	*install_root*`/properties/server.policy`. Default permissions granted to all the product servers.
client.policy	*install_root*`/properties/client.policy`. Default permissions for all of the product client containers and applets on a node.

The static policy files are not managed by configuration and file replication services. Changes made in these files are local and are not replicated to other nodes in the Network Deployment cell.

Dynamic policy files

Policy file	Location
spi.policy	*install_root*/config/cells/*cell_name*/nodes/*node_name*/spi.policy This template is for the Service Provider Interface (SPI) or third-party resources embedded in the product. Examples of SPI are Java Messaging Service (JMS) (MQSeries) and JDBC drivers. The codebase for the embedded resources are dynamically worked out from the configuration (resources.xml file) and run-time data, and permissions defined in the spi.policy files are automatically applied to these resources. The default permission of spi.policy file is java.security.AllPermissions.
library.policy	*install_root*/config/cells/*cell_name*/nodes/*node_name*/library.policy This template is for the library (Java library classes). You can define a shared library to use in multiple product applications. The default permission of the library.policy is empty.
app.policy	*install_root*/config/cells/*cell_name*/nodes/*node_name*/app.policy The app.policy file defines the default permissions granted to all enterprise applications running on *node_name* in *cell_name*.
was.policy	*install_root*/config/cells/*cell_name*/applications/*ear_file_name*/deployments/ *application_name*/META-INF/was.policy Type the previous location on one continuous line. This template is for application-specific permissions. The was.policy is embedded in the Enterprise Archive (EAR) file.
ra.xml	*rar_file_name*/META-INF/was.policy.RAR. This file can have a permission specification defined in the ra.xml file. The ra.xml file is embedded in the RAR file.

Note: Grant entry specified in the app.policy and was.policy files must have a code base defined. If there are grant entries specified without a code base, the policy files are not loaded properly and the application can fail. If the intent is to grant the permissions to all applications, then use *file:${application}* as a code base in the grant entry.

Syntax of the policy file

A policy file contains several policy entries. The following example depicts each policy entry format:

```
grant [codebase <Codebase>] {
permission <Permission>;
 permission <Permission>;
permission <Permission>;
};

<CodeBase>:  A URL.
   For example,  "file:${java.home}/lib/tools.jar"
      When [codebase <Codebase>] is not specified, listed
```

```
                permissions are applied to everything.
      If URL ends with a JAR file name,  only the classes in the
                JAR file belong to the codebase.
                If URL ends with "/", only the class files in the specified
                directory belong to the codebase.
                If URL ends with "*", all JAR and class files in the specified
                directory belong to the codebase.
                If URL ends with "-", all JAR and class files in the specified
                directory and its subdirectories belong to the codebase.
<Permissions>: Consists from
       Permission Type   : class name of the permission
          Target Name       : name specifying the target
          Actions           : actions allowed on target
   For example,
         java.io.FilePermission "/tmp/xxx", "read,write"
```

Please refer to developer kit specifications for the details of each permission.

Syntax of dynamic policy

You can define permissions for specific types of resources in dynamic policy files for an enterprise application. This action is achieved by using *product-reserved symbols*. The reserved symbol scope depends on where it is defined. If you define the permissions in the `app.policy` file, the symbol applies to all the resources on all of the enterprise applications running on *node_name*. If you define the permissions in the `META-INF/was.policy` file, it only applies to the specific enterprise application. Valid symbols for codebase are listed in the following table:

Symbol	Meaning
file:${application}	Permissions apply to all resources within the application
file:${jars}	Permissions apply to all utility Java archive (JAR) files within the application
file:${ejbComponent}	Permissions apply to EJB resources within the application
file:${webComponent}	Permissions apply to Web resources within the application
file:${connectorComponent}	Permissions apply to connector resources within the application

Other than these entries specified by the codebase symbols, you can specify the module name for a granular setting. For example:

```
grant codeBase "file:DefaultWebApplication.war" {
   permission java.security.SecurityPermission "printIdentity";
 };

grant codeBase "file:IncCMP11.jar" {
permission java.io.FilePermission
"${user.install.root}${/}bin${/}DefaultDB${/}-",
"read,write,delete";
};
```

The 6th and 7th lines in the previous code sample are one continuous line.

You can use a relative codebase only in the `META-INF/was.policy` file.

Several product-reserved symbols are defined to associate the permission lists to a specific type of resources.

Symbol	Meaning
file:${application}	Permissions apply to all resources within the application
file:${jars}	Permissions apply to all utility JAR files within the application
file:${ejbComponent}	Permissions apply to enterprise beans resources within the application
file:${webComponent}	Permissions apply to Web resources within the application
file:${connectorComponent}	Permissions apply to connector resources both within the application and stand-alone connector resources.

There are five embedded symbols provided to specify the path and name for java.io.FilePermission. These symbols enable flexible permission specification. The absolute file path is fixed after the installation of the application.

Symbol	Meaning
${app.installed.path}	Path where the application is installed
${was.module.path}	Path where the module is installed
${current.cell.name}	Current cell name
${current.node.name}	Current node name
${current.server.name}	Current server name

Note: You must not use the `${was.module.path}` in the `${application}` entry.

Carefully determine where to add a new permission. An incorrectly specified permission causes an AccessControlException exception. Since dynamic policy resolves the codebase at run time, determining which policy file has a problem is difficult. Add a permission only to the necessary resources. For example, `use ${ejbcomponent}`, and `etc` instead of `${application}`, and update the `was.policy` file instead of the `app.policy` file, if possible.

Static policy filtering

Limited static policy filtering support exists. If the `app.policy` file and the `was.policy` file have permissions defined in the `filter.policy` file with the keyword, `filterMask`, the run time removes the permissions from the applications and an audit message is logged. However, if the permissions defined in the `app.policy` and `was.policy` are compound permissions, for example, `java.security.AllPermission`, the permission is not removed, rather an warning message is written to the log file. The policy filtering only supports Developer Kit permissions, (the permissions package name begins with `java` or `javax`).

Run time policy filtering support is provided to force stricter filtering. If the app.policy file and was.policy file have permissions defined in the filter.policy file with the keyword, runtimeFilterMask, the run time removes the permissions from the applications no matter what permissions are granted to the application. For example, even if a was.policy file has java.security.AllPermission granted to on of its modules, specified permissions such as runtimeFilterMask are removed from the granted permission during run time.

If the **Issue Permission Warning** flag in the Global Security panel is enabled and if the app.policy file and the was.policy file contain custom permissions (non-Developer Kit permissions, where the permissions package name begins with java or javax), a warning message logs. The permission is not removed. If the permission, AllPermission, is listed in the app.policy file and the was.policy file, a warning message logs.

Policy file editing

Using the policy tool provided by the Developer Kit (*install_root*/java/jre/bin/policytool), to edit the previous policy files is recommended. For Network Deployment, extract the policy files from the repository before editing. After the policy file is extracted, use the policy tool to edit the file. Check the modified policy files into the repository and synchronized them with other nodes.

If there are syntax errors in the policy files, the enterprise application or server process might fail to start. Be cautious when editing these policy files. For example, if a policy has a trailing space in the policy permission target name, the policy fails to parse the permission properly in WebSphere Application Server, Version 5.1 IBM Developer Kit, Java Technology Edition Version 1.4.x. In the following example, note the space before the last quote: * \"*\" "

```
grant {
    permission javax.security.auth.PrivateCredentialPermission
         "javax.resource.spi.security.PasswordCredential * \"*\" ","read";
};
```

If the permission is in a policy file loaded by the IBM Developer Kit, Java Technology Edition Version 1.4.x policy tool, the following message might display:

```
Errors have occurred while opening the policy configuration.
View the warning log for more information.
```

or the following message might display in warning log:

```
Warning: Invalid argument(s) for constructor:
javax.security.auth.PrivateCredentialPermission.
```

To fix this problem, edit the permission and remove the trailing space. When the trailing space is removed, the permission loads properly. The following code sample shows the corrected permission:

```
grant {
    permission javax.security.auth.PrivateCredentialPermission
          "javax.resource.spi.security.PasswordCredential * \"*\"","read";
}
```

Troubleshooting

To debug the dynamic policy, there are three ways to generate the detail report of the exception, AccessControlException.

- **Trace** (Configured by RAS trace). Enables traces with the trace specification:

  Attention: The following command is one continuous line

  ```
  com.ibm.ws.security.policy.*=all=enabled:
  com.ibm.ws.security.core.SecurityManager=all=enabled
  ```
- **Trace** (Configured by property). Specifies a `java` property `java.security.debug`. Valid values for the `java.security.debug` property are:
  - Access. Print all debug information including, required permission, code, stack and code base location.
  - Stack. Print debug information including, required permission, code, and stack.
  - Failure. Print debug information including, required permission and code.
- **ffdc**. Enable `ffdc`, modify the `ffdcRun.properties` file by changing Level=4 and LAE=true. Look for a keyword `Access Violation` in the log file.

Configuring Java 2 security policy files:

Java 2 security uses several policy files to determine the granted permissions for each Java programs. See the Dynamic policy article for the list of available policy files supported by WebSphere Application Server Version.

There are two types of policy files supported by WebSphere Application Server: dynamic policy files and static policy files. Static policy files provide the default permissions. Dynamic policy files provide application permissions. There are six dynamic policy files:

Policy file name	Description
`app.policy`	Contains default permissions for all of the enterprise applications in the cell.
`was.policy`	Contains application-specific permissions for an WebSphere Application Server enterprise application. This file is packaged in an enterprise archive (EAR) file.
`ra.xml`	Contains connector application specific permissions for a WebSphere Application Server enterprise application. This file is packaged in a resource adapter archive (RAR) file.
`spi.policy`	Contains permissions for Service Provider Interface (SPI) or third-party resources embedded in WebSphere Application Server. The default contents grant everything. Update this file carefully when the cell requires more protection against SPI in the cell. This file is applied to all of the SPIs defined in the `resources.xml` file.
`library.policy`	Contains permissions for the shared library of enterprise applications.
`filter.policy`	Contains the list of permissions that require filtering from the `was.policy` file and the `app.policy` file in the cell. This filtering mechanism only applies to the `was.policy` and `app.policy` files.

Important: The Signed By keyword is not supported in the following policy files: `app.policy`, `spi.policy`, `library.policy`, `was.policy`, and `filter.policy` files. However, the Signed By keyword is supported in the following policy files:`java.policy`, `server.policy`, and `client.policy` files. The Java Authentication and Authorization Service (JAAS) is not supported in the `app.policy`, `spi.policy`, `library.policy`, `was.policy`, and `filter.policy` files. However, the JAAS principal keyword is supported in a JAAS policy file when it is specified by the Java Virtual Machine (JVM) system property, `java.security.auth.policy`. You can statically set the authorization policy files in `java.security.auth.policy` with `auth.policy.url.n=`*URL* where *URL* is the location of the authorization policy.

1. Identify the policy file to update.

   If the permission is required by an application, update the static policy file. Refer to Configuring static policy files.

   If the permission is required by all of the WebSphere Application Server enterprise applications in the node, refer to Configuring spi.policy files.

   5.1+ If the permission is required only by specific WebSphere Application Server enterprise applications and the permission is required only by a connector, update the `ra.xml` file. Refer to Assembling resource adapter (connector) modules. Otherwise, update the `was.policy` file. Refer to Configuring was.policy files and Adding the was.policy file to applications.

   If the permission is required by shared libraries, refer to Configuring library.policy files.

   If the permission is required by SPI libraries, refer to Configuring spi.policy files.

   Note: It is recommended to pick up the policy file with the smallest scope. You can avoid giving an extra permission to the Java programs and protect the resources. You can update the `ra.xml` file or the `was.policy` file rather than the `app.policy` file. Use specific component symbols ($(ejbcomponent), ${webComponent},${connectorComponent} and ${jars}) than ${application} symbols. Update dynamic policy files than static policy files.

   Add any permission that should never be granted to the WebSphere Application Server enterprise application in the cell to the `filter.policy` file. Refer to Configuring filter.policy files.

2. Restart the WebSphere Application Server enterprise application.

The required permission is granted for the specified WebSphere Application Server enterprise application.

If an WebSphere Application Server enterprise application in a cell requires permissions, some of the dynamic policy files need updating. The symptom of the missing permission is the exception, java.security.AccessControlException. The missing permission is listed in the exception data, for example,

```
java.security.AccessControlException: access denied (java.io.FilePermission
C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar read)
```

The previous two lines were split onto two lines because of the width of the page. However, the permission should be on one line.

When a Java program receives this exception and adding this permission is justified, add a permission to an adequate dynamic policy file, for example,

```
grant codeBase "file:<user client installed location>" {
permission java.io.FilePermission
"C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar", "read";
};
```

The previous two lines were split onto two lines because of the width of the page. However, the permission should be on one line.

To decide whether to add a permission, refer to the article AccessControlException.

Configuring app.policy files:

Java 2 security uses several policy files to determine the granted permissions for each Java program. See the Dynamic policy article for the list of available policy files supported by WebSphere Application Server. The `app.policy` file is a default policy file shared by all of the WebSphere Application Server enterprise applications. The union of the permissions contained in the `app.policy` file, the `server.policy` file, the `app.policy` file, the application `was.policy` file and the permission specification of the `ra.xml` file are applied to the WebSphere Application Server enterprise application. The `app.policy` files are managed by configuration and file replication services.

Important: The Signed By and the Java Authentication and Authorization Service (JAAS) principal keywords are not supported in the `app.policy` file. However, the Signed By keyword is supported in the following files: `java.policy`, `server.policy`, and the `client.policy` files. The JAAS principal keyword is supported in a JAAS policy file when it is specified by the Java Virtual Machine (JVM) system property, `java.security.auth.policy`. You can statically set the authorization policy files in `java.security.auth.policy` with `auth.policy.url.n=`*`URL`* where *`URL`* is the location of the authorization policy.

If the default permissions for enterprise applications (the union of the permissions defined in the `app.policy` file, the `server.policy` file and the `app.policy` file) are enough, no action is required. The default `app.policy` file is used automatically. If a specific change is required to all of the enterprise applications in the cell, update the `app.policy` file. Syntax errors in the policy files cause start failures in the application servers. Edit these policy files carefully.

1. Extract the policy file.
   a. From the command prompt, enter `wsadmin wsadmin> set obj [$AdminConfig extract cells/`*`cell_name`*`/node/`*`node_name`*`/app.policy c:/temp/test/app.policy]`.
2. Edit the extracted `app.policy` file with the Policy Tool.
3. Check in the policy file.
   a. Enter the following at a command prompt `wsadmin> $AdminConfig checkin cells/`*`cell_name`*`/nodes/`*`node_name`*`/app.policyc:/temp/test/was.policy $obj`.

The default Java 2 security policies have been changed for the enterprise application.

Several product-reserved symbols are defined to associate the permission lists to a specific type of resource.

Symbol	Meaning
file:${application}	Permissions apply to all resources within the application
file:${jars}	Permissions apply to all utility Java archive (JAR) files within the application
file:${ejbComponent}	Permissions apply to enterprise bean resources within the application
file:${webComponent}	Permissions apply to Web resources within the application
file:${connectorComponent}	Permissions apply to connector resources both within the application and within stand-alone connector resources.

There are five embedded symbols provided to specify the path and name for java.io.FilePermission. These symbols enable flexible permission specifications. The absolute file path is fixed after the installation of the application.

Symbol	Meaning
${app.installed.path}	Path where the application is installed
${was.module.path}	Path where the module is installed
${current.cell.name}	Current cell name
${current.node.name}	Current node name
${current.server.name}	Current server name

Note: You cannot use the `${was.module.path}` in the `${application}` entry.

The `app.policy` file supplied by WebSphere Application Server resides at *`install_root`*`/config/cells/`*`cell_name`*`/nodes/`*`node_name`*`/app.policy`, which contains the following default permissions:

Attention: In the following code sample, the first two lines related to `permission java.io.FilePermission` were split into two lines each due to the width of the printed page.

```
grant codeBase "file:${application}" {
  // The following are required by Java mail
  permission java.io.FilePermission "${was.install.root}${/}java${/}
  jre${/}lib${/}ext${/}mail.jar", "read";
  permission java.io.FilePermission "${was.install.root}${/}java${/}
  jre${/}lib${/}ext${/}activation.jar", "read";
};

grant codeBase "file:${jars}" {
  permission java.net.SocketPermission "*", "connect";
  permission java.util.PropertyPermission "*", "read";
};

grant codeBase "file:${connectorComponent}" {
  permission java.net.SocketPermission "*", "connect";
```

```
  permission java.util.PropertyPermission "*", "read";
};
grant codeBase "file:${webComponent}" {
  permission java.io.FilePermission "${was.module.path}${/}-", "read, write";
  permission java.lang.RuntimePermission "loadLibrary.*";
  permission java.lang.RuntimePermission "queuePrintJob";
  permission java.net.SocketPermission "*", "connect";
  permission java.util.PropertyPermission "*", "read";
};

grant codeBase "file:${ejbComponent}" {
 permission java.lang.RuntimePermission "queuePrintJob";
 permission java.net.SocketPermission "*", "connect";
 permission java.util.PropertyPermission "*", "read";
};
```

If all of the WebSphere Application Server enterprise applications in a cell require permissions that are not defined as defaults in the `app.policy` file, the `server.policy` file and the `app.policyfile`, then update the `app.policy` file. The symptom of a missing permission is the exception, java.security.AccessControlException. The missing permission is listed in the exception data, for example, `java.security.AccessControlException: access denied (java.io.FilePermission C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar read)`.

When a Java program receives this exception and adding this permission is justified, add a permission to the `server.policy` file, for example:

```
grant codeBase "file:<user client installed location>" {
permission java.io.FilePermission
"C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar", "read"; };
```

To decide whether to add a permission, refer to the article AccessControlException.

Restart all WebSphere Application Server enterprise applications to ensure that the updated `app.policy` file takes effect.

Configuring filter.policy files:

Java 2 security uses several policy files to determine the granted permission for each Java program. Java 2 security policy filtering is only in effect when Java 2 security is enabled. Refer to Configuring Java 2 security. The filtering policy defined in the `filter.policy` file is cell wide. Refer to the article, Dynamic policy, for the list of available policy files supported by WebSphere Application Server. The `filter.policy` file is the only policy file used when restricting the permission instead of granting permission. The permissions listed in the filter policy file are filtered out from the `app.policy` file and the `was.policy` file. Permissions defined in the other policy files are not affected by the `filter.policy` file.

When a permission is filtered out, an audit message is logged. However, if the permissions defined in the `app.policy` file and the `was.policy` file are compound permissions like java.security.AllPermission, for example, the permission is not removed. A warning message is logged. If the Issue Permission Warning flag is enabled (default) and if the `app.policy` file and the `was.policy` file contain custom permissions (non-Java API permission, the permission package name begins with characters other than `java` or `javax`), then a warning message is logged and the

permission is not removed. You can change the value of the Issue Permission Warning flag from the administrative console in the Global Security panel. It is not recommended that you use `AllPermission` for the enterprise application.

There are some default permissions defined in the `filter.policy` file. These permissions are the minimal ones recommended by the product. If more permissions are added to the `filter.policy` file, certain operations can fail for enterprise applications. Add permissions to the `filter.policy` file carefully.

Note:

1. Extract the `filter.policy` file.
   a. From the command prompt, enter `wsadmin wsadmin> set obj [$AdminConfig extract cells/`*`cell_name`*`/filter.policy c:/temp/test/filter.policy]`
2. You cannot use the Policy Tool to edit the `filter.policy` file. Editing must be completed in a text editor. Be careful and verify that there are no syntax errors in the `filter.policy` file. If there are any syntax errors in `filter.policy` file, it will not be loaded by the product security run time, which implies that filtering is disabled.
3. Check in the policy file.
   a. Type the following from a command prompt: `wsadmin> $AdminConfig checkin cells/`*`cell_name`*`/filter.policy c:/temp/test/filter.policy $obj.`

An updated `filter.policy` file is applied to all of the WebSphere Application Server enterprise application after the servers are restarted.

The `filter.policy` file is managed by configuration and file replication services. Changes made in the file are replicated to other nodes in the Network Deployment cell.

The `filter.policy` file supplied by WebSphere Application Server resides at: *`install_root`*`/config/cells/`*`cell_name`*`/filter.policy`.

It contains these permissions as defaults:

```
filterMask {
permission java.lang.RuntimePermission "exitVM";
permission java.lang.RuntimePermission "setSecurityManager";
permission java.security.SecurityPermission "setPolicy";
permission javax.security.auth.AuthPermission "setLoginConfiguration"; };
runtimeFilterMask {
permission java.lang.RuntimePermission "exitVM";
permission java.lang.RuntimePermission "setSecurityManager";
permission java.security.SecurityPermission "setPolicy";
permission javax.security.auth.AuthPermission "setLoginConfiguration"; };
```

The permissions defined in `filterMask` are for static policy filtering. The security run time tries to remove the permissions from applications during application startup. Compound permissions are not removed but are issued with a warning, and application deployment is stopped if applications contain permissions defined in `filterMask`, and if scripting was used (wsadmin tool). The `runtimeFilterMask` defines permissions used by the security run time to deny access to those permissions to application thread. Do not add more permissions to the `runtimeFilterMask`. Application start failure or incorrect functioning might result.

Be careful when adding more permissions to the runtimeFilterMask. Usually, you only need to add permissions to the filterMask stanza.

WebSphere Application Server relies on the filter policy file to restrict or disallow certain permissions that could compromise the integrity of the system. For instance, WebSphere Application Server considers the exitVM and setSecurityManager permissions as those permissions that most applications should never have. If these permissions are granted, then the following scenarios are possible:

- **exitVM** -- A servlet, JSP file, enterprise bean, or other library used by the aforementioned could call the System.exit() API and cause the entire WebSphere Application Server process to terminate.
- **setSecurityManager** -- An application could install its own SecurityManager that could either grant more permissions or bypass the default policy the WebSphere Application Server SecurityManager enforces.

For the updated filter.policy file to take effect, restart related Java processes.

Configuring the was.policy file:

Java 2 security uses several policy files to determine the granted permission for each Java program. See "Java 2 security policy files" on page 357 for the list of available policy files supported by WebSphere Application Server Version 5. The was.policy file is an application-specific policy file for WebSphere Application Server enterprise applications. It is embedded in the enterprise archive (EAR) file (META-INF/was.policy). The was.policy file is located in:

install_root/config/cells/*cell_name*/applications/
ear_file_name/deployments/*application_name*/META-INF/was.policy

The union of the permission contained in the java.policy file, the server.policy file, the app.policy file, application was.policy file and the permission specification of the ra.xml file are applied to the WebSphere Application Server enterprise application. Configuration and file replication services manage was.policy files. Changes made in these files are replicated to other nodes in the Network Deployment cell.

Several product-reserved symbols are defined to associate the permission lists to a specific type of resources.

Symbol	Definition
file:${application}	file:${application}
file:${jars}	Permissions apply to all utility Java archive (JAR) files within the application
file:${ejbComponent}	Permissions apply to enterprise bean resources within the application
file:${webComponent}	Permissions apply to Web resources within the application
file:${connectorComponent}	Permissions apply to connector resources within the application

Important: The Signed By and the Java Authentication and Authorization Service (JAAS) principal keywords are not supported in the was.policy file. The **Signed By** keyword is supported in the following policy files:

java.policy, server.policy, and client.policy. The JAAS principal keyword is supported in a JAAS policy file when it is specified by the Java Virtual Machine (JVM) system property, java.security.auth.policy. You can statically set the authorization policy files in java.security.auth.policy with auth.policy.url.n=*URL* where *URL* is the location of the authorization policy.

Other than these blocks, you can specify the module name for granular settings. For example,

```
"file:DefaultWebApplication.war" {
      permission java.security.SecurityPermission "printIdentity";
 };

grant codeBase "file:IncCMP11.jar" {
      permission java.io.FilePermission
      "${user.install.root}${/}bin${/}DefaultDB${/}-",
      "read,write,delete";
};
```

There are five embedded symbols provided to specify the path and name for the java.io.FilePermission. These symbols enable flexible permission specification. The absolute file path is fixed after the application is installed.

Symbol	Definition
${app.installed.path}	Path where the application is installed
${was.module.path}	Path where the module is installed
${current.cell.name}	Current cell name
${current.node.name}	Current node name
${current.server.name}	Current server name

If the default permissions for the enterprise application (union of the permissions defined in the java.policy file, the server.policy file and the app.policy file) are enough, no action is required. If an application has specific resources to access, update the was.policy file. The first two steps assume that you are creating a new policy file.

Note: Syntax errors in the policy files cause the application server to fail. Use care when editing these policy files.

1. Create or edit a new was.policy file using the Policy Tool. For more information, see "Using PolicyTool to edit policy files" on page 355
2. Package the was.policy file into the enterprise archive (EAR) file.

   For more information, see "Adding the was.policy file to applications" on page 373.The following instructions describe how to import a was.policy file. However, you also can use the Assembly Toolkit to create a new file by clicking **File > New > File**.

   a. Start the Assembly Toolkit and open the J2EE Perspective by selecting **Window > Open Perspective > J2EE**.
   b. Import the client EAR file by selecting **File > Import > EAR file**.
   c. Click **Next**.
   d. Enter the path name to the EAR file in the **EAR File** field or click **Browse** to locate the file.

e. Enter the project name in the **Project name** field.
f. Click **Finish**.
g. Open the Project Navigator view.
h. Expand the EAR file and click **META-INF**. You might find a `was.policy` file in the META-INF directory. If you want to delete the file, right-click the file name and select **Delete**.
i. At the bottom of the Project Navigator view, click **J2EE Hierarchy**.
j. Import the `was.policy` file by right-clicking the **Modules** directory and clicking **Import > File system**.
k. Click **Next**.
l. Enter the path name to the `was.policy` file in the **From directory** field or click **Browse** to locate the file.
m. Verify that the path directory listed in the **Into directory** field lists the correct `META-INF` directory.
n. Click **Finish**.
o. To validate the EAR file, right-click the EAR file, which contains the Modules directory, and click **Run Validation**.
p. To save the new EAR file, right-click the EAR file, and click **Export > Export EAR file**. If you do not save the revised EAR file, the EAR file will contain the new `was.policy` file. However, if the workspace becomes corrupted, you might lose the revised EAR file.
q. To generate deployment code, right-click the EAR file and click **Generate Deployment Code**.

3. Update an existing installed application, if one already exists.
   a. Modify the was.policy file with the Policy Tool. For more information, see "Using PolicyTool to edit policy files" on page 355.
   b. Extract the policy file. Enter the following from a command prompt:

      ```
      wsadmin  wsadmin>  set obj [$AdminConfig extract cells/cell_name
      /application/ear_file_name/deployments/application_name
      /META_INF/was.policy c:/temp/test/was.policy]
      ```

      Enter the three previous lines as one continuous line.
   c. Edit the extracted `was.policy` file with the Policy Tool. Form more information, see "Using PolicyTool to edit policy files" on page 355.
   d. Check in the policy file. Enter the following at a command prompt:

      ```
      wsadmin> $AdminConfig checkin cells/cell_name/application/
      ear_file_name/deployments/application_name/META_INF/was.policy
      c:/temp/test/was.policy $obj
      ```

      Enter the three previous lines as one continuous line.

The updated `was.policy` file is applied to the application after the application restarts.

If an application must access a specific resource that is not defined as a default in the `java.policy` file, the `server.policy` file and the `app.policy`, then delete the `was.policy` file for that application. The symptom of the missing permission is that the exception, `java.security.AccessControlException`. The missing permission is listed in the exception data, `java.security.AccessControlException: access denied (java.io.FilePermission C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar read)`.

When a Java program receives this exception and adding this permission is justified, add a permission to the was.policy file: grant codeBase "file:<user client installed location>" { permission java.io.FilePermission "C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar", "read"; };.

To determine whether to add a permission, refer to the article, "AccessControlException" on page 352.

Restart all applications for the updated app.policy file to take effect.

Configuring spi.policy files:

Java 2 security uses several policy files to determine the granted permission for each Java program. See Dynamic policy for the list of available policy files supported by WebSphere Application Server Version 5.

Since the default permissions for Service Provider Interface (SPI) is AllPermission, the only reason to update the spi.policy file is a restricted SPI permission. When a change in the spi.policy is required, complete the following steps.

Syntax errors in the policy files cause the application server to fail. Edit these policy files carefully.

Important: Do not place the codebase keyword or any other keyword after the filterMask and runtimeFilterMask keywords. The Signed By and the Java Authentication and Authorization Service (JAAS) Principal keywords are not supported in the spi.policy file. The Signed By keyword is supported in the following policy files: java.policy, server.policy, and client.policy. The JAAS Principal keyword is supported in a JAAS policy file that is specified by the Java Virtual Machine (JVM) system property, java.security.auth.policy. You can statically set the authorization policy files in java.security.auth.policy with auth.policy.url.n=*URL* where *URL* is the location of the authorization policy.

1. Extract the policy file.
   a. From the command prompt, enter wsadmin> set obj [$AdminConfig extract cells/*cell_name*/nodes/*node_name*/spi.policy c:/temp/test/spi.policy]
2. Edit the extracted spi.policy with the Policy Tool.
3. Check in the policy file.
   a. Enter the following from a command prompt wsadmin> $AdminConfig checkin cells/*cell_name*/nodes/*node_name*/spi.policy c:/temp/test/spi.policy $obj.

The updated spi.policy is applied to the SPI libraries after the Java process is restarted.

The spi.policy file is the template for SPIs (Service Provider Interface) or third-party resources embedded in the product. Example of SPIs are Java Message Services (JMS) (MQSeries) and Java database connectivity (JDBC) drivers. They are specified in the resources.xml file. The dynamic policy grants the permissions defined in the spi.policy file to the class paths defined in the resources.xml file. The union of the permission contained in the java.policy file and the spi.policy file are applied to the SPI libraries. The spi.policy files are managed by

configuration and file replication services. Changes made in these files are replicated to other nodes in the Network Deployment cell.

The spi.policy file supplied by WebSphere Application Server resides at *install_root*/config/cells/*cell_name*/nodes/*node_name*/spi.policy. It contains the following default permission:

```
grant {
  permission java.security.AllPermission;
};
```

Restart the related Java processes for the changes in the spi.policy file to become effective.

Configuring library.policy files:

Java 2 security uses several policy files to determine the granted permission for each Java programs. See "Java 2 security policy files" on page 357 for the list of available policy files supported by WebSphere Application Server Version 5. The library.policy file is the template for shared libraries (Java library classes). Multiple enterprise applications can define and use shared libraries. Refer to Managing shared libraries for information on how to define and manage the shared libraries.

If the default permissions for a shared library (union of the permissions defined in the java.policy file, the app.policy file and the library.policy file) are enough, no action is required. The default library policy is picked up automatically. If a specific change is required to share a library in the cell, update the library.policy file.

Syntax errors in the policy files cause the application server to fail. Edit these policy files carefully.

Important: Do not place the codebase keyword or any other keyword after the grant keyword. The Signed By keyword and the Java Authentication and Authorization Service (JAAS) Principal keyword are not supported in the library.policy file. The Signed By keyword is supported in the following policy files: java.policy, server.policy, and client.policy. The JAAS Principal keyword is supported in a JAAS policy file when it is specified by the Java Virtual Machine (JVM) system property, java.security.auth.policy. You can statically set the authorization policy files in java.security.auth.policy with auth.policy.url.n=*URL* where *URL* is the location of the authorization policy.

1. Extract the policy file.
   a. From the command prompt, enter wsadmin wsadmin> set obj [$AdminConfig extract cells/*cell_name*/nodes/*node_name*/library.policy c:/temp/test/library.policy]
2. Edit the extracted library.policy file with the Policy Tool. For more information, see "Using PolicyTool to edit policy files" on page 355.
3. Check in the policy file.
   a. Enter the following from a command prompt wsadmin> $AdminConfig checkin cells/*cell_name*/nodes/*node_name*/library.policy c:/temp/test/library.policy $obj.

An updated library.policy is applied to shared libraries after the servers restart.

The union of the permission contained in the java.policy file, the app.policy file, and the library.policy file are applied to the shared libraries. The library.policy file is managed by configuration and file replication services. Changes made in the file are replicated to other nodes in the Network Deployment cell.

The library.policy file supplied by WebSphere Application Server resides at: *install_root*/config/cells/*cell_name*/nodes/*node_name*/library.policy, contains an empty permission entry as a default. For example,

```
grant {
 };
```

If the shared library in a cell requires permissions that are not defined as defaults in the java.policy file, app.policy file and the library.policy file, update the library.policy file. The missing permission causes the exception, java.security.AccessControlException. The missing permission is listed in the exception data, for example:

```
 java.security.AccessControlException: access denied (java.io.FilePermission
C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar read)
```

The previous lines are one continuous line.

When a Java program receives this exception and adding this permission is justified, add a permission to the library.policy file, for example: grant codeBase "file:<user client installed location>" { permission java.io.FilePermission "C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar", "read"; };

to decide whether to add a permission, refer to "AccessControlException" on page 352.

Restart the related Java processes for the changes in the library.policy file to become effective.

Adding the was.policy file to applications:

When Java 2 security is enabled for a WebSphere Application Server, all the applications that run on that WebSphere Application Server undergo a security check before accessing system resources. An application might need a was.policy file if it accesses resources that require more permissions than those granted in the default app.policy file. By default, the product security reads an app.policy file that is located in each node and grants the permissions in the app.policy file to all the applications. Include any additional required permissions in the was.policy file. The was.policy file is only required if an application requires additional permissions.

The default policy file for all applications is specified in the app.policy file. This file is provided by the product security, is common to all applications, and should not be changed. Add any new permissions required for an application in the was.policy file.

The app.policy file is located in the *install_root*/config/cells/*cell_name*/nodes/*node_name* directory. The contents of the app.policy file follow:

Attention: In the following code sample, the two permissions that are required by JavaMail were split into two lines each due to the width of the printed page.

```
// The following permissions apply to all the components under the application.
grant codeBase "file:${application}" {
  // The following are required by JavaMail
  permission java.io.FilePermission "
        ${was.install.root}${/}java${/}jre${/}lib${/}ext${/}mail.jar", "read";
  permission java.io.FilePermission "
        ${was.install.root}${/}java${/}jre${/}lib${/}ext${/}activation.jar", "read";
};

  // The following permissions apply to all utility .jar files  (other
  //  than enterprise beans JAR files) in the application.
grant codeBase "file:${jars}" {
  permission java.net.SocketPermission "*", "connect";
  permission java.util.PropertyPermission "*", "read";
};

// The following permissions apply to connector resources within the application
grant codeBase "file:${connectorComponent}" {
  permission java.net.SocketPermission "*", "connect";
  permission java.util.PropertyPermission "*", "read";
};

// The following permissions apply to all the Web modules (.war files)
// within the application.
grant codeBase "file:${webComponent}" {
  permission java.io.FilePermission "${was.module.path}${/}-", "read, write";
        //  where "was.module.path" is the path where the Web module is
        //  installed. Refer to Dynamic policy concepts for other symbols.
  permission java.lang.RuntimePermission "loadLibrary.*";
  permission java.lang.RuntimePermission "queuePrintJob";
  permission java.net.SocketPermission "*", "connect";
  permission java.util.PropertyPermission "*", "read";
};


// The following permissions apply to all the EJB modules within the application.
grant codeBase "file:${ejbComponent}" {
 permission java.lang.RuntimePermission "queuePrintJob";
 permission java.net.SocketPermission "*", "connect";
 permission java.util.PropertyPermission "*", "read";
};
```

If additional permissions are required for an application or for one or more modules of an application, use the `was.policy` file for that application. For example, use codeBase of ${application} and add required permissions to grant additional permissions to the entire application. Similarly, use codeBase of ${webComponent} and ${ejbComponent} to grant additional permissions to all the Web modules and all the enterprise bean (EJB) modules in the application. You can assign additional permissions to each module (`.war` file or `.jar` file) as shown in the following example.

An example of adding extra permissions for an application in the `was.policy` file:

Attention: In the following code sample, the permission for the EJB module was split into two lines due to the width of the printed page.

```
// grant additional permissions to a Web module
grant codeBase " file:aWebModule.war" {
 permission java.security.SecurityPermission "printIdentity";
};

// grant additional permission to an EJB module
grant codeBase "file:aEJBModule.jar"  {
     permission java.io.FilePermission "
         ${user.install.root}${/}bin${/}DefaultDB${/}-" ."read.write,delete";
     // where, ${user.install.root} is the system property whose value is
     // located in the <install_root> directory.
 };
```

1. Create a `was.policy` file using the policy tool. For more information on using the policy tool, see Using PolicyTool to edit policy files
2. Add the required permissions in the `was.policy` file using the policy tool.
3. Place the `was.policy` file in the application enterprise archive (EAR) file under the `META-INF` directory. Update the application EAR file with the newly created `was.policy` file by using the **jar** command.
4. Verify that the `was.policy` file is inserted, and start the Assembly Toolkit .
5. Verify that the `was.policy` file in the application is syntactically correct. In the Assembly Toolkit, right-click the enterprise application module and click **Run Validation**.

An application EAR file is now ready to run when Java 2 security is enabled.

This step is required for applications to run properly when Java 2 security is enabled. If the `was.policy` file is not created and it does not contain required permissions, the application might not access system resources.

The symptom of the missing permissions is the exception, `java.security.AccessControlException`. The missing permission is listed in the exception data, for example:

```
java.security.AccessControlException: access denied (java.io.FilePermission
C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar read)
```

The previous two lines are one continuous line.

When an application program receives this exception and adding this permission is justified, include the permission in the `was.policy` file, for example,

```
grant codeBase "file:${application}" { permission java.io.FilePermission
"C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar", "read"; };
```

The previous two lines are one continuous line.

Install the application.

Configuring static policy files:

Java 2 security uses several policy files to determine the granted permission for each Java program. See the "Java 2 security policy files" on page 357 article for the list of available policy files supported by WebSphere Application Server Version 5.

There are two types of policy files supported by WebSphere Application Server Version 5, dynamic policy files and static policy files. Static policy files provide the default permissions. Dynamic policy files provide application's permissions.

Policy file name	Description
`java.policy`	Contains default permissions for all of the Java programs on the node. This file seldom changes.
`server.policy`	Contains default permissions for all of the WebSphere Application Server programs on the node. This files is rarely updated.
`client.policy`	Contains default permissions for all of the applets and client containers on the node.

The static policy file is not a configuration file managed by the repository and the file replication service. Changes to this file are local and do not get replicated to the other machine.

1. Identify the policy file to update.
   - If the permission is required only by an application, update the dynamic policy file. Refer to "Configuring Java 2 security policy files" on page 362.
   - If the permission is required only by applets and client containers, update the `client.policy` file. Refer to "Configuring client.policy files" on page 379.
   - If the permission is required only by WebSphere Application Server (servers, agents, managers and application servers), update the `server.policy` file. Refer to "Configuring server.policy files" on page 378.
   - If the permission is required by all of the Java programs running on the Java virtual machine (JVM), update the `java.policy` file. Refer to "Configuring java.policy files" on page 377.
2. Stop and restart the WebSphere Application Server.

The required permission is granted for all of the Java programs running with the restarted JVM.

If Java programs on a node require permissions, the policy file needs updating. If the Java program that required the permission is not part of an enterprise application, update the static policy file. The missing permission causes the exception, java.security.AccessControlException. The missing permission is listed in the exception data, for example:

```
java.security.AccessControlException: access denied (java.io.FilePermission
C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar read)
```

When a Java program receives this exception and adding this permission is justified, add a permission to an adequate policy file, for example:

```
grant codeBase "file:<user client installed location>" {
  permission java.io.FilePermission
```

```
  "C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar",
  "read";
};
```

To decide whether to add a permission, refer to "AccessControlException" on page 352.

Configuring java.policy files:

Java 2 security uses several policy files to determine the granted permission for each Java program. See "Java 2 security policy files" on page 357 for the list of available policy files supported by WebSphere Application Server Version 5. The `java.policy` file is a global default policy file shared by all of the Java programs running in the Java Virtual Machine (JVM) on the node. Modifying this file is not recommended.
If a specific change is required to some of the Java programs on a node and the `java.policy` file requires updating, modify the java.policy file with policy tool. For more information, see "Using PolicyTool to edit policy files" on page 355. A change to the `java.policy` file is local for the node. The default Java policy is picked up automatically. Syntax errors in the policy files cause the application server to fail. Edit these policy files carefully.

An updated `java.policy` file is applied to all the Java programs running in all the JVMs on the local node. Restart the programs for the updates to take effect

The `java.policy` file is not a configuration file managed by the repository and the file replication service. Changes to this file are local and do not get replicated to the other machine. The `java.policy` file supplied by WebSphere Application Server is located at *install_root*`/java/jre/lib/security/java.policy`. It contains these default permissions.

```
// Standard extensions get all permissions by default
grant codeBase "file:${java.home}/lib/ext/*" {
        permission java.security.AllPermission;
};
// default permissions granted to all domains
grant {
        // Allows any thread to stop itself using the java.lang.Thread.stop()
        // method that takes no argument.
        // Note that this permission is granted by default only to remain
        // backwards compatible.
        // It is strongly recommended that you either remove this permission
        // from this policy file or further restrict it to code sources
        // that you specify, because Thread.stop() is potentially unsafe.
        // See "http://java.sun.com/notes" for more information.
        // permission java.lang.RuntimePermission "stopThread";

        // allows anyone to listen on un-privileged ports
        permission java.net.SocketPermission "localhost:1024-", "listen";

        // "standard" properties that can be read by anyone

        permission java.util.PropertyPermission "java.version", "read";
        permission java.util.PropertyPermission "java.vendor", "read";
        permission java.util.PropertyPermission "java.vendor.url", "read";
        permission java.util.PropertyPermission "java.class.version", "read";
```

```
        permission java.util.PropertyPermission "os.name", "read";
        permission java.util.PropertyPermission "os.version", "read";
        permission java.util.PropertyPermission "os.arch", "read";
        permission java.util.PropertyPermission "file.separator", "read";
        permission java.util.PropertyPermission "path.separator", "read";
        permission java.util.PropertyPermission "line.separator", "read";

        permission java.util.PropertyPermission "java.specification.version", "read";
        permission java.util.PropertyPermission "java.specification.vendor", "read";
        permission java.util.PropertyPermission "java.specification.name", "read";

        permission java.util.PropertyPermission "java.vm.specification.version","read";
        permission java.util.PropertyPermission "java.vm.specification.vendor","read";
        permission java.util.PropertyPermission "java.vm.specification.name", "read";
        permission java.util.PropertyPermission "java.vm.version", "read";
        permission java.util.PropertyPermission "java.vm.vendor", "read";
        permission java.util.PropertyPermission "java.vm.name", "read";
      };
```

If some Java programs on a node require permissions that are not defined as defaults in the `java.policy` file, then consider updating the `java.policy` file. Most of the time, other policy files are updated instead of the `java.policy` file. The missing permission causes the exception, java.security.AccessControlException. The missing permission is listed in the exception data, for example:

```
java.security.AccessControlException: access denied (java.io.FilePermission
C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar read)
```

The previous two lines are one continuous line.

When a Java program receives this exception and adding this permission is justified, add a permission to the `java.policy`file, for example:

```
grant codeBase "file:<user client installed location>" {
permission java.io.FilePermission
"C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar", "read"; };
```

To decide whether to add a permission, refer to “AccessControlException” on page 352.

Restart all of the Java processes for the updated `java.policy` file to take effect.

Configuring server.policy files:

Java 2 security uses several policy files to determine the granted permission for each Java program. See “Java 2 security policy files” on page 357 for the list of available policy files supported by WebSphere Application Server Version 5. The `server.policy` file is a default policy file shared by all of the WebSphere servers on a node. The `server.policy` file is not a configuration file managed by the repository and the file replication service. Changes to this file are local and do not replicate to the other machine.
If the default permissions for a server (the union of the permissions defined in the `server.policy` file and the `server.policy` file) are enough, no action is required. The default server policy is picked up automatically. If a specific change is required to some of the server programs on a node, update the `server.policy` file with the Policy Tool. Refer to the “Using PolicyTool to edit policy files” on page 355

355 article to edit policy files. Changes to the server.policy file are local for the node. Syntax errors in the policy files cause the application server to fail. Edit these policy files carefully.

An updated server.policy file is applied to all the server programs on the local node. Restart the servers for the updates to take effect.

If you want to add permissions to an application, use the app.policy file and the was.policy file.

When you do need to modify the server.policy file, locate this file at: *install_root*/properties/server.policy. This file contains these default permissions:

```
// Allow to use sun tools
grant codeBase "file:${java.home}/../lib/tools.jar" {
  permission java.security.AllPermission;
};

// WebSphere system classes
grant codeBase "file:${was.install.root}/lib/-" {
  permission java.security.AllPermission;
};
grant codeBase "file:${was.install.root}/classes/-" {
  permission java.security.AllPermission;
};

// Allow the WebSphere deploy tool all permissions
grant codeBase "file:${was.install.root}/deploytool/-" {
  permission java.security.AllPermission;
};
```

If some server programs on a node require permissions that are not defined as defaults in the server.policy file and the server.policy file, update the server.policy file. The missing permission causes the exception, java.security.AccessControlException. The missing permission is listed in the exception data, for example:

```
java.security.AccessControlException: access denied (java.io.FilePermission
C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar read)
```

The previous two lines are one continuous line.

When a Java program receives this exception and adding this permission is justified, add a permission to the server.policy file, for example:

```
grant codeBase "file:<user client installed location>" {
permission java.io.FilePermission
"C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar", "read"; };
```

To decide whether to add a permission, refer to “AccessControlException” on page 352.

Restart all of the Java processes for the updated server.policy file to take effect.

Configuring client.policy files:

Java 2 security uses several policy files to determine the granted permission for each Java program. See "Java 2 security policy files" on page 357 for the list of available policy files supported by WebSphere Application Server Version 5. The `client.policy` file is a default policy file shared by all of the WebSphere Application Server client containers and applets on a node. The union of the permissions contained in the `client.policy` file and the `client.policy` file are given to all of the WebSphere client containers and applets running on the node. The `client.policy` file is not a configuration file managed by the repository and the file replication service. Changes to this file are local and do not replicate to the other machine. The `client.policy` file supplied by WebSphere Application Server is located at *install_root*`/properties/client.policy`. It contains these default permissions:

```
grant codeBase "file:${java.home}/lib/ext/*" {
  permission java.security.AllPermission;
};
// IBM Developer Kit, Java Technology Edition classes
grant codeBase "file:${java.home}/lib/ext/-" {
  permission java.security.AllPermission;
};
grant codeBase "file:${java.home}/../lib/tools.jar" {
  permission java.security.AllPermission;
};
// WebSphere system classes
grant codeBase "file:${was.install.root}/lib/-" {
  permission java.security.AllPermission;
};
grant codeBase "file:${was.install.root}/classes/-" {
  permission java.security.AllPermission;
};
grant codeBase "file:${was.install.root}/installedConnectors/-" {
  permission java.security.AllPermission;
};
// J2EE 1.3 permissions for client container WAS applications
// in $WAS_HOME/installedApps
grant codeBase "file:${was.install.root}/installedApps/-" {
  //Application client permissions
  permission java.awt.AWTPermission "accessClipboard";
  permission java.awt.AWTPermission "accessEventQueue";
  permission java.awt.AWTPermission "showWindowWithoutWarningBanner";
  permission java.lang.RuntimePermission "exitVM";
  permission java.lang.RuntimePermission "loadLibrary";
  permission java.lang.RuntimePermission "queuePrintJob";
  permission java.net.SocketPermission "*", "connect";
  permission java.net.SocketPermission "localhost:1024-", "accept,listen";
  permission java.io.FilePermission "*", "read,write";
  permission java.util.PropertyPermission "*", "read";
};
// J2EE 1.3 permissions for client container - expanded ear file code base
grant codeBase "file:${com.ibm.websphere.client.applicationclient.archivedir}/-"
 {
  permission java.awt.AWTPermission "accessClipboard";
  permission java.awt.AWTPermission "accessEventQueue";
  permission java.awt.AWTPermission "showWindowWithoutWarningBanner";
  permission java.lang.RuntimePermission "exitVM";
  permission java.lang.RuntimePermission "loadLibrary";
```

```
  permission java.lang.RuntimePermission "queuePrintJob";
  permission java.net.SocketPermission "*", "connect";
  permission java.net.SocketPermission "localhost:1024-", "accept,listen";
  permission java.io.FilePermission "*", "read,write";
  permission java.util.PropertyPermission "*", "read";
};
// For MQ Series
grant codeBase "file:${mq.install.root}/java/*" {
  permission java.security.AllPermission;
};
```

1. If the default permissions for a client (union of the permissions defined in the `client.policy` file and the `client.policy` file) are enough, no action is required. The default client policy is picked up automatically.
2. If a specific change is required to some of the client containers and applets on a node, modify the `client.policy` file with the policy tool. Refer to "Using PolicyTool to edit policy files" on page 355, to edit policy files. Changes to the `client.policy` file are local for the node.

All of the client containers and applets on the local node are granted the updated permissions at the time of execution.

If some client containers or applets on a node require permissions that are not defined as defaults in the `client.policy` file and the default `client.policy` file, update the `client.policy` file. The missing permission causes the exception, java.security.AccessControlException. The missing permission is listed in the exception data, for example,

```
java.security.AccessControlException: access denied (java.io.FilePermission
C:\WebSphere\AppServer\java\jre\lib\ext\mail.jar read)
```

The previous two lines of sample code are one continuous line, but extended beyond the width of the page.

When a client program receives this exception and adding this permission is justified, add a permission to the `client.policy` file, for example, grant codebase "file:*user_client_installed_location*" { permission java.io.FilePermission "C:\WebSphere\AppServer\java\jre\lib\ext\mail.ja", "read"; };.

To decide whether to add a permission, refer to "AccessControlException" on page 352.

Close and restart the browser. You also must restart the client application if you have one.

Migrating Java 2 security policy

Previous WebSphere Application Server releases

Starting from Version 3.x, WebSphere Application Server installed a Java 2 security manager in the server run time to prevent enterprise applications from calling the `System.exit()` and the `System.setSecurityManager()` methods. These two Java APIs have undesirable consequences if called by enterprise applications. The `System.exit()` API, for example, causes the Java virtual machine (application server process) to exit prematurely, which is an undesirable operation for an application server.

However, Java 2 security was not a fully supported feature prior to Version 5. To support Java 2 security properly, all the server run time must be marked as `privileged` (with `doPrivileged()` API calls inserted in the correct places), and identify the default permission sets or policy. Application code is not privileged and subject to the permissions defined in the policy files. The `doPrivileged` instrumentation is important and necessary to support Java 2 security. Without it, the application code must be granted the permissions required by the server run time. This is due to the design and algorithm used by Java 2 security to enforce permission checks. Please refer to the Java 2 security check permission algorithm.

The following two permissions are enforced by the WebSphere Java 2 security manager (hard coded):
- `java.lang.RuntimePermission(exitVM)`
- `java.lang.RuntimePermission(setSecurityManager)`

Application code is denied access to these permissions regardless of what is in the Java 2 security policy. However, the server run time is granted these permissions. All the other permission checks are not enforced.

Partial support was introduced since the version 4.02 product release. Prior to version 4.0.2, Java 2 security was not supported. From version 4.02 and later, only two permissions are supported:
- `java.net.SocketPermission`
- `java.net.NetPermission`

However, not all the product server run time is properly marked as `privileged`. You must grant the application code all the other permissions besides the two listed previously or the enterprise application can potentially fail to run. This Java 2 security policy for enterprise applications is liberal.

What changed

Java 2 Security is fully supported in version 5, which means all permissions are enforced. The default Java 2 security policy for enterprise application is the recommended permission set defined by the J2EE 1.3 specification. Refer to the ${*install_root*}/config/cells/*cell_name*/nodes/*node_name*/app.policy file for the default Java 2 security policy granted to enterprise applications. This is a much more stringent policy compared to previous releases.

All policy is declarative. The product security manager honors all policy declared in the policy files. There is an exception to this rule: enterprise applications are denied access to permissions declared in the ${*install_root*}/config/cells/*cell_name*/filter.policy file.

Note: Enterprise applications that run on Version 4.0.x with Java 2 security enabled are not guaranteed to run successfully when migrating to Version 5 (when Java 2 security is enabled), even if the Java 2 security policy is migrated properly. The default Java 2 security policy for enterprise applications is much more stringent and all permissions are enforced in Version 5. It might fail because the application code does not have the necessary permissions granted where system resources (such as file I/O for example) can be programmatically accessed and are now subject to the permission checking.

Migrating system properties

The following system properties are used in previous releases in relation to Java 2 security:

- **java.security.policy**. The absolute path of the policy file (action required). It contains both system permissions (permissions granted to the Java Virtual Machine (JVM) and the product server run time) and enterprise application permissions. Migrate the Java 2 security policy of the enterprise application to Version 5. For Java 2 security policy migration, see the steps for migrating Java 2 security policy.
- **enableJava2Security**. Used to enable Java 2 security enforcement (no action required). This is deprecated; a flag in the WebSphere configuration application programming interface (API) is used to control whether to enabled Java 2 security. Enable this option through the administrative console.
- **was.home**. Expanded to the installation directory of the WebSphere Application Server (action might be required). This is deprecated; superseded by `${user.install.root}` and `${was.install.root}` properties. If the directory contains instance specific data then `${user.install.root}` is used; otherwise `${was.install.root}` is used. Use these properties interchangeably for the WebSphere Application Server or the Network Deployment environments. See the steps for migrating Java 2 security policy.

Migrating the Java 2 Security Policy

There is no easy way of migrating the Java policy file from Version 4.0.x automatically because there is a mixture of system permissions and application permissions in the same policy file. Manually copy the Java 2 security policy for enterprise applications to a `was.policy` or `app.policy` file. However, migrating the Java 2 security policy to a `was.policy` file is preferable because symbols or relative codebase is used instead of absolute codebase. There are many advantages to this process. The permissions defined in the `was.policy` file should only be granted to the specific enterprise application, while permissions in the `app.policy` file apply to all the enterprise applications running on the node where the `app.policy` file belongs. Refer to the "Java 2 security policy files" on page 357 article for more details on policy management.

The following example illustrates the migration of a Java 2 security policy from a previous release. The contents include the Java 2 security policy file (the default is *install_root*`/properties/java.policy`) for the `app1.ear` enterprise application and the system permissions (permissions granted to the JVM and product server run time). Default permissions are omitted for clarity:

```
// For product Samples
   grant codeBase "file:${install_root}/installedApps/app1.ear/-" {
     permission java.security.SecurityPermission "printIdentity";
     permission java.io.FilePermission
     "${install_root}${/}temp${/}somefile.txt", "read";
   };
```

For clarity of illustration, all the permissions are migrated as the application level permissions in this example. However, you can grant permissions at a more granular level at the component level (Web, enterprise beans, connector or utility Java archive (JAR) component level) or you can grant permissions to a particular component.

1. Ensure that Java 2 security is disabled on the application server.
2. Create a new `was.policy` file (if one is not present) or update the `was.policy` for migrated applications in the configuration repository in

(config/cells/<*cell_name*>/applications/app.ear/deployments/app/META-INF/was.policy) with the following contents:

```
grant codeBase "file:${application}" {
     permission java.security.SecurityPermission "printIdentity";
     permission java.io.FilePermission "
             ${user.install.root}${/}temp${/}somefile.txt", "read";
   };
```

The third and fourth lines in the previous code sample are one continuous line, but extended beyond the width of the page.

3. 5.1 + Use the Assembly Toolkit to attach the `was.policy` file to the enterprise archive (EAR) file. You also can use the Assembly Toolkit to validate the contents of the `was.policy` file. For more information, see "Configuring the was.policy file" on page 368.
4. Validate that the enterprise application does not require additional permissions to the migrated Java 2 Security permissions and the default permissions set declared in the `${was.install.root}/config/cells/`*`cell_name`*`/nodes/`*`node_name`*`/app.policy` file. This requires code review, code inspection, application documentation review, and sandbox testing of migrated enterprise applications with Java 2 security enabled in a pre-production environment. Refer to developer kit APIs protected by Java 2 security for information about which APIs are protected by Java 2 security. If you use third party libraries, consult the vendor documentation for APIs that are protected by Java 2 security. Verify that the application is granted all the required permissions, or it might fail to run when Java 2 security is enabled.
5. Perform pre-production testing of the migrated enterprise application with Java 2 security enabled. **Hint**: Enable trace for the WebSphere Application Server Java 2 security manager in the pre-production testing environment (with trace string: `com.ibm.ws.security.core.SecurityManager=all=enabled`). This can be helpful in debugging the *AccessControlException* exception thrown when an application is not granted the required permission or some system code is not properly marked as *privileged*. The trace dumps the stack trace and permissions granted to the classes on the call stack when the exception is thrown. For more information, see "AccessControlException" on page 352.

   Note: Because the Java 2 security policy is much more stringent compared with previous releases, it is strongly advised that the administrator or deployer review their enterprise applications to see if extra permissions are required before enabling Java 2 security. If the enterprise applications are not granted the required permissions, they fail to run.

Steps for selecting a user registry

Information about users and groups reside in a user registry. In WebSphere Application Server, a user registry authenticates a user and retrieves information about users and groups to perform security-related functions, including authentication and authorization.

Before you begin: Before configuring the user registry you need to know the user name (ID) and password to be used, and you must decide which registry to use (Custom, LDAP, or local OS such as SAF-based).

What you need to know: You need to start the Administrative Console by specifying: `http://server_hostname:9090/admin`

Though different types of registries are supported, only a single active user registry can be configured at once. All the processes in WebSphere Application Server can use one active registry. Configuring the correct registry is a prerequiste to assigning users and groups to roles for applications.

Steps for this task:

1. Click **Security > User Registry** in the Navigation tree on the left.
2. On the user registry panel in the General Properties section of the Configuration tab, enter the server user ID and password.
3. Click **OK**.

Steps for selecting a local OS registry

Before configuring the Local OS registry you need to know the user name (ID) and password that will be used here. This user can be any valid user in the registry. This user will be referred to as either a product security server ID, a server ID or a server user ID in the documentation. Having a server ID means that a user has special privileges when calling protected internal methods.

You need to start the Administrative Console by specifying URL:
`http://<server_hostname>:9090/admin`

1. Click **Security** > **User Registry** > **Local OS** in the Navigation tree on the left.
2. On the Local OS registry panel in the **General Properties** section of the **Configuration** tab, enter the server user ID and password. This ID is the security server ID, which is only used for WebSphere Application Server security and is not associated with the system process that runs the server. The server calls the Local OS registry to authenticate and obtain privilege information about users by calling the native APIs in that particular registry.
3. Click **OK**.

Steps for selecting an LDAP registry

To use LDAP as the user registry, you need to know a valid user name (ID), the user password, the server host and port, the base distinguished name (DN) and if necessary the bind DN and the bind password. You can choose any valid user in the registry that is searchable. In some LDAP servers, the administrative users are not searchable and cannot be used (for example, cn=root in SecureWay). This user is referred to as WebSphere Application Server security server ID, server ID, or server user ID in the documentation. Being a server ID means a user has special privileges when calling some protected internal methods. Normally, this ID and password is used to log into the administrative console once security is turned on. You can use other users to log in if those users are part of the administrative roles.

Perform the following steps to select LDAP as the user registry.

You need to start the administrative console by specifying URL:
`http://server_hostname:9090/admin`

1. Click **Security** > **User Registry** > **LDAP** in the Navigation tree on the left.
2. On the LDAP user registry panel in the General Properties section of the Configuration tab, enter the Server user ID and password. This ID is the security server ID, which is only used for WebSphere Application Server security and is not associated with the system process that runs the server. The server calls the Local OS registry to authenticate and obtain privilege information about users by calling the native APIs in that particular registry.

3. In the type menu, select the type of LDAP server to which you connect. The type is used to preload default LDAP properties. IBM Directory Server users can choose either IBM_Directory_Server or SecureWay as the directory type. Use the IBM_ Directory_server directory type for better performance. Users of the iPlanet Directory Server can choose either iPlanet Directory Server or NetScape as the directory type. Use the iPlanet Directory Server directory type for better performance after configuring the iPlanet to use role (nsRole) as the grouping method. For a list of supported LDAP servers, see "Supported directory services" on page 234.
4. In the Host box, enter the host ID (IP address or domain name system (DNS) name) of the LDAP server.
5. In the Port box, enter host port of the LDAP server. The default value is *389*. If multiple WebSphere Application Servers are installed and configured to run in the same single signon domain, or if the WebSphere Application Server interoperates with a previous version of the WebSphere Application Server, then it is important that the port number match all configurations. For example, if the LDAP port is explicitly specified as 389 in a Version 4.0.x configuration, and a WebSphere Application Server at Version 5 is going to interoperate with the Version 4.0.x server, then verify that port 389 is specified explicitly for the Version 5 server.
6. In the Base Distinguished Name field, enter the base distinguished name of the directory service, indicating the starting point for LDAP searches of the directory service. For example, for a user with a distinguished name (DN) of `cn=John Doe, ou=Rochester, o=IBM, c=US`, you can specify the base DN as (assuming a suffix of c=us): `ou=Rochester,o=IBM,c=us` or `o=IBM,c=us,c=us`. For authorization purposes, this field is case sensitive. This implies that if a token is received (for example, from another cell or Domino) the base DN in the server must match exactly the base DN from the other cell or Domino. If case sensitivity is not a consideration for authorization, enable the Ignore Case field.

   In WebSphere Application Server, Version 5.0.1 or later, the distinguished name is normalized according to the Lightweight Directory Access Protocol (LDAP) specification. In WebSphere Application Server, Version 5, the distinguished name is not normalized. Normalization consists of removing spaces in the base distinguished name before or after commas and equal symbols. If you do not enter a normalized base distinguished name for this field and WebSphere Application Version 5.0.1 or later sends a security token to a version 5 server, the request is rejected during authorization because the distinguished names do not match. An example of a non-normalized base distinguished name is `o = ibm, c = us` or `o=ibm, c=us`. An example of a normalized base distinguished name is `o=ibm,c=us`. To interoperate between WebSphere Application Server Version 5 and later versions, you must enter a normalized base distinguished name in the Base Distinguished Name field. In WebSphere Application Server, Version 5.0.1 or later, the normalization occurs automatically during run time.

   This field is required for all LDAP directories except for the Domino Directory, where it is optional.
7. In the Bind Distinguished Name field, enter the distinguished name for the application server to use when binding to the directory service. If no name is specified, the application server binds anonymously. See the Base Distinguished Name field description for examples of distinguished names.
8. In the Bind Password field, enter the password for the application server to use when binding to the directory service.

9. In the Search Timeout field, enter the timeout value in seconds for an LDAP server to respond before aborting a request. The default value is *300*.
10. Ensure that the Reuse Connection option is checked. Enabled (or checked) is the default and specifies that the server should reuse the LDAP connection. Clear this option only in rare situations where a router is used to spray requests to multiple LDAP servers and when the router does not support affinity.
11. The Ignore Case option allows you to enable or disable case insensitive authorization check. This field is required when IBM Directory Server is selected as the LDAP directory server. Otherwise, this field is optional and can be enabled when a case sensitive authorization check is required. For example, when you use certificates and the certificate contents do not match the case of the entry in the LDAP server. You c an also enable the Ignore Case field when using single signon (SSO) between the product and Domino. The default is *Disabled*.
12. The SSL Enabled option allows you to enable or disable secure socket communication to the LDAP server. When enabled, the LDAP Secure Sockets Layer (SSL) settings are used, if specified.
13. In the SSL Configuration menu, select the Secure Sockets Layer configuration to use for the LDAP connection. This configuration is used only when SSL is enabled for LDAP. The default is *DefaultSSLSettings*.
14. Click **OK**.

Steps for selecting a custom user registry

Before you begin this task, implement and build the `UserRegistry` interface. For more information on developing custom user registries refer to "Selecting a user registry" on page 57.

Perform the following steps to select a custom user registry.

1. Click **Security** > **User Registry** > **Custom** in the Navigation tree on the left.
2. On the Custom user registry panel in the General Properties section of the Configuration tab, enter the Server user ID and password. This ID is the security server ID, which is only used for WebSphere Application Server security and is not associated with the system process that runs the server. The server calls the Local OS registry to authenticate and obtain privilege information about users by calling the native APIs in that particular registry.
3. In the Custom User Registry box, enter the dot-separated class name that implements the `com.ibm.websphere.security.UserRegistry` interface. Put the custom registry class name in the class path. A suggested location is the *%install_root%*`/classes` directory. Although the custom registry implements the `com.ibm.websphere.security.UserRegistry interface`, for backward compatibility, a user registry can alternately implement the `com.ibm.websphere.security.CustomRegistry` interface. The default is `com.ibm.websphere.security.FileRegistrySample`.
4. A check in the Ignore Case check box enables a case insensitive authorization check. The default is *enabled*.
5. Use the Custom Properties link to add any additional properties required to initialize the custom registry. The following property is pre-defined by the product; set this property only when required: `WAS_UseDisplayName`. When set to true, the methods getCallerPrincipal(), getUserPrincipal(), getRemoteUser() return the display name. By default, the securityName of the user is returned. This is primarily introduced to support backward compatibility with the Version 4.0 custom registry.

6. Click **OK**.

Steps for selecting an authentication mechanism

Information about users and groups reside in a user registry. In WebSphere Application Server, a user registry authenticates a user and retrieves information about users and groups to perform security-related functions, including authentication and authorization. Implementation is provided to support multiple operating system or operating environment-based user registries (z/OS SAF registry) and most of the major Lightweight Directory Access Protocol (LDAP)-based user registries. You can use the custom LDAP feature to support any LDAP server by setting up the correct configuration (user and group filters). However, support is not extended to these custom LDAP servers since there are many possibilities that cannot be tested.

The next step in setting up security is to select an authentication mechanism. An authentication mechanism defines rules about security information (for example, whether a credential is forwardable to another Java process), and the format of how security information is stored in both credentials and tokens. Authentication is the process of establishing whether a client is valid in a particular context. A client can be either an end user, a machine, or an application.

An authentication mechanism in WebSphere Application Server typically collaborates closely with a User Registry. The User Registry is the user and groups accounts repository that the authentication mechanism consults with when performing authentication. The authentication mechanism is responsible for creating a credential which is an internal product representation of successfully authenticated client user. Not all credentials are created equal. The abilities of the credential are determined by the configured authentication mechanism.

Although this product provides several authentication mechanisms, only a single active authentication mechanism can be configured at once. The active authentication mechanism is selected when configuring WebSphere global security. WebSphere Application Server for z/OS Version 5 supports the following authentication mechanisms:

- Simple WebSphere Authentication Mechanism (SWAM)
- Light-Weight Third Party Authentication (LTPA)
- Integrated Cryptographic Service Facility (ICSF)

Note: 5.1 + In future releases, IBM intends to deprecate the ICSF authentication mechanism. It is recommended that you migrate to LTPA. For more information on LTPA, see Lightweight Third Party Authentication.

Steps for selecting the SWAM authentication mechanism

If you are using Simple WebSphere Authentication Mechanism (SWAM), there is no setup needed as this is the default mechanism.

Note: SWAM is only valid in a base installation. It is not supported in ND.

Steps for selecting LTPA as the authentication mechanism

You need to start the Administrative Console by specifying URL: `http://server_hostname:9090/admin`.

Perform the following steps to select LTPA as the authentication mechanism for this server.

1. Click **Security** > **Authentication Mechanisms** > **LTPA** in the Navigation tree on the left.
2. Enter the password and confirm it in the password fields. This password is used to encrypt and decrypt the LTPA keys during export and import of the keys. Remember this password because you enter it again when the keys from this cell are exported to another cell.
3. Enter a positive integer value in the Timeout field. This timeout value refers to how long an LTPA token is valid in minutes. The token contains this expiration time so that any server that receives the token can verify that the token is valid before proceeding further. When the token expires, the user is prompted to log in. An optimal value for this field depends on your configuration. The default value is 30 minutes.
4. Click **Apply** or **OK**. The LTPA configuration is now set.
5. Complete the information in the Global Security panel and press OK. When **OK** or **Apply** is clicked in the Global Security panel the LTPA keys are generated automatically the first time, and therefore, you should not generate the keys manually.

Steps for selecting ICSF as the authentication mechanism

ICSF requires the Cryptographic Coprocessor features of the zSeries processor to be enabled and active. You must have ICSF configured and running on your processor before selecting ICSF as your authentication mechanism.

Note: 5.1 + In future releases, IBM intends to deprecate the ICSF authentication mechanism. It is recommended that you migrate to LTPA. For more information on LTPA, see "Lightweight Third Party Authentication" on page 185.

You need to start the Administrative Console by specifying URL: `http://server_hostname:9090/admin`.

Perform the following steps to select ICSF as the authenication mechanism for this server.

1. Click **Security** > **Authentication mechanisms** > **ICSF** in the Navigation tree on the left.
2. In the **Encryption Cryptographic Key** box, specify the label of the cryptographic key to use for single sign-on tokens for Web applications and administrative security when using the Simple Object Access Protocol (SOAP) HTTP connector.
3. Enter a positive integer value in the Timeout field. Specifies the time period in which an ICSF token expires. Verify that this time period is longer than the cache time-out that is configured in the Global Security panel.
4. Click **Apply** or **OK**. The ICSF configuration is now set.

Troubleshooting security configurations

Refer to Security components troubleshooting tips for instructions on how to troubleshoot errors related to security.

The following topics explain how to troubleshoot specific problems related to configuring and enabling security configurations:
- Errors when configuring or enabling security
- Errors or access problems after enabling security
- Errors after enabling Secure Sockets Layer (SSL) or SSL-related error messages

Tuning security configurations

Performance issues typically involve trade-offs between function and speed. Usually, the more function and the more processing involved, the slower the performance. Consider what type of security is necessary and what you can disable in your environment. For example, if your application servers are running in a Virtual Private Network (VPN), consider whether you must disable Single Sockets Layer (SSL). If you have a lot of users, can they be mapped to groups and then associated to your J2EE roles? These questions are things to consider when designing your security infrastructure.

Complete the following steps for general security tuning:

1. Consider disabling Java 2 Security Manager if you know exactly what code is put onto your server and you do not need to protect process resources. Remember that in doing so, you put your local resources at some risk.
2. Disable security for the specific application server that does not require resource protection because some application servers do not have protected resources. If the application server needs to go downstream with credentials, however, this action might not be feasible.
3. Consider propagating new security settings to all nodes before restarting the deployment manager and node agents to change the new security policy. If your security configurations are not consistent across all servers, you get access denied errors. Therefore, you must propagate new security settings when enabling or disabling global security in a Network Deployment environment.

   Configuration changes are generally propagated using configuration synchronization. If auto-synchronization is enabled, you can wait for the automatic synchronization interval to pass, or you can force synchronization before the synchronization interval expires. If you are using manual synchronization, you must synchronize all nodes.

   If the cell is in a configuration state (the security policy is mixed with nodes that have security enabled and disabled) you can use the syncNode utility to synchronize the nodes where the new settings are not propagated.

   Refer to the article, Enabling and disabling global security in the WebSphere Application Server Network Deployment package for more detailed information about enabling security in a distributed environment.
4. Consider increasing the cache and token time-out if you feel your environment is secure enough. By doing so, you have to re-authenticate less often. This action supports subsequent requests to reuse the credentials that already are created. The downside of increasing the token time-out is the exposure of having a token hacked and providing the hacker more time to hack into the system before the token expires. You can use security cache properties to determine the initial size of the primary and secondary hashtable caches, which affect the frequency of rehashing and the distribution of the hash algorithms.
5. Consider changing your administrative connector from Simple Object Access Protocol (SOAP) to Remote Method Invocation (RMI) because RMI uses stateful connections while SOAP is completely stateless. Run a benchmark to determine if the performance is improved in your environment.

6. Use the `wsadmin` script to complete the access IDs for all the users and or groups to speed up the application startup. Complete this action if applications contain many users, or groups, or if applications are stopped and started frequently.

Tuning CSIv2

1. Consider using SSL client certificates instead of a user ID and password to authenticate Java clients. Since you are already making the SSL connection, using mutual authentication adds little overhead while removing the service context containing the user ID and password completely.
2. If you send a large amount of data that is not very security sensitive, reduce the strength of your ciphers. The more data you have to bulk encrypt and the stronger the cipher, the longer this action takes. If the data is not sensitive, do not waste your processing with 128-bit ciphers.
3. Consider putting just an asterisk (*) in the trusted server ID list (meaning trust all servers) when you use Identity Assertion for downstream delegation. Use SSL mutual authentication between servers to provide this trust. Adding this extra step in the SSL handshake performs better than having to fully authenticate the upstream server and check the trusted list. When an asterisk is used, we simply trust the identity token. The SSL connection trusts the server by way of client certificate authentication.
4. Ensure that stateful sessions are enabled for Common Secure Interoperability Version 2 (CSIv2). This is the default, but only requires authentication on the first request and any subsequent token expirations.
5. If you are only communicating with WebSphere Application Server Version 5 servers, make the Active Authentication Protocol CSI, instead of CSI and z/SAS or CSI and SAS. This action removes an interceptor invocation for every request on both the client and server sides.
6. Do this only if you are communicating with servers running WebSphere Application Server, Version 5 or later.
   a. In the `sas.client.props` file, add `com.ibm.CSI.claimTransportAssocSSLTLSRequired=false` and `com.ibm.CSI.claimTransportAssocSSLTLSSupported=false`.
   b. Set the active protocol to `csiv2` instead of `both` in the `sas.client.props` file. The protocol property changes to `com.ibm.CSI.protocol=csiv2`.

Tuning LDAP authentication

1. Select the **Ignore Case** check box in the WebSphere Application Server LDAP User Registry configuration, when case-sensitivity is not important.
2. Select **Reuse Connections** in the WebSphere Application Server LDAP User Registry configuration.
3. Check to see which caches your LDAP server has and take advantage of them. This action is best with LDAP servers that do not change frequently.
4. Choose the directory type of either IBM_Directory_Server or SecureWay, if you are using an IBM Directory Server. The IBM Directory Server yields improved performance because it is programmed to use the new group membership attributes to improve group membership searches. However, it is required that authorization is case insensitive to use IBM Directory Server.
5. Choose either iPlanet Directory Server (also known as Sun ONE) or Netscape as the directory if you are an iPlanet Directory user. Using the iPlanet Directory Server directory increases performance in group membership lookup. However, only use **Role** for group mechanisms.

Tuning Web authentication

1. Consider increasing the cache and token time-out if you feel your environment is secure enough. The Web authentication information is stored in these caches and as long as the authentication information is in the cache, the login module is not invoked to authenticate the user. This supports subsequent requests to reuse the credentials already created. The downside of increasing the token time-out is the exposure of having a token stolen and providing the thief more time to hack into the system before the token expires. See the article for a list of these properties.
2. Consider enabling single singon (SSO). SSO is only available when you select **LTPA** as the authentication mechanism in the **Global Security** panel. When you select SSO, a single authentication to one application server is enough to make requests to multiple application servers in the same SSO domain. There are some situations where SSO is not desirable and should not be used in those situations.

Tuning authorization

1. Consider mapping your users to groups in the user registry. Then associate the groups with your J2EE roles. This association greatly improves performance as the number of users increases.
2. Judiciously assign method-permissions for enterprise beans. For example, you can use an asterisk (*) to indicate all methods in the method-name element. When all the methods in enterprise beans require the same permission, use an asterisk (*) for the method-name to indicate all methods. This indication reduces the size of deployment descriptors and reduces the memory required to load the deployment descriptor. It also reduces the search time during method-permission match for the enterprise beans method.
3. Judiciously assign security-constraints for servlets. For example, you can use the URL pattern `*.jsp` to apply the same authentication data constraints to indicate all JSP files. For a given URL, the exact match in the deployment descriptor takes precedence over the longest path match. Use the extension match (`*.jsp`, `*.do`, `*.html`) if there is no exact match and longest path match for a given URL in the security constraints.

There is always a trade off between performance, feature and security. Security typically adds more processing time to your requests, but for a good reason. Not all security features are required in your environment. When you decide to tune security, you should create a benchmark before making any change to ensure the change is improving performance.

In a large scale deployment, performance is very important. Running benchmark measurements with different combinations of features can help you to determine the best performance versus the benefit configuration for your environment.

Continue to run benchmarks if anything changes in your environment, to help determine the impact of these changes.

Security cache properties

The following system properties determine the initial size of the primary and secondary hash table caches, which affect the frequency of rehashing and the distribution of the hash algorithms. The larger the number of available hash values, the less likely a hash collision occurs, retrieval time might be slower. If several entries compose a hash table cache, creating the table in a larger capacity

supports more efficient hash entries than letting automatic rehashing determine the growth of the table. Rehashing causes every entry to move each time.

com.ibm.websphere.security.util.authCacheEnabled
This cache property (enabled with PQ81585) turns caching on and off. If you set com.bim.websphere.security.util.authCacheEnabled equal to *false* or *no*, then caching is disabled. If you set the property and do not set it to anything other than *false* or *no*, then caching is enabled.

com.ibm.websphere.security.util.authCacheSize
This cache stores basic authentication credentials at the security server. Whenever a Lightweight Third Party Authentication (LTPA) or Integrated Cryptographic Service Facility (ICSF) token expires, a new token generates from the basic authorization credentials in this cache. If basic authorization credentials do not exist, the requesting browser must send the basic authorization credentials to the security server. The browser prompts the user for a user ID and password if a cookie containing the credentials does not exist.

com.ibm.websphere.security.util.tokenCacheSize
This cache stores LTPA or ICSF credentials in the cache using the LTPA or ICSF token as a lookup value. When using an LTPA or ICSF token to log in, the LTPA or ICSF credential is created at the security server for the first time. This cache prevents the need to go to the security server on subsequent logins using an LTPA or ICSF token.

com.ibm.websphere.security.util.CredentialCacheSize
Given the user ID and password for login, this cache returns the concrete credential object without the need to repeat authentication at the security server. If the credential object has expired, repeat authentication is required.

com.ibm.websphere.security.util.LTPAValidationCacheSize
Given the credential token for login, this cache returns the concrete LTPA or ICSF credential object, without the need to revalidate at the security server. If the token has expired, revalidation is required.

Tuning security

Enabling security decreases performance. The following tuning parameters give you considerations for increasing performance.

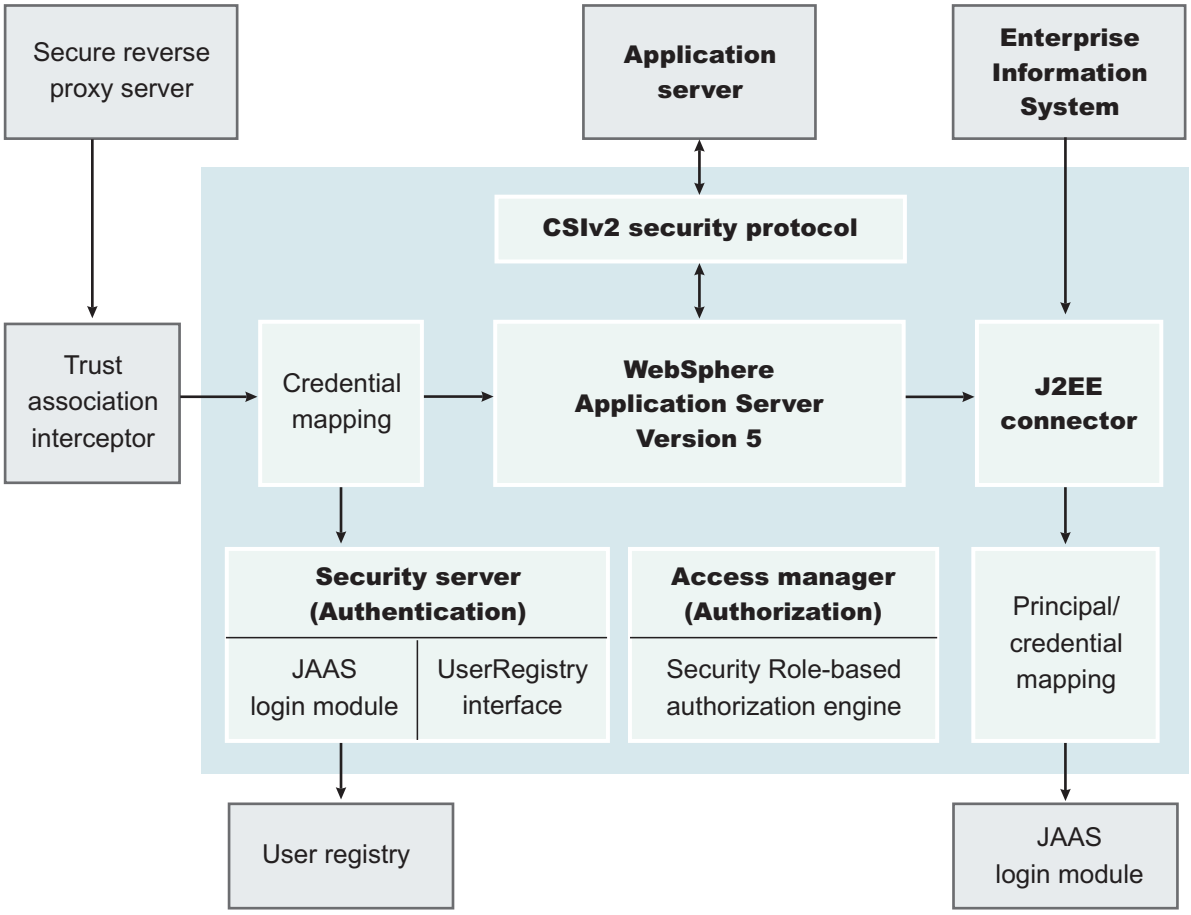
While it is not possible to run WebSphere Application Server for z/OS V5 without security enabled, it is possible to perform certain tuning techniques to make the Application Server run better on z/OS. These techniques are documented in detail in the Security tuning tips for z/OS.

- Disable security in Global security settings. For more information, see “Global security settings” on page 153.
- Fine tune cache timeout in Global security settings. For more information, see “Global security settings” on page 153.
- Security cache properties. For more information, see .
- Tracking session timeout with SSL.
- RACF security settings are documented in detail in the RACF tuning tips for z/OS.
- You can also read about and“Tuning security configurations” on page 390.

Chapter 3. Integrating IBM WebSphere Application Server security with existing security systems

WebSphere Application Server plays an integral part of the multiple-tier enterprise computing framework. WebSphere Application Server adopts the open architecture paradigm and provides many plug-in points to integrate with enterprise software components to provide end-to-end security. WebSphere Application Server plug-in points are based on standard J2EE specifications wherever applicable. WebSphere Application Server is actively involved in various standard bodies to externalize and to standardize plug-in interfaces.

In the following example, several typical multiple-tier enterprise network configurations are discussed. In each case, various WebSphere Application Server plug-in points are used to integrate with other business components. The discussion starts with a basic multiple-tier enterprise network configuration:



A list of terms used in this discussion follows:

Protocol firewall
Prevents unauthorized access from the Internet to the demilitarized zone. The role of this node is to provide the Internet traffic access only on certain ports and to block other IP ports.

WebSphere Application Server plug-in
Redirects all the requests for servlets and JSP pages. Also referred to in

WebSphere Application Server literature as *Web server redirector* was introduced to separate Web server from application server. The advantage of using Web server redirector is that you can move an application server and all the application business logic behind the domain firewall.

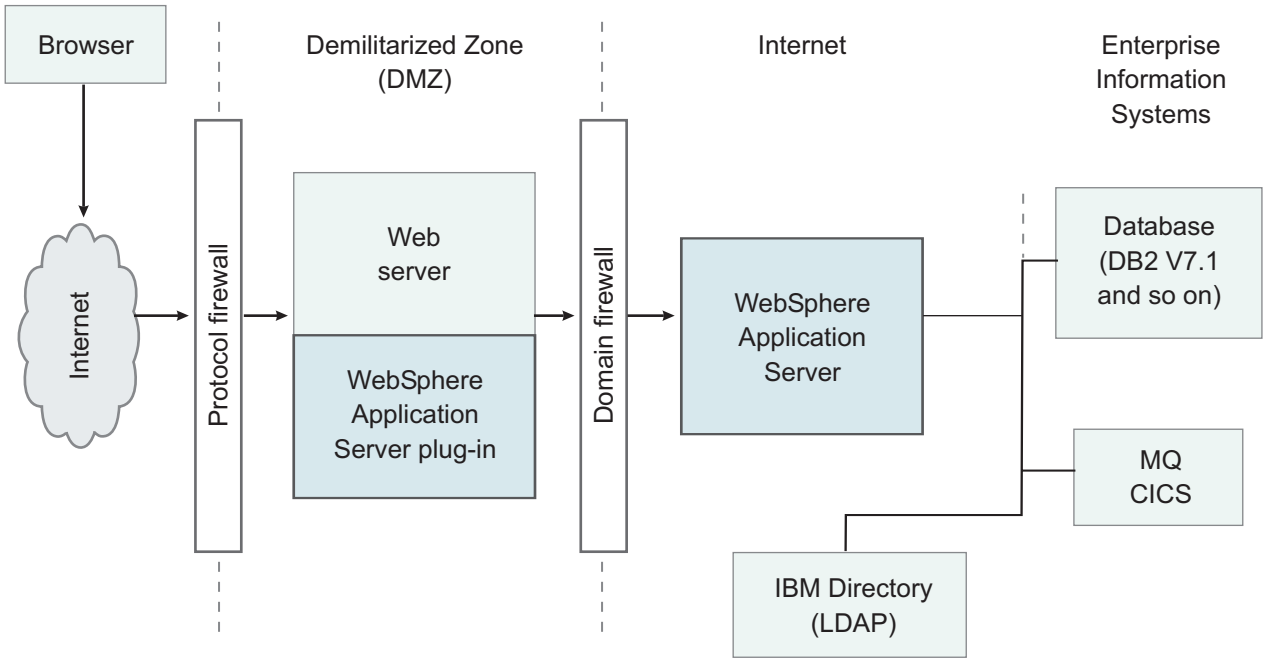
Domain firewall
Prevents unauthorized access from the demilitarized zone to an internal network. The role of this firewall is to allow the network traffic originating from the demilitarized zone and note from the Internet.

Directory
Provides information about the users and their rights in the Web application. The information can contain user IDs, passwords, certificates, access groups, and so forth. This node supplies the information to the security services like authentication and authorization service.

Enterprise information system
Represents existing enterprise applications and business data in back-end databases.

WebSphere Application Server provides the infrastructure to run application business logic and communicate with internal back-end systems and databases Web applications and enterprise beans can access. WebSphere Application Server has a built in HTTPS server that can accept client requests. A typical configuration, however, places WebSphere Application Server behind the domain firewall for better protection. A WebSphere Application Server plug-in to Web server configuration can redirect Web requests to WebSphere Application Server. WebSphere Application Server provides plug-ins for many popular Web servers.

You can configure WebSphere Application Server and the Web server plug-in to communicate through secure SSL channels. You can configure a WebSphere Application Server HTTP server to open communication channels only with a restricted set of Web server plug-ins. You can configure the HTTP server to require client certificate authentication with self-signed certificates and to trust only the signer certificate. For instructions on how to generate self-signed certificates and how to set up secure communications channels between an HTTP server and the WebSphere Application Server plug-in, refer to and .



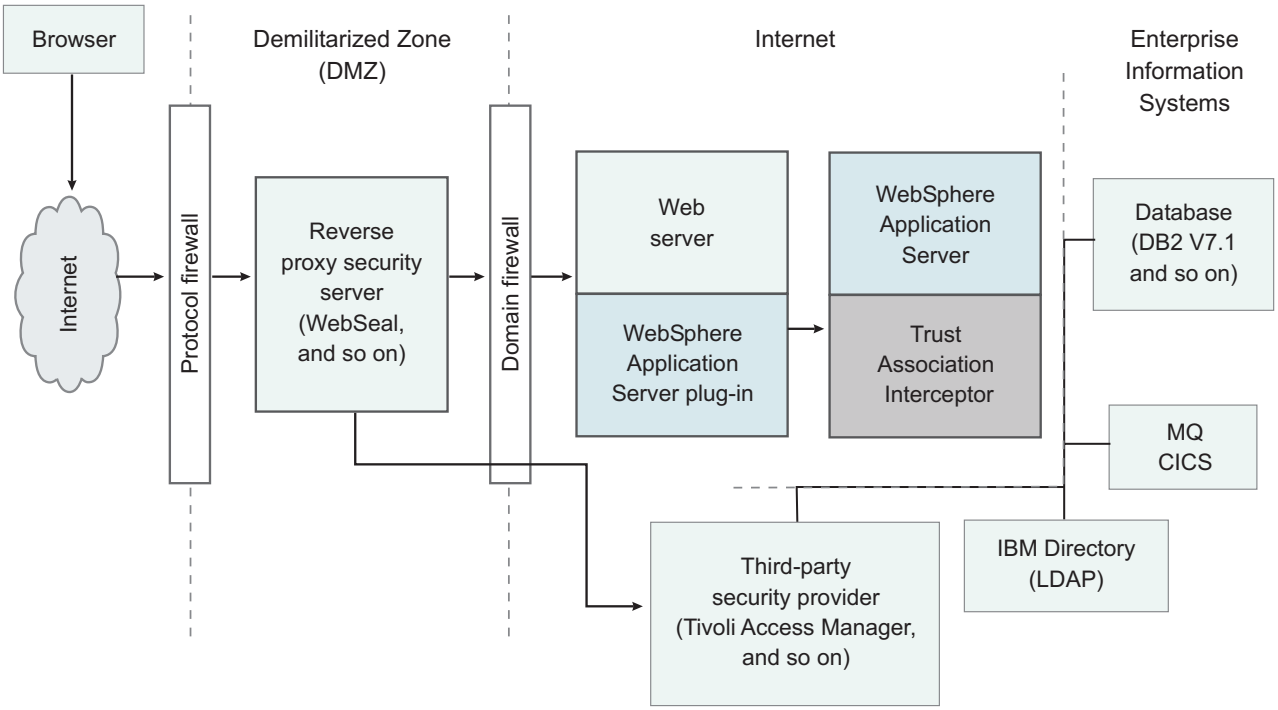
The WebSphere Application Server plug-in routes HTTP requests according to the virtual host and port configuration and the URL pattern matching. Client authentication and finer grained access control are handled by WebSphere Application Server behind the firewall.

In cases where the Web server can contain sensitive data and direct access is not desirable, the following configuration uses Tivoli WebSEAL to shield a Web server from unauthorized requests. WebSEAL is a Reverse Proxy Security Server (RPSS) that uses Tivoli Access Manager to perform coarse-grained access control to filter out unauthorized requests before they reach the domain firewall. WebSEAL uses Tivoli Access Manager to perform access control as illustrated in the picture. WebSphere Application Server supports various user registry implementations through the pluggable user registry interface. WebSphere Application Server ships a Local OS user registry implementation and Lightweight Directory Access Protocol (LDAP).

WebSphere Application Server also supports users in developing their own custom registry and plug-in through the pluggable user registry interface. When integrated with a third party security provider, WebSphere Application Server can share the user registry with the third-party security provider. In the particular example of integrating with WebSEAL, you can configure WebSphere Application Server to use the LDAP user registry, which can be shared with WebSEAL and Tivoli Access Manager. Moreover, you can configure WebSphere Application Server to use the Light Weight Third Party (LTPA) authentication mechanism, which supports the Trust Association Interceptor plug-in point.

Basically, the RPSS performs authentication and adds proper authentication data into the request header and then redirects the request to Web server. A trust relationship is formed between an RPSS and WebSphere Application Server, and the RPSS can assert client identity to WebSphere Application Server to achieve single signon between RPSS and WebSphere Application Server. When the request is forward to WebSphere Application Server, WebSphere Application Server uses the TAI plug-in for the particular RPSS server to evaluate the trust relationship and to extract the authenticated client identity. WebSphere Application Server then

maps the client identity to a WebSphere Application Server security credential. For instructions on setting up a trust association interceptor, refer to Trust associations, Configuring trust association interceptors.



When configured to use the LDAP user registry, WebSphere Application Server uses LDAP to perform authentication. The client ID and password are passed from WebSphere Application Server to the LDAP server. You can configure WebSphere Application Server to set up an SSL connection to LDAP so that passwords are not passed in plain text. To set up an SSL connection from WebSphere Application Server to the LDAP server, refer to Configuring SSL for the LDAP client. WebSphere Application Server Version 5 supports the J2EE Connector Architecture (JCA). The connector architecture defines a standard interface for WebSphere Application Server to connect to heterogeneous enterprise information systems (EIS). Examples of EIS includes database systems, transaction processing such as CICS, and messaging such as Message Queue (MQ). The EIS implementation can perform authentication and access control to protect business data and resources. Resource Adapters authenticate EIS. The authentication data can be provided either by application code or by WebSphere Application Server. WebSphere Application Server provides a principal mapping plug-in point. A principal mapping module plug-in maps the authenticated client principal to a password credential, (that is, user ID and password, for the EIS security domain). WebSphere Application Server ships a default principal mapping module, which maps any authenticated client principal to a configured pair of user IDs and passwords.

Each connector can be configured to use a different set of IDs and passwords. For a description on how to configure JCA principal mapping user IDs and passwords, refer to Managing J2C Authentication Data Entries. A principal mapping module is a special purpose Java Authentication and Authorization Service (JAAS) login module. You can develop your own principal mapping module to fit your particular business application environment. For detailed steps on developing and configuring a custom principal mapping module, refer to the articles, Developing

your own Java 2 security mapping module underneath JAAS Programmatic Login and Managing Java Authentication and Authorization Service (JAAS) Login Configuration.

Security and WebSphere MQseries

It is important to note that security logging information on UNIX systems is not protected because of the world-writeable files in the /var file system of MQseries. MQseries ships the following files with its product:
- -rw-rw-rw- /var/mqm/errors/AMQERR01.LOG
- -rw-rw-rw- /var/mqm/errors/AMQERR02.LOG
- -rw-rw-rw- /var/mqm/errors/AMQERR03.LOG

The previously mentioned files are world-writeable and enable any users on the system to fill up the /var file system where all the security logging information is stored. This leaves the security information unprotected because anyone can access the logging information without being tracked.

To work around this problem, create a file system for the embedded messaging component working data on UNIX. Before you install the embedded messaging component of WebSphere Application Server on UNIX platforms, consider creating and mounting a journalized file system called /var/mqm. Use a partition strategy with a separate volume for the WebSphere MQ data. This means that other system activity is not affected if a large amount of WebSphere MQ work builds up.

To determine the size of the /var/mqm file system for a server installation, consider the following:
- Maximum number of messages in the system at one time
- Contingency for message buildups, if there is a system problem
- Average size of the message data, plus 500 bytes for the message header
- Number of queues
- Size of log files and error messages

Allow 50MB as a minimum for a WebSphere MQ server. You need less space in the /var/mqm file system for a WebSphere MQ client (typically 15MB).

Being secure with WebSphere Application Server for z/OS

IBM WebSphere Application Server for z/OS Version 5 security is a composite security offering that utilizes much of the solid security foundation laid out in WebSphere Application Server for z/OS Version 4 (and also currently utilized by the Network Deployment version of IBM WebSphere Application Server). WebSphere Application Server for z/OS Version 4 is upwardly compatible with WebSphere Application Server for z/OS Version 5, unless otherwise noted.

Introducing WebSphere Application Server for z/OS Version 5 security: Security administration determines security setup. With WebSphere Application Server for z/OS Version 5, security configuration is integrated into the WebSphere Common Security Model and takes advantage of the WebSphere Common Configuration Model for configuration tasks. This makes WebSphere Application Server for z/OS easier to configure if you are already familiar with WebSphere on the Distributed platform.

Security deployment information built into applications on a Distributed platform can be redeployed on WebSphere Application Server for z/OS without requiring modification. Application portability is available in these areas:

- Common configuration model
- WebSphere bindings
- Role-based authorizations
- LTPA authentication
- LDAP implementation of user registries

Note that additional security configuration is required to take advantage of z/OS Security Server-specific services.

Impact of enabling WebSphere global security on WebSphere Application Server for z/OS Version 5: Security can be either enabled or disabled globally (note that WebSphere Application Server for z/OS customization dialogs do not enable global security). When you disable security:

- Internet InterORB Protocol (IIOP) and Hypertext Transfer Protocol (HTTP) clients are not configured
- Administrative security is not used
- SSL transports are not used
- Authorization checks are not conducted for servlets,Enterprise JavaBeans (EJBs), and JMX MBeans
- RunAs settings are ignored
- CBIND checks are not done

Unless security is enabled globally, client authentication or authorization is not performed. This affects administrative and application level security because all security constraints and metadata is ignored. This includes:

- SSL Transport information
- Java client authentication
- Web security constraints
- j
- RunAs attributes
- CBIND checking of IIOP clients
- Role-based authorization checks
- EJBROLE profile checks

Determining the registry authentication mechanism is important when configuring your security properties. Security can be configured using either the z/OS administrative console or the WSADMIN scripting command. Web Container definitions are stored in a Web Container file and Resource Access Control Facility (RACF) or System Authorization Facility (SAF) and SSL (SystemSSL and JSSE) setup information is stored in the customization dialogs.

Choosing authorization mechanisms for Java 2 Platform, Enterprise Edition (J2EE) resources is also important. The types of authentication mechanisms include Application Bindings, SAF EJBROLES profiles, and Pluggable Auhtorization Table Interface. SAF EJBROLES is recommended, and the advantages of using it include (on a z/OS local registry):

- The user-to-role mapping is owned by the system programmer or the RACF administrator.
- Auditing functions are available.

J2EE 1.3 compliance WebSphere Application Server sought in order to meet Common Object Request Broker Architecture (CORBA) and CSIv2 requirements. This includes having a Common Secure Interoperability Version 2 (CSIv2) conformance level of ″0″, enabling Java 2 Security, and utilizing the JAAS Programming Model.

Functions supported on WebSphere Application Server for z/OS Version 5, WebSphere Application Server for z/OS Version 4, or WebSphere Application Server Distributed Version 5

Table 11. Functions supported on WebSphere Application Server for z/OS V5, WebSphere Application Server for z/OS Version 4, or WebSphere Application Server Distributed Version 5

Function	WebSphere Application Server for z/OS Version 5	WebSphere Application Server for z/OS Version 4	WebSphere Application Server Distributed Version 5	Notes
RunAs EJB	x	x	x	
RunAs for Servlets	x		x	
SAF-based IIOP Protocols	x	x		
z/OS connector facilities	x	x		
Global security enable or disable	x		x	
CORBA security interfaces			x	Refer to Migrating to WebSphere Application Server V5.0.
RACF keyrings	x	x		
Authentication functions	x	x	x	*Examples*: Basic, SSL digital certificates, form-based login, security constraints, trust association interceptor
J2EE security resources	x	x	x	
Security environment	x		x	
Web authentication (LTPA)	x		x	
Web authentication (ICSF)	x	x		
EJB using LTPA	x		x	
WebSphere application bindings	x		x	
DCE		x		
Application-level sync-to thread	x			

Table 11. Functions supported on WebSphere Application Server for z/OS V5, WebSphere Application Server for z/OS Version 4, or WebSphere Application Server Distributed Version 5 (continued)

Function	WebSphere Application Server for z/OS Version 5	WebSphere Application Server for z/OS Version 4	WebSphere Application Server Distributed Version 5	Notes
Method-level sync-to thread		x		
Role-based naming security	x		x	
Role-based administrative security	x		x	
SAF registries	x	x		
Identity assertion	x	x	x	• Use trusted servers or CBIND for server authorization required. • On WebSphere Application Server for z/OS Version 4 you must use z/OS Secure Authentication Services (zSAS).
CORBA			x	Refer to Migrating Common Object Request Broker Architecture programmatic login to Java Authentication and Authorization Service
Authentication protocols				*Example*: CSIV2
CSIv2 conformance level ″0″	x		x	
J2EE compliance	x	x	x	
JAAS programming model WebSphere extensions	x		x	

When Migrating to WebSphere Application Server V5.0 there are some things to consider. All basic Version 5 authentication mechanisms for Web clients are similar Version 4, meaning enhancements provided to functions and structure for compatibility.

Key similarities include:

- **Using RunAs:** Use RunAs in order to change identity of a caller, server, or role. This is now part of the servlet specification.
- **Support of SAF-based IIOP authentication protocols:** Network Deployment uses Secure Authentication Services (SAS) for IIOP authentication. z/OS has its own version of SAS called zSAS (with similar functions but different

mechanisms), and it handles functions such as local security, PassTickets, SSL-based authorization, digital certificates with SAF mapping, Kerberos with IBM protocol, and SAF identity assertion.
- **SAF-based authorization and RunAs capability:** This allows you to use SAF (EJBROLE) profiles for permission and delegation security information.
- **Support for z/OS connector facilities:** Instead of using an alias where a user ID and password is stored, the ability to propagate local OS identities is supported.
- **RACF keyring support for HTTP and IIOP:** Use SystemSSL for HTTP, IIOP, and RACF key ring support. You can also use JSSE.
- **Authentication functions:** Web Authentication mechanisms such as basic, Secure Sockets Layer (SSL) digital certificates, form-based login, security constraints, and trust association interceptor offer the same functionality in Version 5 as offered in Version 4. (Note that SSOAuthenticator is supported.)
- **Authorization for J2EE resources:** Authorization for J2EE resources employs roles similar to the ones used in Version 4, and these roles are used as descriptors.
- **Security enablement:** Security can be enabled or disabled globally. When the server comes up there is some level of security on, but security is disabled until the administrator sets it up.
- **Web authentication using LTPA and ICSF:** Single-signon using Integrated Cryptographic Service Facility (ICSF) or Lightweight Third Party Authentication (LTPA) is supported.
- **EJB authentication using LTPA:** EJB authentication using LTPA is supported.
- **WebSphere Application Bindings for Authorization:** WebSphere Application Bindings for Authorization are now supported.
- **DCE authentication:** DCE authentication is no longer supported.
- **Method-level sync-to thread:** Method-level sync-to thread is supported.
- **Role-based naming security:** J2EE roles are used to protect access to the namespace. The new roles and tasks are cosNamingRead, cosNamingWrite, cosNamingCreate, and cosNamingDelete.
- **Role-based administrative security:** The roles delimiting security are:
  - Monitor (least authorization and is read-only)
  - Operator (can do runtime changes)
  - Configurator (can monitor and configuration privileges)

Comparing WebSphere Application Server for z/OS Version 5 with WebSphere Application Server for Network Deployment on Distributed Version 5

A key similarity:
- **Pluggable security model:** The pluggable security model can be authenticated in IIOP (CSIv2), Web Trust Authentication, JMX Connectors, or the Java Authentication and Authorization Service (JAAS) programming model. You must:
  1. Determine which registry is appropriate and what authentication (token) mechanisms are needed
  2. Determine whether or not the registry is local or remote, and what Web authorizations should be used - Web authorizations include Simple WebSphere authentication mechanism (SWAM) and LTPA

Key differences include:
- **SAF registries:** Local operating system registries provide premium functionality on z/OS because z/OS spans a sysplex rather than a single server. z/OS provides certificate to user mapping, authorization, and delegation functions.
- **Identity assertion:** Use trusted servers or CBIND to get the authorization required for the server doing the assertion. Distributed platform requires a server to be placed in the trusted server list. z/OS requires a server ID to have a

specific CBIND authorization. The Assertion types are SAF user ID, Distinguished Name (DN), and SSL client certificate.
- **zSAS and SAS authentication protocols for IIOP clients:** zSAS differs from SAS because it requires SAF credentials to be used when authenticating and also supports RACF PassTickets. The SAS layer in WebSphere Distributed uses CORBA portable interceptors to implement their Secure Association Service, and z/OS does not.
- **CORBA features:** z/OS does not support CORBA security interfaces including the CORBA current, LoginHelper, Credentials, and ServerSideAuthenticator models. CORBA functions have been migrated to JAAS. A one-time conversion effort is expected. Refer to Migrating Common Object Request Broker Architecture programmatic login to Java Authentication and Authorization Service.
- **Authentication protocols:** CSIv2 is an Object Management Group (OMG) specification for the z/OS Security Server and is automatically enabled when WebSphere security is enabled. This is a three-layered approach involving a transport layer (SSL/TLS) for message protection, supplemental client authentication layer for user ID and password (GSSUP), and security attribute layer used by middle servers (who must be specially authorized to the target server) for identity assertion.

J2EE 1.3 compliance

Being J2EE-compliant involves:
- **CSIv2 conformance level ″0″:** This is an OMG (related to the z/OS Security Server) specification, which is part of what used to be the CORBA support. CSIv2 is automatically enabled when security is enabled.
- **Use of Java 2 security:** There is ″security-enabled″ and ″Java 2 security-enabled″, and the default for Java2 is ″on″. This provides a fine-grained access control that is code-based as opposed to subject-based authorization. Each class belongs to one particular domain. Permissions protected by Java 2 security include file access, network access, sockets, exiting Java virtual machine (JVM), administration of properties, and threads. The ″security manager″ is what Java 2 uses as a mechanism for managing security and enforcing the required protections. Extensions to Java 2 security include use of dynamic policy (permissions resource type-based rather than code-based), use of specific default permissions defined for resources in template profiles, and use of filter files to disable policy.
- **Use of JAAS programming:** JAAS programming includes a standard set of APIs for authentication. JAAS is the strategic authorization and authentication mechanism. IBM Developer Kit for Java Technology Edition Version 1.4.x WebSphere Application Server shipped with WebSphere Version 5(but some extensions are supplied).
- **Use of the servlet RunAs function:** WebSphere Application Server Distributed refers to this as ″Delegation Policy″. You can change identity to run as a system, caller, or role (user). This is now part of the servlet specification. Authentication involves using a user ID and password and then mapping the alias to the appropriate XML file to find the user ID of the RunAs role.

Compliance with WebSphere Network Deployment at the API/SPI level

Compliance with WebSphere Network Deployment at the API/SPI level makes deploying applications from Network Deployment on z/OS easier. Features enhanced or deprecated by Network Deployment are enhanced or deprecated by z/OS. However, this does not mean there is no migration for z/OS customers. Compliance with WebSphere Network Deployment at the API/SPI level includes:

- **WebSphere Application Server extensions to the JAAS programming model:** The authorization model is an extension of the Java 2 security model for JAAS programming (so it works with the J2EE model). Subject-based authorization is performed on authenticated user IDs. Instead of merely logging in with a user ID and password, there is now a login process that includes creating a login context, passing callback handlers that prompt for user ID and password, and logging in. WebSphere Application Server for z/OS Version 5 supplies the login module, the callback handler to retrieve the necessary data, the callbacks, the WSSubject choice, and the new extensions (that will only be on z/OS) ″getCallerSubject″ and ″getRunAsSubject″.
- **Use of the WebSphere Application Server security APIs:** z/OS supports WebSphere Application Server security APIs.
- **Use of secure JMX connectors:** JMX connectors can be used with user ID and password credentials. The two connector types are RMI and SOAP/HTTPS (and are for administration). The SOAP connector uses the JSSE SSL repertoires. The RMI connector is subject to the same advantages and restrictions as IIOP mechanisms (such as CSIv2).

Interoperability issues for security

To have interoperability of zSeries Security Authentication Service (zSAS) between C++ and WebSphere Application Server, use the Common Secure Interoperability Version 2 (CSIv2) authentication protocol over Remote Method Invocation over the Internet Inter-ORB Protocol (RMI-IIOP). To have interoperability of zSAS between WebSphere Application Server for Distributed and WebSphere Application Server for z/OS use the CSIv2 authentication protocol over RMI-IIOP.

Interoperating with a C++ common object request broker architecture client

You can achieve interoperability between C++ CORBA clients and WebSphere Version 5 using the z/SAS protocols. z/SAS supports many of hte same functions as CSIv2, only z/SAS uses a propietary architecture. z/SAS supports three types of authentication:

- User ID and password authentication
- User ID and password authentication over SSL
- SSL client certificate authentication

Security authentication from non-Java based C++ client to enterprise beans. WebSphere Application Server supports security in the CORBA C++ client to access protected enterprise beans. If configured, C++ CORBA clients can access protected enterprise bean methods using client certificate to achieve mutual authentication on WebSphere Application Server Enterprise applications.

To support the C++ CORBA client in accessing protected enterprise beans:

- Create an environment file for the client, such as current.env. Set the variables listed below (security_sslKeyring, client_protocol_user, client_protocol_password) in the file.
- Using security_sslKeyring, specify the SSL keyring to a keyring that was created for the client.
- Using client_protocol_user and client_protocol_password, specify a user ID and password if using z/SAS Basic Authentication.

- Point to the environment file using the fully qualified pathname through the environment variable WAS_CONFIG_FILE. For example, in the test shell script test.sh, export WAS_CONFIG_FILE=/WebSphere/V5R0M0/AppServer/bin/current.env.

C++ security setting	Description
client_protocol_password	Specifies the password for the user ID.
client_protocol_user	Specifies the user ID to be authenticated at the target server.
security_sslKeyring	Specifies the name of the RACF keyring the client will use. The keyring must be defined under the user ID that is issuing the command to run the client.

Interoperating with previous product versions

IBM WebSphere Application Server, Version 5 interoperates with the previous product versions (such as Version 4 and Version 3.5). Interoperability is achieved using the zSAS security mechanism for localOS and SAF-based authorization.

1. Enable security with the LTPA authentication mechanism and the LDAP user registry. Make sure that the same LDAP user registry is shared by all the product versions.
2. Extract and add Version 5 server certificates into the server key ring file of the previous version.
   a. Open the Version 5 server key ring file using the key management utility (iKeyman) and extract the server certificate to a file.
   b. Open the server key ring of the previous product version, using the key management utility and add the certificate extracted from product Version 5.
3. Extract and add Version 5 trust certificates into the trust key ring file of the previous product version.
   a. Open the Version 5 trust key ring file using the key management utility and extract the trust certificate to a file.
   b. Open the trust key ring file of the previous product version using the key management utility and add the certificate extracted from Version 5.
4. If single signon (SSO) is enabled, export keys from the Version 5 product and import them into the previous product version. The Version 4 product requires the fix, PQ61779, and the Version 3.5 product requires the fix, PQ59667, for SSO to function.
5. Verify that the application uses the correct JNDI name. In Version 5, the enterprise beans are registered with long JNDI names like, `(top)/nodes/node_name/servers/server_name/HelloHome`. Whereas in previous releases, enterprise beans are registered under a root like, `(top)/HelloHome`. Therefore, EJB applications from previous versions perform a lookup on the Version 5 enterprise beans.

   You can also create EJB name bindings in Version 5 that are compatible with the previous version. To create an EJB name binding at the root Version 5, start the administrative console and click **Environment** > **Naming** > **Naming Space Bindings** > **New** > **EJB** > **Next**. Complete all the fields and enter a short name (for example, `-HelloHome`) as the JNDI Name. Click **Next** and **Finish**.
6. Stop and restart all the servers.

7. Make sure that the correct naming bootstrap port is used to perform naming lookup. In previous product versions, the naming bootstrap port is **900**. In Version 5, the bootstrap port is **2809**.

Security: Resources for learning

Use the following links to find relevant supplemental information about Securing applications and their environment. The information resides on IBM and non-IBM Internet sites, whose sponsors control the technical accuracy of the information.

These links are provided for convenience. Often, the information is not specific to the IBM WebSphere Application Server product, but is useful all or in part for understanding the product. When possible, links are provided to technical papers and Redbooks that supplement the broad coverage of the release documentation with in-depth examinations of particular product areas.

View links to additional information about:
- Planning, business scenarios and IT architecture.
- Programming model and decisions
- Programming specifications
- Administration

Planning, business scenarios and IT architecture
- WebSphere Application Server Library
- WebSphere Application Server Support
- WebSphere Application Server Version 5 Security Redbook

Programming model and decisions
- IBM SDK for z/OS, Java 2 Technology Edition, Version 1.4
  - Refer to Java 2 Security check permission algorithm.

Programming specifications
- J2EE Specifications
- EJB Specifications
- Servlet Specifications
- Common Secure Interoperability Version 2 (CSIv2) Specification
- JavaTM 2 Platform, Standard Edition, v 1.4.2 API Specification

Administration
- WebSphere Application Server Version 4.0 Security Redbook: WebSphere Security Model.
- IBM HTTP Server Support and Documentation
- IBM Directory Server Support and Documentation
- IBM Application Developer Kit Readme
  - For IBM Application Developer Kit refer to `{was_install_root}/java/docs/readme.devkit.ibm.html`
  - For IBM Application Developer Kit Installation and Configuration Readme refer to `{was_install_root}/java/docs/readme.install.ibm.html`
- IBM cryptographic hardware devices
- Supported hardware, software and APIs prerequisite Web site

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