BEA WebLogic Enterprise

Using Security

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Using Security

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About This Document

This document provides an introduction to concepts associated with the BEA WebLogic Enterprise (WLE) security features, a description of how to secure your WLE applications using the WLE security features, and a guide to the use of the application programming interfaces (APIs) in the WLE Security Service.

This document covers the following topics:

- Chapter 1, “Overview of WLE Security,” introduces concepts associated with the WLE security features.
- Chapter 2, “Managing Certificates and Keys,” describes how to set up a public key infrastructure to interact with WLE applications that use the SSL protocol and certificate-based authentication.
- Chapter 3, “Configuring the WLE Environment for the SSL Protocol,” describes configuring the IIOP Listener/Handler, the CORBA C++ ORB, or the CORBA Java ORB so that it can be used with the Secure Sockets Layer (SSL) protocol and certificate-based authentication.
- Chapter 4, “Defining Security for a WLE CORBA Application,” explains the configuration tasks required when using security in a WLE application.
- Chapter 5, “Writing a WLE CORBA Application That Implements Security,” explains how the bootstrapping options work and describes implementing password-based authentication and certificate-based authentication in WLE CORBA applications.
- Chapter 6, “Building and Running the CORBA Sample Applications,” describes how to build and run the Security and Secure Simpapp sample applications.
- Chapter 7, “Writing a WLE Enterprise JavaBean that Implements Security,” describes implementing password-based and certificate-based authentication in WLE EJBs.

- Chapter 8, “Troubleshooting,” provides troubleshooting tips that can be used when solving problems that occur with the security portion of a WLE application.
- Chapter 9, “WLE Security Service APIs,” introduces the WLE Security model and the functional components of the security model.
- Chapter 10, “Security Modules,” includes the Object Management Group (OMG) Interface Definition Language (IDL) for the modules used by the WLE Security service.
- Chapter 11, “C++ Security Reference,” includes the C++ method descriptions.
- Chapter 12, “Java Security Reference,” includes the Java method descriptions.
- Chapter 13, “Automation Security Reference,” includes the Automation method descriptions.

What You Need to Know

This document is intended for programmers who want to incorporate security into their WLE applications and system administrators who are responsible for setting up and maintaining the security infrastructure in an enterprise.

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The BEA WebLogic Enterprise product documentation is available on the BEA corporate Web site. From the BEA Home page, click the Product Documentation button or go directly to the “e-docs” Product Documentation page at http://e-docs.beasys.com.

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Related Information

For more information about CORBA, Java 2 Enterprise Edition (J2EE), BEA TUXEDO, distributed object computing, transaction processing, C++ programming, and Java programming, see the WLE Bibliography in the WebLogic Enterprise online documentation.

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When contacting Customer Support, be prepared to provide the following information:

- Your name, e-mail address, phone number, and fax number
- Your company name and company address
- Your machine type and authorization codes
- The name and version of the product you are using
- A description of the problem and the content of pertinent error messages

Documentation Conventions

The following documentation conventions are used throughout this document.

Convention	Item
boldface text	Indicates terms defined in the glossary.
Ctrl+Tab	Indicates that you must press two or more keys simultaneously.
italics	Indicates emphasis or book titles.

Convention	Item

`monospace text`	Indicates code samples, commands and their options, data structures and their members, data types, directories, and file names and their extensions. Monospace text also indicates text that you must enter from the keyboard.
	Examples:
	`#include <iostream.h> void main ( ) the pointer psz`
	`chmod u+w *`
	`\tux\data\ap`
	`.doc`
	`tux.doc`
	`BITMAP`
	`float`

`monospace boldface text`	Identifies significant words in code. *Example*: `void` **`commit`** `( )`
`monospace italic text`	Identifies variables in code. *Example*: `String` *`expr`*
UPPERCASE TEXT	Indicates device names, environment variables, and logical operators. *Example*s: LPT1 SIGNON OR
`{ }`	Indicates a set of choices in a syntax line. The braces themselves should never be typed.

`[ ]`	Indicates optional items in a syntax line. The brackets themselves should never be typed.
	Example:
	`buildobjclient [-v] [-o name ] [-f` *`file-list`*`]...`
	`[-l` *`file-list`*`]...`

`|`	Separates mutually exclusive choices in a syntax line. The symbol itself should never be typed.

Convention	Item

. . .	Indicates one of the following in a command line:
	■ That an argument can be repeated several times in a command line
	■ That the statement omits additional optional arguments
	■ That you can enter additional parameters, values, or other information
	The ellipsis itself should never be typed.
	Example:
	`buildobjclient [-v] [-o name ] [-f file-list]...`
	`[-l file-list]...`

. . .	Indicates the omission of items from a code example or from a syntax line. The vertical ellipsis itself should never be typed.

1 Overview of WLE Security

This topic includes the following sections:

- WLE Security Features
- Link-Level Encryption
- Username/Password Authentication
- The SSL Protocol
- Certificate-Based Authentication
- Commonly Asked Questions about WLE Security

WLE Security Features

The BEA WebLogic Enterprise (referred to as WLE) product enables you to integrate the following essential security features into your WLE applications:

- Authentication allows the two communicating parties to be certain that they are speaking with someone whom they trust. By using usernames and passwords or digital certificates and public-key technology, a WLE object and the application that invokes a request on the WLE object can each be authenticated to the other.
- Confidentiality is the ability to keep communication secret from parties other than the intended recipient. It is achieved by encrypting all data. The WLE product provides mechanisms that enable two communicating parties to negotiate an algorithm they both support and to agree on the keys with which to encrypt the data.
- Integrity is a guarantee that the data being transferred has not been modified in transit. The same handshake that allows two parties to agree on a method of encryption also provides a means of supplying integrity through the use of shared data integrity secrets. Shared data integrity secrets ensure that when data is received, any modifications made to the data while in transit will be detected.

The WLE product provides the security features:

- Link-Level Encryption
- Username/Password authentication
- The SSL protocol
- Certificate-based authentication

The remainder of this topic describes how the different security features work in the WLE product.

Link-Level Encryption

Link-level encryption (LLE) is the encryption of messages going across network links between machines in a WLE domain or between WLE domains. The objective of LLE is to ensure confidentiality so that a network-based eavesdropper cannot learn the content of WLE system messages or WLE application-generated messages. LLE is point-to-point, which means that data may be encrypted/decrypted as many times as it flows over network links.

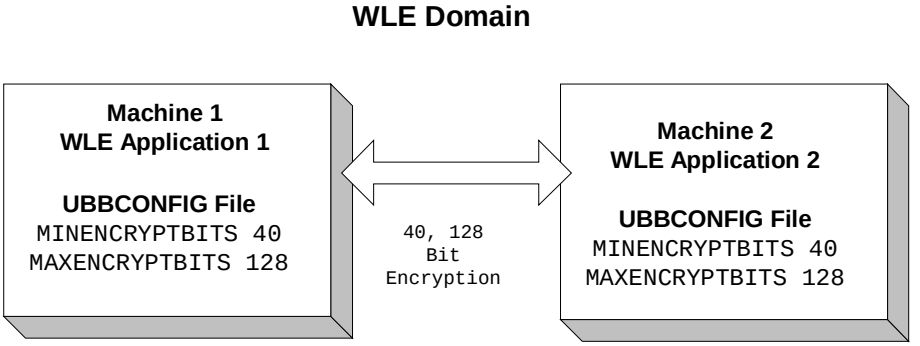
How LLE Works

LLE works in the following way:

1. The system administrator sets a parameter to control the encryption strength.
2. The WLE domain receives the initial connection and starts to negotiate the encryption level to be used between the WLE applications.
3. The two WLE applications agree on the largest common key size supported by both.
4. The configured maximum key size parameter is reduced to agree with the installed software's capabilities. This step must be done at link negotiation time, because at configuration time it may not be possible to verify a particular machine's installed encryption package.
5. The WLE applications exchange messages using the appropriate encryption level.

Figure 1-1 illustrates these steps.

Figure 1-1 How LLE Works



Development Process

The implementation of LLE is an administrative task. The system administrators for each WLE application set parameters in the `UBBCONFIG` file that control encryption strength. When the two WLE applications establish communication, they negotiate what level of encryption to use to exchange messages. Once an encryption level is negotiated, it remains in effect for the lifetime of the network connection.

Username/Password Authentication

The WLE product supports a username/password mechanism to provide authentication to existing WLE applications and to new WLE applications that are not prepared to deploy a full public key infrastructure (PKI). When using Username/Password authentication, the applications that initiate invocations on WLE objects authenticate themselves to the WLE domain using a defined username and password.

The WLE product utilizes a delegated trust authentication model. In this model, initiating applications authenticate to a trusted gateway process. In the WLE product, the trusted gateway process is the IIOP Listener/Handler. As part of successful authentication, a security association, called a security context, is established between the initiating application and the IIOP Listener/Handler that controls access to WLE objects.

Two levels of Username/Password authentication are provided:

- Application password—In this security scenario, the client application authenticates itself to the WLE domain. A user name or client application name, and application password are used to authenticate the client application.
- System authentication—In this security scenario, the client application provides the same information as when using application password authentication and additional authentication data that is verified by a WLE-provided authentication server (`AUTHSRV`) before access is granted to client application.

Username/Password authentication is available in both the base WLE product and the WLE Security pack. If you install the WLE Security pack and choose to use Username/Password authentication, the SSL protocol can be used to provide confidentiality to communication between different machines. When using Username/Password authentication, you have the option of using the `Tobj::PrincipalAuthenticator::logon()` or the `SecurityLevel2::PrincipalAuthenticator::authenticate()` methods.

How Username/Password Authentication Works

Username/Password authentication works in the following way:

1. The initiating application instantiates the Bootstrap object with any of the URL address formats. For more information about which URL address format to use with the Bootstrap object, see “Understanding the Address Formats of the Bootstrap Object” on page 5-2.
2. The initiating application obtains credentials for the user. The initiating application must provide proof material to be used by the WLE domain to authenticate the user. This proof material consists of the name of the user and a password.

- The initiating application creates the security context using a `PrincipalAuthenticator` object. The request for authentication is sent to the IIOP Listener/Handler. The proof material in the authentication request is securely relayed to the authentication server, which verifies the supplied information.
- If the verification succeeds, the WLE system constructs a `Credentials` object that is used by all future invocations. The `Credentials` object for the user is associated with the `Current` object that represents the security context.

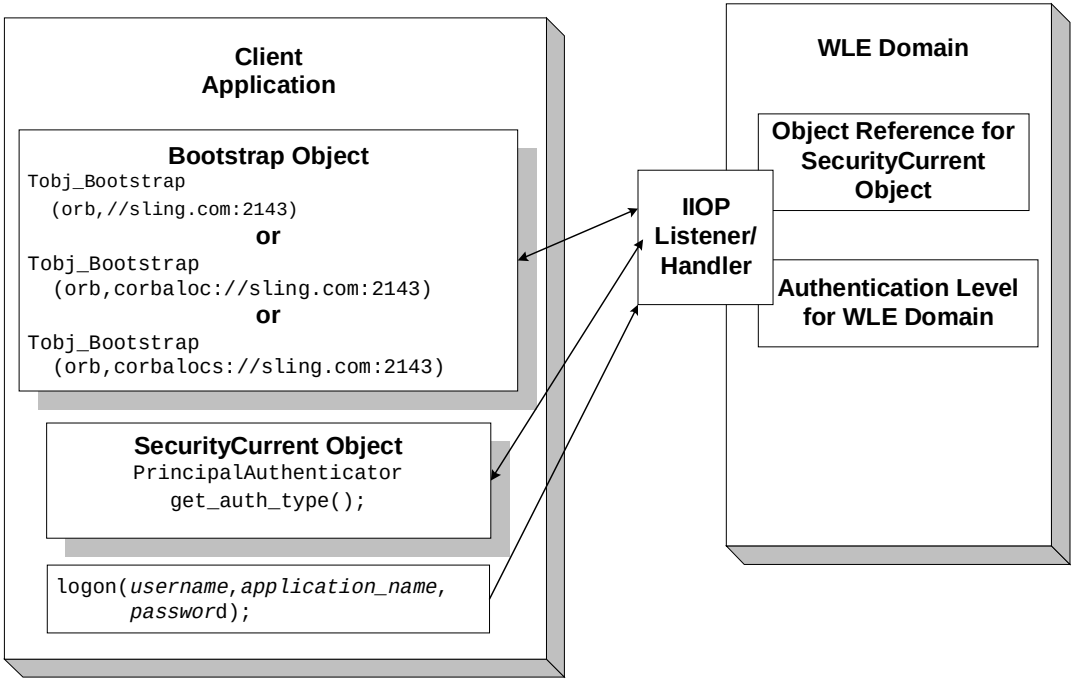
3. The initiating application invokes a WLE object in the WLE domain using an object reference. The request is packaged into an IIOP request and is forwarded to the IIOP Listener/Handler that associates the request with the previously established security context.

   If the SSL protocol is used to secure the connection for confidentiality and integrity, the data will also be protected from eavesdropping.

4. The IIOP Listener/Handler receives the request from the initiating application.
5. The IIOP Listener/Handler forwards the request, along with the credentials of the initiating application, to the appropriate WLE object.

Figure 1-2 illustrates these steps.

Figure 1-2 How Username/Password Authentication Works



Development Process for Username/Password Authentication

Defining Username/password authentication for a WLE application includes administration and programming steps. Table 1-1 and Table 1-2 list the administration and programming steps for Username/Password authentication. For a detailed description of the administration steps for Username/Password authentication, see “Defining Security for a WLE CORBA Application” on page 4-1. For a complete description of the programming steps, see “Writing a WLE CORBA Application That Implements Security” on page 5-1.

Table 1-1 Administration Steps for Username/Password Authentication

Step	Description
1	Set the SECURITY parameter in the UBBCONFIG file to either APP_PW or USER_AUTH.
2	If you defined the SECURITY parameter as USER_AUTH, configure the authentication server (AUTHSRV) in the UBBCONFIG file.
3	Use the tpusradd and tpgrpadd commands to define lists of authorized users and groups.
4	Use the tmloadcf command to load the UBBCONFIG file. When the UBBCONFIG file is loaded, the system administrator is prompted for a password. The password entered at this time becomes the password for the WLE application.

Table 1-2 Programming Steps for Username/Password Authentication

Step	Description
1	Write application code that uses the Bootstrap object to obtain a reference to the SecurityCurrent object.
2	Write application code that obtains the PrincipalAuthenticator object from the SecurityCurrent object.
3	Write application code that uses the Tobj::PrincipalAuthenticator::logon() or SecurityLevel2::PrincipalAuthenticator::authenticate() operation to establish a security context with the WLE domain.
4	Write application code that prompts the user for the password defined when the UBBCONFIG file is loaded.

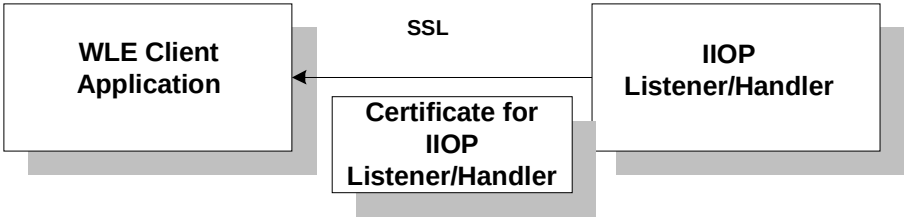
The SSL Protocol

The WLE product provides the industry-standard Secure Sockets Layer (SSL) protocol to establish secure communications between client and server applications. When using the SSL protocol, principals use digital certificates to prove their identity to a peer.

The default behavior of the SSL protocol in the WLE product is to have the IIOP Listener/Handler prove its identity to the principal who initiated the SSL connection using a digital certificate. The digital certificate is verified to ensure that the certificate has not been tampered with or expired. If there is a problem with the digital certificate in the chain, the SSL connection is terminated. In addition, the issuer of the digital certificate is compared against a list of trusted certificate authorities to verify the digital certificate received from the IIOP Listener/Handler has been signed by a certificate authority that is trusted by the WLE domain.

Figure 1-3 provides a conceptual overview of the SSL protocol.

Figure 1-3 The SSL Protocol



How the SSL Protocol Works

The SSL protocol works in the following manner:

1. The initiating application instantiates the Bootstrap object with a URL in the form of `corbaloc://host:port` or `corbalocs://host:port`.

   If you use the `corbaloc://host:port` URL address format, the bootstrapping process is unsecure. You can use the `authenticate()` method of the `SecurityLevel2::Current` interface and the `invocations_options_required()` method to secure the bootstrapping process and specify that certificate-based authentication is to be used.

2. The initiating application receives the digital certificate of the principal in this case the IIOP Listener/Handler. The security context is established as result of a `Tobj_Bootstrap::resolve_initial_references()` or a `Tobj::PrincipalAuthenticator::Logon()` method. This step is transparent to the user of the application.

3. If the verification succeeds, the WLE system constructs a `Credentials` object. The `Credentials` object for the principal represents the security context for the current thread of execution.

4. The initiating application invokes a WLE object in the WLE domain using an object reference.

5. The request is packaged into an IIOP request and is forwarded to the IIOP Listener/Handler that associates the request with the established security context.

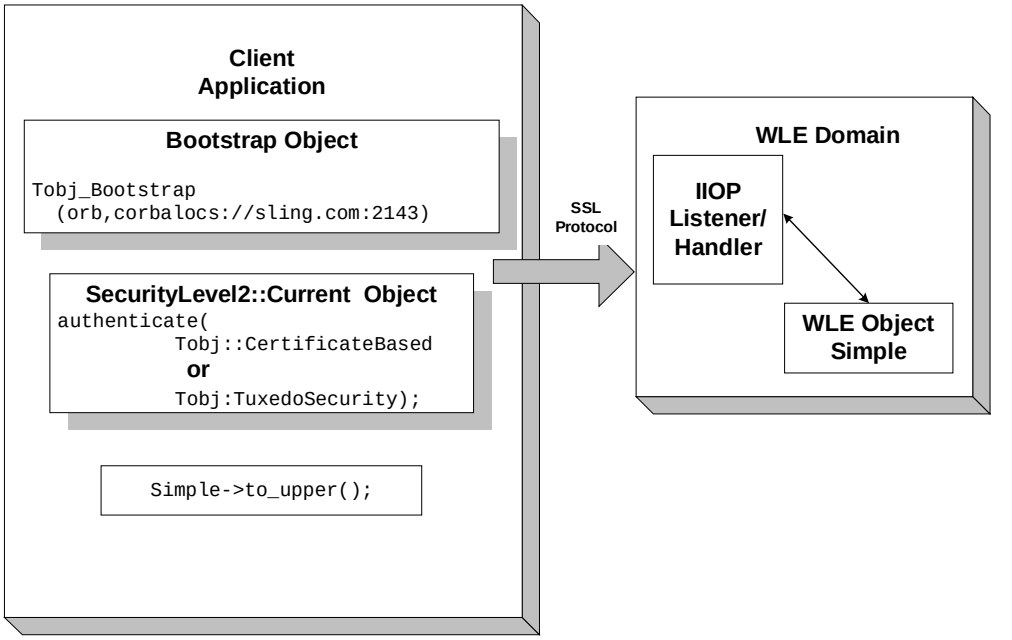
   The request is digitally signed and encrypted before it is sent to the IIOP Listener/Handler. The WLE system performs the signing and sealing of requests.

6. The IIOP Listener/Handler receives the request from the initiating application. The digital signature of the request is verified and the request is decrypted.

7. The IIOP Listener/Handler forwards the request to the appropriate WLE object.

Figure 1-4 illustrates these steps.

Figure 1-4 How the SSL Protocol Works in a WLE Application



Requirements for Using the SSL Protocol

To use the SSL protocol in a WLE application, you need to install the WLE Security Pack. Information about installing the WLE Security Pack can be found in the *BEA WebLogic Enterprise Installation Guide*.

The WLE implementation of the SSL protocol is flexible enough to fit into most public key infrastructures. The WLE product requires that certificates are stored in an LDAP-enabled directory. You can choose any LDAP-enabled directory service. You can also choose the certificate authority from which to obtain certificates and private keys used in a WLE application. You must have an LDAP-enabled directory service and a certificate authority in place before using the SSL protocol in a WLE application.

Development Process for the SSL Protocol

Using the SSL protocol in a WLE application is primarily an administration process. Table 1-4 lists the administration steps required to set up the infrastructure required to use the SSL protocol and configure the IIOP Listener/Handler for the SSL protocol. For a detailed description of the administration steps, see "Managing Certificates and Keys" on page 2-1 and "Configuring the WLE Environment for the SSL Protocol" on page 3-1.

Once the administration steps are complete, you can use either Username/Password authentication or Certificate authentication in your WLE application. For more information, see "Writing a WLE CORBA Application That Implements Security" on page 5-1. In addition, you can use the SSL protocol with Enterprise JavaBeans, for more information, see "Writing a WLE Enterprise JavaBean that Implements Security" on page 7-1.

Note: If you are using the BEA CORBA C++ or CORBA Java ORB as a server application, the ORB can also be configured to use the SSL protocol. For more information, see "Configuring the WLE Environment for the SSL Protocol" on page 3-1.

Table 1-3 Administration Steps for the SSL Protocol

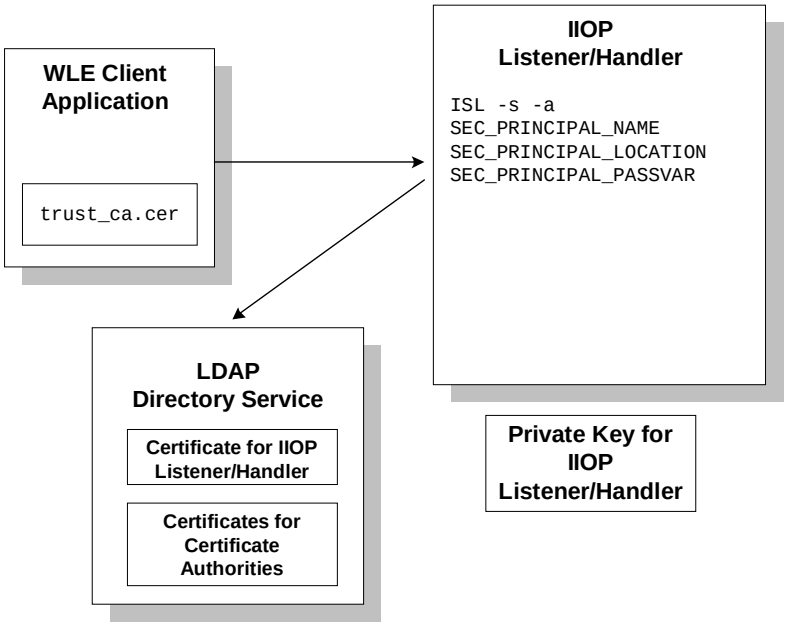
Step	Description
1	Install the WLE Security pack.
2	Set up an LDAP-enabled directory service.
3	Obtain a certificate and private key for the IIOP Listener/Handler from a certificate authority.
4	Publish the certificates for the IIOP Listener/Handler and the certificate authority in the LDAP-enabled directory service.
5	Define the `SEC_PRINCIPAL_NAME`, `SEC_PRINCIPAL_LOCATION`, and `SEC_PRINCIPAL_PASSVAR` parameters for the ISL server process in the `UBBCONFIG` file.
6	Define a port for secure communication on the IIOP Listener/Handler using the `-s` option of the ISL command.

Table 1-3 Administration Steps for the SSL Protocol

Step	Description
7	Create a Trusted Certificate Authority file (trust_ca.cer) that defines the certificate authorities trusted by the IIOP Listener/Handler.
8	Use the `tmloadcf` command to load the `UBBCONFIG` file.
9	Optionally, create a Peer Rules file (`peer_val.rul`) for the IIOP Listener/Handler.
10	Optionally, modify the LDAP Search filter file to reflect the directory hierarchy in place in your enterprise.

Figure 1-5 illustrates the configuration of a WLE application that uses the SSL protocol.

Figure 1-5 Configuration for Using the SSL Protocol in a WLE Application



Certificate-Based Authentication

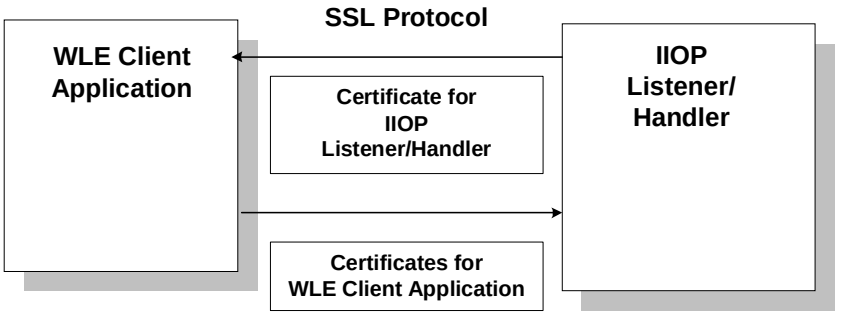
Certificate-based authentication requires that each side of an SSL connection proves its identity to the other side of the connection. In the WLE product, the IIOP Listener/Handler presents its digital certificate to the principal who initiated the SSL connection. The initiator then provides a chain of digital certificates that are used by the IIOP Listener/Handler to verify the identity of the initiator.

Once a chain of digital certificates is successfully verified, the IIOP Listener/Handler retrieves the value of the distinguished name from the subject of the digital certificate. The WLE product uses the email address element of the subject's distinguished name as the identity of the principal. The IIOP Listener/Handler uses the identity of the principal to impersonate the principal and establish a security context between the initiating application and the WLE domain.

Once the principal has been authenticated, the principal that initiated the request and the IIOP Listener/Handler agree on a cipher suite that represents the type and strength of encryption that they both support. They also agree on the encryption key and synchronize to start encrypting all subsequent messages.

Figure 1-6 provides a conceptual overview of the certificate-based authentication.

Figure 1-6 Certificate-Based Authentication



How Certificate-based Authentication Works

Certificate-based authentication works in the following manner:

1. The initiating application instantiates the Bootstrap object with a URL in the form of `corbaloc://host:port` or `corbalocs://host:port` and controls the requirement for protection by setting attributes on the `SecurityLevel2::Credentials` object returned as a result of the `SecurityLevel2::PrincipalAuthenticator::authenticate` operation.

Note: You can also use the `SecurityLevel2::Current::authenticate()` method to secure the bootstrapping process and specify that certificate-based authentication is to be used.

2. The initiating application obtains the digital certificate and the private key of the principal. Retrieval of this information may require proof material to be supplied to gain access to the principal's private key and certificate. The proof material typically is a pass phrase rather than a password.

   The security context is established as result of a `Tobj_Bootstrap::resolve_initial_references()` or a `Tobj::PrincipalAuthenticator::Logon()` method. This step is transparent to the user of the application.

3. If the verification succeeds, the WLE system constructs a `Credentials` object. The `Credentials` object for the principal represents the security context for the current thread of execution.

4. The initiating application invokes a WLE object in the WLE domain using an object reference.

5. The request is packaged into an IIOP request and is forwarded to the IIOP Listener/Handler that associates the request with the established security context.

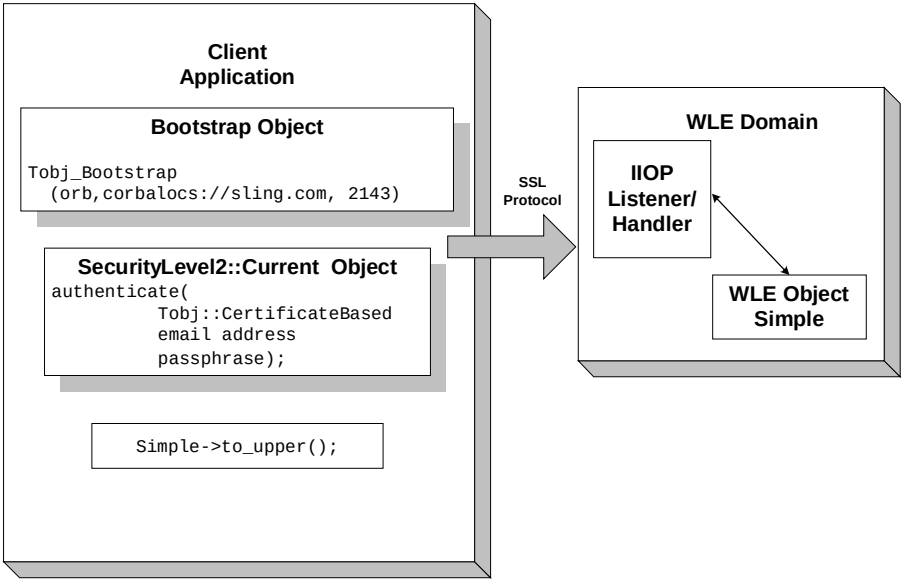
6. The request is digitally signed and encrypted before it is sent to the IIOP Listener/Handler. The WLE system performs the signing and sealing of requests.

7. The IIOP Listener/Handler receives the request from the initiating application. The digital signature of the request is verified and the request is decrypted.

8. The IIOP Listener/Handler maps the principals certificate identity to a TUXEDO user identity.

9. The IIOP Listener/Handler forwards the request, along with the TUXEDO identity of the principal, to the appropriate WLE object.

Figure 1-7 How Certificate-Based Authentication Works



Requirements for Using Certificate-Based Authentication

Certificate-based authentication uses the SSL protocol so you need to install the WLE Security Pack. Information about installing the WLE Security Pack can be found in the *BEA WebLogic Enterprise Installation Guide*. You also need an LDAP-enabled directory. You can choose any LDAP-enabled directory service. You can also choose the certificate authority from which to obtain certificates and private keys used in a WLE application. You must have an LDAP-enabled directory service and a certificate authority in place before using certificate-based authentication in a WLE application.

Development Process for Certificate-Based Authentication

Using certificate-based authentication in a WLE application includes administration and programming steps. Table 1-4 and Table 1-5 list the administration and programming steps for certificate-based authentication. For a detailed description of the administration steps, see “Managing Certificates and Keys” on page 2-1 and “Configuring the WLE Environment for the SSL Protocol” on page 3-1.

Table 1-4 Administration Steps for Certificate-Based Authentication

Step	Description
1	Install the WLE Security pack.
2	Set up an LDAP-enabled directory service.
3	Obtain a certificate and private key for the IIOP Listener/Handler from a certificate authority.
4	Obtain a certificate and private key for the WLE application from a certificate authority.
5	Store the private key files for the WLE application in the Home directory of the user or in `$TUXDIR/udataobj/security/keys`.
6	Publish the certificates for the IIOP Listener/Handler, the WLE application, and the certificate authority in the LDAP-enabled directory service.
7	Define the `SEC_PRINCIPAL_NAME`, `SEC_PRINCIPAL_LOCATION`, and `SEC_PRINCIPAL_PASSVAR` for the ISL server process in the `UBBCONFIG` file.
8	Use the `tpusradd` command to define the authorized users of your WLE application.
9	Define a port for secure on the IIOP Listener/Handler using the `-s` option of the ISL command.
10	Enable certificate-based authentication in the IIOP Listener/Handler using the `-a` option of the ISL command.
11	Create a Trusted Certificate Authority file (trust_ca.cer) that defines the certificate authorities trusted by the IIOP Listener/Handler.

Table 1-4 Administration Steps for Certificate-Based Authentication

Step	Description
12	Create a Trusted Certificate Authority file (trust_ca.cer) that defines the certificate authorities trusted by the WLE client application.
13	Use the `tmloadcf` command to load the `UBBCONFIG` file.
14	Optionally, create a Peer Rules file (`peer_val.rul`) for both the WLE client application and the IIOP Listener/Handler.
15	Optionally, modify the LDAP Search filter file to reflect the directory hierarchy in place in your enterprise.

Figure 1-8 illustrates the configuration of a WLE application that uses certificate-based authentication.

Figure 1-8 Configuration for Using Certificate-Based Authentication in a WLE Application

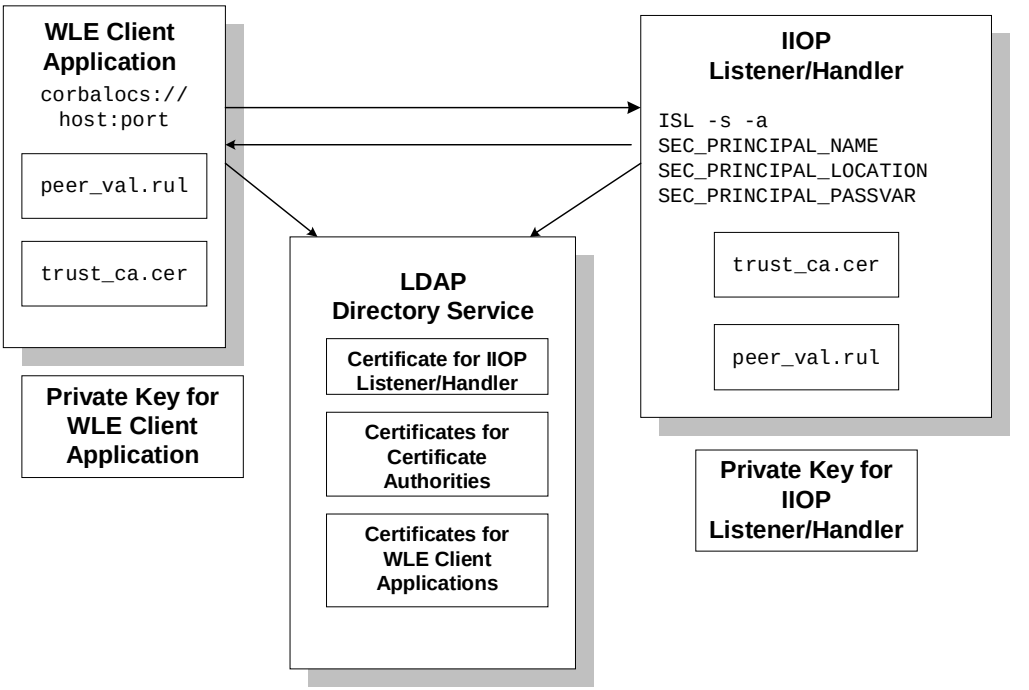


Table 1-5 lists the programming steps for using certificate-based authentication in a WLE application. For more information, see “Writing a WLE CORBA Application That Implements Security” on page 5-1. In addition, you can use certificate-based authentication with Enterprise JavaBeans, for more information see “Writing a WLE Enterprise JavaBean that Implements Security” on page 7-1.

Table 1-5 Programming Steps for Certificate-Based Authentication

Step	Description
1	Write application code that uses the `corbaloc` or `corbalocs` URL address formats of the Bootstrap object. Note that the CommonName in the Distinguished Name of the certificate of the IIOP Listener/Handler must match exactly the host name provided in the URL address format.

Table 1-5 Programming Steps for Certificate-Based Authentication

Step	Description
2	Write application code that uses the `authenticate()` method of the `SecurityLevel2::Current` interface to perform authentication. Specify `Tobj::CertificateBased` for the method argument and the pass phrase for the private key as the `auth_data` argument for `Security::Opaque`.

Commonly Asked Questions about WLE Security

The following sections answer some of the commonly asked questions about the WLE security features.

Do I have to Change the Security in an Existing WLE Application?

The answer is no. If you are using security interfaces from previous versions of the WLE product in your WLE application there is no requirement for you to change your WLE application. You can leave your current security scheme in place and your existing WLE application will work with WLE applications built with the WLE 5.0 product.

For example, if your WLE application consists of a set of server applications which provide general information to all client applications which connect to them, there is really no need to implement a stronger security scheme. If your WLE application has a set of server applications which provide information to client applications on an internal network which provides enough security to detect sniffers, you don't need to implement the features in the WLE Security Pack.

Can I Use the SSL Protocol in an Existing WLE Application?

The answer is yes. You may want to take advantage of the extra security protection provided by the SSL protocol in your existing WLE application. For example, if you have a WLE server application which provides stock prices to a specific set of client applications, you can use the SSL protocol to make sure the client applications are connected to the correct WLE server application and that they are not being routed to a fake WLE server application with incorrect data. A username and password is sufficient proof material to authenticate the client application. However, by using the SSL protocol, the username and password will be encrypted adding an additional level of security.

The SSL protocol offers WLE applications the following benefits:

- Protection of the entire conversation including the initial bootstrapping process. The SSL protocol protects against man-in-the-middle attacks, replay attacks, tampering, and sniffing.
- Even if you only use the default settings, the SSL protocol provides signed and sealed protection since the default encryption settings are a minimum of 40 bit by default.
- Client verification of the connected IIOP Listener/Handler using the certificate of the IIOP Listener/Handler. The client application can then apply additional security rules to restrict access to the client application by the IIOP Listener/Handler. This protection also applies to IIOP Listener/Handlers connecting to remote server applications when using callback objects.

To use the SSL protocol in a WLE application, set up the infrastructure to use digital certificates, change the command line options on the ISL server process to use the SSL protocol, and configure a port for secure communications on the IIOP Listener/Handler. If your existing WLE application uses username/password authentication, you can use that code with the SSL protocol. If your WLE C++ CORBA client application does not already catch the `InvalidDomain` exception when resolving initial references to the Bootstrap object and performing authentication, write code to handle this exception. For more information, see “The SSL Protocol” on page 1-9.

Note: The Java implementation of the `Tobj_Bootstrap::resolve_initial_references()` method does not throw an `InvalidDomain` exception. When the `corbaloc` or `corbalocs` URL address formats are used, the `Tobj_Bootstrap::resolve_initial_references()` method internally catches the `InvalidDomain` exception and throws the exception as a `COMM_FAILURE`. The method functions this way in order to provide backward compatibility.

When Should I Use Mutual Certificate-Based Authentication?

You might be ready to migrate your existing WLE application to use Internet connections between the WLE application and web browsers and commercial web servers. For example, users of your WLE application might be shopping over the internet. The users must be confident that:

- They are in fact communicating with the server at the online store and not an impostor that mimics the store's server to get credit card information.
- The data exchanged between the user of the WLE application and the online store will be unintelligible to network eavesdroppers.
- The data exchanged with the online store will arrive unaltered. An instruction to order $500 worth of merchandise must not accidently or maliciously become a $5000 order.

In these situations, the SSL protocol and certificate-based authentication offer WLE applications the maximum level of protection. In addition to the benefits achieved through the use of the SSL protocol, certificate-based authentication offers WLE applications:

- IIOP Listener/Handler verification of the client application that initiates a request using the certificate of the client application. In addition, the IIOP Listener/Handler can apply additional rules which restrict access to the client application based on the identity established by the certificate. A remote ORB acting as a server application can also be configured to allow mutual authentication and verify the identity of a client application based on a certificate.

- Inside the WLE domain, the client application can still have a TUXEDO username and password. The IIOP Listener/Handler will perform maps the identity defined in a certificate to a TUXEDO username and password thus allowing existing WLE applications to have an identity in native WLE server applications.

For more information, see “The SSL Protocol” on page 1-9 and “Certificate-Based Authentication” on page 1-14

2 Managing Certificates and Keys

This topic includes the following sections:

- Installing the WLE Security Pack
- Using the LDAP Directory Service with Your WLE Application
- Editing the LDAP Search Filter File
- Publishing a Certificate for the Certificate Authority
- Obtaining Digital Certificates and Private Keys for Principals
- Storing the Private Keys in a Common Location
- Defining the Trusted Certificate Authorities
- Creating a Peer Rules File

The WLE product requires you have an LDAP-enabled directory service and a certificate authority (either commercial or private) set up for your organization.

Perform the tasks in this topic only if you are using the SSL Protocol or certificate-based authentication.

Installing the WLE Security Pack

To use the SSL protocol or certificate-based authentication to protect communication between principals and the WLE domain, you need to install the WLE Security Pack. The WLE Security Pack contains the files necessary to enable the use of the SSL protocol. For complete information about installing the WLE Security Pack, see the *BEA WebLogic Enterprise Installation Guide*.

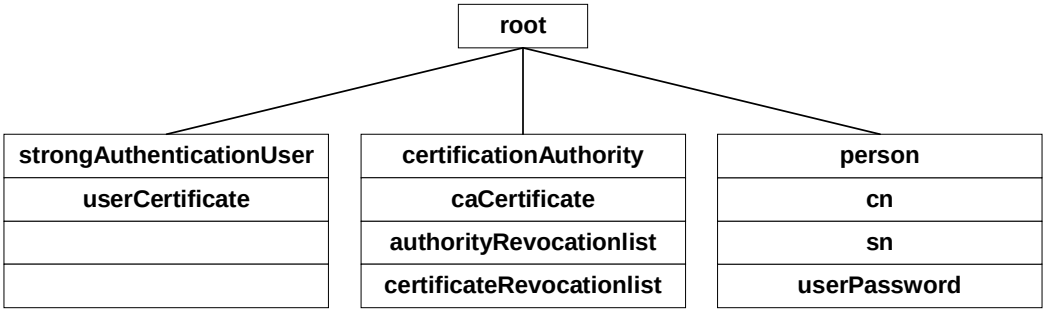
Using the LDAP Directory Service with Your WLE Application

The use of a global directory service is the most popular way to store certificates. A directory service simplifies the management of information that needs to be globally available to an ever-growing number of users. The Lightweight Directory Access Protocol (LDAP) provides access to a variety of directory services.

The WLE product retrieves digital certificates for principals and certificate authorities from an LDAP-enabled directory service, such as Netscape Directory Service or Microsoft Active Directory. Before you can use the SSL protocol or certificate-based authentication, you need to install an LDAP-enabled directory service and configure it for your organization. The WLE product requires that the digital certificates be stored in the directory service in Privacy Enhanced Mail (PEM) format.

Directory services define a hierarchy of object classes. While there are a number of different object classes, there is a small set associated with digital certificates. Figure 2-1 illustrates the object classes associated with digital certificates.

Figure 2-1 LDAP Directory Structure for Digital Certificates



By default, the WLE product retrieves digital certificates from the following object classes:

- `certificationAuthority`—contains digital certificates for certificate authorities
- `strongAuthenticationUser`—contains digital certificates for principals and the IIOP Listener/Handler.

Refer to the *BEA WebLogic Enterprise Installation Guide* for information about integrating your LDAP-enabled directory service into the WLE environment.

Editing the LDAP Search Filter File

When configuring a WLE application to use the SSL protocol or certificate-based authentication, you may need to customize the LDAP search filter file to limit the scope of the search of the directory service. Customizing the LDAP search filter file can result in significant performance gains. The WLE Security Pack ships with the following LDAP search filters:

- A filter stanza that searches the directory service for digital certificates assigned to certificate authorities. The filter limits its search to instances of the `certificationAuthority` object class.

- A filter stanza that searches the directory service for digital certificates assigned to principals. The filter limits its search to instances of the `strongAuthenticationUser` object class.

If the directory service scheme for your organization is defined to store digital certificates in object classes other than `certificationAuthority` and `strongAuthenticationUser`, the LDAP search filter file must be modified to specify those object classes.

If can specify a location of the LDAP search filter file during the installation of the WLE Security pack. For more information, see the *BEA WebLogic Enterprise Installation Guide*.

The LDAP search filter file is owned by the administrator account. BEA recommends that the file be protected so that only the owner has read and write privileges for the file and all other users have only read privileges for the file.

To limit the search of the directory service for certificates for principals and certificate authorities, you need to modify the following tags in the LDAP search filter file:

- `BEA_person_lookup`
- `BEA_issuer_lookup`

These tags identify the stanzas in the LDAP search filter file that contains the filter expression that will be used when looking up information in the directory service. These BEA-specific tags allow the stanzas of an LDAP search filter file to be stored in a common LDAP search filter file with stanzas used by other LDAP-enabled applications that might be found in your organization.

The following is an example of the stanzas of an LDAP search filter file used by the WLE product for the SSL protocol and certificate-based authentication:

```
“BEA_person_lookup”
 “.*”  “ “ “(|(objectClass=strongAuthenticationUser) (mail=%v))”
                                        “email address”
          “(|(objectClass=strongAuthenticationUser) (mail=%v))”
                                        “start of email address”
“BEA_issuer_lookup”
 “.*” “ ” “(&(objectClass=certificationAuthority)
            (cn=%v))”  “exact match cn”
            (sn=%v))”   “exact match sn”
```

- `BEA_person_lookup` specifies to search the LDAP directory service for principals by their email addresses.

- `BEA_issuer_lookup` specifies to search the LDAP directory service for principals by their common names (`cn`).

See the documentation for your LDAP-enabled directory service for additional information about LDAP Search File filters.

Publishing a Certificate for the Certificate Authority

During the authentication process, the identity of a principal depends on the integrity of the public key value in the principal's digital certificate and the private key associated with the digital certificate.A certificate authority is a trusted entity that confirms the integrity of a digital certificate. All digital certificates must be signed by a certificate authority. In order to use the SSL protocol or certificate-based authentication in a WLE application, you need to set up a certificate authority from which to obtain digital certificates.

When setting up security for a WLE application, it is important to choose a suitable certificate authority, make the digital certificate for the certificate authority available, and then use the certificate authority to sign digital certificates for your WLE application. You can use a commercial or private certificate authority of your choice with the WLE product. The certificate authority must be in place before using the SSL protocol or certificate-based authentication.

Once you have chosen a certificate authority, you need a digital certificate for the certificate authority you are using. Refer to the documentation for the certificate authority you are using for instructions on obtaining a digital certificate for the certificate authority. Load the digital certificate for the certificate authority in the `certificationAuthority` object class of the LDAP-enabled directory service you are using.

Obtaining Digital Certificates and Private Keys for Principals

When using the SSL protocol and certificate-based authentication, the IIOP Listener/Handler and any principal that will use your WLE application require a digital certificate and private key to prove their identity to initiators of an SSL connection.

Refer to the documentation for the certificate authority you are using for instructions on obtaining a digital certificate for a principal. Load the digital certificates for the principals in the `strongAuthenticationUser` object class of the LDAP-enabled directory service you are using.

Storing the Private Keys in a Common Location

When a principal gets a digital certificate from a certificate authority, they also get a file with a private key. Principals need this private key file to verify their identity in the authentication process. Store the private key file in a local directory structure that is accessible to remote applications. Assign the private key file protections so that only the owner of the private key file has write privileges and all other users only have read privileges for the file.

The WLE system uses the email address of the principal to construct a name for the private key file as follows:

1. The `@` character in the name is replaced by an underscore (_) character.
2. All characters after the dot (`.`) character are deleted.
3. A `.PEM` file extension is appended to the file.

For example, if the name of the principal is `milozzi@bigcompany.com` the resulting private key file is `milozzi_bigcompany.pem`. This naming convention allows an enterprise to have multiple principals that share a common username but are in different email domains.

The WLE software looks in the following directories for private key files:

UNIX

`$HOME`

Window NT

`%HOMEDRIVE% %HOMEPATH%`

The WLE software also looks in the following directory for private key files:

`$TUXDIR/udataobj/security/keys`

The `/keys` directory should be protected so that only the administrator has read and write privileges for the directory and all other users should only have read privileges for the directory.

Listing 2-1 provides an example of a private key file.

Listing 2-1 Example of Private Key File

```
-----BEGIN ENCRYPTED PRIVATE KEY-----
MIICoDAaBgkqhkiG9w0BBQMwDQQItSFrtYcfKygCAQUEggKAEgrMxo8gYB/MOSXG
SbbCn10vTov6LUndfBNd6Ktg8KX9BFEuR3+26aVq9z9jwJiHsU8ZONxRx+7TV/p4
kDfPy2iwe/jWmNzbyge5ig84igXtkGEHPODWQY/ODmVxq4GwBnt0U5WMjnYt4X8m
y2UsvW9VhZGTzrUGCQ30z9Ixln/pm8PJB8pTBEtJ8rYiNbQGiuwB9GOyZIANYGy+
crfrTIhLp3z4aStcihP1b3R9lFw+t2feYKEQnCfaPmwwJLIk6/bp9Gd6LEEVR45y
+zUxj1uE5K26GyWE/mcdhDtAy+212s5lnfjs5voi1Uv5ER88fTtYjAcMljty0PM/
cIBb8+gEzKQOnjocryWJQHE9rUxnQjdpiCj/FEjz3DPN67AvHcx2UOAqholbNzqn
79c+nnnm9YcnFREwnwTKCticyvXTCsIT/bHD/Tn2RyjVW8Dbq/23I2YZLEMR2+k7
kdeanB8RpHdNHJVTKQM3A/tPo/aSkx6Ce7tXjGCJCyuCGDVRtCxupo2NRYcGi45Z
CzOvJB8tSGLw4WHh/iK8V0dM7H6qV115t4Ha3k+uYU1+0D/eTSfQV77KAfTXLvoO
4LAbV/JvLbAUCD70U/COl8yijllXSZPf6IB1Y5XH8P+FMgCkDOqwYG8zMWjbcgCj
abDVITdwYL5rCaIt8Nnz9xy7c2vKkYoCJLVIvZEVZE22gP77zcE73K4zfv/IlMBV
7npzaWqF4mSnBY5Z5JskM349fiehIKhmTHiBkX0K1r8RNIDle+c9uvbCD+94/q0Z
OYh7K0cycO0sjrIu1jrQQmEy4rFcrSWIOVWNMdN0rPrdR1Rd8T3IRkwo4+aO/icd
gL+rOA==
-----END ENCRYPTED PRIVATE KEY-----
```

Defining the Trusted Certificate Authorities

When establishing an SSL connection, the WLE processes (client applications and the IIOP Listener/Handler) check the identity of the certificate authority and certificates from the peer's digital certificate chain against a list of trusted certificate authorities to ensure the certificate authority is trusted by the organization. This check is similar to the check done in Web browsers. If the comparison fails, the initiator of the SSL connection refuses to authenticate the target and drops the SSL connection. It is typically the job of the system administrator to define a list of trusted certificate authorities.

Retrieve from the LDAP-enabled directory service the digital certificates for the certificate authorities that are to be trusted. Cut and paste the PEM formatted digital certificates into a file named `trust_ca.cer` which is stored in `$TUXDIR/udataobj/security/certs`. The `trust_ca.cer` can be edited with any text editor.

The `trust_ca.cer` file should be owned by the administrator account. BEA recommends that the file be protected so that only the owner has read and write privileges for the file and all other users have only read privileges for the file.

Listing 2-2 provides an example of a Trusted Certificate Authority file.

Listing 2-2 Example of Trusted Certificate Authority File

```
-----BEGIN CERTIFICATE----

MIIEuzCCBCSgAwIBAgIQKtZuM5AOzS9dZaIATJxIuDANBgkqhkiG9w0BAQQFADCB
zDEXMBUGA1UEChMOVmVyaVNpZ24sIEluYy4xHzAdBgNVBAsTFlZlcmlTaWduIFRy
dXN0IE5ldHdvcmsxRjBEBgNVBAsTPXd3dy52ZXJpc2lnbi5jb20vcmVwb3NpdG9y
eS9SUEEgSW5jb3JwLiBCeSBSZWYuLExJQUIuTFREKGMpOTgxSDBGBgNVBAMTP1Zl
cmlTaWduIENsYXNzIDEgQ0EgSW5kaXZpZHVhbCBTdWJzY3JpYmVyLVBlcnNvbmEg
Tm90IFZhbGlkYXRlZDAeFw05OTA2MTQwMDAwMDBaFw0wMDA2MTMyMzU5NTlaMIIB
GjEXMBUGA1UEChMOVmVyaVNpZ24sIEluYy4xHzAdBgNVBAsTFlZlcmlTaWduIFRy
dXN0IE5ldHdvcmsxRjBEBgNVBAsTPXd3dy52ZXJpc2lnbi5jb20vcmVwb3NpdG9y
eS9SUEEgSW5jb3JwLiBieSBSZWYuLExJQUIuTFREKGMpOTgxHjAcBgNVBAsTFVBl
cnNvbmEgTm90IFZhbGlkYXRlZDE0MDIGA1UECxMrRGlnaXRhbCBJRCBDbGFzcyAx
IC0gTWljcm9zb2Z0IEZ1bGwgU2VydmljZTEYMBYGA1UEAxQPUGF1bCBCLiBQYXRy
aWNrMSYwJAYJKoZIhvcNAQkBFhdwYXVsLnBhdHJpY2tAYmVhc3lzLmNvbTBcMA0G
CSqGSIb3DQEBAQUAA0sAMEgCQQDAbJhRRy6eDWiCu4kYLpTPYWtnMmleDb20aqGE
CBdCbyWpkEgl63LFy+LkVdEqfS60zQBFhK4O5f50sT5U7mThAgMBAAGjggGPMIIB
```

```
izAJBgNVHRMEAjAAMIGsBgNVHSAEgaQwgaEwgZ4GC2CGSAGG+EUBBwEBMIGOMCgG
CCsGAQUFBwIBFhxodHRwczovL3d3dy52ZXJpc2lnbi5jb20vQ1BTMGIGCCsGAQUF
BwICMFYwFRYOVmVyaVNpZ24sIEluYy4wAwIBARo9VmVyaVNpZ24ncyBDUFMgaW5j
b3JwLiBieSByZWZlcmVuY2UgbGlhYi4gbHRkLiAoYyk5NyBWZXJpU2lnbjARBglg
hkgBhvhCAQEEBAMCB4AwgYYGCmCGSAGG+EUBBgMEeBZ2ZDQ2NTJiZDYzZjIwNDcw
MjkyOTg3NjNjOWQyZjI3NTA2OWM3MzU5YmVkMWIwNTlkYTc1YmM0YmM5NzAxNzQ3
ZGE1ZDNmMjE0MWJlYWRiMmJkMmU4OTIxNmFlNmJmN2Q0MTE0OTlhYTNiMzQ3ZjRm
M2VhNDU2NDAzBgNVHR8ELDAqMCigJqAkhiJodHRwOi8vY3JsLnZlcmlzaWduLmNv
bS9jbGFzczEuY3JsMA0GCSqGSIb3DQEBBAUAA4GBAA0da2gPa4CuEK79rmU62Zwt
+h8f5o3+xerPQd2nVTgE/rinpV1r/9/EgNBvHxnFV6WAnjrfaux1GYKaZfLV/dim
91oyKj/DxVi+t9d1SRbCxE7Ubv0ctGxKJQl7d6ybN0xuIrDNAuuhu2rr6P3ALR79
2Ci6rHHC0HlJGqEFNs95

-----END CERTIFICATE-----

-----BEGIN CERTIFICATE----

MIIEuzCCBCSgAwIBAgIQKtZuM5AOzS9dZaIATJxIuDANBgkqhkiG9w0BAQQFADCB
zDEXMBUGA1UEChMOVmVyaVNpZ24sIEluYy4xHzAdBgNVBAsTFlZlcmlTaWduIFRy
dXN0IE5ldHdvcmsxRjBEBgNVBAsTPXd3dy52ZXJpc2lnbi5jb20vcmVwb3NpdG9y
eS9SUEEgSW5jb3JwLiBCeSBSZWYuLExJQUIuTFREKGMpOTgxSDBGBgNVBAMTP1Zl
cmlTaWduIENsYXNzIDEgQ0EgSW5kaXZpZHVhbCBTdWJzY3JpYmVyLVBlcnNvbmEg
Tm90IFZhbGlkYXRlZDAeFw05OTA2MTQwMDAwMDBaFw0wMDA2MTMyMzU5NTlaMIIB
GjEXMBUGA1UEChMOVmVyaVNpZ24sIEluYy4xHzAdBgNVBAsTFlZlcmlTaWduIFRy
dXN0IE5ldHdvcmsxRjBEBgNVBAsTPXd3dy52ZXJpc2lnbi5jb20vcmVwb3NpdG9y
eS9SUEEgSW5jb3JwLiBieSBSZWYuLExJQUIuTFREKGMpOTgxHjAcBgNVBAsTFVBl
cnNvbmEgTm90IFZhbGlkYXRlZDE0MDIGA1UECxMrRGlnaXRhbCBJRCBDbGFzcyAx
IC0gTWljcm9zb2Z0IEZ1bGwgU2VydmljZTEYMBYGA1UEAxQPUGF1bCBCLiBQYXRy
aWNrMSYwJAYJKoZIhvcNAQkBFhdwYXVsLnBhdHJpY2tAYmVhc3lzLmNvbTBcMA0G
CSqGSIb3DQEBAQUAA0sAMEgCQQDAbJhRRy6eDWiCu4kYLpTPYWtnMmleDb20aqGE
CBdCbyWpkEgl63LFy+LkVdEqfS60zQBFhK4O5f50sT5U7mThAgMBAAGjggGPMIIB
izAJBgNVHRMEAjAAMIGsBgNVHSAEgaQwgaEwgZ4GC2CGSAGG+EUBBwEBMIGOMCgG
CCsGAQUFBwIBFhxodHRwczovL3d3dy52ZXJpc2lnbi5jb20vQ1BTMGIGCCsGAQUF
BwICMFYwFRYOVmVyaVNpZ24sIEluYy4wAwIBARo9VmVyaVNpZ24ncyBDUFMgaW5j
b3JwLiBieSByZWZlcmVuY2UgbGlhYi4gbHRkLiAoYyk5NyBWZXJpU2lnbjARBglg
hkgBhvhCAQEEBAMCB4AwgYYGCmCGSAGG+EUBBgMEeBZ2ZDQ2NTJiZDYzZjIwNDcw
MjkyOTg3NjNjOWQyZjI3NTA2OWM3MzU5YmVkMWIwNTlkYTc1YmM0YmM5NzAxNzQ3
ZGE1ZDNmMjE0MWJlYWRiMmJkMmU4OTIxNmFlNmJmN2Q0MTE0OTlhYTNiMzQ3ZjRm
M2VhNDU2NDAzBgNVHR8ELDAqMCigJqAkhiJodHRwOi8vY3JsLnZlcmlzaWduLmNv
bS9jbGFzczEuY3JsMA0GCSqGSIb3DQEBBAUAA4GBAA0da2gPa4CuEK79rmU62Zwt
+h8f5o3+xerPQd2nVTgE/rinpV1r/9/EgNBvHxnFV6WAnjrfaux1GYKaZfLV/dim
91oyKj/DxVi+t9d1SRbCxE7Ubv0ctGxKJQl7d6ybN0xuIrDNAuuhu2rr6P3ALR79
2Ci6rHHC0HlJGqEFNs95

-----END CERTIFICATE-----
```

Creating a Peer Rules File

When communicating across network links, it is important to validate the peer to which you are connected is the intended or authorized peer. Without this check, it is possible to make a secure connection, exchange secure messages, and receive a valid chain of digital certificates but still be vulnerable to a man-in-the-middle attach. You perform peer validation by verifying a set of specified information contained in the peer digital certificate against a list of information that specifies the rules for validating peer trust. The system administrator maintains the Peer Rules file.

The peer rules are maintained in an ASCII file named `peer_val.rul`. Store the `peer_val.rul` file in the following location in the WLE directory structure:

`$TUXDIR/udataobj/security/certs`

Listing 2-3 provides an example of a Peer Rules file.

Listing 2-3 Example of Peer Rules File

```
#
# This file contains the list of rules for validating if
# a peer is authorized as the target of a secure connection
#
O=Ace Industry
O=”BEA Systems, Inc.”; OU=Enteprise Engineering;L=Nashua;S=NH
O=”Netscape Communications, Corp.”, C=US
o=Ace Industry, ou=QA, cn=www.ace.com
```

Each rule in the Peer Rules file is comprised of a set of elements that are identified by a key. The WLE product recognizes the key names listed in Table 2-1.

Table 2-1 Supported Keys for Peer Rules File

Key	Attribute
`CN`	CommonName
`SN`	SurName
`L`	LocalityName

Table 2-1 Supported Keys for Peer Rules File

Key	Attribute
S	StateOrProvinceName
O	OrganizationName
OU	OrganizationalUnitName
C	CountryName
E	EmailAddress

Each key is followed by an optional white space, the character =, an optional white space, and finally the value to be compared. The key is not case sensitive. A rule is not a match unless the subject's distinguished name contains each of the specified elements in the rule and the values of those elements match the values specified in the rule, including case and punctuation.

Each line in the Peer Rules file contains a single rule that is used to determine if a secure connection is to be established. Rules cannot span lines; the entire rule must appear on a single line. Each element in the rule can be separated by either a comma (,) or semi-colon (;) character.

Lines beginning with the pound character (#) are comments. Comments cannot appear on the same line as the name of an organization.

A value must be enclosed in single quotation marks if one of the following cases is true:

- Strings contain any of the following characters:

  , + = "" <CR> < > # ;

- Strings have leading or trailing spaces
- Strings contain consecutive spaces

By default, the WLE product verifies peer information against the Peer Rules file. If you do not want to perform this check, create an empty Peer Rules file.

3 Configuring the WLE Environment for the SSL Protocol

This topic includes the following sections:

- Setting Parameters for the SSL Protocol
- Defining a Port for SSL Communications
- Enabling Certificate-based Authentication
- Enabling Host Matching
- Setting the Encryption Strength
- Setting the Interval for Session Renegotiation
- Defining Security Parameters for the IIOP Listener/Handler
- Example of Setting Parameters on the ISL System Process
- Example of Setting Command Line Options on the CORBA C++ ORB

Perform the tasks in this topic only if you are using the SSL Protocol or certificate-based authentication.

Setting Parameters for the SSL Protocol

To use the SSL protocol or certificate-based authentication with the IIOP Listener/Handler, the CORBA C++ object request broker (ORB), or the CORBA Java ORB, you need to:

- Specify the secure port on which SSL connections will be accepted.
- Enable certificate-based authentication.
- Specify the strength that will be used when encrypting data.
- Optionally, set the interval for session renegotiation (IIOP Listener/Handler only).

The following sections detail how to use the options of the ISL command, the command line options of the CORBA C++ ORB, or the system properties of the CORBA Java ORB to set these SSL parameters.

Defining a Port for SSL Communications

To define a port for SSL communications:

- Use the `-S` option of the ISL command to specify which port of the IIOP Listener/Handler will listen for secure connections using the SSL protocol. You can configure the IIOP Listener/Handler to allow only SSL connections by setting the `-S` option and `-n` option of the ISL command to the same value.
- If you are using a remote CORBA C++ or CORBA Java ORB, use the `-ORBsecurePort` command line option or system property on the ORB to specify which port of the ORB will listen for secure connections using the SSL protocol. You should set this command line option or system property when using callback objects or the WLE Notification Service.

Note: If you are using the SSL protocol with a joint client/server application, you must specify a port number for SSL communications. You cannot use the default.

Defining a secure port for SSL communication requires the WLE Security Pack to be installed. If the `-S` option or the `-ORBsecurePort` command line option or system property is executed and a license to enable the use of the SSL protocol does not exist, the IIOP Listener/Handler, CORBA C++ ORB, or CORBA Java ORB will not start.

Enabling Certificate-based Authentication

To enable certificate-based authentication:

- Use the `-a` option of the ISL command to specify that certificate-based authentication must be used by applications connecting to the IIOP Listener/Handler.
- Use the `-ORBmutualAuth` command line option or system property on the ORB to specify that certificate-based authentication must be used by applications connecting to the CORBA C++ or CORBA Java ORB.

Enabling certificate-based authentication requires the WLE Security Pack to be installed. If the `-a` option or the `-ORBmutualAuth` command line option or system property is executed and a license to enable the use of the SSL protocol does not exist, the IIOP Listener/Handler, CORBA C++ ORB, or CORBA Java ORB will not start.

Enabling Host Matching

The SSL protocol is capable of encrypting messages for confidentiality; however, the use of encryption does nothing to prevent a man-in-the-middle attack. During a man-in-the-middle attack, a principal masquerades as the location from which an initiating application retrieves the initial object references used in the bootstrapping process.

To prevent man-in-the-middle attacks, it is necessary to perform a check to ensure that the digital certificate received during an SSL connection is for the principal for which the connection was intended. Host Matching is a check that the host specified in the object reference used to make the SSL connection matches the common name in the

subject in the distinguished name specified in the target's digital certificate. Host Matching is performed only by the initiator of an SSL connection, and confirms that the target of a request is actually located at the same network address specified by the domain name in the target's digital certificate. If this comparison fails, the initiator of the SSL connection refuses to authenticate the target and drops the SSL connection. Host Matching is not technically part of the SSL protocol and is similar to the same check done in Web browsers.

The domain name contained in the digital certificate must match exactly the host information contained in the object reference. Therefore, the use of DNS host names instead of IP addresses is strongly encouraged.

By default Host Matching in enabled in the IIOP Listener/Handler and in the CORBA C++ and CORBA Java ORBs. If you need to enable Host Matching, do one of the following:

- In the IIOP Listener/Handler, specify the `-v` option of the ISL command.
- In the CORBA C++ or CORBA Java ORBs, specify the `–ORBpeerValidate` command line option or system property.

The values for the `-v` option and the `-ORBpeerValidate` command line option or system property are as follows:

- `none`—No host matching is performed.
- `detect`—If the object reference used to make the SSL connection does not match the host name in the target's certificate, the IIOP Listener/Handler or the ORB does not authenticate the target and drops the SSL connection. The `detect` value is the default value.
- `warn`—If the object reference used to make the SSL connection does not match the host name in the target's certificate, the IIOP Listener/Handler or the ORB sends a message to the user log and continues processing.

If there is more than one IIOP Listener/Handler in a WLE domain configured for SSL connections (for example, in the case of fault tolerance), BEA recommends using DNS alias names for the IIOP Listener/Handlers or creating different digital certificates for each IIOP Listener/Handler. The `–H` switch on the IIOP Listener can be used to specify the DNS alias name so that object references will be created correctly.

Setting the Encryption Strength

To set the encryption strength:

- Use the `-z` and `-Z` options of the ISL command to set the encryption strength in the IIOP Listener/Handler.
- Use the `-ORBminCrypto` and `-ORBmaxCrypto` command line option or system property on the ORB to set the encryption strength in the CORBA C++ or CORBA Java ORB.

The `-z` option and the `-ORBminCrypto` command line option or system property set the minimum level of encryption used when an application establishes an SSL connection with the IIOP Listener/Handler, the CORBA C++ ORB, or the CORBA Java ORB. The valid values are 0, 40, 56, and 128. 0 means the data is signed but not sealed while 40, 56, and 128 specify the length (in bits) of the encryption key. If this minimum level of encryption is not met, the SSL connection fails. The default is 40.

The `-Z` option and the `-ORBmaxCrypto` command line option or system property set the maximum level of encryption used when an application establishes an SSL connection with the IIOP Listener/Handler, the CORBA C++ ORB, or the CORBA Java ORB. The valid values are 0, 40, 56, and 128. 0 means that data is signed but not sealed while 40, 56, and 128 specify the length (in bits) of the encryption key. The default minimum value is 40. The default maximum value is whatever capability is specified by the license.

The `–z` or `–Z` options and the `-ORBminCrypto` and `-ORBmaxCrypto` command line options or system properties are available only if the WLE Security pack is installed.

To change the strength of encryption currently used in a WLE application, you need to shut down the IIOP Listener/Handler or the ORB.

The combination in which you set the encryption values is important. The encryption values set in the initiator of an SSL connection need to be a subset of the encryption values set in the target of an SSL connection.

Table 3-1 lists combinations of encryption values and describes the encryption behavior.

Table 3-1 Combinations of Encryption Values

`-z` `-ORBminCrypto`	`-Z` `-ORBmaxCrypto`	**Description**
No value specified	No value specified	If the use of the SSL protocol is specified by some other command line option or system property but no values are specified for `ORBminCrypto` and `ORBmaxCrypto`, these command line options or system properties are assigned their default values.
0	No value specified	Maximum encryption defaults to the maximum value specified in the license. Tamper/replay detection and privacy protection are negotiated.
No value specified	0	Tamper/replay detection is negotiated. Privacy protection is not provided.
0	0	Tamper/replay detection is negotiated. Privacy protection is not provided.
40, 56, 128	No value specified	Maximum encryption defaults to the maximum value specified in the license. Privacy protection can be negotiated to the maximum allowed by the SSL license.
No value specified	40, 56, 12	Privacy protection can be negotiated to the value specified by the `-Z` option as long as it is less than the maximum allowed by the SSL license. The `-z` option defaults to 40.
40, 56, 128	40, 56, 128	Privacy protection can be negotiated between the values specified by the `-z` option up to the value specified by the `-Z` option as long as the values are less than the maximum allowed by the SSL license.

Note: In all combinations listed in Table 3-1, the value of the SSL license controls the maximum bit strength. If a bit strength is specified beyond the maximum licensed value, the IIOP Listener/Handler or ORB will not start and an error will be generated indicating the bit strength setting is invalid. Stopping the

IIOP Listener/Handler or ORB from starting, instead of lowering the maximum value and giving only a warning, protects against an incorrectly configured application running with less protection than was expected.

If a cipher that exceeds the maximum licensed bit strength is somehow negotiated, the SSL connection is not established.

The WLE product supports the cipher suites described in Table 3-2.

Table 3-2 SSL Cipher Suites Supported by the WLE Product

Cipher Suite	Key Exchange Type	Symmetric Key Strength
SSL_RSA_WITH_RC4_128_SHA	RSA	128
SSL_RSA_WITH_RC4_128_MD5	RSA	128
SSL_RSA_WITH_DES_CDC_SHA	RSA	56
SSL_RSA_EXPORT_WITH_RC4_40_MD5	RSA	40
SSL_RSA_EXPORT_WITH_DES40_CBC_SHA	RSA	40
SSL_RSA_EXPORT_WITH_RC2_CBC_40_MD5	RSA	40
SSL_DH_DSS_EXPORT_WITH_DES40_CBC_SHA	Diffie Hellman	40
SSL_DH_RSA_EXPORT_WITH_DES40_CBC_SHA	Diffie Hellman	40
SSL_RSA_WITH_3DES_EDE_CBC_SHA	RSA	112
SSL_RSA_WITH_NULL_SHA	RSA	0
SSL_RSA_WITH_NULL_MD5	RSA	0

Setting the Interval for Session Renegotiation

Note: You set the interval for session renegotiation only in the IIOP Listener/Handler.

Use the `-R` option of the ISL command to control the time between session renegotiations. Periodic renegotiation of an SSL session refreshes the symmetric keys used to encrypt and decrypt information which limits the time a symmetric key is exposed. You can keep long-term SSL connections more secure by periodically changing the symmetric keys used for encryption.

The `–R` option specifies the renegotiation interval in minutes. If an SSL connection does renegotiate within the specified interval, the IIOP Listener/Handler will request the application to renegotiate the SSL session for inbound connections or actually perform the renegotiation in the case of outbound connections. The default is 0 minutes which results in no periodic session renegotiations.

You can not use session renegotiation when enabling certificate-based authentication using the -a option of the ISL command.

Defining Security Parameters for the IIOP Listener/Handler

For the IIOP Listener/Handler to participate in SSL connections, the IIOP Listener/Handler authenticates itself to the peer that initiated the SSL connection. This authentication requires a digital certificate. The private key associated with the digital certificate is used as part of establishing an SSL connection that results in an agreement between the principal and the peer (in this case a client application and the IIOP Listener/Handler) on the session key. The session key is a symmetric key (as opposed to the private-public keys) that is used to encrypt data during an SSL session.You define the following information for the IIOP Listener/Handler so that it can be authenticated by peers:

- SEC_PRINCIPAL_NAME

  Specifies the identity of the IIOP Listener/Handler.

- SEC_PRINCIPAL_LOCATION

  Specifies the location of the private key file. For example, $TUXDIR/udataobj/security/keys/milozzi.pem.

- SEC_PRINCIPAL_PASSVAR

  Specifies an environment variable that holds the pass phrase for the private key of the IIOP Listener/Handler. If this parameter is not specified, you will be prompted for it when you enter the tmloadcf command.

These parameters are included in the part of the SERVERS section of the UBBCONFIG file that defines the ISL system process.

Example of Setting Parameters on the ISL System Process

You set parameters for the SSL protocol in the portion of the SERVERS section of the UBBCONFIG that defines information for the ISL server process. Listing 3-1 includes code from a UBBCONFIG file that set parameters to configure the IIOP Listener/Handler for the SSL protocol and certificate-based authentication.

Listing 3-1 Using the ISL Command in the UBBCONFIG File

```
...
ISL
       SRVGRP = SYS_GRP
       SRVID  = 5
       CLOPT  = “-A -- -a -z40 -Z128 -S3579 -n //ICEPICK:2569
       SEC_PRINCIPAL_NAME=”BLOTTO”
       SEC_PRINCIPAL_LOCATION=”BLOTTO.pem”
       SEC_PRINCIPAL_VAR=”AUDIT_PASS”
```

Example of Setting Command Line Options on the CORBA C++ ORB

Listing 3-2 contains sample code that illustrates using the command line options on the CORBA C++ ORB to configure the ORB for the SSL protocol.

Listing 3-2 Example of Setting the Command Line Options on the CORBA C++ ORB

```
ChatClient    -ORBid BEA_IIOP
              -ORBsecurePort 2100
              -ORBminCrypto 40
              -ORBMaxCrypto 128
              TechTopics
```

Example of Setting System Properties on the CORBA Java ORB

Listing 3-3 contains sample code that illustrates using the system properties of the CORBA Java ORB to configure the ORB for the SSL protocol.

Listing 3-3 Example of Setting the System Properties on the CORBA Java ORB

```
ChatClient    -DTOBJADDR=corbalocs://piglet:1900
              -Dorg.omg.CORBA=ORBPort=1948
              -classpath=%CLASSPATH% client
              -ORBMaxCrypto 128
```

CHAPTER

4 Defining Security for a WLE CORBA Application

This topic includes the following sections:

- Setting Parameters for Security in the UBBCONFIG File
- Defining Authorized Users

Setting Parameters for Security in the UBBCONFIG File

To configure security for your WLE application, you need to set parameters in the `UBBCONFIG` file that define the following:

- The server process being used as the authentication server in the WLE application. (This parameter is required for Username/Password authentication only).
- The security level of the WLE application.
- The level of encryption to be used when using link-level encryption.
- The identity of the IIOP Listener/Handler, which is the location of and the password phrase for the private key for the IIOP Listener/Handler. (These parameters are required for certificate-based authentication only).

Note: For information about setting security parameters for the IIOP Listener/Handler in the `UBBCONFIG` file, see "Defining Security Parameters for the IIOP Listener/Handler" on page 3-8.

To set parameters in the `UBBCONFIG` file, open the file in any text editor. The parameters for security take effect when you use the `tmloadcf` command to update the configuration parameters for your WLE application. The following sections describe setting the parameters for security in the `UBBCONFIG` file.

Configuring the Authentication Server

Note: You only need to configure the Authentication Server, if you have specified a value of `USER_AUTH` or higher for the `SECURITY` parameter.

Username/Password authentication requires that an authentication server be configured for the purpose of authenticating users by checking their individual passwords against a file of legal users. The WLE system uses a default authentication server called `AUTHSRV` to perform authentication.

For a WLE application to authenticate users, the value of the AUTHSVC parameter in the RESOURCES section of the UBBCONFIG file needs to specify the name of the process to be used as the authentication server for the WLE application. The service must be called AUTHSVC**.** If the AUTHSVC parameter is specified in the RESOURCES section of the UBBCONFIG file, the SECURITY parameter must also be specified with a value of at least USER_AUTH. If the value is not specified, an error will occur when the system executes the tmloadcf command.

In addition, you need to define AUTHSVR in the SERVERS section of the UBBCONFIG file. The SERVERS section contains information about the server processes to be booted in the WLE application. For more information about the parameters in the SERVERS section of the UBBCONFIG file, see the *Administration Guide* in the WebLogic Enterprise online documentation.

Listing 4-1 contains the portion of the UBBCONFIG file that defines the authentication server.

Listing 4-1 Parameters for the Authentication Server

```
*RESOURCES
  SECURITY  USER_AUTH
  AUTHSVC   "AUTHSVC"

*SERVERS
  AUTHSVR
    SRVGRP="SYS_GRP"
    SRVID=1
    RESTART=Y
    GRACE=60
    MAXGEN=2
```

Defining a Security Level

As part of defining security for a WLE application, you need to define the SECURITY parameter in the RESOURCES section of the UBBCONFIG file. The SECURITY parameter has the following format:

```
*RESOURCES
       SECURITY {NONE|APP_PW|USER_AUTH|ACL|MANDATORY_ACL}
```

Table 4-1 describes the values for the SECURITY parameter.

Table 4-1 Values for the SECURITY Parameter

Value	Description
NONE	Indicates that no password or access checking is performed in the WLE application. `Tobj::PrincipalAuthenticator::get_auth_type()` returns a value of TOBJ_NOAUTH.
APP_PW	Indicates that client applications are required to supply an application password to access the WLE domain. The `tmloadcf` command prompts for an application password. `Tobj::PrincipalAuthenticator::get_auth_type()` returns a value of TOBJ_SYSAUTH.
USER_AUTH	Indicates that client applications are required to authenticate themselves to the WLE domain using a password. The value USER_AUTH is similar to APP_PW but, in addition, indicates that user authentication will be done during client initialization. The `tmloadcf` command prompts for an application password. `Tobj::PrincipalAuthenticator::get_auth_type()` returns a value of TOBJ_APPAUTH.
ACL	Indicates that authentication is used in the WLE application and access control checks are performed on interfaces, services, queue names, and event names. If an associated ACL is not found for a name, it is assumed that permission is granted. The `tmloadcf` command prompts for an application password. `Tobj::PrincipalAuthenticator::get_auth_type` returns a value of TOBJ_APPAUTH.
MANDATORY_ACL	Indicates that authentication is used in the WLE application and access control checks are performed on interfaces, services, queue names, and event names. The value MANDATORY_ACL is similar to ACL, but permission is denied if an associated ACL is not found for the name.The `tmloadcf` command prompts for an application password. `Tobj::PrincipalAuthenticator::get_auth_type` returns a value of TOBJ_APPAUTH.

When using Username/Password authentication, the value of the SECURITY parameter must be APP_PW or greater.

If the IIOP Listener/Handler is configured for using certificate-based authentication, the value of the SECURITY parameter must be USER_AUTH or greater.

Setting the Level of Encryption

You can encrypt the messages between WLE applications on different machines in the same WLE domain using link-level encryption. In the UBBCONFIG file for each WLE application, you need to set the MINENCRYPTBITS and MAXENCRYPTBITS parameters for the machines that establish the network connection, as follows.

- The MINENCRYPTBITS parameter specifies that at least the defined number of bits are meaningful.
- The MAXENCRYPTBITS parameter specifies that encryption should be negotiated up to the defined level.

The possible values for the MINENCRYPTBITS and MAXENCRYPTBITS parameters are 0, 40, and 128. A value of zero means no encryption is used, while 40 and 128 specify the number of significant bits in the encryption key.

Sample UBBCONFIG File for Username/Password Authentication

Listing 4-3 includes a UBBCONFIG file for an application which uses Username/Password authentication. The key sections of the UBBCONFIG file are noted in bold face text.

Listing 4-2 Sample UBBCONFIG File for Username/Password Authentication

```
*RESOURCES
    IPCKEY    55432
    DOMAINID  securapp
    MASTER    SITE1
    MODEL     SHM
    LDBAL     N
    SECURITY  USER_AUTH
    AUTHSVR "AUTHSVC"
```

```
*MACHINES
    "ICEAXE"
    LMID        = SITE1
    APPDIR      = "D:\M3\samples\corba\SECURAPP"
    TUXCONFIG   = "D:\M3\samples\corba\SECURAPP\results\tuxconfig"
    TUXDIR      = "D:\WLE5"
    MAXWSCLIENTS = 10

*GROUPS
    SYS_GRP
       LMID    = SITE1
       GRPNO   = 1
    APP_GRP
       LMID    = SITE1
       GRPNO   = 2

*SERVERS
    DEFAULT:
    RESTART = Y
    MAXGEN  = 5

    AUTHSVR
        SRVGRP  = SYS_GRP
        SRVID   = 1
        RESTART = Y
        GRACE   = 60
        MAXGEN   = 2

    TMSYSEVT
        SRVGRP  = SYS_GRP
        SRVID   = 1

    TMFFNAME
        SRVGRP  = SYS_GRP
        SRVID   = 2
        CLOPT   = "-A -- -N -M"

    TMFFNAME
        SRVGRP  = SYS_GRP
        SRVID   = 3
        CLOPT   = "-A -- -N"

    TMFFNAME
        SRVGRP  = SYS_GRP
        SRVID   = 4
        CLOPT   = "-A -- -F"

    simple_server
        SRVGRP  = APP_GRP
```

```
        SRVID   = 1
        RESTART = N

    ISL
        SRVGRP  = SYS_GRP
        SRVID   = 5
        CLOPT    = “-A -- -n //PCWIZ::2500”
```

Sample UBBCONFIG File for Certificate-Based Authentication

Listing 4-3 includes a UBBCONFIG file for an application which uses certificate-based authentication. The key sections of the UBBCONFIG file are noted in bold face text.

Listing 4-3 Sample UBBCONFIG File for Certificate-Based Authentication

```
*RESOURCES
    IPCKEY    55432
    DOMAINID  simpapp
    MASTER    SITE1
    MODEL     SHM
    LDBAL     N
    SECURITY  USER_AUTH

*MACHINES
    "ICEAXE"
    LMID        = SITE1
    APPDIR      = "D:\M3\samples\corba\SIMPAP~1"
    TUXCONFIG   = "D:\M3\samples\corba\SIMPAP~1\results\tuxconfig"
    TUXDIR      = "D:\WLE5"
    MAXWSCLIENTS = 10

*GROUPS
    SYS_GRP
       LMID    = SITE1
       GRPNO   = 1
    APP_GRP
       LMID    = SITE1
       GRPNO   = 2

*SERVERS
    DEFAULT:
```

```
RESTART = Y
MAXGEN  = 5

TMSYSEVT
    SRVGRP  = SYS_GRP
    SRVID   = 1

TMFFNAME
    SRVGRP  = SYS_GRP
    SRVID   = 2
    CLOPT   = "-A -- -N -M"

TMFFNAME
    SRVGRP  = SYS_GRP
    SRVID   = 3
    CLOPT   = "-A -- -N"

TMFFNAME
    SRVGRP  = SYS_GRP
    SRVID   = 4
    CLOPT   = "-A -- -F"

simple_server
    SRVGRP  = APP_GRP
    SRVID   = 1
    RESTART = N

ISL
    SRVGRP  = SYS_GRP
    SRVID   = 5
    CLOPT   = "-A -- -a -z40 -Z128 -S2458 -n //ICEAXE:2468"
    SEC_PRINCIPAL_NAME="IIOPListener"
    SEC_PRINCIPAL_LOCATION="IIOPListener.pem"
    SEC_PRINCIPAL_PASSVAR="ISH_PASS"
```

Defining Authorized Users

As part of configuring security for a WLE application, you need to define the principals and groups of principals who have access to the WLE application. The WLE system uses the email address of a principal to map the external identity of a principal represented by a digital certificate to an identity used by a WLE application to authenticate a principal.

You use the `tpusradd` command to create files containing lists of authorized principals. The `tpusradd` command adds a new principal entry to the WLE security data files. This information is used by the `AUTHSRV` to authenticate principals. The file that contains the principals is called `tpusr`.

The file is a colon-delimited, flat ASCII file, readable only by the administrator of the WLE application. The system file entries have a limit of 512 characters per line. The file is kept in the application directory, specified by the environment variable `$APPDIR`. The environment variable `$APPDIR` must be set to the path name of the WLE application.

The `tpusradd` file should be owned by the administrator account. BEA recommends that the file be protected so that only the owner has read and write privileges for the file and all other users have only read privileges for the file.

When defining names of authorized users for a WLE EJB, there is a one-to-one association between the users defined with the `tpusradd` command and the security roles defined in the deployment descriptor of the WLE EJB.

The `tpusradd` command has the following options:

`-u` *`uid`*

The user identification number. uid must be a positive decimal integer below 128K. uid must be unique within the list of existing identifiers for the application. uid defaults to the next available (unique) identifier greater than 0.

`-c` *`client_name`*

A string of printable characters that specifies the name of the principal. The name may not contain a colon (:). pound sign (#), or a newline (n). The principal name must be unique within the list of existing principals for the WLE application. The name of the principal can be either the name of a WLE client application or a WLE EJB.

Listing 4-4 includes a sample `tpusradd` file.

Listing 4-4 Sample tpusradd File

```
Cltname       Uid

milozzi       122
smart         555
patt          1234
butler        15555
```

Note: Use the `tpgrpadd` command to add groups of principals to the WLE security data files.

In addition to the `tpusradd` and `tpgrpadd` commands, the WLE product provides the following commands to modify the `tpusr` and `tpgrp` files:

- `tpusrdel`
- `tpusrmod`
- `tpgrpdel`
- `tpgrpmod`

For a complete description of the commands, see *WLE Reference* in the WebLogic Enterprise online documentation.

5 Writing a WLE CORBA Application That Implements Security

This topic contains the following sections:

- Understanding the Address Formats of the Bootstrap Object
- Using Username/Password Authentication
- Using Certificate-based Authentication
- Using the Invocations_Options_Required() Method

Understanding the Address Formats of the Bootstrap Object

The Bootstrap object in the WLE product has been enhanced so that users can specify that all communication to a given IIOP Listener/Handler be protected. The Bootstrap object supports `corbaloc` and `corbalocs` Uniform Resource Locator (URL) address formats to be used when specifying the location of the IIOP Listener/Handler. The type of security provided depends on the format of URL used to specify the location of the IIOP Listener/Handler.

As with the Host and Port address format, you use the URL address formats to specify the location of the IIOP Listener/Handler, but the bootstrapping process behaves differently. When using the `corbaloc` or `corbalocs` URL address format, the initial connection to the IIOP Listener/Handler is deferred until either:

- The principal uses Username/Password authenticate with either the `Tobj::PrincipalAuthenticator::logon` or the `SecurityLevel2::PrincipalAuthenticator::authenticate` methods.
- The principal calls the `Tobj_Bootstrap::resolve_initial_references` method using an object ID value other than SecurityCurrent.

Using the `corbalocs` URL address format indicates that the SSL protocol is used to the protect at least the integrity of the connection between the principal and the IIOP Listener/Handler.

Table 5-1 highlights the differences between the two URL address formats.

Table 5-1 Differences Between `corbaloc` and `corbalocs` URL Address Formats

URL Address Formats	Functionality
`corbaloc`	By default, invocations on the IIOP Listener/Handler are unprotected. Configuring the IIOP Listener/Handler for the SSL protocol is optional. A principal can secure the bootstrapping process by using the `SecurityLevel2::Current::authenticate()`and `SecurityLeve12::Credentials::invocation_options_required( )` methods to specify that certificate-based authentication is to be used.

URL Address Formats	Functionality
`corbalocs`	Invocations on the IIOP Listener/Handler are protected and the IIOP Listener/Handler, the CORBA C++ ORB, or the CORBA Java ORB must be configured to enable the use of the SSL protocol. For more information, see "Configuring the WLE Environment for the SSL Protocol" on page 3-1.

Both the `corbaloc` and `corbalocs` URL address formats provide stringified object references that are easily manipulated in both TCP/IP and Domain Name System (DNS) environments. The `corbaloc` and `corbalocs` URL address formats contain a DNS-style host name or an IP address and port.

The URL address formats follow and extend the definition of object URLs adopted by the Object Management Group (OMG) as part of the Interoperable Naming Service submission. The WLE software also extends the URL format described in the OMG Interoperable Naming Service submission to support a secure form that is modeled after the URL for secure HTTP, as well as to support functionality in previous releases of the WLE product.

Listing 5-1 contains examples of the new URL address formats.

Listing 5-1 Examples of the `corbaloc` and `corbalocs` URL Address Formats

```
corbaloc://555xyz.com:1024,corbaloc://555backup.com:1022,
corbaloc://555last.com:1999
corbalocs://555xyz.com:1024,(corbalocs://555backup.com:1022|corba
locs://555last.com:1999)
corbaloc://555xyz.com:1111
corbalocs://24.128.122.32:1011, corbalocs://24.128.122.34
```

As an enhancement to the URL syntax described in the OMG Interoperable Naming Service submission, the WLE product extends the syntax to support a list of multiple URLs, each with a different scheme. Listing 5-2 contains examples of specifying multiple URLs.

Listing 5-2 Examples of Specifying Multiple URL Address Formats

```
corbalocs://555xyz.com:1024,corbaloc://555xyz.com:1111
corbalocs://ctxobj.com:3434,corbalocs://mthd.com:3434,corbaloc://force.com:1111
```

In the examples in Listing 5-2, if the parser reaches the URL `corbaloc://force.com:1111`, it resets its internal state as if it had never attempted secure connections, and then begins attempting unprotected connections. This situation occurs if the client application has not set any SSL parameters on the Credentials object.

The following sections describe the behavior when using the different address formats of the Bootstrap object.

Using the Host and Port Address Format

If a WLE client application uses the Host and Port address format of the Bootstrap object, the constructor method of the Bootstrap object constructs an object reference using the specified host name and port number. The invocation to the IIOP Listener/Handler is made without the protections offered by the SSL protocol.

The client application can still authenticate using Username/Password authentication. However, since the bootstrapping process is performed over an unprotected and unverified link, all communications are vulnerable to the following security attacks:

- The Man-in-the-Middle attack, because there was no verification that the principal to which the connection was made was the desired principal.
- The Denial of Service attack, because no object references were returned, the object references returned were invalid, or the security token was invalid.
- The Sniffer attack, because the information was sent in the clear so that anyone with a packet sniffer can see the content of a message that was not encrypted (for example, only the username/password information is encrypted).
- The Tamper attack, because the integrity of the information is not protected. The contents of the message could be changed and the change would not be detected.
- The Replay attack, because the same request can be sent repeatedly without detection.

Note: If the IIOP Listener/Handler is configured for the SSL protocol and the Host and Port address format of the Bootstrap object is used, the invocation on the specified WLE object results in a `INVALID_DOMAIN` exception.

Using the corbaloc URL Address Format

By default, the invocation on the IIOP Listener/Handler is unprotected when using the `corbaloc` URL address format and Username/Password authentication. Therefore, all communications are vulnerable to the following security attacks:

- The Man-in-the-Middle attack, because there was no verification that the principal to which the connection was made was the desired principal.
- The Denial of Service attack, because no object references were returned, the object references returned were invalid, or the security token was invalid.
- The Sniffer attack, because the information was sent in the clear so that anyone with a packet sniffer can see the content of a message that was not encrypted (for example, only the username/password information is encrypted).
- The Tamper attack, because the integrity of the information is not protected. The content of the message could be changed and the change would not be detected.
- The Replay attack, because the same request can be sent repeatedly without detection.

You can protect the bootstrapping process when using the `corbaloc` URL address format by using the `SecurityLevel2::Current::authenticate()` method, specifying that certificate-based authentication is to be used, and setting the `invocation_methods_required` method on the Credentials object.

Note: If the IIOP Listener/Handler is configured for the SSL protocol and not for certificate-based authentication and the `corbaloc` URL address format is used, the invocation on the specified WLE object results in an `INVALID_DOMAIN` exception.

BEA recommends that existing WLE applications migrate to the `corbaloc` URL address format instead of using the Host and Port Address format.

Using the corbalocs URL Address Format

The `corbalocs` URL address format is the recommended format to use to ensure that communications between principals and the IIOP Listener/Handler are protected. The `corbalocs` URL address format functions in the same way as the `corbaloc` URL

address format, except the SSL protocol is used to protect all communications with the IIOP Listener/Handler, the CORBA C++ ORB, or the CORBA Java ORB regardless of the type of authentication used**.**

When the defaults are used with the `corbalocs` URL address format, communications are vulnerable only to Denial of Service security attacks. Using the SSL protocol and certificate-based authentication guards against Sniffer, Tamper, and Replay attacks. In addition, the validation check of the host specified in the digital certificate guards against Man-in-the-Middle attacks.

To use the `corbalocs` URL address format, the IIOP Listener/Handler, the CORBA C++ ORB, or the CORBA Java ORB must be configured to enable the use of the SSL protocol. For more information about configuring the IIOP Listener/Handler, the CORBA C++ ORB, or the CORBA Java ORB for the SSL protocol, see "Configuring the WLE Environment for the SSL Protocol" on page 3-1.

Using Username/Password Authentication

This section describes implementing Username/Password authentication in WLE applications.

The Security Sample Application

The Security sample application demonstrates Username/Password authentication. The Security sample application requires each student using the application to have an ID and a password. The Security sample application works in the following manner:

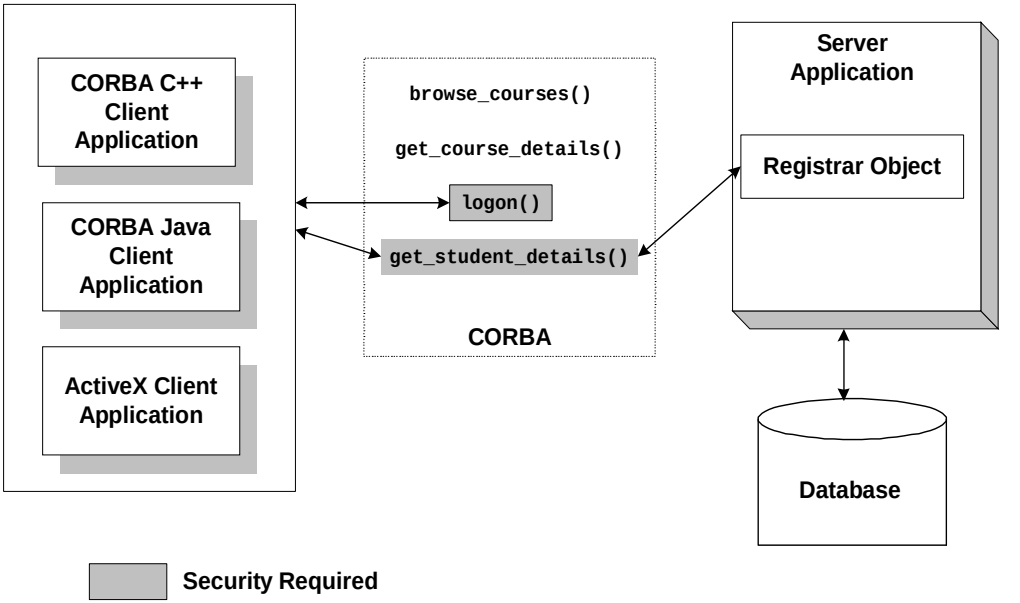
1. The client application has a logon method. This method invokes operations on the PrincipalAuthenticator object, which is obtained as part of the process of logging on to access the domain.

2. The server application implements a `get_student_details()` method on the `Registrar` object to return information about a student. After the user is authenticated and the logon is complete, the `get_student_details()` method accesses the student information in the database to obtain the student information needed by the client logon method.

3. The database in the Security sample application contains course and student information.

Figure 5-1 illustrates the Security sample application.

Figure 5-1 Security Sample Application



The source files for the Security sample application are located in the `\samples\corba\university` directory in the WLE software. For information about building and running the Security sample application, see "Building and Running the CORBA Sample Applications" on page 6-1.

Writing the Client Application

When using Username/Password authentication, write client application code that does the following:

1. Uses the Bootstrap object to obtain a reference to the SecurityCurrent object for the specific WLE domain. You can use the Host and Port Address format, the `corbaloc` URL address format, or the `corbalocs` URL address format.

2. Gets the PrincipalAuthenticator object from the SecurityCurrent object.
3. Uses one of the following methods to authenticate the principal:
   - C++—`SecurityLevel2::PrincipalAuthenticator::authenticate()` using `Tobj::TuxedoSecurity`
   - Java—`SecurityLevel2.PrincipalAuthenticator.authenticate()` using `Tobj::TuxedoSecurity`
   - C++—`Tobj::PrincipalAuthenticator::logon()`
   - Java—`Tobj.PrincipalAuthenticator.logon()`

   The `SecurityLevel2::PrincipalAuthenticator` interface is defined in the CORBAservices Security Service specification. This interface contains two methods that are use to accomplish the authentication of the principal. There are two methods because authentication of principals may require more than one step. The `authenticate()` method allows the caller to authenticate and optionally select attributes for the principal of this session.

   The WLE product extends the PrincipalAuthenticator object with functionality to support similar security to that found in BEA TUXEDO. The enhanced functionality is provided by the `Tobj::PrincipalAuthenticator` interface.

   The methods defined for the `Tobj::PrincipalAuthenticator` interface provide a focused, simplified form of the equivalent CORBA-defined interface. You can use either the CORBA-defined or the WLE extensions when developing a WLE application.

   The `Tobj::PrincipalAuthenticator` interface provides the same functionality as the `SecurityLevel2::PrincipalAuthenticator` interface. However, unlike the `SecurityLevel2::PrincipalAuthenticator::authenticate()` method, the `logon()` method of the `Tobj::PrincipalAuthenticator` interface does not return a Credentials object. As a result, WLE applications that need to use more than one principal identity are required to call the `Current::get_credentials()` method immediately after the `logon()` method to retrieve the Credentials object as a result of the logon. Retrieval of the Credentials object directly after a logon method should be protected with serialized access.

The following sections contain C++ and Java code examples that illustrate implementing Username/Password authentication. For a Visual Basic code example, see “Automation Security Reference” on page 13-1.

C++ Code Example of Using the SecurityLevel2::PrincipalAuthenticator::authenticate() Method

Listing 5-3 contains C++ code that performs Username/Password authentication using the `SecurityLevel2::PrincipalAuthenticator::authenticate()`method.

Listing 5-3 C++ Client Application that uses the SecurityLevel2::PrincipalAuthenticator::authenticate() Method

```
...
//Create Bootstrap object
     Tobj_Bootstrap* bootstrap = new Tobj_Bootstrap(orb,
                       corbalocs://sling.com:2143);

//Get SecurityCurrent object
CORBA::Object_var var_security_current_oref =
     bootstrap.resolve_initial_references("SecurityCurrent");
SecurityLevel2::Current_var var_security_current_ref =
     SecurityLevel2::Current::_narrow(var_security_current_oref.in());

//Get the PrincipalAuthenticator
SecurityLevel2::PrincipalAuthenticator_var var_principal_authenticator_oref =
     var_security_current_oref->principal_authenticator();

const char * user_name = "john"
const char * client_name = "university";
char system_password[31] = {'\0'};
char user_password[31] = {'\0'};

//Determine the security level
Tobj::AuthType auth_type = var_bea_principal_authenticator->get_auth_type();
switch (auth_type)
{
   case Tobj::TOBJ_NOAUTH;
   break;

   case Tobj::TOBJ_SYSAUTH
   strcpy(system_password, "sys_pw");

   case Tobj::TOBJ_APPAUTH
    strcpy(system_password, "sys_pw");
    strcpy(user_password, "john_pw");
    break;
}
if (auth_type != Tobj::TOBJ_NOAUTH)
```

```
{
     SecurityLevel2::Credentials_var             creds;
     Security::Opaque_var                        auth_data;
     Security::AttributeList_var                 privileges;
     Security::Opaque_var                        cont_data;
     Security::Opaque_var                        auth_spec_data;

var_bea_principalauthenticator->build_auth_data(user_name,
                                                client_name,
                                                system_password,
                                                user_password,
                                                NULL,
                                                auth_data,
                                                privileges);
Security::AuthenticationStatus status =
      var_bea_principalauthenticator->authenticate(
                                                   Tobj::TuxedoSecurity,
                                                   user_name,
                                                   auth_data,
                                                   privileges,
                                                   creds,
                                                   cont_data, auth_spec_data);

if (status != Security::SecAuthSuccess)
 {
    //Failed authentication
    return;
 }
}

// Proceed with application
...
```

Java Code Example of Using the SecurityLevel2.PrincipalAuthenticator.authenticate() Method

Listing 5-4 contains Java code that performs Username/Password authentication using the `SecurityLevel2.PrincipalAuthenticator.authenticate()`method.

Listing 5-4 Java Client Application that uses the

SecurityLevel2.PrincipalAuthenticator.authenticate() Method

```
...
// Create Bootstrap object
      Tobj_Bootstrap bs =
         new Tobj_Bootstrap(orb, corbalocs://sling.com:2143);

// Get SecurityCurrent object
      org.omg.CORBA.Object secCurObj =
         bs.resolve_initial_references( "SecurityCurrent" );
      org.omg.SecurityLevel2.Current secCur2Obj =
         org.omg.SecurityLevel2.CurrentHelper.narrow(secCurObj);

 // Get Principal Authenticator
      org.omg.Security.PrincipalAuthenticator princAuth =
         secCur2Obj.principal_authenticator();
      com.beasys.Tobj.PrincipalAuthenticator auth =
         Tobj.PrincipalAuthenticatorHelper.narrow(princAuth);

 // Get Authentication type
      com.beasys.Tobj.AuthType authType = auth.get_auth_type();

      // Initialize arguments
      String userName = "John";
      String clientName = "Teller";
      String systemPassword = null;
      String userPassword = null;
      byte[] userData = new byte[0];

      // Prepare arguments according to security level requested
      switch(authType.value())
        {
        case com.beasys.Tobj.AuthType._TPNOAUTH:
           break;

        case com.beasys.Tobj.AuthType._TPSYSAUTH:
          systemPassword = "sys_pw";
          break;

        case com.beasys.Tobj.AuthType._TPAPPAUTH:
          systemPassword = "sys_pw";
          userPassword = "john_pw";
          break;
        }

      // Build security data
      org.omg.Security.OpaqueHolder auth_data =
         new org.omg.Security.OpaqueHolder();
      org.omg.Security.AttributeListHolder privs =
```

```
                    new Security.AttributeListHolder();
                auth.build_auth_data(userNname, clientName, systemPassword,
                                     userPassword, userData, authData,
                                     privs);

                // Authenticate user
                org.omg.SecurityLevel2.CredentialsHolder creds =
                    new org.omg.SecurityLevel2.CredentialHolder();
                org.omg.Security.OpaqueHolder cont_data =
                    new org.omg.Security.OpaqueHolder();
                org.omg.Security.OpaqueHolder auth_spec_data =
                    new org.omg.Security.OpaqueHolder();

                org.omg.Security.AuthenticationStatus status =
                    auth.authenticate(com.beasys.Tobj.TuxedoSecurity.value,
                                     0, userName, auth_data.value(),
                                     privs.value(), creds, cont_data,
                                     auth_spec_data);
                if (status != AuthenticatoinStatus.SecAuthSuccess)
                  System.exit(1);
                }
            ...
```

C++ Code Example of Using the Tobj::PrincipalAuthenticator::logon() Method

Listing 5-5 contains C++ code that performs Username/Password authentication using the `Tobj::PrincipalAuthenticator::logon()`method.

Listing 5-5 C++ Client Application that uses the Tobj::PrincipalAuthenticator::logon() Method

```
...
CORBA::Object_var var_security_current_oref =
     bootstrap.resolve_initial_references("SecurityCurrent");
SecurityLevel2::Current_var var_security_current_ref =
     SecurityLevel2::Current::_narrow(var_security_current_oref.in());

//Get the PrincipalAuthenticator
SecurityLevel2::PrincipalAuthenticator_var var_principal_authenticator_oref =
     var_security_current_oref->principal_authenticator();

//Narrow the PrincipalAuthenticator
Tobj::PrincipalAuthenticator_var var_bea_principal_authenticator =
     Tobj::PrincipalAuthenticator::_narrow
                                  var_principal_authenticator_oref.in());
```

```
const char * user_name = “john”
const char * client_name = “university”;
char system_password[31] = {‘\0’};
char user_password[31] = {‘\0’};

//Determine the security level
Tobj::AuthType auth_type = var_bea_principal_authenticator->get_auth_type();
switch (auth_type)
{
   case Tobj::TOBJ_NOAUTH;
   break;

   case Tobj::TOBJ_SYSAUTH
   strcpy(system_password, “sys_pw”);

   case Tobj::TOBJ_APPAUTH
    strcpy(system_password, “sys_pw”);
    strcpy(user_password, “john_pw”);
    break;
}
if (auth_type != Tobj::TOBJ_NOAUTH)

{
     SecurityLevel2::Credentials_var            creds;
     Security::Opaque_var                       auth_data;
     Security::AttributeList_var                privileges;
     Security::Opaque_var                       cont_data;
     Security::Opaque_var                       auth_spec_data;
var_bea_principalauthenticator->build_auth_data(user_name,
                                                client_name,
                                                system_password,
                                                user_password,
                                                NULL,
                                                auth_data,
                                                privileges);
//Determine the security level
Tobj::AuthType auth_type = var_bea_principal_authenticator->get_auth_type();
Security::AuthenticationStatus status = var_bea_principal_authenticator->logon(
                                                  user_name,
                                                  client_name,
                                                  system_password,
                                                  user_password,
                                                  0);


if (status != Security::SecAuthSuccess)
 {
    //Failed authentication
```

```
    return;
 }
}
// Proceed with application
...
// Log off
      try
         {
           logoff();
         }
...
```

Java Code Example of Using the Tobj.PrincipalAuthenticator.logon() Method

Listing 5-6 contains Java code that performs Username/Password authentication using the `Tobj.PrincipalAuthenticator.logon()` method.

Listing 5-6 Java Client Application That Uses the Tobj.PrincipalAuthenticator.logon() Method

```
...
      // Create bootstrap object
      Tobj_Bootstrap bs =
         new Tobj_Bootstrap(orb, corbaloc://sling.com;2143);

      // Get security current
      org.omg.CORBA.Object secCurObj =
         bs.resolve_initial_references( "SecurityCurrent" );
      org.omg.SecurityLevel2.Current secCur2Obj =
         org.omg.SecurityLevel2.CurrentHelper.narrow(secCurObj);

      // Get Principal Authenticator
      org.omg.Security.PrincipalAuthenticator princAuth =
         secCur2Obj.principal_authenticator();
      com.beasys.Tobj.PrincipalAuthenticator auth =
         Tobj.PrincipalAuthenticatorHelper.narrow(princAuth);

      // Get Authentication type
      com.beasys.Tobj.AuthType authType = auth.get_auth_type();

      // Initialize arguments
      String userName = "John";
      String clientName = "Teller";
      String systemPassword = null;
      String userPassword = null;
      byte[] userData = new byte[0];
```

```
      // Prepare arguments according to security level requested
      switch(authType.value())
        {
        case com.beasys.Tobj.AuthType._TPNOAUTH:
           break;

        case com.beasys.Tobj.AuthType._TPSYSAUTH:
          systemPassword = "sys_pw";
          break;

        case com.beasys.Tobj.AuthType._TPAPPAUTH:
          systemPassword = "sys_pw";
          userPassword = "john_pw";
          break;
        }

      // TUXEDO-style Authentication
      org.omg.Security.AuthenticationStatus status =
         auth.logon(userName, clientName, systemPassword,
                    userPassword, userData);
...

// Proceed with application

// Log off
      try
         {
           auth.logoff();
         }
...
```

Using Certificate-based Authentication

This section describes implementing certificate-based authentication in WLE applications.

The Secure Simpapp Sample Application

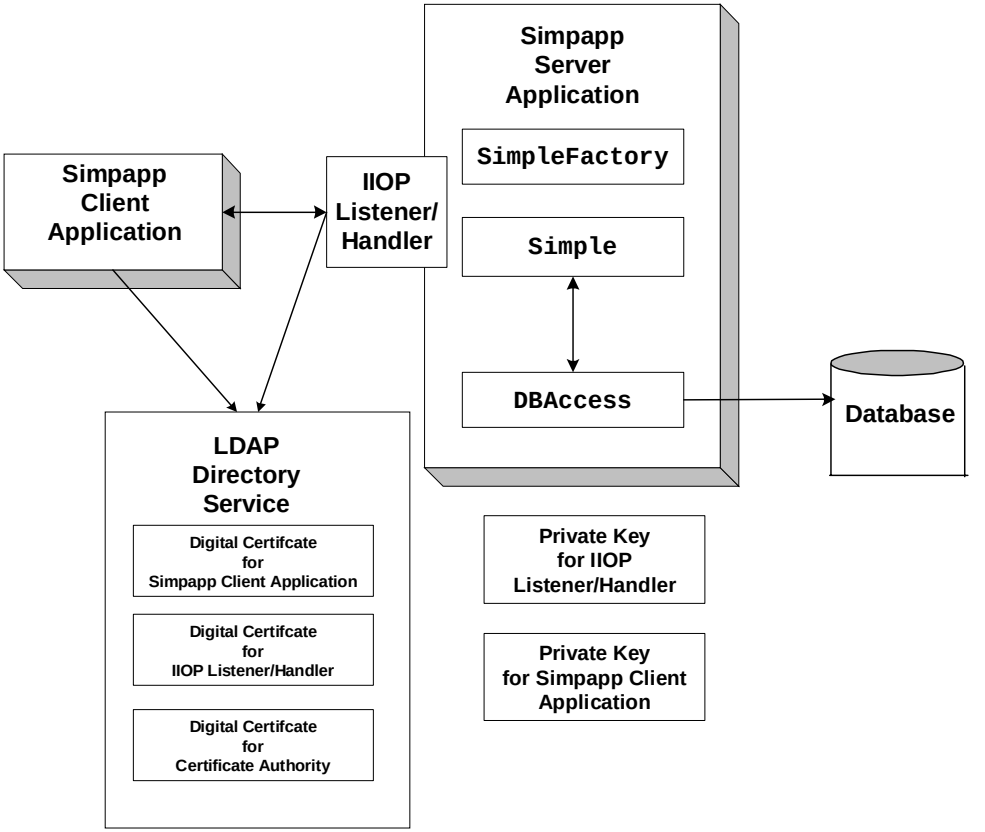
The Secure Simpapp sample application uses the existing Simpapp sample application and modifies the code and configuration files to support secure communications through the SSL protocol and certificate-based authentication.

The server application in the secure Simpapp sample application provides an implementation of a CORBA object that has the following two methods:

- The `upper` method accepts a string from the client application and converts the string to uppercase letters.
- The `lower` method accepts a string from the client application and converts the string to lowercase letters.

Figure 5-2 illustrates how the Secure Simpapp sample application works.

Figure 5-2 Secure Simpapp Sample Application



The Simpapp sample application was modified in the following ways to support certificate-based authentication and the SSL protocol:

- In the `ISL` section of the `UBBCONFIG` file, the `-a`, `-S`, `-z`, and `-Z` options of the ISL command are specified to configure the IIOP Listener/Handler for the SSL protocol.
- In the `ISL` section of the `UBBCONFIG` file, the `SEC_PRINCIPAL_NAME`, the `SEC_PRINCIPAL_LOCATION`, and the `SEC_PRINCIPAL_PASSVAR` parameters are defined to specify proof material for the IIOP Listener/Handler.
- The code for the client application uses the `corbalocs` URL address format.

- The code for the client application uses the `authenticate()` method of the `SecurityLevel2:Current` interface to authenticate the principal and obtain credentials for the principals.

The source files for the C++ and Java versions of the Secure Simpapp sample application are located in the `\samples\corba\simpappSSL` and `\samples\corba\simpappSSL_java` directories of the WLE software. For instructions for building and running the Secure Simpapp sample application, see "Building and Running the CORBA Sample Applications" on page 6-1.

Writing the Client Application

When using certificate-based authentication, write client application code that does the following:

1. Uses the Bootstrap object to obtain a reference to the SecurityCurrent object for the specific WLE domain. Use either the `corbalocs` URL address format.
2. Gets the PrincipalAuthenticator object from the SecurityCurrent object.
3. Uses the `authenticate()` method of the `SecurityLevel2:Current` interface to authenticate the principals and obtain credentials for the principals. When using certificate-based authentication, specify `Tobj::CertificateBased` for the `method` argument and the pass phrase for the private key as the `auth_data` argument for `Security::Opaque`.

The following sections contain C++ and Java code examples that illustrate implementing certificate-based authentication.

C++ Code Example of Certificate-based Authentication

Listing 5-7 illustrates using certificate-based authentication in a C++ client application.

Listing 5-7 C++ Client Application That Uses Certificate-Based Authentication

```
....
```

```
// Initialize the ORB
CORBA::ORB_var v_orb = CORBA::ORB_init(argc, argv, "");

// Create the bootstrap object
Tobj_Bootstrap bootstrap(v_orb.in(), corbalocs://sling.com:2143);

// Resolve SecurityCurrent

CORBA::Object_ptr seccurobj =
        bootstrap.resolve_initial_references("SecurityCurrent");
SecurityLevel2::Current_ptr seccur =
        SecurityLevel2::Current::_narrow(seccurobj);

// Perform certificate-based authentication
        SecurityLevel2::Credentials_ptr   the_creds;
        Security::AttributeList_varprivileges;
        Security::Opaque_var continuation_data;
        Security::Opaque_var auth_specific_data;
        Security::Opaque_var response_data;

//Principal email address
        char emailAddress[] = “milozzi@bigcompany.com;”
// Pass phrase for principal’s digital certificate
        char password[] = “asdawrewe98infldi7;”

// Convert the certificate private key password to opaque
        unsigned long password_len = strlen(password);
         Security::Opaque ssl_auth_data(password_len);

// Authenticate principal certificate with principal authenticator
          for(int i = 0; (unsigned long) i < password_len; i++)
          ssl_auth_data[i] = password[i];
          Security::AuthenticationStatus auth_status;
          SecurityLevel2::PrincipalAuthenticator_var PA =
                          seccur->principal_authenticator();

          auth_status = PA->authenticate(Tobj::CertificateBased,
                                         emailAddress,
                                         ssl_auth_data,
                                         privileges,
                                         the_creds,
                                         continuation_data,
                                          auth_specific_data);

              while(auth_status == Security::SecAuthContinue) {
              auth_status = PA->continue_authentication(
                                         response_data,
                                         the_creds,
                                         continuation_data,
                                          auth_specific_data);
```

```
                    }
            ...
```

Java Code Example of Certificate-based Authentication

Listing 5-8 illustrates using certificate-based authentication in a C++ client application.

Listing 5-8 Java Client Application That Uses Certificate-based Authentication

```
...
// Initialize the ORB.

      Properties Prop;
      Prop = new Properties(System.getProperties());
      Prop.put("org.omg.CORBA.ORBClass","com.beasys.CORBA.iiop.ORB");
      Prop.put("org.omg.CORBA.ORBSingletonClass",
                "com.beasys.CORBA.idl.ORBSingleton");

      ORB orb = ORB.init(args, Prop);

// Create the Bootstrap object

      Tobj_Bootstrap bs = new Tobj_Bootstrap(orb,
                corbalocs://foo:2501);

//Resolve SecurityCurrent
      org.omg.CORBA.object ocurr =
         bs.resolve_initial_references(“SecurityCurrent”);
      org.omg.SecurityLevel2.Current curr =
         org.omg.SecurityLevel2.CurrentHelper.narrow(occur);

// Get Principal Authenticator

      com.beasys.Tobj.PrincipalAuthenticator pa =
          (com.beasys.Tobj.PrincipalAuthenticator)
              curr.principal_authenticator();

      OpaqueHolder auth_data = new OpaqueHolder();
      AttributeListHolder privileges = new AttributeListHolder();
      org.omg.SecurityLevel2.CredentialsHolder creds =
          new org.omg.SecurityLevel2.CredentialsHolder();
      OpaqueHolder continuation_data = new OpaqueHolder();
```

```
OpaqueHolder auth_specific_data = new OpaqueHolder();
auth_data.value=new String (“deathstar”).getbytes(“UTF8);
if(pa.authenticate(com.beasys.Tobj.CertificateBased.value,
                   “vader@largecompany.com”,
                    auth_data.value,
                    privileges.value,
                    the_creds,
                    continuation_data,
                     auth_specific_data)

  !AuthenticationStatus.SecAuthSuccess) {
      System.err.println(“logon failed”);
      System.exit(1);
   }
 ...
```

Using the Invocations_Options_Required() Method

When using certificate-based authentication, it may be necessary for a principal to explicitly define the security attributes it requires. For example, a bank application may have specific security requirements it needs met before the bank application can transfer data to a database. The `invocation_options_required()` method of the `SecurityLevel2::Credentials` interface allows the principal to explicitly control the security characteristics of the SSL connection. When using the `corbaloc` URL address format, you can secure the bootstrapping process by using the `authenticate()`and `invocation_options_required()` methods of the `SecurityLevel2::Credentials` interface.

Perform the following steps to use the `invocation_options_required()` method :

1. Write application code that uses the `authenticate()` method of the `SecurityLevel2::Current` object to specify certificate-based authentication is being used

2. Use the `invocation_options_required()` method to specify the security attributes the principal requires. See the description of the `invocation_options_required()` method in the "C++ Security Reference" on page 11-1 and "Java Security Reference" on page 12-1 for a complete list of security options.

Listing 5-9 provides a C++ example of using the `invocation_options_required()` method.

Listing 5-9 C++ Example of Using the invocation_options_required() Method

```
// Initialize the ORB
CORBA::ORB_var v_orb = CORBA::ORB_init(argc, argv, "");

// Create the bootstrap object
Tobj_Bootstrap bootstrap(v_orb.in(), corbalocs://sling.com:2143);

// Resolve SecurityCurrent

CORBA::Object_ptr seccurobj =
        bootstrap.resolve_initial_references("SecurityCurrent");
SecurityLevel2::Current_ptr seccur =
        SecurityLevel2::Current::_narrow(seccurobj);

// Perform certificate-based authentication
        SecurityLevel2::Credentials_ptr   the_creds;
Security::AttributeList_var        privileges;
        Security::Opaque_var continuation_data;
        Security::Opaque_var auth_specific_data;
        Security::Opaque_var response_data;

//Principal email address
        char emailAddress[] = "milozzi@bigcompany.com;"
// Pass phrase for principal's digital certificate
        char password[] = "asdawrewe98infldi7;"

// Convert the certificate private key password to opaque
        unsigned long password_len = strlen(password);
         Security::Opaque ssl_auth_data(password_len);

// Authenticate principal certificate with principal authenticator
          for(int i = 0; (unsigned long) i < password_len; i++)
          ssl_auth_data[i] = password[i];
          Security::AuthenticationStatus auth_status;
          SecurityLevel2::PrincipalAuthenticator_var PA =
                           seccur->principal_authenticator();
```

```
                    auth_status = PA->authenticate(Tobj::CertificateBased,
                                                   emailAddress,
                                                   ssl_auth_data,
                                                   privileges,
                                                   the_creds,
                                                   continuation_data,
                                                    auth_specific_data);
                    the_creds->invocation_options_required(
                                          Security::Integrity|
                                          Security::DetectReplay|
                                          Security::DetectMisordering|
                                          Security::EstablishTrustInTarget|
                                          Security::EstalishTrustInClient|
                                         Security::SimpleDelegation);

                    while(auth_status == Security::SecAuthContinue) {
                          auth_status = PA->continue_authentication(
                                                   response_data,
                                                   the_creds,
                                                   continuation_data,
                                                    auth_specific_data);

                        }
            ...
```

Listing 5-10 provdes a Java example of using the `invocation_options_required()` method

Listing 5-10 Java Example of Using the invocation_options_required() Method

```
...
// Initialize the ORB.

      Properties Prop;
      Prop = new Properties(System.getProperties());
      Prop.put("org.omg.CORBA.ORBClass","com.beasys.CORBA.iiop.ORB");
      Prop.put("org.omg.CORBA.ORBSingletonClass",
                "com.beasys.CORBA.idl.ORBSingleton");

      ORB orb = ORB.init(args, Prop);

// Create the Bootstrap object

      Tobj_Bootstrap bs = new Tobj_Bootstrap(orb,
                corbalocs://foo:2501);
```

```
//Resolve SecurityCurrent
      org.omg.CORBA.object ocurr =
         bs.resolve_initial_references("SecurityCurrent");
      org.omg.SecurityLevel2.Current curr =
         org.omg.SecurityLevel2.CurrentHelper.narrow(occur);

// Get Principal Authenticator

      com.beasys.Tobj.PrincipalAuthenticator pa =
          (com.beasys.Tobj.PrincipalAuthenticator)
              curr.principal_authenticator();

      OpaqueHolder auth_data = new OpaqueHolder();
      AttributeListHolder privileges = new AttributeListHolder();
      org.omg.SecurityLevel2.CredentialsHolder creds =
          new org.omg.SecurityLevel2.CredentialsHolder();
      OpaqueHolder continuation_data = new OpaqueHolder();
      OpaqueHolder auth_specific_data = new OpaqueHolder();
      auth_data.value=new String ("deathstar").getbytes("UTF8);
      if(pa.authenticate(com.beasys.Tobj.CertificateBased.value,
                         "vader@largecompany.com",
                          auth_data.value,
                          privileges.value,
                          the_creds,
                          continuation_data,
                           auth_specific_data)
      org.omg.SecurityLevel2.Credentials credentials = curr.get_credentials(
          org.omg.Security.CredentialType.SecInvocationCredentials);

      credentials.invocation_options_required(
          (short) (org.omg.Security.Integrity.value |
           org.omg.Security.DetectReplay.value|
           org.omg.Security.DetectMisordering.value|
           org.omg.Security.EstablishTrustInTarget.value|
           org.omg.Security.EstablishTrustInClient.value|
           org.omg.Security.SimpleDelegation.value)
          );
        !AuthenticationStatus.SecAuthSuccess) {
            System.err.println("logon failed");
            System.exit(1);
         }
       ...
```

CHAPTER

6 Building and Running the CORBA Sample Applications

The topic contains the following sections:

- Building and Running the Security Sample Application
- Building and Running the Secure Simpapp Sample Application

Building and Running the Security Sample Application

The Security sample application demonstrates using Username/Password authentication. The sample application has both C++ and Java client applications. For a description of the Security sample application, see “Writing a WLE CORBA Application That Implements Security” on page 5-1 This section describes how to build the Security sample application and how to use the client applications in the Security sample application.

Perform the following steps to build the Security sample application:

1. Copy the files for the Security sample application into a work directory.
2. Verify the settings of the environment variables.
3. Change the protection on the files for the Security sample application.
4. Set the environment variables.
5. Initialize the database.
6. Load the `UBBCONFIG` file.
7. Compile the client and server sample applications.
8. Start the server application in the Security sample application.
9. Start the C++ client application in the Security sample application.
10. Start the Java client application in the Security sample application.

The following sections describe these steps.

Refer to `Readme.txt` in the `\`*`WLEdir`*`\samples\corba\university\security` directory for troubleshooting information and the latest information about using the Security sample application.

Step 1: Copy the files for the Security sample application into a work directory.

You need to copy the files for the Security sample application into a work directory on your local machine. The files for the Security sample application are located in the following directories:

Windows NT

drive:*WLEdir*\samples\corba\university\security

UNIX

/usr/*WLEdir*/samples/corba/university/security

In addition, you need to copy the `utils` directory into your work directory. The `utils` directory contains files that set up logging, tracing, and access to the database used with the Security sample application.

You will use the files listed in Table 6-1 to create the Security sample application.

Table 6-1 Files Included in the Security Sample Application

File	Description
`univs.idl`	The OMG IDL code that declares the `CourseSynopsisEnumerator`, `Registrar`, and `RegistrarFactory` interfaces.
`univss.cpp`	The C++ source code for the server application in the Security sample application.
`univs_i.h` `univs_i.cpp`	The C++ source code for method implementations of the `CourseSynopsisEnumerator`, `Registrar`, and `RegistrarFactory` interfaces.
`univsc.cpp`	The C++ source code for the C++ client application in the Security sample application.
`UnivSApplet.java`	The Java source code for the Java client application in the Security sample application.

Table 6-1 Files Included in the Security Sample Application

File	Description
`univs_utils.h` `univs_utils.cpp`	The files that define database access functions for the CORBA C++ client application.
`univs.icf`	The Implementation Configuration File (ICF) for the Security sample application.
`setenvs.sh`	A UNIX script that sets the environment variables needed to build and run the Security sample application.
`setenvs.cmd`	An MS-DOS command procedure that sets the environment variables needed to build and run the Security sample application.
`ubb_s.mk`	The `UBBCONFIG` file for the UNIX operating system.
`ubb_s.nt`	The `UBBCONFIG` file for the Windows NT operating system.
`makefiles.mk`	The `makefile` for the Security sample application on the UNIX operating system.
`makefiles.nt`	The `makefile` for the Security sample application on the Windows NT operating system.
`log.cpp`, `log.h`, `log_client.cpp`, and `log_server.cpp`	The client and server applications that provide logging and tracing functions for the sample applications. These files are located in the `\utils` directory.
`oradbconn.cpp` and `oranoconn.cpp`	The files that provide access to an Oracle SQL database instance. These files are located in the `\utils` directory.
`samplesdb.cpp` and `samplesdb.h`	The files that provide print functions for the database exceptions in the sample applications.These files are located in the `\utils` directory.
`unique_id.cpp` and `unique_id.h`	C++ Unique ID class routines for the sample applications.These files are located in the `\utils` directory.

Table 6-1 Files Included in the Security Sample Application

File	Description
`samplesdbsql.h` and `samplesdbsql.pc`	C++ class methods that implement access to the SQL database. These files are located in the `\utils` directory.
`university.sql`	The SQL for the University database. This file is located in the `\utils` directory.
`Readme.txt`	The file that provide the latest information about building and running the Security sample application.

Step 2: Verify the settings of the environment variables.

Before building and running the Security sample application, you need to ensure that certain environment variables are set on your system. In most cases, these environment variables are set as part of the installation procedure. However, you need to check the environment variables to ensure they reflect correct information.

Table 6-5 lists the environment variables required to run the Security sample application.

Table 6-2 Required Environment Variables for the Security Sample Application

Environment Variable	Description

`APPDIR`	The directory path where you copied the sample application files. For example:
	Windows NT
	`APPDIR=c:\`*`work`*`\securityapp`
	UNIX
	`APPDIR=/usr/`*`work`*`/securityapp`

Table 6-2 Required Environment Variables for the Security Sample Application

Environment Variable	Description

TUXCONFIG	The directory path and name of the configuration file. For example:
	Windows NT
	`TUXCONFIG=c:\work\securityapp\tuxconfig`
	UNIX
	`TUXCONFIG=/usr/work/securityapp/tuxconfig`

TUXDIR	The directory path where you installed the WLE software. For example:
	Windows NT
	`TUXDIR=c:\WLEdir`
	UNIX
	`TUXCONFIG=/usr/local/WLEdir`

JDKDIR	The directory path where you installed the JDK software. For example:
	Windows NT
	`JDKDIR=c:\jdk1.2.2`
	UNIX
	`JDKDIR=/usr/local/jdk1.2.1`
	You need to specify this parameter only if you plan to use the Java version of the Secure Simpapp sample application.

To verify that the information for the environment variables defined during installation is correct, perform the following steps:

Windows NT

1. From the Start menu, select Settings.
2. From the Settings menu, select the Control Panel.

   The Control Panel appears.
3. Click the System icon.

   The System Properties window appears.
4. Click the Environment tab.

   The Environment page appears.

5. Check the settings of the environment variables.

UNIX

```
ksh prompt>printenv TUXDIR

ksh prompt>printenv JAVA_HOME
```

To change the settings, perform the following steps:

Windows NT

1. On the Environment page in the System Properties window, click the environment variable you want to change or enter the name of the environment variable in the Variable field.
2. Enter the correct information for the environment variable in the Value field.
3. Click OK to save the changes.

UNIX

```
ksh prompt>export TUXDIR=directorypath

ksh prompt>export JAVA_HOME=directorypath
```

Step 3:Change the Protection on the Files for the Security Sample Application.

During the installation of the WLE software, the sample application files are marked read-only. Before you can edit the files or build the files in the Security sample application, you need to change the protection of the files you copied into your work directory, as follows:

Windows NT

```
prompt>attrib -r drive:\workdirectory\*.*
```

UNIX

```
prompt>chmod u+rw /workdirectory/*.*
```

Step 4: Set the Environment Variables

Use the following command to set the environment variables used to build the client and server applications in the Security sample application:

Windows NT

```
prompt>setenvs
```

UNIX

```
prompt>/bin/ksh
prompt>. ./setenvs.sh
```

Step 5: Initialize the Database

Use the following command to initialize the database used with the Security sample application:

Windows NT

```
prompt>nmake -f makefiles.nt initdb
```

UNIX

```
prompt>make -f makefiles.mk initdb
```

Step 6: Load the UBBCONFIG File

Use the following command to load the `UBBCONFIG` file:

Windows NT

```
prompt>tmloadcf -y ubb_s.nt
```

UNIX

```
prompt>tmloadcf -y ubb_s.mk
```

The build process for the `UBBCONFIG` file prompts you for an application password. This password will be used to log on to the client applications. Enter the password and press Enter. You are then prompted to verify the password by entering it again.

Step 7: Compile the Security Sample Application

The directory for the Security sample application contains a `makefile` that builds the client and server sample applications in the Security sample application.

Use the following command to build the C++ client and server applications in the Security sample application:

Windows NT

```
prompt>nmake -f makefiles.nt
```

UNIX

```
prompt>make -f makefiles.mk
```

To build the Java client application in the Security sample application:

Windows NT

```
prompt>nmake -f makefiles.nt javaclient
```

UNIX

```
prompt>make -f makefiles.mk javaclient
```

Step 8: Start the server application

Start the system processes and the server application in the Security sample application by entering the following command:

```
prompt>tmboot -y
```

Before using another sample application, enter the following command to stop the system processes and the server application in the Security sample application.

```
prompt>tmshutdown
```

Step 8: Start the C++ client application

Start the C++ client application in the Security sample application by performing the following steps:

1. At the MS-DOS prompt, enter the following command:

   ```
   prompt>univs_client
   ```

2. At the `Enter student id:` prompt, enter any number between 100001 and 100010.

3. Press Enter.

4. At the `Enter domain password:` prompt, enter the password you defined when you loaded the `UBBCONFIG` file.

5. Press Enter.

Step 9: Start the Java client application.

To run the Java client application in the Security sample application, perform the following steps:

1. Modify the following lines in the `UnivSApplet.html` file:

   ```
   code="UnivSApplet.class"
   codebase=.
   ```

   to read as follows:

   ```
   code="UnivSApplet"
   archive="UnivSApplet.jar,m3envobj.jar"
   ```

2. Copy the modified `UnivSApplet.html` file to the source directory for the Web server (the directory varies by Web server product).

3. Create a `UnivSApplet.jar` file, as follows:

   a. Create a `tmp` directory under the directory where you built the sample application and copy the `UniversityS` subdirectory and the class files it contains into the `tmp` directory.

Copy the class files in the Security sample application directory that were generated by the `makefile` into the `tmp` directory, set the directory (`cd`) to the `tmp` directory, and issue one of the following commands to create a jar file that contains all the Security sample application classes:

`jar -cf ..\UnivSApplet.jar *.*` (Microsoft Windows NT systems)
`jar -cf ../UnivSApplet.jar *` (UNIX systems)

4. Copy the `UnivSApplet.jar` file you just created to the source directory for the Web server (the directory name varies by Web server product).

5. Copy the `m3envobj.jar` file from the appropriate subdirectory (`%TUXDIR%\udataobj\java` Microsoft Windows NT systems or `${TUXDIR}/udataobj/java` UNIX systems) to the Web server source directory.

6. Make sure the Security server application is running, start up your Web browser, and point it to the node where the Web server is running.

Note: On Microsoft Windows NT systems, the node name needs to be in all uppercase characters. For example, if the node is specified as `SERVER` in the `UBBCONFIG` file and in the `UnivSApplet.html` file, set your browser to `http://SERVER/UnivSApplet.html`.

1. Modify the following lines in the `UnivSApplet.html` file:

```
code="UnivSApplet.class"
codebase=.
```

to read as follows:

```
code="UnivSApplet"
archive="UnivSApplet.jar,m3envobj.jar"
```

2. Copy the modified `UnivSApplet.html` file to the source directory for the Web server (the directory varies by Web server product).

3. After executing the `makefile` to build the Security sample application, create a `UnivSApplet.jar` file, as follows:

   a. Create a `tmp` directory under the directory where you built the sample application and copy the `UniversityS` subdirectory and the class files it contains into the `tmp` directory.

   Copy the class files in the Security sample application directory that were generated by the `makefile` into the `tmp` directory, set the directory (`cd`) to

the `tmp` directory, and issue one of the following commands to create a jar file that contains all the Production sample application classes:

`jar -cf ..\UnivSApplet.jar *.*` (Microsoft Windows NT systems)
`jar -cf ../UnivSApplet.jar *` (UNIX systems)

4. Copy the `UnivSApplet.jar` file you just created to the source directory for the Web server (the directory name varies by Web server product).

5. Copy the `m3envobj.jar` file from the appropriate subdirectory (`%TUXDIR%\udataobj\java` Microsoft Windows NT systems or `${TUXDIR}/udataobj/java` UNIX systems) to the Web server source directory.

6. Make sure the Security server application is running, start up your Web browser, and point it to the node where the Web server is running.

Note: On Microsoft Windows NT systems, the node name needs to be in all uppercase characters. For example, if the node is specified as `SERVER` in the `UBBCONFIG` file and in the `UnivSApplet.html` file, set your browser to `http://SERVER/UnivPApplet.html`.

A logon window appears.

7. Enter a number between 100001 and 100010 in the `student ID` field.

8. Enter the password you defined when you loaded the `UBBCONFIG` file in the `Domain Password` field.

9. Click the Logon button.

10. Enter a search string to find a course.

Building and Running the Secure Simpapp Sample Application

The Secure Simpapp sample application demonstrates using the SSL protocol and certificate-based authentication to protect communications between client applications and the WLE domain. There are C++ and Java versions of the Secure Simpapp sample application.

Perform the following steps to build and run the Secure Simpapp sample application:

1. Copy the files for the Secure Simpapp sample application into a work directory.
2. Change the protection attribute on the files for the Secure Simpapp sample application.
3. Verify the environment variables.
4. Execute the `runme` command.

Before you can use the Secure Simpapp sample application, obtain a certificate and private key (`IIOPListener.pem`) for the IIOP Listener/Handler from the certificate authority in your enterprise and load the certificate in a Lightweight Directory Access Protocol (LDAP)-enabled directory service. The `runme` command prompts you for the pass phrase for the private key for the IIOP Listener/Handler.

Step 1: Copy the Files for the Secure Simpapp Sample Application into a Work Directory

You need to copy the files for the Secure Simpapp sample application into a work directory on your local machine. The following sections detail the directory location and sources files for the C++ and Java versions of the Secure Simpapp sample application.

C++ Version of the Secure Simpapp Sample Application

The files for the C++ version of the Secure Simpapp sample application are located in the following directories:

Windows NT

*drive:**WLEdir*\samples\corba\simpappSSL

UNIX

*/usr/local/WLedir/*samples/corba/simappSSL

You will use the files listed in Table 6-3 to build and run the C++ version of the Secure Simpapp sample application.

Table 6-3 Files Included in the C++ Version of the Secure Simpapp Sample Application

File	Description
Simple.idl	The OMG IDL code that declares the Simple and SimpleFactory interfaces.This file is copied from the WLE simappSSL_java directory by the runme command file.
Simples.cpp	The C++ source code that overrides the default Server::initialize and Server::release methods.
Simplec.cpp	The C++ source code for the client application in the Secure Simpapp sample application.
Simple_i.cpp	The C++ source code that implements the Simple and SimpleFactory methods.
Simple_i.h	The C++ header file that defines the implementation of the Simple and SimpleFactory methods.
Readme.html	This file provides the latest information about building and running the C++ version of the Secure Simpapp sample application.
runme.cmd	The Windows NT batch file that builds and runs the C++ version of the Secure Simpapp sample application.

Table 6-3 Files Included in the C++ Version of the Secure Simpapp Sample Application

File	Description
`runme.ksh`	The UNIX Korn shell script that builds and executes the C++ version of the Secure Simpapp sample application.
`makefile.mk`	The makefile for the C++ version of the Secure Simpapp sample application on the UNIX operating system. This file is used to manually build the C++ version of the Secure Simpapp sample application. Refer to the `Readme.html` file for information about manually building the C++ version of the Secure Simpapp sample application. The UNIX `make` command needs to be in the path of your machine.
`makefiles.nt`	The makefile for the C++ version of the Secure Simpapp sample application on the Windows NT operating system. This makefile can be used directly by the Visual C++ `nmake` command. This file is used to manually build the C++ version of the Secure Simpapp sample application. Refer to the `Readme.html` file for information about manually building the C++ version of the Secure Simpapp sample application. The Windows NT `nmake` command needs to be in the path of your machine.

Java Version of the Secure Simpapp Sample Application

The files for the Java version of the Secure Simpapp sample application are located in the following directories:

Windows NT

drive:`\`*WLEdir*`\samples\corba\simpappSSL_java`

UNIX

`/usr/local/`*WLedir*`/samples/corba/simappSSL_java`

You will use the files listed in Table 6-4 to build and run the Java Secure Simpapp sample application.

Table 6-4 Files Included in the Java Version of the Secure Simpapp Sample Application

File	Description
`Simple.idl`	The OMG IDL code that declares the `Simple` and `SimpleFactory` interfaces.This file is copied from the WLE `simpappSSL_java` directory by the `runme` command file.
`ServerImpl.java`	The Java source code that overrides the `Server.initialize` and `Server.release` methods.
`SimpleClient.java`	The Java source code for the client application in the Secure Simpapp sample application.
`SimpleFactoryImpl.java`	The Java source code that implements the `SimpleFactory` methods.
`SimpleImpl.java`	The Java source code that implements the `Simple` methods.
`Simple.xml`	The Server Description File used to associate activation and transaction policy values with CORBA interfaces. For the Java version of the Secure Simpapp sample application, the `Simple` and `SimpleFactory` interfaces have an activation policy of `method` and a transaction policy of `optional`.
`Readme.html`	The file that provides the latest information about building and running the Java version of the Secure Simpapp sample application.
`runme.cmd`	The Windows NT batch file that builds and runs the Java version of the Secure Simpapp sample application.
`runme.ksh`	The UNIX Korn shell script that builds and executes the Java version of the Secure Simpapp sample application.

Table 6-4 Files Included in the Java Version of the Secure Simpapp Sample Application

File	Description
`makefile.mk`	The makefile for the Java version of the Secure Simpapp sample application on the UNIX operating system. This file is used to manually build the Secure Simpapp sample application. Refer to the `Readme.html` file for information about manually building the Secure Simpapp sample application. The UNIX `make` command needs to be in the path of your machine.
`makefiles.nt`	The makefile for the Secure Simpapp sample application on the Windows NT operating system. This file is used to manually build the Java version of the Secure Simpapp sample application. Refer to the `Readme.html` file for information about manually building the Secure Simpapp sample application. The Windows NT `nmake` command needs to be in the path of your machine.

Step 2: Change the protection attribute on the files for the Secure Simpapp sample application.

During the installation of the WLE software, the sample application files are marked read-only. Before you can edit or build the files in the Secure Simpapp sample application, you need to change the protection attribute of the files you copied into your work directory, as follows:

Windows NT

```
prompt>attrib -r drive:\workdirectory\*.*
```

UNIX

```
prompt>/bin/ksh
ksh prompt>chmod u+w /workdirectory/*.*
```

On the UNIX operating system platform, you also need to change the permission of `runme.ksh` to give execute permission to the file, as follows:

```
ksh prompt>chmod +x runme.ksh
```

Step 3: Verify the settings of the environment variables.

Before building and running the Secure Simpapp sample application, you need to ensure that certain environment variables are set on your system. In most cases, these environment variables are set as part of the installation procedure. However, you need to check the environment variables to ensure they reflect correct information.

Table 6-5 lists the environment variables required to run the Secure Simpapp sample application.

Table 6-5 Required Environment Variables for the Secure Simpapp Sample Application

Environment Variable	Description
APPDIR	The directory path where you copied the sample application files. For example: **Windows NT** APPDIR=c:*work*\simpappSSL **UNIX** APPDIR=/usr/*work*/simpappSSL
TUXCONFIG	The directory path and name of the configuration file. For example: **Windows NT** TUXCONFIG=c:\work\simpappSSL\tuxconfig **UNIX** TUXCONFIG=/usr/*work*/simpappSSL/tuxconfig

Table 6-5 Required Environment Variables for the Secure Simpapp Sample Application

Environment Variable	Description

JDKDIR	The directory path where you installed the JDK software. For example:
	Windows NT
	`JDKDIR=c:\jdk1.2.2`
	UNIX
	`JDKDIR=/usr/local/jdk1.2.1`
	You need to specify this parameter only if you plan to use the Java version of the Secure Simpapp sample application.

TOBJADDR	The host name and port number of the IIOP Listener/Handler. The port number must be defined as a port for SSL communications. For example: **Windows NT** `TOBJADDR=trixie::1111` **UNIX** `TOBJADDR=trixie::1111`

JAVA_HOME	The directory path where you installed the JDK software. For example:
	Windows NT
	`JAVA_HOME=c:\JDK1.2`
	UNIX
	`JAVA_HOME=/usr/local/JDK1.2`
	You need to define this environment variable only when you use the Java version of the Secure Simpapp sample application.

RESULTSDIR or JRESULTSDIR	A subdirectory of `APPDIR` where files that are created as a result of executing the `runme` command are stored. For example:
	Windows NT
	`RESULTSDIR=c:\workdirectory\`
	UNIX
	`RESULTSDIR=/usr/local/workdirectory/`
	When using the Java version of the Secure Simpapp sample application, specify the `JRESULTSDIR` environment variable.

To verify that the information for the environment variables defined during installation is correct, perform the following steps:

Windows NT

1. From the Start menu, select Settings.
2. From the Settings menu, select the Control Panel.

   The Control Panel appears.
3. Click the System icon.

   The System Properties window appears.
4. Click the Environment tab.

   The Environment page appears.
5. Check the settings of the environment variables.

UNIX

```
ksh prompt>printenv TUXDIR
ksh prompt>printenv JAVA_HOME
```

To change the settings, perform the following steps:

Windows NT

1. On the Environment page in the System Properties window, click the environment variable you want to change or enter the name of the environment variable in the `Variable` field.
2. Enter the correct information for the environment variable in the `Value` field.
3. Click OK to save the changes.

UNIX

```
ksh prompt>export TUXDIR=directorypath
ksh prompt>export JAVA_HOME=directorypath
```

Step 4: Execute the runme command.

The `runme` command automates the following steps:

1. Setting the system environment variables

2. Loading the `UBBCONFIG` file
3. Compiling the code for the client application
4. Compiling the code for the server application
5. Starting the server application using the `tmboot` command
6. Starting the client application
7. Stopping the server application using the `tmshutdown` command

Note: You can also run the Secure Simpapp sample application manually. The steps for manually running the Secure Simpapp sample application are described in the `Readme.html` file.

To build and run the Secure Simpapp sample application, enter the `runme` command, as follows:

Windows NT

```
prompt>cd workdirectory

prompt>runme
```

UNIX

```
ksh prompt>cd workdirectory

ksh prompt>./runme.ksh
```

The Secure Simpapp sample application runs and prints the following messages:

```
Testing simpapp
    cleaned up
    prepared
    built
    loaded ubb
    booted
    ran
    shutdown
    saved results
  PASSED
```

During execution of the `runme` command, you are prompted for a password. Enter the pass phrase of the private key of the IIOP Listener/Handler.

Table 6-6 lists the C++ files in the work directory generated by the `runme` command.

Table 6-6 C++ Files Generated by the `runme` Command

File	Description
`Simple_c.cpp`	Generated by the `idl` command, this file contains the client stubs for the `SimpleFactory` and `Simple` interfaces.
`Simple_c.h`	Generated by the `idl` command, this file contains the client definitions of the `SimpleFactory` and `Simple` interfaces.
`Simple_s.cpp`	Generated by the `idl` command, this file contains the server skeletons for the `SimpleFactory` and `Simple` interfaces.
`Simple_s.h`	Generated by the `idl` command, this file contains the server definition for the `SimpleFactory` and `Simple` interfaces.
`.adm/.keybd`	A file that contains the security encryption key database. The subdirectory is created by the `tmloadcf` command in the `runme` command.
`results`	A directory generated by the `runme` command.

Table 6-7 lists the Java files in the work directory generated by the `runme` command.

Table 6-7 Java Files Generated by the `runme` Command

File	Description
`SimpleFactory.java`	Generated by the `m3idltojava` command for the `SimpleFactory` interface. The `SimpleFactory` interface contains the Java version of the OMG IDL interface. It extends `org.omg.CORBA.Object`.
`SimpleFactoryHolder.java`	Generated by the `m3idltojava` command for the `SimpleFactory` interface.This class holds a public instance member of type `SimpleFactory`. The class provides operations for `out` and `inout` arguments that are included in CORBA, but that do not map exactly to Java.

Table 6-7 Java Files Generated by the `runme` Command

File	Description
`SimpleFactoryHelper.java`	Generated by the `m3idltojava` command for the `SimpleFactory` interface. This class provides auxiliary functionality, notably the `narrow` method.
`_SimpleFactoryStub.java`	Generated by the `m3idltojava` command for the `SimpleFactory` interface. This class is the client stub that implements the `SimpleFactory.java` interface.
`_SimpleFactoryImplBase.java`	Generated by the `m3idltojava` command for the `SimpleFactory` interface. This abstract class is the server skeleton. It implements the `SimpleFactory.java` interface. The user-written server class `SimpleFactoryImpl` extends `_SimpleFactoryImplBase`.
`Simple.java`	Generated by the `m3idltojava` command for the `Simple` interface. The `Simple` interface contains the Java version of the OMG IDL interface. It extends `org.omg.CORBA.Object`.
`SimpleHolder.java`	Generated by the `m3idltojava` command for the `Simple` interface.This class holds a public instance member of type `Simple`. The class provides operations for `out` and `inout` arguments that CORBA has but that do not match exactly to Java.
`SimpleHelper.java`	Generated by the `m3idltojava` command for the `Simple` interface. This class provides auxiliary functionality, notably the `narrow` method.
`_SimpleStub.java`	Generated by the `m3idltojava` command for the `Simple` interface. This class is the client stub that implements the `Simple.java` interface.

Table 6-7 Java Files Generated by the `runme` Command

File	Description
`_SimpleImplBase.java`	Generated by the `m3idltojava` command for the `Simple` interface. This abstract class is the server skeleton. It implements the `Simple.java` interface. The user-written server class `SimpleImpl` extends `_SimpleImplBase`.
`Simple.ser`	The Server Descriptor File generated by the `buildjobjserver` command in the `runme` command.
`Simple.jar`	The server Java Archive file generated by the `buildjavaserver` command in the `runme` command.
`.adm/.keybd`	A file that contains the security encryption key database. The subdirectory is created by the `tmloadcf` command in the `runme` command.
`results`	A directory generated by the `runme` command.

Table 6-8 lists files in the `RESULTS` or `JRESULTS` directory generated by the `runme` command.

Table 6-8 Files in the `results` Directory Generated by the runme Command

File	Description
`input`	Contains the input that the `runme` command provides to the Java client application.
`output`	Contains the output produced when the `runme` command executes the Java client application.
`expected_output`	Contains the output that is expected when the Java client application is executed by the `runme` command. The data in the `output` file is compared to the data in the `expected_output` file to determine whether or not the test passed or failed.

Table 6-8 Files in the `results` Directory Generated by the runme Command

File	Description
`log`	Contains the output generated by the `runme` command. If the `runme` command fails, check this file for errors.
`setenv.cmd`	Contains the commands to set the environment variables needed to build and run the Java Secure Simpapp sample application on the Windows NT operating system platform.
`setenv.ksh`	Contains the commands to set the environment variables needed to build and run the Java Secure Simpapp sample application on the UNIX operating system platform.
`stderr`	Generated by the `tmboot` command, which is executed by the `runme` command. If the `-noredirect` JavaServer option is specified in the `UBBCONFIG` file, the `System.err.println` method sends the output to the `stderr` file instead of to the `ULOG` file.
`stdout`	Generated by the `tmboot` command, which is executed by the `runme` command. If the `-noredirect` JavaServer option is specified in the `UBBCONFIG` file, the `System.out.println` method sends the output to the `stdout` file instead of to the `ULOG` file.
`tmsysevt.dat`	Contains filtering and notification rules used by the TMSYSEVT (system event reporting) process. This file is generated by the `tmboot` command in the `runme` command.
`tuxconfig`	A binary version of the `UBBCONFIG` file.
`ubb`	The `UBBCONFIG` file for the Java Secure Simpapp sample application.
`ULOG.<date>`	A log file that contains messages generated by the `tmboot` command.

Using the Secure Simpapp Sample Application

Run the server application in the Secure Simpapp sample application, as follows:

Windows NT

```
prompt>tmboot
```

UNIX

```
ksh prompt>tmboot
```

Run the client application in the Secure Simpapp sample application, as follows:

Windows NT

```
prompt>java -classpath .;%TUXDIR%\udataobj\java\jdk\m3envobj.jar
-DTOBJADDR=%TOBJADDR% SimpleClient
String?
Hello World
HELLO WORLD
hello world
```

UNIX

```
ksh prompt>java -classpath .:$TUXDIR/udataobj/java/jdk\
/m3envobj.jar -DTOBJADDR=$TOBJADDR SimpleClient
String?
Hello World
HELLO WORLD
hello world
```

Note: The Secure Simpapp sample client application uses the client-only JAR file `m3envobj.jar`. However, you can also use the `m3.jar` file to run the client application.

Before using another sample application, enter the following commands to stop the Secure Simpapp sample application and to remove unnecessary files from the work directory:

Windows NT

```
prompt>tmshutdown -y

prompt>nmake -f makefile.nt clean
```

UNIX

```
ksh prompt>tmshutdown -y
ksh prompt>make -f makefile.mk clean
```

CHAPTER

7 Writing a WLE Enterprise JavaBean that Implements Security

This topic includes the following sections:

- Before You Begin
- How Authentication Works with WLE EJBs
- Development Steps
- Step 1: Define security roles for the methods of the WLE EJB.
- Step 2: Specify security roles in the Deployment Descriptor of the EJB.
- Step 3: Define the JNDI environment properties.
- Step 4: Establish the InitialContext.
- Step 5: Use Home to get a WLE EJB.
- Step 6: Use the getCallerPrincipal Method to authenticate a WLE EJB.

Before You Begin

This document describes the BEA implementation of the Security feature. The information in this document supplements the Sun Microsystems, Inc. evolving Enterprise JavaBeans 1.1 Specification (Public Release, October 18,1999).

Note: Before proceeding with the remainder of this topic, you should be familiar with the entire content of Sun's specification, particularly Chapter 15, "Security Management."

This topic describes only the integrating security into WLE EJBs. For a complete description of developing an EJB using the WLE product, see *Getting Started* in the WebLogic Enterprise online documentation.

Note: An EJB in the WLE domain that issues a callback to a remote J2EE client application cannot propagate the security context of that client application in the callback.

How Authentication Works with WLE EJBs

From the perspective of an EJB container, EJBs are nontrusted entities that require authentication. The WLE product uses a JNDI implementation that runs within the EJB container's trusted environment. Using the `WLEInitialContextFactory` JNDI factory with security environment properties establishes the security context for the WLE client application. The WLE client application authenticates itself with the WLE domain when establishing the JNDI Initial context.

Development Steps

Table 7-1 lists the development steps required to implement security in a WLE EJB.

Table 7-1 Development Steps for Implementing Security in a WLE EJB

Step	Description
1	Define security roles for the methods of the WLE EJB.
2	Specify security roles in the Deployment Descriptor of the EJB.
3	Define the JNDI environment properties.
4	Establish the InitialContext.
5	Use Home to get the WLE EJB.
6	Use the `getCallerPrincipal` method to authenticate the WLE EJB.

Step 1: Define security roles for the methods of the WLE EJB.

During the assembly and deployment of an EJB package, you define security roles and associate roles with methods in the deployment descriptor. Security roles are mapped to groups of users in the WLE security environment. You can use any of the techniques described in the Security Management chapter of the Enterprise JavaBeans 1.1 Specification to define security roles for the methods of a WLE EJB.

It is possible that two methods with the same name or name/signature appear in both the bean's home and remote interfaces. To handle this case, the optional `<method-intf>` element may further restrict the selection to either `Home` or `Remote` interface methods.

In a mandatory access control environment, any method invocation not specifically authorized is denied. Sometimes a method does not have a defined `<method-permission>` element. If the `SECURITY` parameter in the `RESOURCES` section of the `UBBCONFIG` file is set to `MANDATORY_ACL` access on a method without an associated `<method-permission>` element, access is denied. This is the

recommended setting for production environments. For all other settings of the `SECURITY` parameter, access to a method without an associated `<method-permission>` element is allowed.

There may be methods that should be available to everyone, even in a mandatory access control environment. The WLE system defines a special role name `*` which means everyone has access to the method.

Step 2: Specify security roles in the Deployment Descriptor of the EJB.

You specify security roles for the methods of an EJB in the deployment descriptor of the bean. In the WLE product, there is a one-to-one association between the security roles defined in the deployment descriptor of the EJB and the groups defined with the `tpgrpadd` commands. Role names may be referenced in deployment descriptors before the corresponding group exists. A run time, if a bean's deployment descriptor references a role that does not have a corresponding group, the role is ignored.

Role names are restricted to any alphanumeric characters, a dash (`-`), an underscore(`_`), the at-sign (`@`), and a period (`.`). The maximum length of a role name is 30 characters. If the name of a security role does not conform to these limitations, it will not be possible for users to have the defined security role.

Listing 7-1 includes code that defines a security role.

Listing 7-1 Defining a Security Role for a Method in an EJB

```
...
<assembly-descriptor>
   <security-role>
     <description>
       "teller" is a role name
     </description>
   </security-role>

       <method-permission>
         <role-name>teller</role-name>
```

```
          <method>
               <ejb-name>Accounting</ejb-name>
               <method-name>withdraw</methodname>
          </method>
               ...
       </method-permission>
       ...
</assembly-descriptor>
...
```

Step 3: Define the JNDI environment properties.

The following sections describe the JNDI environment properties that must be set to enable either Username/Password or certificate-based authentication.

WLEContext.INITIAL_CONTEXT_FACTORY Property

The class `com.beasys.jndi.WLEInitialContextFactory` is the JNDI Service Provider Interface (SPI). This initial context provides an entry point into the WLE domain. Set `WLEContext.INITIAL_CONTEXT_FACTORY` to `com.beasys.jndi.WLEInitialContextFactory` to access the WLE domain.

Listing 7-2 includes code that defines the `WLEContext.INITIAL_CONTEXT_FACTORY` property for the WLE environment.

Listing 7-2 WLEContext.INITIAL_CONTEXT_FACTORY Property

```
Hashtable env = new Hashtable();
/*
*Specify the initial context implementation to use.
*The service provider supplies the factory class.
*/
env.put(WLEContext.INITIAL_CONTEXT_FACTORY,
```

```
        "com.beasys.jndi.WLEInitialContextFactory");
...
```

WLEContext.PROVIDER_URL Property

Specifies the entry point into the WLE domain. The value should reflect the host and port of the IIOP Listener/Handler of the target WLE domain. Use one of the following URL address formats when specifying the location of the IIOP Listener/Handler:

- `corbaloc://hostname:portnumber`

  Indicates that the IIOP/RMI protocol is to be used to communicate with the WLE domain. This URL address format only supports Username/Password authentication.

- `corbalocs://hostname:portnumber`

  Indicates that the SSL protocol is to be used to communicate with the WLE domain. This URL address format supports both Username/password and certificate-based authentication.

The host and port combination in the URL must match the ISL parameter in the WLE application's `UBBCONFIG` file. The format of the host and port combination as well as the capitalization must match. If the addresses do not match, communication with the WLE domain fails.

Listing 7-3 includes code that defines the `WLEContext.PROVIDER_URL` property for the WLE environment.

Listing 7-3 WLEContext.PROPERTY_URL Property

```
...
env.put(WLEContext.PROVIDER_URL,
         "corbaloc://"myhost:1000");
...
```

A WLE server application that acts as a client application (referred to as a joint client/server application) must set the `WLEContext.PROPERTY_URL` as an empty or null string. The joint client/server application connects to the current application in which it was booted.

WLEContext.SECURITY_AUTHENTICATION Property

Set this property to indicate the type of authentication to be used. The valid values for this property are as follows:

- `None`—Indicates that no authentication is performed
- `Simple`—Indicates that Username/Password authentication is performed
- `Strong`—Indicates that certificate-based authentication is performed

See Table 7-2 for additional keys that need to be specified to use Username/Password or certificate-based authentication.

Listing 7-4 includes code that defines the `WLEContext.SECURITY_AUTHENTICATION` property for the WLE environment.

Listing 7-4 WLEContext.SECURITY_AUTHENTICATION Property

```
...
env.put(WLEContext.SECURITY_AUTHENTICATION, ”strong”);
...
```

Table 7-2 WLE Property Keys for Security

Property Key	Meaning
`WLEContext.SECURITY_PRINCIPAL`	Specifies the identity of the principal used when authenticating the caller to the WLE domain.

Table 7-2 WLE Property Keys for Security

Property Key	Meaning
WLEContext.SECURITY_CREDENTIALS	Specifies the credentials of the principal when authenticating the caller to the WLE domain. ■ For certificate-based authentication enabled via SECURITY_AUTHENTICATION="strong", it specifies the pass phrase used to access the private key and certificate for the EJB. ■ For password-based authentication enabled via SECURITY_AUTHENTICATION="simple", it specifies a string that is the user's password or an arbitrary object user_data used by the authentication server (AUTHSVR) to verify the credentials of the EJB.
WLEContext.CLIENT_NAME	Specifies the name of the EJB defined by the -c option of the tpusradd command. For more information, see "Defining Authorized Users" on page 4-8
WLEContext.SYSTEM_PASSWORD	The system password. Required only when using Username/Password authentication.

Listing 7-5 includes the WLE keys used to define Username/Password authentication.

Listing 7-5 WLE Keys for Username/Password Authentication

```
...
   Hashtable env = new Hashtable();
   env.put(Context.PROVIDER_URL, "corbalocs://"myhost:1000")

env.put(Context.INITIAL_CONTEXT_FACTORY,
                  "com.beasys.jndi.WLEInitialContextFactory");

//Password-Based Authentication
env.put(WLEContext.SECURITY_PRINCIPAL, "milozzi");
env.put(WLEContext.SYSTEM_CREDENTIALS, "mypassword");
env.put(WLEContext.CLIENT_NAME, "writers");
env.put(WLEContext.SECURITY_AUTHENTICATION, "simple");
env.put(WLEContext.SYSTEM_PASSWORD, "password");
...
```

Listing 7-6 includes the WLE keys used to define certificate-based authentication.

Listing 7-6 WLE Keys for Certificate-Based Authentication

```
...
//Certificate-Based Authentication
env.put(WLEContext.SECURITY_AUTHENTICATION, ”strong”);
env.put(WLEContext.SYSTEM_PASSWORD, “SSL”);
env.put(WLEContext.SECURITY_PRINCIPAL, “milozzi”);
env.put(WLEContext.SECURITY_CREDENTIALS, “credentials”);
...
```

Step 4: Establish the InitialContext.

To access a WLE EJB using JNDI, you establish an InitialContext using the following code:

```
Context ctx = new InitialContext(env);
```

Specifying `env` as `com.beasys.com.jndi.WLEInitialContextFactory`. After the context is created, the client application has access to bean homes in the WLE domain using WLE as the name service provider.

A WLE EJB is implicitly associated with the security context specified when the `WLEContext` object is created. To specify a new security context, the EJB needs to close the current security context and establish a new security context with new security attributes. Use the following code to close the current security context:

```
ctx.close();
```

Step 5: Use Home to get a WLE EJB.

Client applications use the bean’s home interface to create or find beans. The beans’s home is obtained by using the `lookup` method on the InitialContext.

Step 6: Use the getCallerPrincipal Method to authenticate a WLE EJB.

Use the `getCallerPrincipal` method on the `javax.ejb.EJBContext` associated with a WLE EJB to authenticate the principal. You can also use the `isCallerInRole` method to determine the role of the client application invoking methods on the EJB. The default principal is `IIOP Client`.

Limitations and Restrictions

It is possible to deploy the same EJB more than once with different deployment descriptors that set different access control policies. In this case access control is based on the deployment descriptor from which a particular bean is loaded. Security policies are not considered when the WLE system has a choice of how to route a request to any particular bean or container.

Example of Using Security in a WLE EJB

Listing 7-7 illustrates using Username/Password authentication in a WLE EJB.

Note: The code example in Listing 7-7 uses the `corbalocs` URL address format so that the SSL protocol is used to protect the integrity of the communications.

Listing 7-7 Username/Password Authentication in a WLE EJB

```
static public Context getInitialContext() throws Exception {
  Hashtable env = new Hashtable ();
  env.put(WLEContext.INITIAL_CONTEXT_FACTORY,
          “com.beasys.jndi.WLEInitialContextFactory”);
```

```
  env.put(WLEContext.PROVIDER_URL, corbalocs://myhost:7002);

return new InitialContext(env);

  //Password-Based Authentication
env.put(WLEContext.SECURITY_AUTHENTICATION, ”simple”);
env.put(WLEContext.SYSTEM_PASSWORD, “RMI”);
env.put(WLEContext.SECURITY_PRINCIPAL, “milozzi);
env.put(WLEContext.CLIENT_NAME, “writers);
env.put(WLEContext.SECURITY_CREDENTIALS, “password”);
```

Listing 7-8 illustrates using certificate-based authentication in a WLE EJB.

Listing 7-8 Certificate-based Authentication in a WLE EJB

```
...
  Hashtable env = new Hashtable ();
  env.put(WLEContext.INITIAL_CONTEXT_FACTORY,
           “com.beasys.jndi.WLEInitialContextFactory”);

  env.put(WLEContext.PROVIDER_URL, corbalocs://myhost:7002);

return new InitialContext(env);

//Certificate-Based Authentication
env.put(WLEContext.SECURITY_AUTHENTICATION, ”strong”);
env.put(WLEContext.SECURITY_PRINCIPAL, “milozzi@bigcompany.com”);
env.put(WLEContext.CLIENT_NAME, “writers);
env.put(WLEContext.SYSTEM_PASSWORD, “SSL”);
env.put(WLEContext.SECURITY_CREDENTIALS, “credentials”);
```

8 Troubleshooting

This topic includes the following sections:

- Using ULOGS and ORB Tracing
- CORBA::ORB_init Problems
- Username/Password Authentication Problems
- Certificate-Based Authentication Problems
- Tobj::Bootstrap:: resolve_initial_references Problems
- IIOP Listener/Handler Startup Problems
- Configuration Problems
- Problems with Using Callbacks Objects with the SSL Protocol
- Troubleshooting Tips for Digital Certificates

Note: The problems in this topic pertain to using the SSL protocol and certificate-based authentication with WLE CORBA applications.

Using ULOGS and ORB Tracing

In general, Object Request Brokers (ORBs) write important failures to the `ULOG` file. When using the CORBA C++ ORB, you can also enable ORB internal tracing which may provide information in addition to the information that appears in the `ULOG` file.

When looking the `ULOG` file, note that remote ORB processes by default do not write data to the `ULOG` file in `APPDIR`.

- On UNIX, the remote ORB writes information to a `ULOG` file in the current directory.
- On Windows NT, the remote ORB writes information to a `ULOG` file in the `c:\ulog` directory.

You can set the `ULOGPFX` environment variable to control the location of the `ULOG` file for remote ORBs (for example, you can set the location of the `ULOG` file to `APPDIR` so that all information is put in the same `ULOG` file). Set the `ULOGPFX` environment variable as follows:

UNIX

```
setenv ULOGPFX $APPDIR/ULOG
```

Windows NT

```
set ULOGPFX=%APPDIR%\ULOG
```

To enable ORB tracing, perform the following steps:

1. Create a file named `trace.dat` in `APPDIR`. The contents of `trace.dat` should have `all=on`.
2. Use the following command to set the `OBB_TRACE_INPUT` environment variable to point to the `trace.dat` file before running the application:

   ```
   set OBB_TRACE_INPUT=%APPDIR%\trace.dat
   ```

   If you want ORB tracing sent to separate files, add the following line to the `trace.dat` file:

   ```
   output=obbtrace%p.log
   ```

   This command sends the trace output to files that are named after each running process. You may want to do this if you are using ORB tracing on UNIX to an NFS mounted drive. In this case, trace performance is slow due to the user log opening, writing, and closing the file for each trace statement.

The CORBA Java ORB logs error messages to the `ULOG` file in all error situations as well as puts minor codes to all system exceptions thrown by the ORB. Therefore, tracing is not necessary.

CORBA::ORB_init Problems

Note: This section applies to the CORBA C++ ORB only.

The `ORB_init` routine does not perform internal ORB tracing so you will not see any trace output for invalid argument processing. Therefore, you need to double check the arguments that were passed to the `ORB_init` routine.

If a `CORBA::BAD_PARAM` exception occurs when executing the `ORB_init` routine, verify that all required arguments have values. Also, check that arguments which expect a value from a specific set of valid values have the correct value. Note that values for the arguments of the `ORB_init` routine are case sensitive.

If a `CORBA::NO_PERSMISSION` exception occurs and an SSL argument was specified to the `ORB_init` routine, make sure the WLE Security Pack is installed. Also, verify that the specified level of encryption does not exceed the encryption level supported by the WLE Security Pack.

If a `CORBA::IMP_LIMIT` exception occurs when executing the `ORB_init` routine, verify that the `ORBport` and `ORBSecurePort` system properties have the same value.

If a `CORBA::Initialize` exception occurs when executing the `ORB_init` routine, verify that the values for `OrbId` or `configset` are valid.

Note: The `OrbId` and `configset` values apply to the CORBA C++ ORB only.

If Secure Socket Layer (SSL) arguments are passed to the `ORB_init` routine, the ORB attempts to load and initialize the SSL protocol. If no SSL arguments are passed, the ORB does not attempt to initialize the SSL protocol.

The ORB is not aware of the new URL address formats for the Bootstrap object so if you specify a corbaloc or corbalocs URL address format, the ORB does not try to load the SSL protocol during the ORB_init routine.

If SSL arguments were specified to the `ORB_init` routine, check the following:

- The specified values for the SSL arguments do not conflict with each other or other ORB arguments.
- Whether or not the ORB is a native process. If the ORB is a native process, SSL arguments are not supported.

- That the value specified for the `maxCrypto` system property is less than the value specified for the `minCrypto` system property.
- Application controlled SSL configuration parameters that are not correct. The `ORB_init` routine does not perform digital certificate lookups check so look for missing or corrupted files that would case the dynamic libraries not the loaded. Also, verify the dynamic libraries are loaded. The ORB trace function will provide information about whether or not the dynamic libraries are loaded.

If the problem persists, turn on ORB tracing. ORB tracing will log SSL failures that occur when the `liborbssl` dynamic library is loaded and initialized.

Username/Password Authentication Problems

If the client application fails when using the `corbalocs` URL address format with Username/Password authentication, check the following:

- The proper configuration steps were performed. See “Configuring the WLE Environment for the SSL Protocol”and “Defining Security for a WLE CORBA Application” for the list of the required configuration steps.
- An initialization error occurred. Specify a valid SSL system property to the `ORB_init` routine, an error occurs if:
  - The IIOP Listener/Handler is not available. The ORB trace log will show failed connection attempts.
  - The IIOP Listener/Handler is available but it does not support the SSL protocol. The `ULOG` file will show that a non-GIOP message was received.
  - The IIOP Listener/Handler was available and configured for the SSL protocol but the SSL connection could not be established. This error can occur when the range of encryption strengths supported by the IIOP Listener/Handler and the range of encryption strengths required by the client application don't match.

Certificate-Based Authentication Problems

If the client application fails when using the `corbalocs` URL address format with certificate-based authentication, check the following:

- The proper configuration steps were performed. See “Configuring the WLE Environment for the SSL Protocol”and “Defining Security for a WLE CORBA Application” for the list of the required configuration steps.
- Determine whether or not an initialization error occurred.
- Specify a valid SSL system property to the `ORB_init` routine, an error occurs if:
  - The IIOP Listener/Handler is not available. The ORB trace log will show failed connection attempts.
  - The IIOP Listener/Handler is available but it does not support the SSL protocol. The `ULOG` file will show that a non-GIOP message was received.
  - The IIOP Listener/Handler was available and configured for the SSL protocol but the SSL connection could not be established. This error can occur when the range of encryption strengths supported by the IIOP Listener/Handler and the range of encryption strengths required by the client application don't match. The error can also occur when the client application does not trust the certificate chain of the IIOP Listener/Handler or the client application did not receive a certificate from the IIOP Listener/Handler. The error will be written to the ULOG file and the error will also show up in the ORB trace output.

  If an error does not occur, the problem is in the authentication process and the `ULOG` file will contain one of the following error statements indicating the problem:

  - `Couldn’t connect to an LDAP server`
  - `Couldn’t find a filter that matched the client certificate`
  - `The client certificate was not found in LDAP`
  - `The private key file could not be found`
  - `The passphrase used to open the private key is not correct`

- `The public key from the client certificate did not match the private key`

Additional certificate problems can also occur. See "Tobj::Bootstrap:: resolve_initial_references Problems" for more information about the types of certificate errors that can occur.

Note: At this point of the initialization process, the failure is not due to a problem in the IIOP Listener/Handler.

Tobj::Bootstrap:: resolve_initial_references Problems

If a failure occurs when performing a `Tobj::Bootstrap::resolve_initial_references` with the `corbaloc` or `corbalocs` URL address format, a `CORBA::InvalidDomain` exception is raised. This exception may mask `CORBA::NO_PERMISSION` or `CORBA::COMM_FAILURE` exceptions that are raised internally. Look at the `ULOG` file and turn on ORB tracing to get more details on the error. The following errors may occur:

- If the IIOP Listener/Handler is not available, the ORB trace log will show failed connection attempts.
- If the IIOP Listener/Handler is available but it does not support the SSL protocol, the `ULOG` file will show that a non-GIOP message was received.
- If the IIOP Listener/Handler is available and configured for the SSL protocol but the SSL connection could not be established. An error can occur if the range of encryption strengths supported by the IIOP Listener/Handler and required by the client application don't match.
- The IIOP Listener/Handler couldn't map a certificate to a Username/Password user name. Verify that the security level for the WLE application is set to `USER_AUTH` and that Username/Password user name matches the principal name passed into the authenticate call. Also, check that the user name doesn't exceed the 30 character limit.

Additional certificate problems can occur. See ""Troubleshooting Tips for Digital Certificates" on page 8-9" for more information about the types of certificate errors that can occur.

Note: The Java implementation of the `Tobj_Bootstrap::resolve_initial_references()` method does not throw an `InvalidDomain` exception. When the `corbaloc` or `corbalocs` URL address formats are used, the `Tobj_Bootstrap::resolve_initial_references()` method internally catches the `InvalidDomain` exception and throws the exception as a `COMM_FAILURE`. The method functions this way in order to provide backward compatibility.

IIOP Listener/Handler Startup Problems

This section describes problems that can occur during the startup of the IIOP Listener/Handler.

If a failure occurs when starting the IIOP Listener/Handler, check the `ULOG` file for a description of the error. The IIOP Listener/Hander verifies that the values for the SSL arguments specified in the `CLOPT` parameters are valid. If any of the values are invalid, the appropriate error is recorded in the `ULOG` file. This check is similar to the argument checking done by the ORB.

The IIOP Listener/Handler will not start its processes unless the `-m` option is specified. The ISH is the process that actually loads and initializes the SSL libraries. If there is a problem loading and initializing the SSL libraries in the ISH process, the error will not be recorded in the `ULOG` file until the ISH process starts to handle incoming requests from client application.

If you suspect a problem with the startup of the IIOP Listener/Handler processes, check the `ULOG` file.

Configuration Problems

The following are miscellaneous tips to resolve the common configuration problems which may occur when using the WLE Security Pack:

- The ORB `-ORBpeerValidate` command line option or system property and the `-v` option of the ISL command do not control the peer validation rules checking. This system property and option only control the checking of the host name specified in the peer certificate against the host name of the machine to which the principal was connected.
- The only way to disable the peer validation rules on an installed kit is to create an empty file for `%TUXDIR%\udataobj\security\certs\peer_val.rul`. If you are writing a script that builds your WLE application, you can also not register the `peer_val.rul` file in the script.
- When enabling renegotiation intervals in the IIOP Listener/Handler, check that the option on the ISL command is `-R` not `-r`. If you use an `-r`, the IIOP Listener/Handler will use the SSL protocol but the renegotiation interval will not be used. In addition, the `ULOG` file will note that an unknown option was specified on the IIOP Listener/Handler.

  Another way to determine if the IIOP Listener/Handler is performing renegotiations is to enable ORB tracing on the client side and check whether the cipher suite negotiation callback is being called the configured renegotiation interval. Note that the client application must be sending requests for in order for renegotiations to occur.
- If you have defined the `SECURITY` parameter in the WLE application's `UBBCONFIG` file to be `APP_PW` or greater and you have configured the IIOP Listener/Handler to use the SSL protocol but not mutual authentication, you must use Username/Password authentication with the `corbaloc`s URL address format to communicate with the IIOP Listener/Handler. If you try to use certificate-based authentication, the IIOP Listener/Handler will not ask the principal for a certificate when establishing an SSL connection and the IIOP Listener/Handler is not able to map the identity of the principal to a TUXEDO identity.

Problems with Using Callbacks Objects with the SSL Protocol

If you have a joint client/server application and the client portion of the joint client/server application specifies security requirements using either the `corbalocs` URL address format or by requiring credentials, you must use the `-ORBsecurePort` system property with the `ORB_init` routine to specify that a secure port be used.

If you do not specify the `-ORBsecurePort` system property, the server registration will fail with a `CORBA::NO_PERMISSION` exception. To verify this is the problem, enable ORB tracing and look for the following trace output:

```
TCPTransport::Listen: FAILURE: Attempt to listen on clear port
while Credentials require SSL be used
```

If you want to use the SSL protocol with callback objects, the joint client/server application must use the `SecurityLevel2::PrincipalAuthenticator::authenticate()` method with certificate-based authentication. Otherwise, the joint client/server application does not have a certificate with which to identify itself to the IIOP Listener/Handler which in this case is the initiator of the SSL connection.

Troubleshooting Tips for Digital Certificates

In general, problems with digital certificates occur when:

- One of the digital certificates in the certificate chain of the IIOP Listener/Handler is not from a certificate authority defined in the `trust_ca.cer` file.
- The name the IIOP Listener/Handler connected to the client application does not match the host name specified in digital certificates of the IIOP Listener/Handler when a host match is performed. The name of the IIOP Listener/Handler is specified in the `CommonName` attribute of the distinguish name of the IIOP

Listener/Handler. The host name and the `CommonName` attribute must match exactly.

You can verify this error by setting the `-ORBpeerValidate` system property to `none` and executing the `ORB_init` routine again.

- One of the digital certificates in the certificate chain of the IIOP Listener/Handler does not match the specified peer validation rules.
- The digital certificate of the IIOP Listener/Handler is invalid. The digital certificate of the IIOP Listener/Handler becomes invalid when the digital certificate is tampered with, it expires, or the certificate authority that issued the digital certificate expires.

If a digital certificate is rejected for no explainable reason, perform the following steps:

1. Open the digital certificate in a viewer, for example, Windows Explorer.
2. Look at the `KeyUsage` and `BasicConstraints` properties of the digital certificate. A small yellow triangle with an exclamation mark indicates the property is critical. Any digital certificate with a property marked critical is rejected by the WLE software.
3. If the none of the properties of the digital certificate are critical, check the properties of the next digital certificate in the certificate chain. Perform this step until all the properties of all the digital certificates in the certificate chain have been verified.

9 WLE Security Service APIs

This topic includes the following sections:

- The WLE Security Model
- Functional Components of the WLE Security Service
- The Principal Authenticator Object
- The Credentials Object
- The SecurityCurrent Object

For the C++, Java, and Automation method descriptions for the WLE Security Service, see the following topics:

- "C++ Security Reference" on page 11-1
- "Java Security Reference" on page 12-1
- "Automation Security Reference" on page 13-1

The WLE Security Model

The security model in the WLE product defines only a framework for security. The WLE product provides the flexibility to support different security mechanisms and policies that can be used to achieve the appropriate level of functionality and assurance for a particular WLE application.

The security model in the WLE product defines:

- Under what conditions client applications may access objects in a WLE domain
- What type of proof material principals are required to authenticate themselves to the WLE domain

The security model in the base WLE product is a combination of the security model defined in the CORBAservices Security Service specification[1] and the value-added extensions that provide a focused, simplified form of the security model found in BEA TUXEDO.

The following sections describe the general characteristics of the WLE security model.

Authentication of Principals

Authentication of principals (for example, an individual user, a client application, a server application, a joint client/server application, or an IIOP Listener/Handler) provides security officers with the ability to ensure that only registered principals have access to the objects in the system. An authenticated principal is used as the primary mechanism to control access to objects. The act of authenticating principals allows the security mechanisms to:

- Make principals accountable for their actions
- Control access to protected objects

1. All references to the CORBAservices Security Service specification in this document are to the Revision 1.5, December 1998 edition, published by the Object Management Group.

- Identify the originator of a request
- Identify the target of request

Controlling Access to Objects

The WLE security model provides a simple framework through which a security officer can limit access to the WLE domain to authorized users only. Limiting access to objects allows security officers to prohibit access to objects by unauthorized principals. The access control framework consists of two parts:

- The object invocation policy that is enforced automatically on object invocation
- An application access policy that the user-written application can enforce

Administrative Control

The system administrator is responsible for setting security policies for the WLE application. The WLE product provides a set of configuration parameters and utilities. Using the configuration parameters and utilities, a system administrator can configure the WLE application to force the principals to be authenticated to access a system on which WLE software is installed. To enforce the configuration parameters, the system administrator uses the `tmloadcf` command to update the configuration file for a particular WLE application.

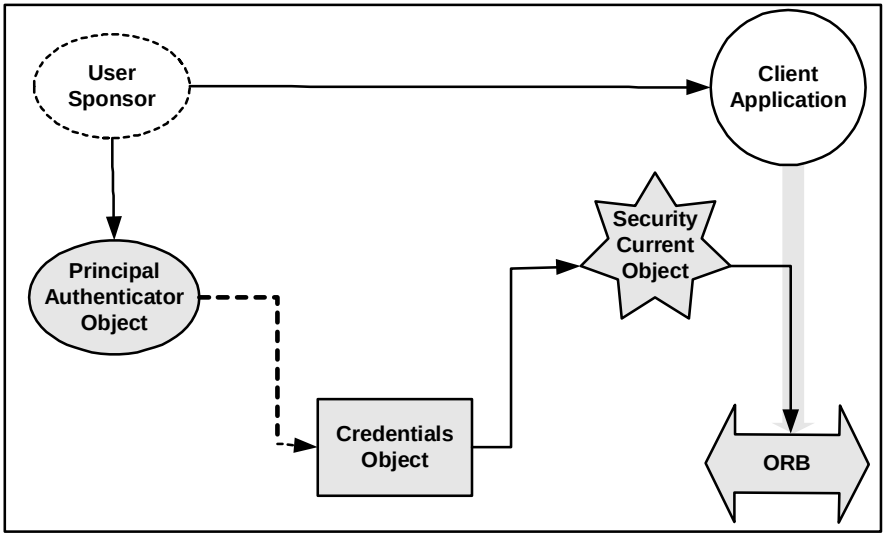
For more information about configuring security for your WLE application, see "Configuring the WLE Environment for the SSL Protocol" on page 3-1 and "Defining Security for a WLE CORBA Application" on page 4-1.

Functional Components of the WLE Security Service

The WLE security model is based on the process of authenticating principals to the WLE domain. The objects of the WLE Security Service are used to authenticate a principal. The principal provides identity and authentication data, such as a password, to the client application. The client application uses the Principal Authenticator object to make the calls necessary to authenticate the principal. The credentials for the authenticated principal are associated with the security system's implementation of the SecurityCurrent object and are represented by a Credentials object.

Figure 9-1 illustrates the authentication process used in the WLE security model.

Figure 9-1 Authentication Process in the WLE Product



The following sections describe the objects in the WLE security model.

The Principal Authenticator Object

The Principal Authenticator object is used by a principal that requires authentication but has not been authenticated prior to calling the object system. The act of authenticating a principal results in the creation of a Credentials object that is made available as the default credentials for the application.

The Principal Authenticator object is a singleton object; there is only a single instance allowed in a process address space. The Principal Authenticator object is also stateless. A Credentials object is not associated with the Principal Authenticator object that created it.

All Principal Authenticator objects support the `SecurityLevel2::PrincipalAuthenticator` interface defined in the CORBAservices Security Service specification. This interface contains two methods that are used to accomplish the authentication of the principal. This is because authentication of principals may require more than one step. The `authenticate` method allows the caller to authenticate, and optionally select, attributes for the principal of this session.

Any invocation that fails because the security infrastructure does not permit the invocation will raise the standard exception `CORBA::NO_PERMISSION`. A method that fails because the feature requested is not supported by the security infrastructure implementation will raise the `CORBA::NO_IMPLEMENT` standard exception. Any parameter that has inappropriate values will raise the `CORBA::BAD_PARAM` standard exception. If a timing-related problem raises a `CORBA::COMM_FAILURE`. The Bootstrap object maps most system exceptions to `CORBA::Invalid_Domain`.

The Principal Authenticator object is a locality-constrained object. Therefore, a Principal Authenticator object may not be used through the DII/DSI facilities of CORBA. Any attempt to pass a reference to this object outside of the current process, or any attempt to externalize it using `CORBA::ORB::object_to_string`, will result in the raising of the `CORBA::MARSHAL` exception.

Using the Principal Authenticator Object with Certificate-based Authentication

The Principal Authenticator object has been enhanced to support certificate-based authentication. The use of certificate-based authentication is controlled by specifying the `Security::AuthenticationMethod` value of `Tobj::CertificateBased` as a parameter to the `PrincipalAuthenticator::authenticate` operation. When certificate-based authentication is used, the implementation of the `PrincipalAuthenticator::authenticate` operation must retrieve the credentials for the principal by obtaining the private key and digital certificates for the principal and registering them for use with the SSL protocol.

The values of the `security_name` and `auth_data` parameters of the `PrincipalAuthenticator::authenticate` operation are used to open the private key for the principal. If the user does not specify the proper values for both of these parameters, the private key cannot be opened and the user fails to be authenticated. As a result of successfully opening the private key, a chain of digital certificates that represent the local identity of the principal is built. Both the private key and the chain of digital certificates must be registered to be used with the SSL protocol.

WLE Extensions to the Principal Authenticator Object

The WLE product extends the Principal Authenticator object to support a security mechanism similar to the security in BEA TUXEDO. The enhanced functionality is provided by defining the `Tobj::PrincipalAuthenticator` interface. This interface contains methods to provide similar capability to that available from BEA TUXEDO through the `tpinit` function. The interface `Tobj::PrincipalAuthenticator` is derived from the CORBA `SecurityLevel2::PrincipalAuthenticator` interface.

The extended Principal Authenticator object adheres to all the same rules as the Principal Authenticator object defined in the CORBAservices Security Service specification.

The implementation of the extended Principal Authenticator object requires users to supply a user name, client name, and additional authentication data (for example, passwords) used for authentication. Because the information needs to be transmitted over the network to the IIOP Listener/Handler, it is protected to ensure confidentiality. The protection must include encryption of any information provided by the user.

An extended Principal Authenticator object that supports the `Tobj::PrincipalAuthenticator` interface provides the same functionality as if the `SecurityLevel2::PrincipalAuthenticator` interface were used to perform the authentication of the principal. However, unlike the `SecurityLevel2::PrincipalAuthenticator::authenticate` method, the logon method defined on the `Tobj::PrincipalAuthenticator` interface does not return a Credentials object.

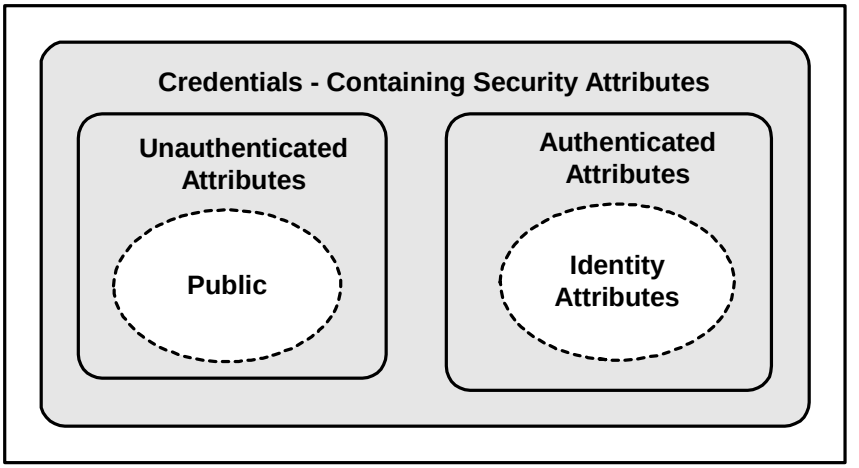
The Credentials Object

A Credentials object (as shown in Figure 9-2) holds the security attributes of a principal. The Credentials object provides methods to obtain and set the security attributes of the principals it represents. These security attributes include its authenticated or unauthenticated identities and privileges. It also contains information for establishing security associations.

Credentials objects are created as the result of:

- Authentication
- Copying an existing Credentials object
- Asking for a Credentials object via the SecurityCurrent object

Figure 9-2 The Credentials Object



Multiple references to a Credentials object are supported. A Credentials object is stateful. It maintains state on behalf of the principal for which it was created. This state includes any information necessary to determine the identity and privileges of the principal it represents. Credentials objects are not associated with the Principal Authenticator object that created it, but must contain some indication of the authentication authority that certified the principal's identity.

The Credentials object is a locality-constrained object; therefore, a Credentials object may not be used through the DII/DSI facilities. Any attempt to pass a reference to this object outside of the current process, or any attempt to externalize it using `CORBA::ORB::object_to_string`, will result in the raising of the `CORBA::MARSHAL` exception.

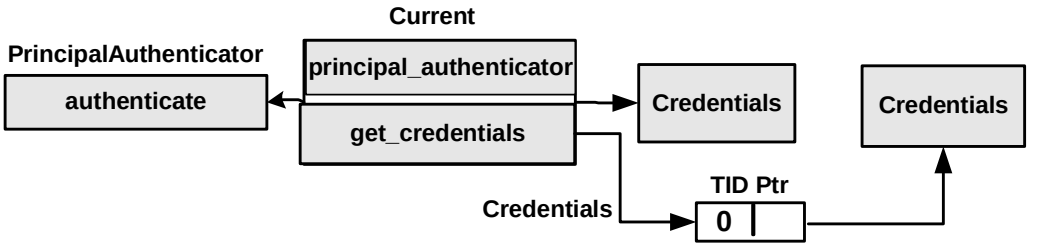
The Credentials object has been enhanced to allow application developers to indicate the security attributes for establishing secure connections. These attributes allow developers to indicate whether a secure connection requires integrity, confidentiality, or both. To support this capability, two new attributes were added to the `SecurityLevel2::Credentials` interface.

- The `invocation_options_supported` attribute indicates which security options are allowed when establishing a secure connection.
- The `invocation_options_required` attribute allows the application developer to specify the minimum set of security options that must be used in establishing a secure connection.

The SecurityCurrent Object

The SecurityCurrent object (see Figure 9-3) represents the current execution context at both the principal and target objects. The SecurityCurrent object represents service-specific state information associated with the current execution context. Both client and server applications have SecurityCurrent objects that represent state associated with the thread of execution and the process in which the thread is executing.

Figure 9-3 The SecurityCurrent Object



The SecurityCurrent object is a singleton object; there is only a single instance allowed in a process address space. Multiple references to the SecurityCurrent object are supported.

The CORBAservices Security Service specification defines two interfaces for the SecurityCurrent object associated with security:

- `SecurityLevel1::Current`, which derives from `CORBA::Current`
- `SecurityLevel2::Current`, which derives from the `SecurityLevel1::Current` interface

Both interfaces give access to security information associated with the execution context.

At any stage, a client application can determine the default credentials for subsequent invocations by calling the `Current::get_credentials` method and asking for the invocation credentials. These default credentials are used in all invocations that use object references.

When the `Current::get_attributes` method is invoked by a client application, the attributes returned from the Credentials object are those of the principal.

The SecurityCurrent object is a locality-constrained object; therefore, a SecurityCurrent object may not be used through the DII/DSI facilities. Any attempt to pass a reference to this object outside of the current process, or any attempt to externalize it using `CORBA::ORB::object_to_string`, results in a `CORBA::MARSHAL` exception.

10 Security Modules

This topic contains the Object Management Group (OMG) Interface Definition Language (IDL) definitions for the following modules that are used in the WLE Security Service:

- CORBA
- TimeBase
- Security
- Security Level 1
- Security Level 2
- Tobj

CORBA Module

The OMG added the `CORBA::Current` interface to the CORBA module to support the Current pseudo-object. The change enables the CORBA module to support Security Replaceability and Security Level 2.

Listing 10-1 shows the `CORBA::Current` interface OMG IDL statements.

Listing 10-1 CORBA::Current Interface OMG IDL Statements

```
module CORBA {
       // Extensions to CORBA
       interface Current {
       };
};

// This information is taken from CORBAservices: Common Object
// Services Specification, page 15-230. Revised Edition:
// March 31, 1995. Updated: November 1997. Used with permission by
OMG.
```

TimeBase Module

All data structures pertaining to the basic Time Service, Universal Time Object, and Time Interval Object are defined in the TimeBase module. This allows other services to use these data structures without requiring the interface definitions. The interface definitions and associated enums and exceptions are encapsulated in the TimeBase module.

Listing 10-2 shows the TimeBase module OMG IDL statements.

Listing 10-2 TimeBase Module OMG IDL Statements

```
// From time service
module TimeBase {
       // interim definition of type ulonglong pending the
       // adoption of the type extension by all client ORBs.
```

```
        struct ulonglong {
               unsigned long      low;
               unsigned long      high;
        };
        typedef ulonglong         TimeT;
        typedef short             TdfT;
        struct UtcT {
               TimeT              time;     // 8 octets
               unsigned long      inacclo;  // 4 octets
               unsigned short     inacchi;  // 2 octets
               TdfT              tdf;       // 2 octets
                                           // total 16 octets
        };
};

// This information is taken from CORBAservices: Common Object
// Services Specification, p. 14-5. Revised Edition:
// March 31, 1995. Updated: November 1997. Used with permission by
OMG.
```

Table 10-1 defines the TimeBase module data types.

Note: This information is taken from *CORBAservices: Common Object Services Specification*, p. 14-6. Revised Edition: March 31, 1995. Updated: November 1997. Used with permission by OMG.

Table 10-1 TimeBase Module Data Type Definitions

Data Type	Definition
`Time ulonglong`	OMG IDL does not at present have a native type representing an unsigned 64-bit integer. The adoption of technology submitted against that RFP will provide a means for defining a native type representing unsigned 64-bit integers in OMG IDL. Pending the adoption of that technology, you can use this structure to represent unsigned 64-bit integers, understanding that when a native type becomes available, it may not be interoperable with this declaration on all platforms. This definition is for the interim, and is meant to be removed when the native unsigned 64-bit integer type becomes available in OMG IDL.
`Time TimeT`	`TimeT` represents a single time value, which is 64 bit in size, and holds the number of 100 nanoseconds that have passed since the base time. For absolute time, the base is 15 October 1582 00:00.

Table 10-1 TimeBase Module Data Type Definitions (Continued)

Data Type	Definition
`Time TdfT`	`TdfT` is of size 16 bits short type and holds the time displacement factor in the form of seconds of displacement from the Greenwich Meridian. Displacements east of the meridian are positive, while those to the west are negative.
`Time UtcT`	`UtcT` defines the structure of the time value that is used universally in the service. When the `UtcT` structure is holding, a relative or absolute time is determined by its history. There is no explicit flag within the object holding that state information. The `inacclo` and `inacchi` fields together hold a value of type `InaccuracyT` packed into 48 bits. The `tdf` field holds time zone information. Implementation must place the time displacement factor for the local time zone in this field whenever it creates a Universal Time Object (UTO). The content of this structure is intended to be opaque; to be able to marshal it correctly, the types of fields need to be identified.

Security Module

The Security module defines the OMG IDL for security data types common to the other security modules. This module depends on the TimeBase module and must be available with any ORB that claims to be security ready.

Listing 10-3 shows the data types supported by the Security module.

Listing 10-3 Security Module OMG IDL Statements

```
module Security {
        typedef sequence<octet>   Opaque;

       // Extensible families for standard data types
       struct ExtensibleFamily {
              unsigned short       family_definer;
              unsigned short       family;
        };

       //security attributes
       typedef unsigned long        SecurityAttributeType;
```

```
// identity attributes; family = 0
const SecurityAttributeType  AuditId = 1;
const SecurityAttributeType  AccountingId = 2;
const SecurityAttributeType  NonRepudiationId = 3;

// privilege attributes; family = 1
const SecurityAttributeType  Public = 1;
const SecurityAttributeType  AccessId = 2;
const SecurityAttributeType  PrimaryGroupId = 3;
const SecurityAttributeType  GroupId = 4;
const SecurityAttributeType  Role = 5;
const SecurityAttributeType  AttributeSet = 6;
const SecurityAttributeType  Clearance = 7;
const SecurityAttributeType  Capability = 8;

struct AttributeType {
        ExtensibleFamily       attribute_family;
        SecurityAttributeType  attribute_type;
};

typedef sequence <AttributeType>   AttributeTypeLists;
struct SecAttribute {
       AttributeType   attribute_type;
       Opaque          defining_authority;
       Opaque          value;
       // The value of this attribute can be
      // interpreted only with knowledge of type
};

typedef sequence<SecAttribute>  AttributeList;

// Authentication return status
enum AuthenticationStatus {
       SecAuthSuccess,
       SecAuthFailure,
       SecAuthContinue,
       SecAuthExpired
};

// Authentication method
 typedef unsigned long   AuthenticationMethod;

 enum CredentialType {
       SecInvocationCredentials;
       SecOwnCredentials;
       SecNRCredentials
```

```
        // Pick up from TimeBase
        typedef TimeBase::UtcT   UtcT;
};

// This information is taken from CORBAservices: Common Object
// Services Specification, pp. 15-193 to195. Revised Edition:
// March 31, 1995. Updated: November 1997. Used with permission by
OMG.
```

Table 10-2 describes the Security module data type.

Table 10-2 Security Module Data Type Definition

Data Type	Definition
`sequence<octet>`	Data whose representation is known only to the Security Service implementation.

Security Level 1 Module

This section defines those interfaces available to client application objects that use only Level 1 Security functionality. This module depends on the CORBA module and the Security and TimeBase modules. The Current interface is implemented by the ORB.

Listing 10-4 shows the Security Level 1 module OMG IDL statements.

Listing 10-4 Security Level 1 Module OMG IDL Statements

```
module SecurityLevel1 {
        interface Current : CORBA::Current {// PIDL
              Security::AttributeList get_attributes(
                in Security::AttributeTypeList  attributes
              );
        };
};

// This information is taken from CORBAservices: Common Object
// Services Specification, p. 15-198. Revised Edition:
```

```
// March 31, 1995. Updated: November 1997. Used with permission by
OMG.
```

Security Level 2 Module

This section defines the additional interfaces available to client application objects that use Level 2 Security functionality. This module depends on the CORBA and Security modules.

Listing 10-5 shows the Security Level 2 module OMG IDL statements.

Listing 10-5 Security Level 2 Module OMG IDL Statements

```
module SecurityLevel2 {
       // Forward declaration of interfaces
       interface PrincipalAuthenticator;
       interface Credentials;
       interface Current;

      // Interface Principal Authenticator
       interface PrincipalAuthenticator {
            Security::AuthenticationStatus authenticate(
                   in Security::AuthenticationMethod  method,
                   in string                    security_name,
                   in Security::Opaque          auth_data,
                   in Security::AttributeList   privileges,
                   out Credentials              creds,
                   out Security::Opaque         continuation_data,
                   out Security::Opaque         auth_specific_data
             );

             Security::AuthenticationStatus
                          continue_authentication(
                     in Security::Opaque       response_data,
                     inout Credentials         creds,
                     out Security::Opaque      continuation_data,
                     out Security::Opaque      auth_specific_data
             );
        };

       // Interface Credentials
       interface Credentials {
```

```
                attribute Security::AssociationOptions
                                  invocation_options_supported;
                attribute Security::AssociationOptions
                                   invocation_options_required;
                Security::AttributeList get_attributes(
                     in Security::AttributeTypeList   attributes
                );
                boolean is_valid(
                       out Security::UtcT      expiry_time
                );
        };

        // Interface Current derived from SecurityLevel1::Current
        // providing additional operations on Current at this
        // security level. This is implemented by the ORB.
        interface Current : SecurityLevel1::Current { // PIDL
                void set_credentials(
                       in Security::CredentialType   cred_type,
                       in Credentials                cred
                );

                Credentials get_credentials(
                     in Security::CredentialType   cred_type
                );
                readonly attribute PrincipalAuthenticator
                          principal_authenticator;
      };
};

// This information is taken from CORBAservices: Common Object
// Services Specification, pp. 15-198 to 200. Revised Edition:
// March 31, 1995. Updated: November 1997. Used with permission by
// OMG.
```

Tobj Module

This section defines the Tobj module interfaces.

This module provides the interfaces you use to program the BEA TUXEDO style of authentication.

Listing 10-6 shows the Tobj module OMG IDL statements.

Listing 10-6 Tobj Module OMG IDL Statements

```
//Tobj Specific definitions

        //get_auth_type () return values
        enum AuthType {
              TOBJ_NOAUTH,
              TOBJ_SYSAUTH,
              TOBJ_APPAUTH
       };

       typedef sequence<octet>    UserAuthData;

      interface PrincipalAuthenticator :
              SecurityLevel2::PrincipalAuthenticator { // PIDL
               AuthType get_auth_type();

              Security::AuthenticationStatus logon(
                     in string            user_name,
                     in string            client_name,
                     in string            system_password,
                     in string            user_password,
                     in UserAuthData      user_data
               );
               void logoff();

              void build_auth_data(
                     in string                    user_name,
                     in string                    client_name,
                     in string                    system_password,
                     in string                    user_password,
                     in UserAuthData              user_data,
                     out Security::Opaque         auth_data,
                     out Security::AttributeList  privileges
              );
        };
};
```

CHAPTER

11 C++ Security Reference

This topic contains the C++ method descriptions for the WLE Security Service.

SecurityLevel1::Current::get_attributes

Synopsis — Returns attributes for the Current interface.

OMG IDL Definition

```
Security::AttributeList get_attributes(
       in Security::AttributeTypeList   attributes
       );
};
```

Argument

`attributes`
The set of security attributes (privilege attribute types) whose values are desired. If this list is empty, all attributes are returned.

Description — This method gets privilege (and other) attributes from the principal's credentials for the Current interface.

Return Values — The following table describes valid return values.

Table 11-1

Return Value	Meaning
`Security::Public`	Empty (Public is returned when no authentication was performed)
`Security::AccessId`	Null terminated ASCII string containing the WLE user name
`Security::PrimaryGroupId`	Null terminated ASCII string containing the WLE name of the principal

Note: The other attribute types are never returned. The `defining_authority` field is always empty.

Note: This information is taken from *CORBAservices: Common Object Services Specification*, pp. 15-103, 104. Revised Edition: March 31, 1995. Updated: November 1997. Used with permission by OMG.

SecurityLevel2::Current::authenticate

Synopsis Authenticates the principal and optionally obtains credentials for the principal.

OMG IDL Definition

```
Security::AuthenticationStatus
     authenticate(
       in   Security::AuthenticationMethod  method,
       in   Security::SecurityName          security_name,
       in   Security::Opaque                auth_data,
       in   Security::AttributeList         privileges,
       out  Credentials                     creds,
       out  Security::Opaque                continuation_data,
       out  Security::Opaque                auth_specific_data );
```

Arguments

`method`

The security mechanism to be used. Valid values are `Tobj::TuxedoSecurity` and `Tobj::CertificateBased`.

`security_name`

The principal's identification information (for example, logon information). The value must be a pointer to a NULL-terminated string containing the user name of the principal. The string is limited to 30 characters, excluding the NULL character.

When using certificate-based authentication, this name is used to look up a certificate in the LDAP-enabled directory service. It is also used as the basis for the name of the file in which the private key is stored. For example: `milozzi@company.com` is email address used to look up a certificate in the LDAP-enabled directory service and `milozzi_company.pem` is the name of the private key file.

`auth_data`

The principals' authentication, such as their password or private key. If the `Tobj:TuxedoSecurity` security mechanism is specified, the value of this argument is dependent on the configured level of authentication. If the `Tobj::CertificateBased` argument is specified, the value of this argument is the pass phrase used to decrypt the private key of the principal.

`privileges`

The privilege attributes requested.

`creds`

The object reference of the newly created Credentials object.The object reference is not fully initialized; therefore, the object reference cannot be used until the return value of the `SecurityLevel2::Current::authenticate` method is `SecAuthSuccess`.

`continuation_data`
: If the return value of the `SecurityLevel2::Current::authenticate` method is `SecAuthContinue`, this argument contains the challenge information for the authentication to continue. The value returned will always be empty.

`auth_specific_data`
: Information specific to the authentication service being used. The value returned will always be empty.

Description

The `SecurityLevel2::Current::authenticate` method is used by the client application to authenticate the principal and optionally request privilege attributes that the principal requires during its session with the WLE domain.

If the `Tobj::TuxedoSecurity` security mechanism is to be specified, the same functionality can be obtained by calling the `Tobj::PrincipalAuthenticator::logon` operation, which provides the same functionality but is specifically tailored for use with the TUXEDO-style authentication security mechanism.

Return Values

The following table describes the valid return values.

Table 11-2

Return Value	Meaning
`SecAuthSuccess`	The object reference of the newly created Credentials object returned as the value of the `creds` argument is initialized and ready to use.
`SecAuthFailure`	The authentication process was inconsistent or an error occurred during the process. Therefore, the `creds` argument does not contain an object reference to a Credentials object. If the `Tobj::TuxedoSecurity` security mechanism is used, this return value indicates that authentication failed or that the client application was already authenticated and did not call either the `Tobj::PrincipalAuthenticator::logoff` or `Tobj_Bootstrap::destroy_current` operation.

Table 11-2

Return Value	Meaning
SecAuthContinue	Indicates that the authentication procedure uses a challenge/response mechanism. The creds argument contains the object reference of a partially initialized Credentials object. The continuation_data indicates the details of the challenge.
SecAuthExpired	Indicates that the authentication data contained some information, the validity of which had expired; therefore, the creds argument does not contain an object reference to a Credentials object. If the Tobj::TuxedoSecurity security mechanism is used, this return value is never returned.
CORBA::BAD_PARAM	The CORBA::BAD_PARAM exception occurs if: ■ Values for the security_name, auth_data, or privileges arguments are not specified. ■ The length of an input argument exceeds the maximum length of the argument. ■ The value of the method argument is Tobj::TuxedoSecurity and the content of the auth_data argument contains a username or a clientname as an empty or a NULL string.

SecurityLevel2::Current::set_credentials

Synopsis Sets credentials type.

OMG IDL Definition

```
void set_credentials(
            in Security::CredentialType   cred_type,
            in Credentials                creds
);
```

Arguments

`cred_type`
The type of credentials to be set; that is, invocation, own, or non-repudiation.

`creds`
The object reference to the Credentials object, which is to become the default.

Description This method can be used only to set `SecInvocationCredentials`; otherwise, `set_credentials` raises `CORBA::BAD_PARAM`. The credentials must have been obtained from a previous call to `SecurityLevel2::Current::get_credentials` or `SecurityLevel2::PrincipalAuthenticator::authenticate`.

Return Values None.

Note: This information is taken from *CORBAservices: Common Object Services Specification*, p. 15-104. Revised Edition: March 31, 1995. Updated: November 1997. Used with permission by OMG.

SecurityLevel2::Current::get_credentials

Synopsis Gets credentials type.

OMG IDL Definition

```
Credentials get_credentials(
        in Security::CredentialType   cred_type
);
```

Argument

`cred_type`
: The type of credentials to get.

Description This call can be used only to get `SecInvocationCredentials`; otherwise, `get_credentials` raises `CORBA::BAD_PARAM`. If no credentials are available, `get_credentials` raises `CORBA::BAD_INV_ORDER`.

Return Values Returns the active credentials in the client application only.

Note: This information is taken from *CORBAservices: Common Object Services Specification*, p. 15-105. Revised Edition: March 31, 1995. Updated: November 1997. Used with permission by OMG.

SecurityLevel2::Current::principal_authenticator

Synopsis Returns the `PrincipalAuthenticator`.

OMG IDL Definition

```
readonly attribute PrincipalAuthenticator
                       principal_authenticator;
```

Description The `PrincipalAuthenticator` returned by the `principal_authenticator` attribute is of actual type `Tobj::PrincipalAuthenticator`. Therefore, it can be used both as a `Tobj::PrincipalAuthenticator` and as a `SecurityLevel2::PrincipalAuthenticator`.

Note: This method raises `CORBA::BAD_INV_ORDER` if it is called on an invalid SecurityCurrent object.

Return Values Returns the `PrincipalAuthenticator`.

SecurityLevel2::Credentials

Synopsis Represents a particular principal's credential information that is specific to a process. A Credentials object that supports the SecurityLevel2::Credentials interface is a locality-constrained object. Any attempt to pass a reference to the object outside its locality, or any attempt to externalize the object using the `CORBA::ORB::object_to_string()` operation, results in a `CORBA::Marshall` exception.

OMG IDL Definition

```
#ifndef _SECURITY_LEVEL_2_IDL
#define _SECURITY_LEVEL_2_IDL

#include <SecurityLevel1.idl>

#pragma prefix "omg.org"

module SecurityLevel2
  {
  interface Credentials
    {
    attribute Security::AssociationOptions
                              invocation_options_supported;
    attribute Security::AssociationOptions
                              invocation_options_required;
Security::AttributeList
    get_attributes(
      in   Security::AttributeTypeList     attributes );

    boolean
    is_valid(
      out  Security::UtcT                  expiry_time );



};
  };
#endif /* _SECURITY_LEVEL_2_IDL */
```

C++ Declaration

```
class SecurityLevel2
  {
  public:
    classCredentials;
    typedefCredentials *Credentials_ptr;

  class  Credentials : public virtual CORBA::Object
    {
    public:
```

```
    static Credentials_ptr _duplicate(Credentials_ptr obj);
    static Credentials_ptr _narrow(CORBA::Object_ptr obj);
    static Credentials_ptr _nil();

    virtual Security::AssociationOptions
       invocation_options_supported() = 0;
    virtual void
       invocation_options_supported(
          const Security::AssociationOptions  options ) = 0;
    virtual Security::AssociationOptions
       invocation_options_required() = 0;
    virtual void
       invocation_options_required(
          const Security::AssociationOptions  options ) = 0;

    virtual Security::AttributeList *
      get_attributes(
        const Security::AttributeTypeList & attributes) = 0;

    virtual CORBA::Boolean
      is_valid( Security::UtcT_out expiry_time) = 0;

  protected:
    Credentials(CORBA::Object_ptr obj = 0);
    virtual ~Credentials() { }

  private:
    Credentials( const Credentials&) { }
    void operator=(const Credentials&) { }
  };  // class Credentials
};  // class SecurityLevel2
```

SecurityLevel2::Credentials::get_attributes

Synopsis Gets the attribute list attached to the credentials.

OMG IDL Definition

```
Security::AttributeList get_attributes(
      in AttributeTypeList   attributes
);
```

Argument

`attributes`
: The set of security attributes (privilege attribute types) whose values are desired. If this list is empty, all attributes are returned.

Description This method returns the attribute list attached to the credentials of the principal. In the list of attribute types, you are required to include only the type value(s) for the attributes you want returned in the `AttributeList`. Attributes are not currently returned based on attribute family or identities. In most cases, this is the same result you would get if you called `SecurityLevel1::Current::get_attributes()`, since there is only one valid set of credentials in the principal at any instance in time. The results could be different if the credentials are not currently in use.

Return Values Returns attribute list.

Note: This is information taken from *CORBAservices: Common Object Services Specification*, p. 15-97. Revised Edition: March 31, 1995. Updated: November 1997. Used with permission by OMG.

SecurityLevel2::Credentials::invocation_options_supported

Synopsis Indicates the maximum number of security options that can be used when establising an SSL connection to make an invocation on an object in the WLE domain.

OMG IDL Definition

```
attribute Security::AssociationOptions(
                                    invocation_options_supported;
```

Argument None.

Description This method should be used in conjunction with the `SecurityLevel2::Credentials::invocation_options_required` method.

The following security options can be specified:

Table 11-3

Security Option	Description
`NoProtection`	The SSL protocol does not provide message protection.
`Integrity`	The SSL protocol provides an integrity check of messages. Digital signatures are used to protect the integrity of messages.
`Confidentiality`	The SSL connection protects the confidentiality of messages. Crytography is used to protect the confidentiality of messages.
`DetectReplay`	The SSL protocol provides replay detection. Replay occurs when a message is sent repeatedly with no detection..
`DetectMisordering`	The SSL protocol provides sequence error detection for requests and request fragments.
`EstablishTrustInTarget`	Indicates that the target of a request authenticates itself to the initiating principal.
`EstablishTrustinTarget`	Indicates that the initiating principal authenticates itself to the target of the request.
`NoDelegation`	Indicates that the principal permits an intermediate object to use its privileges for the purpose of access control decisions. However, the principal's privileges are not delegated so the intermediate object cannot use the privileges when invoking the next object in the chain.

Table 11-3

Security Option	Description
`SimpleDelegation`	Indicates that the principal permits an intermediate object to use its privileges for the purpose of access control decisions, and delegates the privileges to the intermediate object. The target object receives only the privileges of the client application and does not know the identity of the intermediate object. When this invocation option is used without restrictions on the target object, the behavior is known as impersonation.
`CompositeDelegation`	Indicates that the principal permits the intermediate object to use its credentials and delegate them. The privileges of both the principal and the intermediate object can be checked.

Return Values

The list of defined security options.

If the `Tobj::TuxedoSecurity` security mechanism is used to create the security association, only the `NoProtection`, `EstablishTrustInClient`, and `SimpleDelegation` security options are returned. The `EstablishTrustInClient` security option appears only if the security level of the WLE application is defined to require passwords to access the WLE domain.

Note: A `CORBA::BAD_PARAM` exception is returned if the security options specified are not supported by the security mechanism defined for the WLE application. This exception can also occur if the security options specified have less capabilities than the security options specified by the `SecurityLevel2::Credentials::invocation_options_required` method.

A Credentials object with a security mechanism of `Tobj::TuxedoSecurity` always returns the `CORBA::BAD_PARAM` exception.

SecurityLevel2::Credentials::invocation_options_required

Synopsis Specifies the minimum number of security options to be used when establishing an SSL connection to make an invocation on a target object in the WLE domain.

OMG IDL Definition

```
attribute Security::AssociationOptions(
                                    invocation_options_required;
```

Argument None.

Description Use this method to specify that communication between principals and the WLE domain should be protected. After using this method, a Credentials object makes an invocation on a target object using the SSL protocol with the defined level of security options. This method should be used in conjunction with the `SecurityLevel2::Credentials::invocation_options_supported` method.

The following security options can be specified:

Table 11-4

Security Option	Description
`NoProtection`	The SSL protocol does not provide message protection.
`Integrity`	The SSL protocol provides an integrity check of messages. Digital signatures are used to protect the integrity of messages.
`Confidentiality`	The SSL connection protects the confidentiality of messages. Crytography is used to protect the confidentiality of messages.
`DetectReplay`	The SSL protocol provides replay detection. Replay occurs when a message is sent repeatedly with no detection..
`DetectMisordering`	The SSL protocol provides sequence error detection for requests and request fragments.
`EstablishTrustInTarget`	Indicates that the target of a request authenticates itself to the initiating principal.
`EstablishTrustinTarget`	Indicates that the initiating principal authenticates itself to the target of the request.

Table 11-4

Security Option	Description
`NoDelegation`	Indicates that the principal permits an intermediate object to use its privileges for the purpose of access control decisions. However, the principal's privileges are not delegated so the intermediate object cannot use the privileges when invoking the next object in the chain.
`SimpleDelegation`	Indicates that the principal permits an intermediate object to use its privileges for the purpose of access control decisions, and delegates the privileges to the intermediate object. The target object receives only the privileges of the client application and does not know the identity of the intermediate object. When this invocation option is used without restrictions on the target object, the behavior is known as impersonation).
`CompositeDelegation`	Indicates that the principal permits the intermediate object to use its credentials and delegate them. The privileges of both the principal and the intermediate object can be checked.

Return Values

The list of defined security options.

If the `Tobj::TuxedoSecurity` security mechanism is used to create the security association, only the `NoProtection`, `EstablishTrustInClient`, and `SimpleDelegation` security options are returned. The `EstablishTrustInClient` security option appears only if the security level of the WLE application is defined to require passwords to access the WLE domain.

Note: A `CORBA::BAD_PARAM` exception is returned if the security options specified are not supported by the security mechanism defined for the WLE application. This exception can also occur if the security options specified have more capabilities than the security options specified by the `SecurityLevel2::Credentials::invocation_options_supported` method.

A Credentials object with a parameter of `Tobj::TuxedoSecurity` always returns the `CORBA::BAD_PARAM` exception.

SecurityLevel2::Credentials::is_valid

Synopsis Checks status of credentials.

OMG IDL Definition

```
boolean is_valid(
     out Security::UtcT      expiry_time
);
```

Description This method returns `TRUE` if the credentials used are active at the time; that is, you did not call `Tobj::PrincipalAuthenticator::logoff` or `Tobj_Bootstrap::destroy_current`. If this method is called after `Tobj::PrincipalAuthenticator::logoff()`, `FALSE` is returned. If this method is called after `Tobj_Bootstrap::destroy_current()`, the `CORBA::BAD_INV_ORDER` exception is raised.

Return Values The expiration date returned contains the `maximum unsigned long long` value in C++ and `maximum long` in Java. Until the `unsigned long long` datatype is adopted, the `ulonglong` datatype is substituted. The `ulonglong` datatype is defined as follows:

```
// interim definition of type ulonglong pending the
// adoption of the type extension by all client ORBs.
struct ulonglong {
       unsigned long      low;
       unsigned long      high;
};
```

Note: This information is taken from *CORBAservices: Common Object Services Specification*, p. 15-97. Revised Edition: March 31, 1995. Updated: November 1997. Used with permission by OMG.

SecurityLevel2::PrincipalAuthenticator

Synopsis Allows a principal to be authenticated. A Principal Authenticator object that supports the `SecurityLevel2::PrincipalAuthenticator` interface is a locality-constrained object. Any attempt to pass a reference to the object outside its locality, or any attempt to externalize the object using the `CORBA::ORB::object_to_string()` operation, results in a `CORBA::Marshall` exception.

OMG IDL Definition

```
#ifndef _SECURITY_LEVEL_2_IDL
#define _SECURITY_LEVEL_2_IDL

#include <SecurityLevel1.idl>

#pragma prefix “omg.org”

module SecurityLevel2
  {
  interface PrincipalAuthenticator
    {    // Locality Constrained
    Security::AuthenticationStatus authenticate (
        in   Security::AuthenticationMethod method,
        in   Security::SecurityName         security_name,
        in   Security::Opaque               auth_data,
        in   Security::AttributeList        privileges,
        out  Credentials                    creds,
        out  Security::Opaque               continuation_data,
        out  Security::Opaque               auth_specific_data
    );

    Security::AuthenticationStatus continue_authentication (
        in   Security::Opaque               response_data,
        in   Credentials                    creds,
        out  Security::Opaque               continuation_data,
        out  Security::Opaque               auth_specific_data
    );
    };
  };
#endif // SECURITY_LEVEL_2_IDL


#pragma prefix "beasys.com"
module Tobj
  {
  const Security::AuthenticationMethod
     TuxedoSecurity = 0x54555800;
```

```
    CertificateBased = 0x43455254;
  };
```

C++ Declaration

```
class SecurityLevel2
  {
  public:
    classPrincipalAuthenticator;
    typedefPrincipalAuthenticator * PrincipalAuthenticator_ptr;

  class PrincipalAuthenticator : public virtual CORBA::Object
    {
    public:
      static PrincipalAuthenticator_ptr
        _duplicate(PrincipalAuthenticator_ptr obj);
      static PrincipalAuthenticator_ptr
        _narrow(CORBA::Object_ptr obj);
      static PrincipalAuthenticator_ptr _nil();


      virtual Security::AuthenticationStatus
          authenticate (
            Security::AuthenticationMethod method,
            const char * security_name,
            const Security::Opaque & auth_data,
            const Security::AttributeList & privileges,
            Credentials_out creds,
            Security::Opaque_out continuation_data,
            Security::Opaque_out auth_specific_data) = 0;


      virtual Security::AuthenticationStatus
          continue_authentication (
                     const Security::Opaque & response_data,
                    Credentials_ptr & creds,
                    Security::Opaque_out continuation_data,
                    Security::Opaque_out auth_specific_data) = 0;

    protected:
      PrincipalAuthenticator(CORBA::Object_ptr obj = 0);
      virtual ~PrincipalAuthenticator() { }


    private:
      PrincipalAuthenticator( const PrincipalAuthenticator&) { }
      void operator=(const PrincipalAuthenticator&) { }
    };  // class PrincipalAuthenticator
  };
```

SecurityLevel2::PrincipalAuthenticator::continue_authentication

Synopsis Always fails.

OMG IDL Definition

```
Security::AuthenticationStatus continue_authentication(
       in Security::Opaque              response_data,
       inout Credentials                creds,
       out Security::Opaque             continuation_data,
       out Security::Opaque             auth_specific_data
);
```

Description Because the WLE software does authentication in one step, this method always fails and returns `Security::AuthenticationStatus::SecAuthFailure`.

Return Values Always returns `Security::AuthenticationStatus::SecAuthFailure`.

Note: This information is taken from *CORBAservices: Common Object Services Specification*, pp. 15-92, 93. Revised Edition: March 31, 1995. Updated: November 1997. Used with permission by OMG.

Tobj::PrincipalAuthenticator::get_auth_type

Synopsis Gets the type of authentication expected by the WLE domain.

OMG IDL Definition

```
AuthType get_auth_type();
```

Description This method returns the type of authentication expected by the WLE domain.

Note: This method raises `CORBA::BAD_INV_ORDER` if it is called with an invalid SecurityCurrent object.

Return Values A reference to the `Tobj_AuthType` enumeration. The following table describes the valid return values.

Table 11-5

Return Value	Meaning
`TOBJ_NOAUTH`	No authentication is needed; however, the client application can still authenticate itself by specifying a user name and a client application name. No password is required. To specify this level of security, specify the `NONE` value for the `SECURITY` parameter in the `RESOURCES` section of the `UBBCONFIG` file.
`TOBJ_SYSAUTH`	The client application must authenticate itself to the WLE domain, and must specify a user name, a name, and a password for the client application. To specify this level of security, specify the `APP_PW` value for the `SECURITY` parameter in the `RESOURCES` section of the `UBBCONFIG` file.
`TOBJ_APPAUTH`	The client application must provide proof material that authenticates the client application to the WLE domain.The proof material may be a password or a digital certificate. To specify this level of security, specify the `USER_AUTH` value for the `SECURITY` parameter in the `RESOURCES` section of the `UBBCONFIG` file.

Returns the type of authentication required to access the WLE domain.

Tobj::PrincipalAuthenticator::logon

Synopsis Authenticates the principal.

OMG IDL Definition

```
Security::AuthenticationStatus logon(
        in string          user_name,
        in string          client_name,
        in string          system_password,
        in string          user_password,
        in UserAuthData    user_data
);
```

Arguments

`user_name`
: The WLE user name. The authentication level `is TOBJ_NOAUTH`. If `user_name` is NULL or empty, or exceeds 30 characters, `logon` raises `CORBA::BAD_PARAM`.

`client_name`
: The WLE name of the client application. The authentication level is `TOBJ_NOAUTH`. If the `client_name` is NULL or empty, or exceeds 30 characters, logon raises the `CORBA::BAD_PARAM` exception.

`system_password`
: The WLE client application password. The authentication level is `TOBJ_SYSAUTH`. If the client name is NULL or empty, or exceeds 30 characters, logon raises the `CORBA::BAD_PARAM` exception.

Note: The `system_password` must not exceed 30 characters.

`user_password`
: The user password (needed for use by the default WLE authentication service). The authentication level is `TOBJ_APPAUTH`.

`user_data`
: Data that is specific to the client application (needed for use by a custom WLE authentication service). The authentication level is `TOBJ_APPAUTH`.

Note: `TOBJ_SYSAUTH` includes the requirements of `TOBJ_NOAUTH`, plus a client application password. `TOBJ_APPAUTH` includes the requirements of `TOBJ_SYSAUTH`, plus additional information, such as a user password or user data.

Note: The `user_password` and `user_data` arguments are mutually exclusive, depending on the requirements of the authentication service used in the configuration of the WLE domain. The WLE default authentication service expects a user password. A customized authentication service may

require user data. The logon call raises the `CORBA::BAD_PARAM` exception if both `user_password` and `user_data` are specified.

Description

This method authenticates the principal via the IIOP Listener/Handler so that the principal can access a WLE domain. This method is functionally equivalent to `SecurityLevel2::PrincipalAuthenticator::authenticate`, but the arguments are oriented to TUXEDO-style authentication.

Note: This method raises `CORBA::BAD_INV_ORDER` if it is called with an invalid SecurityCurrent object.

Return Values

The following table describes the valid return values.

Table 11-6

Return Value	Meaning
`Security::AuthenticationStatus::SecAuthSuccess`	The authentication succeeded.

`Security::AuthenticationStatus::SecAuthFailure`	The authentication failed, or the client application was already authenticated and did not call one of the following methods:
	`Tobj::PrincipalAuthenticator:logoff`
	`Tobj_Bootstrap::destroy_current`

`CORBA::INVALID_DOMAIN`	The method was used with the `corbaloc` or `corbalocs` URL address format.

Tobj::PrincipalAuthenticator::logoff

Synopsis Discards the security context associated with the principal.

OMG IDL Definition

```
void logoff();
```

Description This call discards the security context, but does not close the network connections to the WLE domain. `Logoff` also invalidates the current credentials. After logging off, invocations using existing object references fail if the authentication type is not `TOBJ_NOAUTH`.

If the principal is currently authenticated to a WLE domain, calling `Tobj_Bootstrap::destroy_current()` calls `logoff` implicitly.

Note: This method raises `CORBA::BAD_INV_ORDER` if it is called with an invalid SecurityCurrent object.

Return Values None.

Tobj::PrincipalAuthenticator::build_auth_data

Synopsis Creates authentication data and attributes for use by `SecurityLevel2::PrincipalAuthenticator::authenticate`.

OMG IDL Definition

```
void build_auth_data(
       in string                    user_name,
       in string                    client_name,
       in string                    system_password,
       in string                    user_password,
       in UserAuthData              user_data,
       out Security::Opaque         auth_data,
       out Security::AttributeList  privileges
);
```

Arguments

`user_name`
The WLE user name.

`client_name`
The WLE client name.

`system_password`
The WLE client application password.

`user_password`
The user password (default WLE authentication service).

`user_data`
Client application-specific data (custom WLE authentication service).

`auth_data`
For use by `authenticate`.

`privileges`
For use by `authenticate`.

Note: If `user_name`, `client_name`, or `system_password` is NULL or empty, or exceeds 30 characters, the subsequent `authenticate` method invocation raises the `CORBA::BAD_PARAM` exception.

Note: The `user_password` and `user_data` parameters are mutually exclusive, depending on the requirements of the authentication service used in the configuration of the WLE domain. The WLE default authentication service expects a user password. A customized authentication service may require user data. If both `user_password` and `user_data` are specified, the subsequent authentication call raises the `CORBA::BAD_PARAM` exception.

Description

This method is a helper function that creates authentication data and attributes to be used by `SecurityLevel2::PrincipalAuthenticator::authenticate`.

Note: This method raises `CORBA::BAD_INV_ORDER` if it is called with an invalid SecurityCurrent object.

Return Values

None.

CHAPTER

12 Java Security Reference

For information about the security package application programming interface (API), see the *WLE Javadoc*.

13 Automation Security Reference

This topic contains the Automation method descriptions for the WLE Security service. In addition, the topic contains programming examples that illustrate using the Automation methods to implement security in an ActiveX client application.

Note: The Automation security methods do not support certificate-based authentication or the use of the SSL procotol.

Method Descriptions

This section describes the Automation Security Service methods.

DISecurityLevel2_Current

The `DISecurityLevel2_Current` object is a BEA implementation of the CORBA Security model. In this release of the WLE software, the `get_attributes()`, `set_credentials()`, `get_credentials()`, and `Principal_Authenticator()` methods are supported.

DISecurityLevel2_Current.get_attributes

Synopsis Returns attributes for the Current interface.

MIDL Mapping

```
HRESULT get_attributes(
  [in] VARIANT attributes,
  [in,out,optional] VARIANT* exceptionInfo,
  [out,retval] VARIANT* returnValue);
```

Automation Mapping

```
Function get_attributes(attributes, [exceptionInfo])
```

Parameters

`attributes`
: The set of security attributes (privilege attribute types) whose values are desired. If this list is empty, all attributes are returned.

`exceptioninfo`
: An optional input argument that allows the client application to get additional exception data if an error occurs. For the ActiveX client applications, all exception data is returned in the OLE Automation Error Object.

Description This method gets privilege (and other) attributes from the credentials for the client application from the Current interface.

Return Values A variant containing an array of `DISecurity_SecAttribute` objects. The following table describes the valid return values.

Return Value	Meaning
`Security::Public`	Empty (Public is returned when no authentication was performed.)
`Security::AccessId`	Null-terminated ASCII string containing the WLE user name
`Security::PrimaryGroupId`	Null-terminated ASCII string containing the WLE name of the client application

DISecurityLevel2_Current.set_credentials

Synopsis Sets credentials type.

MIDL Mapping

```
HRESULT set_credentials(
  [in] Security_CredentialType cred_type,
  [in] DISecurityLevel2_Credentials* cred,
  [in,out,optional] VARIANT* exceptionInfo);
```

Automation Mapping

```
Sub set_credentials(cred_type As Security_CredentialType,
                    cred As DISecurityLevel2_Credentials,
                      [exceptionInfo])
```

Description This method can be used only to set `SecInvocationCredentials`; otherwise, `set_credentials` raises `CORBA::BAD_PARAM`. The credentials must have been obtained from a previous call to `DISecurityLevel2_Current.get_credentials`.

Arguments

`cred_type`
: The type of credentials to be set; that is, invocation, own, or nonrepudiation.

`cred`
: The object reference to the Credentials object, which is to become the default.

`exceptioninfo`
: An optional input argument that allows the client application to get additional exception data if an error occurs. For the ActiveX client applications, all exception data is returned in the OLE Automation Error Object.

Return Values None.

DISecurityLevel2_Current.get_credentials

Synopsis Gets credentials type.

MIDL Mapping

```
HRESULT get_credentials(
  [in] Security_CredentialType cred_type,
  [in,out,optional] VARIANT* exceptionInfo,
  [out,retval] DISecurityLevel2_Credentials** returnValue);
```

Automation Mapping

```
Function get_credentials(cred_type As Security_CredentialType,
                  [exceptionInfo]) As DISecurityLevel2_Credentials
```

Description This call can be used only to get `SecInvocationCredentials`; otherwise, `get_credentials` raises `CORBA::BAD_PARAM`. If no credentials are available, `get_credentials` raises `CORBA::BAD_INV_ORDER`.

Arguments

`cred_type`
: The type of credentials to get.

`exceptioninfo`
: An optional input argument that allows the client application to get additional exception data if an error occurs. For the ActiveX client application, all exception data is returned in the OLE Automation Error Object.

Return Values A `DISecurityLevel2_Credentials` object for the active credentials in the client application only.

DISecurityLevel2_Current.principal_authenticator

Synopsis Returns the `PrincipalAuthenticator`.

MIDL Mapping

```
HRESULT principal_authenticator([out, retval]
            DITobj_PrincipalAuthenticator** returnValue);
```

Automation Mapping

```
Property principal_authenticator As DITobj_PrincipalAuthenticator
```

Description The `PrincipalAuthenticator` returned by the `principal_authenticator` property is of actual type `DITobj_PrincipalAuthenticator`. Therefore, it can be used as a `DISecurityLevel2_PrincipalAuthenticator`.

Note: This method raises `CORBA::BAD_INV_ORDER` if it is called on an invalid SecurityCurrent object.

Return Values A `DITobj_PrincipalAuthenticator` object.

DITobj_PrincipalAuthenticator

The `DITobj_PrincipalAuthenticator` object is used to log in to and log out of the WLE domain. In this release of the WLE software, the `authenticate`, `build_auth_data()`, `continue_authentication()`, `get_auth_type()`, `logon()`, and `logoff()` methods are implemented

DITobj_PrincipalAuthenticator.authenticate

Synopsis Authenticates the client application.

MIDL Mapping

```
HRESULT authenticate(
     [in] long                                  method,
     [in] BSTR                                  security_name,
     [in] VARIANT                               auth_data,
     [in] VARIANT                               privileges,
     [out] DISecurityLevel2_Credentials**

                                                creds,
     [out] VARIANT*                             continuation_data,
     [out] VARIANT*                             auth_specific_data,
     [in,out,optional] VARIANT*                 exceptionInfo,
     [out,retval] Security_AuthenticationStatus* returnValue);
```

Automation Mapping

```
Function authenticate(method As Long, security_name As String,
      auth_data, privileges, creds As DISecurityLevel2_Credentials,
        continuation_data, auth_specific_data,
        [exceptionInfo]) As Security_AuthenticationStatus
```

Arguments

`method`
: Must be `Tobj::TuxedoSecurity`. If `method` is invalid, `authenticate` raises `CORBA::BAD_PARAM`.

`security_name`
: The WLE user name.

`auth_data`
: As returned by `DITobj_PrincipalAuthenticator.build_auth_data`. If `auth_data` is invalid, `authenticate` raises `CORBA::BAD_PARAM`.

`privileges`
: As returned by `DITobj_PrincipalAuthenticator.build_auth_data`. If `privileges` is invalid, `authenticate` raises `CORBA::BAD_PARAM`.

`creds`
: Placed into the SecurityCurrent object.

`continuation_data`
: Always empty.

`auth_specific_data`
: Always empty.

`exceptioninfo`
: An optional input argument that allows the client application to get additional exception data if an error occurs. For the ActiveX client application, all exception data is returned in the OLE Automation Error Object.

Description

This method authenticates the client application via the IIOP Listener/Handler so that it can access a WLE domain.

Return Values

A `Security_AuthenticationStatus` Enum value. The following table describes the valid return values.

Return Value	Meaning
`Security::Authentication Status:: SecAuthSuccess`	The authentication succeeded.
`Security::Authentication Status:: SecAuthFailure`	The authentication failed, or the client application was already authenticated and did not invoke `Tobj::PrincipalAuthenticator:logoff` or `Tobj_Bootstrap::destroy_current`.

DITobj_PrincipalAuthenticator.build_auth_data

Synopsis

Creates authentication data and attributes for use by `DITobj_PrincipalAuthenticator.authenticate`.

MIDL Mapping

```
HRESULT build_auth_data(
  [in] BSTR                 user_name,
  [in] BSTR                 client_name,
  [in] BSTR                 system_password,
  [in] BSTR                 user_password,
  [in] VARIANT              user_data,
  [out] VARIANT*            auth_data,
  [out] VARIANT*            privileges,
  [in,out,optional] VARIANT* exceptionInfo);
```

Automation Mapping

```
Sub build_auth_data(user_name As String, client_name As String,
   system_password As String, user_password As String, user_data,
   auth_data, privileges, [exceptionInfo])
```

Arguments

`user_name`
: The WLE user name.

`client_name`
: A name of the WLE client application.

`system_password`
: The password for the WLE client application.

`user_password`
: The user password (default WLE authentication service).

`user_data`
: Client application-specific data (custom WLE authentication service).

`auth_data`
: For use by `authenticate`.

`privileges`
: For use by `authenticate`.

`exceptioninfo`
: An optional input argument that allows the client application to get additional exception data if an error occurs. For the ActiveX client application, all exception data is returned in the OLE Automation Error Object.

Note: If `user_name`, `client_name`, or `system_password` is NULL or empty, or exceeds 30 characters, the subsequent `authenticate` method invocation raises the `CORBA::BAD_PARAM` exception.

Note: The `user_password` and `user_data` parameters are mutually exclusive, depending on the requirements of the authentication service used in the configuration of the WLE domain. The WLE default authentication service expects a user password. A customized authentication service may require user data. If both `user_password` and `user_data` are specified, the subsequent authentication call raises the `CORBA::BAD_PARAM` exception.

Description

This method is a helper function that creates authentication data and attributes to be used by `DITObj_PrincipalAuthenticator.authenticate`.

Note: This method raises `CORBA::BAD_INV_ORDER` if it is called with an invalid SecurityCurrent object.

Return Values

None.

DITobj_PrincipalAuthenticator.continue_authentication

Synopsis Always returns `Security::AuthenticationStatus::SecAuthFailure`.

MIDL Mapping

```
HRESULT continue_authentication(
  [in] VARIANT response_data,
  [in,out] DISecurityLevel2_Credentials** creds,
  [out] VARIANT* continuation_data,
  [out] VARIANT* auth_specific_data,
  [in,out,optional] VARIANT* exceptionInfo,
  [out,retval] Security_AuthenticationStatus* returnValue);
```

Automation Mapping

```
Function continue_authentication(response_data,
   creds As DISecurityLevel2_Credentials, continuation_data,
   auth_specific_data, [exceptionInfo]) As
   Security_AuthenticationStatus
```

Description Because the WLE software does authentication in one step, this method always fails and returns `Security::AuthenticationStatus::SecAuthFailure`.

Return Values Always returns `SecAuthFailure`.

DITobj_PrincipalAuthenticator.get_auth_type

Synopsis Gets the type of authentication expected by the WLE domain.

MIDL Mapping

```
HRESULT get_auth_type(
        [in, out, optional] VARIANT* exceptionInfo,
        [out, retval] Tobj_AuthType* returnValue);
```

Automation Mapping

```
Function get_auth_type([exceptionInfo]) As Tobj_AuthType
```

Argument

`exceptioninfo`
An optional input argument that allows the client application to get additional exception data if an error occurs. For the ActiveX client application, all exception data is returned in the OLE Automation Error Object.

Description This method returns the type of authentication expected by the WLE domain.

Note: This method raises `CORBA::BAD_INV_ORDER` if it is called with an invalid SecurityCurrent object.

Returned Values A reference to the `Tobj_AuthType` enumeration. The following table describes the valid return values.

Return Value	Meaning
`TOBJ_NOAUTH`	No authentication is needed; however, the client application can still authenticate itself by specifying a user name and a client application name. No password is required. To specify this level of security, specify the `NONE` value for the `SECURITY` parameter in the `RESOURCES` section of the `UBBCONFIG` file.

Return Value	Meaning
TOBJ_SYSAUTH	The client application must authenticate itself to the WLE domain, and must specify a user name, a name, and a password for the client application. To specify this level of security, specify the APP_PW value for the SECURITY parameter in the RESOURCES section of the UBBCONFIG file.
TOBJ_APPAUTH	The client application must provide proof material that authenticates the client application to the WLE domain.The proof material may be a password or a digital certificate. To specify this level of security, specify the USER_AUTH value for the SECURITY parameter in the RESOURCES section of the UBBCONFIG file.

DITobj_PrincipalAuthenticator.logon

Synopsis Logs in to the WLE domain. The correct input parameters depend on the authentication level.

MIDL Mapping

```
HRESULT logon(
  [in] BSTR                                  user_name,
  [in] BSTR                                  client_name,
  [in] BSTR                                  system_password,
  [in] BSTR                                  user_password,
  [in] VARIANT                               user_data,
  [in,out,optional] VARIANT*                 exceptionInfo,
  [out,retval] Security_AuthenticationStatus*
                                             returnValue);
```

Automation Mapping

```
Function logon(user_name As String, client_name As String,
   system_password As String, user_password As String,
   user_data, [exceptionInfo]) As Security_AuthenticationStatus
```

Description For remote WLE client applications, this method authenticates the client application via the IIOP Listener/Handler so that the remote client application can access a WLE domain. This method is functionally equivalent to `DITobj_PrincipalAuthenticator.authenticate`, but the parameters are oriented to WLE security.

Arguments

`user_name`
: The WLE user name. This parameter is required for `TOBJ_NOAUTH`, `TOBJ_SYSAUTH`, and `TOBJ_APPAUTH` authentication levels.

`client_name`
: The name of the WLE client application. This parameter is required for `TOBJ_NOAUTH`, `TOBJ_SYSAUTH`, and `TOBJ_APPAUTH` authentication levels.

`system_password`
: A password for the WLE client application. This parameter is required for `TOBJ_SYSAUTH` and `TOBJ_APPAUTH` authentication levels.

`user_password`
: The user password (default WLE authentication service). This parameter is required for the `TOBJ_APPAUTH` authentication level.

`user_data`

Application-specific data (custom authentication service). This parameter is required for the `TOBJ_APPAUTH` authentication level.

Note: If `user_name`, `client_name`, or `system_password` is NULL or empty, or exceeds 30 characters, the subsequent `authenticate` method invocation raises the `CORBA::BAD_PARAM` exception.

Note: If the authorization level is `TOBJ_APPAUTH`, only one of `user_password` or `user_data` may be supplied.

`exceptioninfo`

An optional input argument that allows the client application to get additional exception data if an error occurs. For the ActiveX client application, all exception data is returned in the OLE Automation Error Object.

Return Values

The following table describes the valid return values.

Return Value	Meaning
`Security::AuthenticationStatus::SecAuthSuccess`	The authentication succeeded.

`Security::AuthenticationStatus::SecAuthFailure`	The authentication failed, or the client application was already authenticated and did not call one of the following methods:
	`Tobj::PrincipalAuthenticator:logoff`
	`Tobj_Bootstrap::destroy_current`

DITobj_PrincipalAuthenticator.logoff

Synopsis Discards the current security context associated with the WLE client application.

MIDL Mapping

```
HRESULT logoff([in, out, optional] VARIANT* exceptionInfo);
```

Automation Mapping

```
Sub logoff([exceptionInfo])
```

Description This call discards the context associated with the WLE client application, but does not close the network connections to the WLE domain. `Logoff` also invalidates the current credentials. After logging off, calls using existing object references fail if the authentication type is not `TOBJ_NOAUTH`.

If the client application is currently authenticated to a WLE domain, calling `Tobj_Bootstrap.destroy_current()` calls `logoff` implicitly.

Argument

`exceptioninfo`
: An optional input argument that allows the client application to get additional exception data if an error occurs. For the ActiveX client applications, all exception data is returned in the OLE Automation Error Object.

Return Values None.

DISecurityLevel2_Credentials

The `DISecurityLevel2_Credentials` object is a BEA implementation of the CORBA Security model. In this release of the WLE software, the `get_attributes()` and `is_valid()` methods are supported.

DISecurityLevel2_Credentials.get_attributes

Synopsis Gets the attribute list attached to the credentials.

MIDL Mapping

```
HRESULT get_attributes(
  [in] VARIANT attributes,
  [in,out,optional] VARIANT* exceptionInfo,
  [out,retval] VARIANT* returnValue);
```

Automation Mapping

```
Function get_attributes(attributes, [exceptionInfo])
```

Arguments

`attributes`
: The set of security attributes (privilege attribute types) whose values are desired. If this list is empty, all attributes are returned.

`exceptioninfo`
: An optional input argument that allows the client application to get additional exception data if an error occurs. For the ActiveX client application, all exception data is returned in the OLE Automation Error Object.

Description This method returns the attribute list attached to the credentials of the client application. In the list of attribute types, you are required to include only the type value(s) for the attributes you want returned in the `AttributeList`. Attributes are not currently returned based on attribute family or identities. In most cases, this is the same result you would get if you called `DISecurityLevel2.Current::get_attributes()`, since there is only one valid set of credentials in the client application at any instance in time. The results could be different if the credentials are not currently in use.

Return Values A variant containing an array of `DISecurity_SecAttribute` objects.

DISecurityLevel2_Credentials.is_valid

Synopsis Checks the status of credentials.

MIDL Mapping

```
HRESULT is_valid(
  [out] IDispatch** expiry_time,
  [in,out,optional] VARIANT* exceptionInfo,
  [out,retval] VARIANT_BOOL* returnValue
```

Automation Mapping

```
Function is_valid(expiry_time As Object,
   [exceptionInfo]) As Boolean
```

Description This method returns `TRUE` if the credentials used are active at the time; that is, you did not call `DITobj_PrincipalAuthenticator.logoff` or `destroy_current`. If this method is called after `DITobj_PrincipalAuthenticator.logoff()`, `FALSE` is returned. If this method is called after `destroy_current()`, the `CORBA::BAD_INV_ORDER` exception is raised.

Return Values The output `expiry_time` as a `DITimeBase_UtcT` object set to max.

Programming Example

This section contains the portions of an ActiveX client application that implement the following:

- Using the Bootstrap object to obtain the SecurityCurrent object
- Getting the Principal Authenticator object from the SecurityCurrent object
- Using TUXEDO-style authentication
- Logging off the WLE domain

Listing 13-1 ActiveX Client Application That Uses TUXEDO-Style Authentication

```
Set objSecurityCurrent = objBootstrap.CreateObject("Tobj.SecurityCurrent")
Set objPrincipalAuthenticator = objSecurityCurrent.principal_authenticator

     AuthorityType = objPrincipalAuthenticator.get_auth_type
     If AuthorityType = TOBJ_APPAUTH Then logonStatus =
                                    oPrincipalAuthenticator.Logon(
                                    UserName,_
                                    ClientName,_
                                    SystemPassword,_
                                    UserPassword
                                    User Data)
End If

     objPrincipalAuthenticator.logoff()
```

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