SYBASE®
An SAP Company

Web Services Users Guide

Adaptive Server® Enterprise

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Sybase, Inc., One Sybase Drive, Dublin, CA 94568.

Contents

CHAPTER 1

Understanding Adaptive Server Enterprise Web Services

This chapter discusses the following:

Overview

A Web service is a self-contained, modular application that can be accessed through a network connection. Using a Web service, the end user trades performance for increased interoperability enforced by adherence to the Simple Object Access Protocol (SOAP), Web Services Description Language (WSDL), and Extensible Markup Language (XML) open standards.

Regardless of the programming language in which it has been implemented, a Web service can be accessed from many different platforms and operating systems, thus greatly enhancing the ability for diverse applications to share data. By using many discrete Web services, each handling a limited set of specific tasks, business enterprises can dynamically and incrementally integrate by exposing their existing software in a secure and controlled environment. By providing a standardized means to invoke remote applications, Web services reduce the amount of code required for infrastructure. By enabling users to extract implementation from exposed interfaces (WSDL), Web services provide the tools needed to build a service-oriented architecture (SOA).

Adaptive Server Enterprise Web Services

Adaptive Server® Enterprise (ASE) Web Services consists of the ASE Web Services Engine that runs independently of Adaptive Server Enterprise.

The ASE Web Services Engine provides the following functionality:

- Enables client applications to access SQL and stored procedures in Adaptive Server Enterprise using SOAP.
- Enables Adaptive Server Enterprise to access the Web services of other applications. These external Web services are mapped to Adaptive Server Enterprise proxy tables at runtime.
- Provides user-defined Web services, which enable the execution of SQL commands in Adaptive Server Enterprise using a Web browser or SOAP client.

For more information on the ASE Web Services Engine, see Chapter 2, "Understanding the ASE Web Services Engine."

Advantages of ASE Web Services

With the ASE Web Services Engine, the user can use stored procedures, user-defined functions, and SQL to query and manipulate data. A client application can send a SOAP request containing SQL commands and receive results through SOAP. Data is returned according to the SQLX standard, and the client application can receive XML data, schema, and DTDs.

Stored procedures and functions

Stored procedures separate the internal, logical view of the data from business-level logic and extend the influence and performance of SQL. Stored procedures can also be executed remotely. The user can use both stored procedures and user-defined functions to invoke Java methods, as specified in the ANSI SQLJ standard, and to retrieve data in standard XML format.

SQL

Because SQL can be used to manipulate XML data, SOAP-enabled client applications can use the ASE Web Services Engine to manage data in Adaptive Server Enterprise. SQL can also be used to invoke Web services through the ASE Web Services Engine.

Security

The ASE Web Services security features include Secure Sockets Layer (SSL) and provide important database security and authorization features, like access control through the Lightweight Directory Access Protocol (LDAP).

LDAP

LDAP is an Internet protocol for accessing directories in a distributed environment. An LDAP server stores the user information needed to establish connections between resources and grant access to directories, eliminating the need for client applications to know this information. ASE Web Services enables client applications to access Web methods using LDAP.

ASE Web Services supports LDAP version 3 servers. For more detailed information on using LDAP to enable user authentication and to locate Adaptive Server Enterprise data servers, see the *Security Administration Guide* for Adaptive Server Enterprise.

User-defined Web services

Using user-defined Web services, you can execute SQL commands in Adaptive Server Enterprise using a Web browser or SOAP client. This functionality allows you to define the name of a Web service, the SQL to execute, and the URL location.

User-defined Web services allow you to create an interface to Adaptive Server Enterprise that is compliant with SOA.

Web services standards

Web services are structured with XML, described with WSDL, and transferred with SOAP over HTTP. ASE Web Services enables client applications to access Web services and can consume remote Web services.

XML

XML is used to describe data. XML is derived from SGML and possesses some qualities of other markup languages, like HTML. However, XML is extensible because its tags are user-defined, making it ideal for exchanging data in a structure that is intelligible to two or more communicating applications.

Example

The following isql query to the pubs2 database finds information on discounts:

```
select * from discounts
```

This query produces the following result set:

```
discounttype          stor_id lowqty highqty discount
--------------------- ------- ------ ------- ---------
Initial Customer      NULL      NULL    NULL 10.500000
Volume Discount       NULL       100    1000 6.700000
Huge Volume Discount  NULL      1001    NULL 10.000000
Customer Discount     8042      NULL    NULL 5.000000
```

This result set can be represented in XML in many ways. The following is an XML representation produced by ASE Web Services and formatted in SQLX, which is part of the ANSI standard for SQL:

```
<?xml version="1.0" encoding="UTF-8">
<ws xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance">
   <row>
      <discounttype>Initial Customer</discounttype>
      <discount>10.5</discount>
   </row>
   <row>
      <discounttype>Volume Discount</discounttype>
      <lowqty>100</lowqty>
      <highqty>1000</highqty>
```

```
      <discount>6.7</discount>
   </row>
   <row>
      <discounttype>Huge Volume Discount
</discounttype>
      <lowqty>1001</lowqty>
      <discount>10.0</discount>
   </row>
   <row>
      <discounttype>Customer Discount</discounttype>
      <stor_id>8042</stor_id>
      <discount>5.0</discount>
   </row>
</ws>
```

The initial line describes the XML version and character encoding. The remaining tags are user-defined and describe both the structure and data of the document. These user-defined tags enable documents to be customized for a specific application, such as one that uses discount information to compute prices.

XML document structure

The user-defined elements and their arrangement in a well-formed XML document is defined either by a Document Type Definition (DTD) or an XML schema.

Following is a DTD for the previous example for discount information:

```
<!DOCTYPE ws [
<!ELEMENT ws (row*)>
<!ELEMENT row (discounttype, stor_id?, lowqty?,
highqty?, discount)>
<!ELEMENT discounttype (#PCDATA)>
<!ELEMENT stor_id (#PCDATA)>
<!ELEMENT lowqty (#PCDATA)>
<!ELEMENT highqty (#PCDATA)>
<!ELEMENT discount (#PCDATA)>
]>
```

The following is part of an XML schema for the previous example for discount information:

```
<xsd:schema
 xmlns:xsd="http://www.w3.org/2001/XMLSchema"
   xmlns:sqlxml="http://www.iso-
      standards.org/mra/9075/sqlx">
```

```
    <xsd:import
      namespace="http://www.w3.org/2001/XMLSchema"
       schemaLocation="http://www.iso-
          standards.org/mra/9075/sqlx.xsd" />
    <xsd:complexType name="RowType.ws">
       <xsd:sequence>
          <xsd:element name="discounttype"
           type="VARCHAR_40" />
          <xsd:element name="stor_id" type="CHAR_4"
           minOccurs="0" maxOccurs="1"/>
          <xsd:element name="lowqty" type="SMALLINT"
           minOccurs="0" maxOccurs="1"/>
          <xsd:element name="highqty" type="SMALLINT"
           minOccurs="0" maxOccurs="1"/>
          <xsd:element name="discount" type="FLOAT" />
       </xsd:sequence>
    </xsd:complexType>
    <xsd:complexType name="TableType.ws">
       <xsd:sequence>
          <xsd:element name="row" type="RowType.ws"
           minOccurs="0" maxOccurs="unbounded"/>
       </xsd:sequence>
    </xsd:complexType>
    <xsd:simpleType name="VARCHAR_40">
       <xsd:restriction base="xsd:string">
          <xsd:maxLength value="40"/>
       </xsd:restriction>
    </xsd:simpleType>
    <xsd:simpleType name="VARCHAR_4">
       <xsd:restriction base="xsd:string">
          <xsd:maxLength value=”4”/>
       </xsd:restriction>
    </xsd:simpleType>
    <xsd:simpleType name="SMALLINT">
       <xsd:restriction base="xsd:integer">
          <xsd:maxInclusive value="32767"/>
          <xsd:minInclusive value="-32768"/>
       </xsd:restriction>
    </xsd:simpleType>
    <xsd:simpleType name="FLOAT">
       <xsd:restriction base="xsd:float"/>
    </xsd:simpleType>
    <xsd:element name="ws" type="TableType.ws"/>
</xsd:schema>
```

An XML schema or DTD can be included as part of the XML document they describe or be referenced as separate files. The respective file suffixes for an XML schema and a DTD are *.xsd* and *.dtd*.

For more detailed information on XML, refer to the following documents:

- World Wide Web Consortium (W3C), at http://www.w3.org
- W3C, Extensible Markup Language (XML), at http://www.w3.org/XML/

WSDL

A WSDL document is written in XML and describes a Web service. In addition to specifying the location of the Web service, a WSDL description also specifies the methods provided by the Web service, and the messages, datatypes, and communication protocols used by the Web service with the following tags:

- <service> – defines the name of the Web service. For example, a Web service called ExecuteStoredProcService could be named as follows:

```
<wsdl:service name="ExecuteStoredProcService">
 <wsdl:port binding="impl:aseSoapBinding" name="ase">
  <wsdlsoap:address location="http://myserver:8181/services/ase"/>
 </wsdl:port>
</wsdl:service>
```

  A WSDL document may contain one or more <service> tags. In the case of the ASE Web Services Engine, there is only one service, which is named “ase.”

- <binding> – defines the communication protocols used. The following example uses the SOAP protocol:

```
<wsdl:binding name="aseSoapBinding" type="impl:ExecuteStoredProc">
...
</wsdl:binding>
```

  WSDL also supports use of HTTP and MIME protocols.

- <port> – specifies the Web service address. For example:

```
<wsdl:port binding="impl:aseSoapBinding" name="ase">
 <wsdlsoap:address location="http://myserver:8181/services/ase"/>
</wsdl:port>
```

  The <port> tag has attributes for name and binding.

- <message> – defines the messages used. For example:

```
 <wsdl:message name="executeRequest">
  <wsdl:part name="service" type="xsd:string"/>
  <wsdl:part name="userName" type="xsd:string"/>
  <wsdl:part name="password" type="xsd:string"/>
  <wsdl:part name="sqlxOptions" type="xsd:string"/>
  <wsdl:part name="sql" type="xsd:string"/>
 </wsdl:message>
```

This is a request message for a method called executeRequest. The <part> tags correspond to parameter values for the method call in a request message and to return values in a response.

- <operation> – associates a message with a Web method request or response. For example:

```
  <wsdl:operation name="execute" parameterOrder="service userName
   password sqlxOptions sql">
   <wsdl:input message="impl:executeRequest" name="executeRequest"/>
   <wsdl:output message="impl:executeResponse" name="executeResponse"/>
  </wsdl:operation>
```

- <portType> – defines the methods provided. The <operation> tag is a child element of <portType>. For example:

```
 <wsdl:portType name="ExecuteStoredProc">
  <wsdl:operation name="execute" parameterOrder="aseServerName
asePortNumber
....
  </wsdl:operation>
 </wsdl:portType>
```

- <types> – defines the datatypes used. WSDL uses XML schema syntax to define datatypes.

WSDL is usually automatically generated by the ASE Web Services Engine and can be viewed in a Web browser at the following location:

```
http://myserver:producer_port/services/ase?wsdl
```

where:

- *myserver* – is the name of the host on which the ASE Web Services Engine is running,
- *producer_port* – is the port number.

SOAP

SOAP is a platform- and language-independent protocol based on XML that is used to send messages and data between applications. SOAP defines the structure of messages, describes how messages are to be processed, and provides rules for encoding application-defined datatypes. SOAP allows applications to send and receive remote procedure calls (RPCs) using any standard transport-layer protocol, usually HTTP.

SOAP message structure

A SOAP message consists of a header and a body, both of which are contained in a SOAP envelope. Generally, the SOAP request message contains no header information, but the response message corresponding to the previous request message contains a header and does not necessarily show the body of the message..

See the following for detailed information on SOAP:

- Simple Object Access Protocol (1:1) at http://www.w3.org/TR/SOAP/
- Simple Object Access Protocol (1.2) Part 1 at http://www.w3.org/TR/soap12-part1/
- Simple Object Access Protocol (1.2) Part 2 at http://www.w3.org/TR/soap12-part2/

CHAPTER 2

Understanding the ASE Web Services Engine

This chapter discusses the following:

The ASE Web Services Engine provides the following functionality:

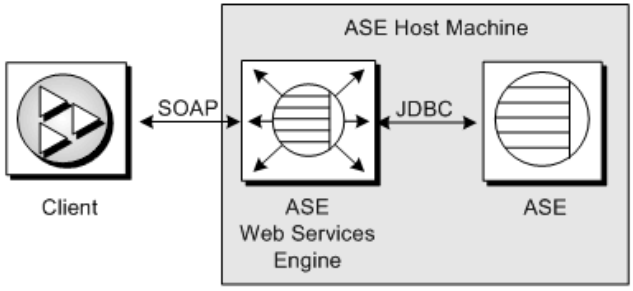
- Producer of Web services – enables a client application to access Adaptive Server Enterprise stored procedures and SQL using SOAP.
- Consumer of Web services – enables Adaptive Server Enterprise to access and execute Web methods.

Producer of Web services

The ASE Web Services Engine acts as a producer of Web services by enabling a client application to access Adaptive Server Enterprise stored procedures and SQL using SOAP. The output of the ASE Web Services Engine complies with SQLX, which is defined as part of the ANSI specification for SQL.

Note Sybase® recommends that you run the ASE Web Services Engine on the same machine as Adaptive Server Enterprise.

Figure 2-1: ASE Web Services Engine for client access to ASE



The client can send a SQL or stored procedure command as a SOAP request, and any result is returned as a SOAP response. The data in the SOAP response conforms to the SQLX standard.

Producer components

Acting as a producer of Web services, the ASE Web Services Engine uses three components: an HTTP handler, a SOAP handler, and an XML mapper.

Figure 2-2: ASE Web Services Engine as producer

HTTP handler

The HTTP handler supports HTTP 1.1 and listens for requests sent using the HTTP POST and GET methods. The HTTP handler also supports SSL connections.

Note Do not use GET HTTP requests. These commands embed all arguments within the URL, which cannot be encrypted. Use POST HTTP, which moves all arguments into the body of the HTTP request and allows the whole contents to be encrypted.

SOAP handler

The SOAP handler supports SOAP 1.2 and processes SOAP requests. The SOAP handler also generates WSDL files describing Web services.

XML mapper

The XML mapper encodes relational data, returned from Adaptive Server Enterprise through JDBC, into XML that complies with the SQLX standard. The XML mapper also generates a DTD and an XML schema to describe the data.

Producer Web methods

The ASE Web Services Engine provides the following methods:

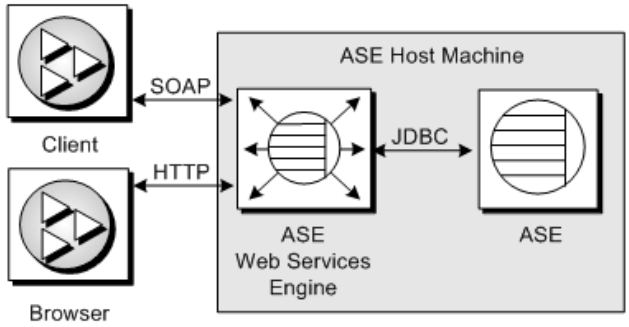
- execute – executes a SQL statement or stored procedure.
- login – establishes a persistent connection to Adaptive Server Enterprise.
- logout – explicitly terminates an Adaptive Server Enterprise connection.

For information on using these Web methods, see Chapter 4, “Using ASE Web Services.”

User-defined Web services

In addition to the Web methods provided by the ASE Web Services Engine, ASE Web Services enables you to create Web services and execute SQL commands in Adaptive Server Enterprise using either a Web browser or a SOAP client.

Figure 2-3: User-defined Web services



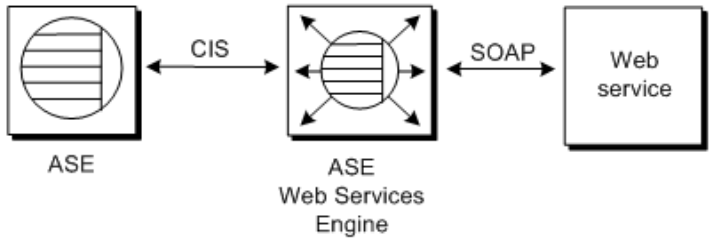
You can create a user-defined Web service with the create service command, which enables you to specify the SQL to be executed, create a first-class object for which permissions can be controlled with the grant command, and control whether the service can be invoked with a Web browser or a SOAP client. The ASE Web Services Engine automatically generates WSDL for user-defined Web services. For details on creating and using user-defined Web services, see Chapter 4, "Using ASE Web Services."

Note Do not use GET HTTP requests. These commands embed all arguments within the URL, which cannot be encrypted. Use POST HTTP, which moves all arguments into the body of the HTTP request and allows the whole contents to be encrypted.

Consumer of Web services

The ASE Web Services Engine acts as a consumer of Web services by enabling Adaptive Server Enterprise to access and execute Web methods. A Web method is made accessible by mapping it to an Adaptive Server Enterprise proxy table using information provided in the WSDL file for the Web method. A Web method can then be invoked with a select on the proxy table.

Figure 2-4: Accessing remote Web services

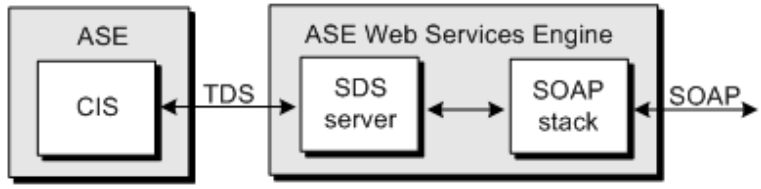


Note The Web service accessed may reside within or beyond a firewall.

Consumer components

Acting as a consumer of Web services, the ASE Web Services Engine uses a Specialty Data Store (SDS) server and a WSDL parser. The SDS is used as a Component Integration Service (CIS) to map the Web method to a proxy table. The proxy table is constructed using a WSDL file parsed with Apache Axis.

Figure 2-5: ASE Web Services Engine as consumer



SDS server

When Adaptive Server Enterprise receives a select statement for a Web method proxy table, Adaptive Server Enterprise forwards the request to the ASE Web Services Engine in a Tabular Data Stream™ (TDS). The SDS server, which acts as a server for CIS, allows the ASE Web Services Engine to intercept and handle the TDS from Adaptive Server Enterprise.

SOAP stack

The SOAP stack is a layered set of functionalities that collectively handle the serialization and transport of XML-encoded data. The SOAP stack uses the WSDL file for a Web method to determine the structure of a corresponding proxy table. The SOAP stack also generates SOAP requests corresponding to the select statement submitted to Adaptive Server Enterprise and sends these SOAP requests to a SOAP server. The SOAP stack supports both RPC/encoded and document/literal Web methods.

RPC/encoded methods

The SOAP messages for an RPC/encoded Web method contain an XML element for each method parameter. Messages for an RPC/encoded Web method are encoded according to the SOAP specification. The proxy table representing an RPC/encoded Web method contains a column for each input and output parameter.

Note If an RPC/encoded Web method has no input or output parameters, it cannot be mapped to a proxy table. A proxy table for a Web method without parameters would have no columns. A table with no columns cannot be created in Adaptive Server Enterprise.

Note Currently, only simple types are mapped to columns. Complex types or arrays used in RPC/encoded Web methods result in the Web method not being mapped to a proxy table.

Document/literal methods

In the SOAP messages for a document/literal Web method, the communicating parties specify the data being transmitted and formatted according to XML schemas incorporated into the WSDL file. Messages for a document/literal Web method are serialized and deserialized according to the WSDL file for the Web method. The proxy table representing a document/literal Web method contains two columns: _inxml and outxml.

The Web Services Interoperability (WSI) Organization, which defines practical interoperability guidelines, recommends using document/literal Web methods to enhance portability. Sybase supports this recommendation.

Proxy tables

Because they point to Web methods, Web Services proxy tables are of type procedure and are subject to all restrictions for this type:

- Commands – You cannot issue a delete, update, or insert command against a table of type procedure, nor can you issue a create index, truncate table, or alter table command.
- Joins – A Web Services proxy table can only be joined with one other table, and that table cannot be another Web Services proxy table.
- Queries – Column names beginning with underscore ('_') are used to specify input parameters. These columns are referred to as parameter columns and must be in the where clause of a select statement.

For a complete description of the restrictions for procedure tables, see the *Component Integration Services Users Guide*.

Web Services engine as a consumer versus producer

When the Web Services engine acts as a consumer of Web Services (that is, when Adaptive Server queries Web Services for the results of web service calls from any external services available on the Internet), Adaptive Server can make requests from any Web Services engine that is defined in its sysservers table.

When the Web Services engine acts as a producer of Web Services defined on Adaptive Server, the Web Services engine is aware only of the Adpative Server defined in its properties file, and can request results from only this Adaptive Server.

CHAPTER 3

Installing and Configuring ASE Web Services

This chapter discusses the following:

ASE Web Services is installed as part of the installation for Adaptive Server Enterprise. ASE Web Services may be configured during the installation of Adaptive Server Enterprise using a configuration wizard or after the installation from Sybase Central. For instructions on installing Adaptive Server Enterprise, see the *Installation Guide* for Adaptive Server Enterprise.

Note Unless otherwise specified, directories listed in this and subsequent chapters are assumed to reside under the *$SYBASE/WS-15_0* directory on UNIX and the *%SYBASE%\WS-15_0* directory on Windows.

Installing Web Services

Perform the following to install Web Services:

1 Add an entry to the interfaces file for the Web Services Consumer. The interfaces file is located in *$SYBASE* (or *%SYBASE%* on Windows).

2 If necessary, update the *ws.properties* file. The *ws.properties* file contains a number of runtime properties for the WebServices server, including the server name, port number, error logging, and so on. The *ws.properties* file contains directions for updating in its commented section. Update the values in the file to suit your installation.

The default location for *ws.properties* is:

- On UNIX – *ws.properties* is located in *$SYBASE/WS-15_0/props/*
- On Windows – *ws.properties* is located in *%SYBASE%\WS-15_0\props*

3 Run the configssl utility to configure SSL for Web Services: The syntax is:

```
configssl  -d domain_hostName -k keystore -h
httpsPort -f property_file-c certificate_password
-s keystore_password
```

Where:

- *domain_hostName* – is the host name of the URL used to connect to Web Services using SSL. For example, the *domain_hostName* for the *mydomainhostname* URL is:

  ```
  http://mydomainhostname:8183/services/ase
  ```

  domain_hostName has no default value.
- *keystore* – full path to the file that stores certificates. The default locations are:
  - On UNIX – *$SYBASE/WS-15_0/props/keystore*
  - On Windows – *%SYBASE%\WS-15_0\props\keystore*
- *httpsPort* – the port number to listen for an SSL connection. The default port number is 8182.
- *property_file* – the location and name of the *properties* file to update. The default locations are:
  - On UNIX – *$SYBASE/WS-15_0/props/ws.properties*
  - On Windows – *%SYBASE%\WS-15_0\props\ws.properties*
- *certificate_password* – the password for the certificate. *certificate_password* has no default value. configssl prompts for a password if you do not provide one.

- *keystore_password* – the password for the *keystore*. *keystore_password* has no default value. configssl prompts for a password if you do not provide one.

This example configures SSL for Web Services on host name “sybase”:

```
/sybase/ase157/WS-15_0/bin/configssl -d asekernel1 -c sybase -s sybase
-k /sybase/ase157/WS-15_0/producer/keystore  -h  8187  -f
/sybase/ase157/WS-15_0/props/ws.properties
configssl initiating execution at Thu Jan 19 19:43:59 PST 2012.

Using SYBASE as /sybase/ase157
Using SYBASE_WS as WS-15_0
Using SYBASE_JRE6 as /sybase/ase157/shared/JRE-6_0_24_64BIT

Generating 1,024 bit RSA key pair and self-signed certificate
(SHA1withRSA) with a validity of 360 days
       for: CN=asekernel1, OU=ASEWS, O=Sybase, L=Boulder, ST=CO, C=US
[Storing /sybase/ase157/WS-15_0/producer/keystore]
Certificate stored in file </sybase/ase157/WS-
15_0/producer/wscertificate.cer>
\nUpdating /sybase/ase157/WS-15_0/props/ws.properties file to reflect
new SSL settings.
Succeed to set permission mode as '600' for file '/sybase/ase157/WS-
15_0/props/ws.properties'
Update of /sybase/ase157/WS-15_0/props/ws.properties complete.

configssl execution complete at Thu Jan 19 19:44:02 PST 2012
```

4 If necessary, run *installws*. If Adaptive Server includes the sp_webservices stored procedure, *installws* was run previously, and you need not run it again.

5 If necessary, add a server entry to sysservers for Web Services:

```
sp_addserver 'web_services_name, 'sds',
'web_services_name'
```

For example, to add a server entry for a Web Services named ‘ws:’

```
sp_addserver 'ws',sds,'ws'
```

Configuring Web Services

You can use the Configuration Utility to configure ASE Web Services either during or after the installation of ASE Web Services:

- Configuring during installation – You have the option of configuring ASE Web Services during a custom installation of the ASE Web Services feature.
- Configuring after installation – If you do not configure the Web Services feature during installation, you must configure the feature from Sybase Central after the installation is complete. Sybase Central provides a GUI Configuration Utility similar to that used in the installation procedure. You can also configure the Web Services feature in silent mode or in command/console mode.

Configuring during installation

To configure Web Services, activate the Configuration Utility during the installation of the Web Services feature, and follow the steps in the wizard.

Configuring after installation

If you have already installed ASE Web Services, you can start the Configuration Utility from the Adaptive Server Enterprise plug-in to Sybase Central. You can configure Web Services using the installation GUI, or you can use the command/console or silent modes.

❖ **Starting the Configuration Utility GUI from Sybase Central**

1. Click on the Utilities folder in the Folders view for the Adaptive Server Enterprise plug-in of Sybase Central.
2. Find the Configure Web Service icon in the details view to the right of the Folders view. Select the icon for Configure Web Service to start the Configuration Utility.
3. Follow the steps in the wizard.

❖ **Starting the Configuration Utility in command/console mode**

1. Open a console window.
2. Enter the following command:

```
aseplugin -I
```

3 Follow the steps indicated on the console.

❖ **Starting the Configuration Utility in silent mode**

1 Edit the entries in your *myres.properties* file to indicate the desired values. To set a property, add "=" and the property value to the *myres.properties* entry. For details on the contents of the *myres.properties* file, see "myres.properties" in the Appendix, "Configuration Properties."

2 Open a console window.

3 Enter the following command:

```
aseplugin -s path
```

where *path* is the path to your *myres.properties* file.

In silent mode, no further user action is necessary to configure Web Services.

Licensing

License entry for ASE Web Services is handled by the InstallShield installation for Adaptive Server Enterprise.

To check out your ASE Web Services license from SySAM, do the following before you run the ASE Web Services Engine:

1 Establish an isql session with your Adaptive Server Enterprise.

2 Activate ASE Web Services by entering the following command in isql:

```
sp_configure 'enable webservices', 1
```

Configuration files

The *props* directory contains the following configuration files:

- *ws.properties* – contains configuration settings for ASE Web Services. For details on these configuration properties, see Appendix B, "Configuration Properties."

- *logging.properties* – The file defines where logging output is sent. You can direct output to a log file or to the console. If output is directed to a log file, you can specify when to roll over to a new log file. You can also control the format of logging messages. For information on log rollover policies, see "Rolling over log files" on page 53.

  The *logging.properties* file entries and logging behavior follow that for the Apache log4j package. For detailed information, refer to the documentation for log4j at http://jakarta.apache.org/log4j/docs/documentation.html.

- *wsmsg.properties file* – is for internal use by ASE Web Services.

Security

To ensure secure operation of ASE Web Services, Sybase recommends that you do the following:

- Install ASE Web Services on the same machine as Adaptive Server Enterprise.
- Use SSL to connect to the ASE Web Services Engine. For instructions on configuring SSL, see "Configuring SSL" on page 24.

ASE Web Services supports all authorization measures supported by Adaptive Server Enterprise.

Note For the most current information on security in ASE Web Services, see the Adaptive Server Enterprise *Release Bulletin*.

Configuring SSL

Note Two certificate passwords are created by default as "sybase" from InstallShield during installation. You can change these from Sybase Central later.

SSL is configured automatically using the Configuration Utility from InstallShield or from Sybase Central. However, you can also configure SSL manually. To manually configure SSL for ASE Web Services, run the *configssl* script, which can be found in the *bin* directory:

```
configssl -d <domain_hostName> -k <keystore>
-h <httpsPort> -f <property_file>
-c <certificate_password> -s <keystore_password>
```

where:

- *domain_hostName* – is the host name of the URL to connect to using SSL. For example, the *domain_hostName* for the following URL would be `mydomainhostname`:

  ```
  http://mydomainhostname:8183/services/ase
  ```

  There is no default for this parameter value.

- *keystore* – is the location and file at which to store certificates. The default location for UNIX is *$SYBASE/WS-15_0/props/keystore*, or *%SYBASE%\WS-15_0\props\keystore* for Windows.

- *httpsPort* – is the port on which to listen for an SSL connection. The default is 8182.

- *property_file* – is the location and name of the properties file to update. The default location for UNIX is *$SYBASE/WS-15_0/props/ws.properties*, or *%SYBASE%\WS-15_0\props\ws.properties* for Windows.

- *certificate_password* – is the password for the certificate. There is no default for this parameter value. If no password is supplied when the script is invoked, the script will prompt for a value.

- *keystore_password* – is the password for the keystore. There is no default for this parameter value. If no password is supplied when the script is invoked, the script will prompt for a value.

Note You can also add your own certificate for SSL. For instructions on how to add your own certificate, see the documentation for the keytool utility in the JRE that manipulates the *keystore* file. The JRE delivered with ASE Web Services is version 1.4.

The *WS.properties* file sets the *keystore* location with *com.sybase.ase.ws.producer.ssl.keystore*. The WS Producer is the only user of the *keystore* location. The WS Consumer uses a separate certificate, which is located in the JRE by default. To consume Webservices over HTTPS (SSL) as a WS consumer, import the Producer's SSL certificate into the keystore for the JRE (for example, with *$SYBASE/$SYBASE_JRE6_64/lib/security/cacerts*

Installing a certificate for Microsoft .NET

A Microsoft .NET client requires a certificate to access the ASE Web Services Engine using SSL. Use the following procedure to install a certificate for Microsoft .NET.

❖ **Installing a certificate for Microsoft .NET**

1 Start the ASE Web Services Engine with SSL. For instructions on starting the ASE Web Services Engine, see "Starting and stopping the ASE Web Services Engine" on page 29.

2 Enter the following in the Address bar of Microsoft Internet Explorer:

```
https://<producer_host>:<SSL_port>
```

where:

- *producer_host* – is the host on which the ASE Web Services Engine runs.
- *SSL_port* – is the port for the ASE Web Services Engine.

The Security Alert dialog box appears.

3 Click View Certificate. The Certificate dialog box appears.

4 Click Install Certificate. The Certificate Manager Import wizard opens.

5 Click Next until the Certificate Manager Import wizard indicates that the certificate was successfully installed and returns to the Certificate dialog box.

6 Click OK. The browser returns you to the Security Alert dialog box.

7 Click Yes. The browser window should display a page titled "Welcome to the ASE Web Services."

❖ **Verifying the certificate installation**

1 Close all browser windows.

2 Restart Microsoft Internet Explorer.

3 Enter the following in the Address bar of Microsoft Internet Explorer:

```
https://<producer_host>:<SSL_port>
```

where:

- *producer_host* – is the host on which the ASE Web Services Engine runs.
- *SSL_port* – is the port for the ASE Web Services Engine.

No Security Alert dialog box should appear.

CHAPTER 4

Using ASE Web Services

This chapter discusses the following:

Before using ASE Web Services, make sure you have completed the configuration tasks in Chapter 3, “Installing and Configuring ASE Web Services.”

Using the ASE Web Services Engine

This section documents the following:

- Starting and stopping the ASE Web Services Engine
- ASE Web Services methods
- Using sp_webservices
- Invoking a Web service

Starting and stopping the ASE Web Services Engine

To start the ASE Web Services Engine for ASE Web Services, execute the *runws* script, which is located in the *bin* directory:

```
runws -U <ase_username> -P <ase_password>
-S <ase_server_name> -f <property_file> -v
```

To stop the ASE Web Services Engine for ASE Web Services, execute the *stopws* script, also located in the *bin* directory:

```
stopws -U <ase_username> -P <ase_password>
-S <ase_server_name> -f <property_file> -v
```

The parameters are the same for both the *runws* and *stopws* scripts:

- *ase_username* is the user name for the Adaptive Server Enterprise. There is no default for this parameter value. If you do not supply a value for this parameter, you will be prompted for one.
- *ase_password* is the password for the Adaptive Server Enterprise. There is no default for this parameter value. If you do not supply a value for this parameter, you will be prompted for one.
- *ase_server_name* is the name of the Web service. There is no default for this parameter value. If you do not supply a value for this parameter, you will be prompted for one.
- *property_file* is the location and name of the properties file to update. The default location for UNIX is *$SYBASE/WS-15_0/props/ws.properties*, or *%SYBASE%\WS-15_0\props\ws.properties* for Windows.
- `-v` specifies that the ASE Web Services Engine should display version information at startup or shutdown.

Conditions

The ASE Web Services Engine will start or stop if the following conditions are met:

- The *ase_server_name* provided is located on an LDAP server pointed to by the *libtcl.cfg* file or in the *interfaces* file for Adaptive Server Enterprise.

  ASE Web Services first searches for an entry containing the value of *ase_server_name* on an LDAP server pointed to by the *libtcl.cfg* file. ASE Web Services locates the *libtcl.cfg* file using the `com.sybase.ase.ws.libtcl` entry in the *ws.properties* file. If no entry is found on an LDAP server, ASE Web Services looks for an entry in the *interfaces* file for Adaptive Server Enterprise.

  Note On Windows systems, the *interfaces* file is named *sql.ini*.

  ASE Web Services locates the *interfaces* file using the `com.sybase.ase.ws.interfaces` entry in the *ws.properties* file.

- A successful login can be made using the *ase_username* and *ase_password* provided.

  Note The password for an Adaptive Server Enterprise user cannot be set to a null string. The sa login allows null-string passwords by default. Sybase does not recommend using null passwords.

- The login to Adaptive Server Enterprise has sa role privileges.
- The following stored procedure command has been executed in isql for your Adaptive Server Enterprise:

```
sp_configure 'enable webservices', 1
```

Verification

After successfully executing the *runws* script, verify that ASE Web Services is enabled and that the ASE Web Services Engine is running.

❖ **Verifying that ASE Web Services is enabled**

To verify that ASE Web Services is enabled:

- Execute the following command on Adaptive Server Enterprise:

```
sp_configure 'enable webservices'
```

  If sp_configure returns a value of 1, the Web Services feature has been enabled. A return value of 0 indicates the feature is not enabled.

❖ **Verifying that the ASE Web Services Engine is running**

- Check the *producer.log* or *consumer.log* file in the *logs* directory for messages indicating that the ASE Web Services Engine is running. For example:

```
2004-03-29 16:29:29.522 INFO [main] - Starting HTTP Server on Port: 8181
```

  For SSL, the log indicates an HTTPS port and related SSL information. For example:

```
2004-03-29 16:29:29.532 INFO [main] - Https Port [8182], KeyPassword: ...
```

Note The *runproducer*, *stopproducer*, *runconsumer*, and *stopconsumer* scripts have been kept in 15.0 release for compatibility with previous releases of ASE Web Services. However, in the 15.0 release, these scripts call the *runws* and *stopws* scripts.

ASE Web Services methods

To access ASE Web Services, your client must use the methods exposed by the ASE Web Services Engine. These methods are mapped in SOAP as rpc:

```
<soap:binding style="rpc" ...>
```

Message data is encoded:

```
<soap:body use="encoded" ....>
```

The ASE Web Services Engine provides the following methods:

- execute – executes a SQL statement or stored procedure.
- login – establishes a persistent connection to Adaptive Server Enterprise.
- logout – explicitly terminates an Adaptive Server Enterprise connection.

These methods are supported by Adaptive Server Enterprise by default and are provided as one Web service (with one WSDL file). The syntax for these methods is the same whether they are invoked using HTTP or SSL.

execute

The execute method executes a Transact-SQL statement or stored procedure in Adaptive Server Enterprise.

Syntax

execute *aseServerName userName password sqlxOptions sql*

Parameters

- *aseServerName*

  SOAP string indicating the name of the Adaptive Server Enterprise server in the *interfaces* file or LDAP server.

  At each invocation of the execute method, ASE Web Services uses the value of *aseServerName* in the same way that *ase_server_name* is used to start or stop the ASE Web Services Engine. See "Starting and stopping the ASE Web Services Engine" on page 29 for details.

- *userName*

  SOAP string indicating the user ID needed to log in to the Adaptive Server Enterprise.

- *password*

  SOAP string indicating the password needed to log in to the Adaptive Server Enterprise.

- *sqlxOptions*

SOAP string indicating one or more option parameters. These parameters specify characteristics of the SQLX result set. The following are valid option parameters:

- general
- binary={hex | base64}
- columnstyle={element | attribute}
- entitize={yes | no | cond}
- format={yes | no}
- header={yes | no}
- multipleentitize={yes | no}
- multipleresults={all | data}
- ncr={non_ascii | no}
- nullstyle={attribute | omit}
- prefix="*value*"
- root={yes | no}
- rowname="*value*"
- schemaloc="*value*"
- statement={yes | no}
- tablename="*value*"
- targetns="*value*"
- xsidecl={yes | no}

You must provide a value for *value*. For more information on SQLX functions and options, see *XML Services in Adaptive Server Enterprise*.

- *sql*

  SOAP string indicating the SQL statement or stored procedure to be executed on Adaptive Server Enterprise. The size of the SOAP string specified in the *sql* parameter is limited by the value of the com.sybase.ase.ws.maxpostsize property setting in the *ws.properties* file. For a description of this and other properties, see Appendix B, "Configuration Properties."

Examples

Example 1 Checks the version number for Adaptive Server Enterprise.

```
execute johndoe-sun sa password "tablename=ws" "select
@@version"
```

This example invokes the Web method directly. ASE Web Services returns an XML schema, a DTD, and a result set containing the result of the executed statement.

Note You must provide the *userName* and password parameters to invoke the execute method. Adaptive Server verifies it can execute the specified SQL statement.

Example 2 Computes a left join on tables in the pubs2 database.

```
execute johndoe-sun sa password "tablename=ws"
"select title, price, au_fname, au_lname from (titles
left join titleauthor on titles.title_id =
titleauthor.title_id ) left join authors on
titleauthor.au_id = authors.au_id and titles.price >
$15.00”
```

login

The login method establishes a persistent connection to Adaptive Server Enterprise.

Syntax

login *aseServerName userName password*

Parameters

- *aseServerName*

  SOAP string indicating the name of the Adaptive Server Enterprise on which to execute the SQL statement or stored procedure.

  For the login method, ASE Web Services uses the value of *aseServerName* in the same manner as for the execute method.

- *username*

  SOAP string indicating the user ID needed to log in to the Adaptive Server Enterprise.

- *password*

  SOAP string indicating the password needed to log in to the Adaptive Server Enterprise.

Usage

Before a SQL statement or stored procedure can be executed on Adaptive Server Enterprise, a connection must first be established. However, the login method is optional. If you invoke an execute method without first invoking the login method, ASE Web Services automatically establishes a non-persistent connection to Adaptive Server Enterprise. The login method initiates a persistent connection to Adaptive Server Enterprise. The connection is terminated with the logout method. Persistent connections that are inactive for 60 seconds are terminated automatically.

logout

The logout method terminates a persistent connection to Adaptive Server Enterprise.

Syntax

```
logout
```

Usage

The logout method terminates a persistent connection to Adaptive Server Enterprise established by the login method.

Using sp_webservices

The sp_webservices stored procedure creates and manages the proxy tables used in the ASE Web Services Engine. This section documents the options and parameters for sp_webservices.

The sp_webservices stored procedure has the following options:

- add – creates a proxy table.
- help – displays usage information for sp_webservices.
- list – lists the proxy tables mapped to a WSDL file.
- modify – modifies timeout setting.
- remove – removes proxy tables mapped to a WSDL file.

There are additional sp_webservices options for use with user-defined Web services. For information on these options, see "Using sp_webservices with user-defined Web services" on page 47.

Note For information on restrictions for Web Services proxy tables, see "Web Services proxy table restrictions" in Chapter 6, "Troubleshooting."

add

The add option is used to create a proxy table for a Web method specified by a WSDL file. When the add option is used successfully, the list option is invoked automatically to describe the schema of the new proxy table.

Syntax

```
sp_webservices 'add', 'wsdl_uri' [, sds_name]
    [, 'method_name=proxy_table
    [,method_name=proxy_table ]* ' ]
```

Parameters

- *wsdl_uri*

  The location for the WSDL file to be mapped to the new proxy table. If this parameter is specified, Web Services ensures that the URI exists in the syswsdl table.

- *sds_name*

  The name specified for the ASE Web Services Engine in the *interfaces* or *sql.ini* file. The default value is ws. If no entry exists in the sysattributes table, an error results.

- *method_name*

  The name of the Web method to be mapped to a proxy table. The *method_name* specified must be the name of a Web method specified in the associated WSDL file.

- *proxy_table*

  The name of proxy table to which the Web method specified in *method_name* is mapped.

Usage

If you not specify *method_name* and *proxy_table* values for a Web method, the proxy table generated for the Web method is, by default, the name of the Web method specified in the WSDL file. If there is already a proxy table with the name of this Web method, a new proxy table is generated with a name like the following:

```
method_nameN
```

where *method_name* is the default proxy table name, and *N* is a digit from 1 to 9 denoting each successive mapping of the Web method. There can be as many as 99 duplicate proxy tables.

If you do specify *method_name* and *proxy_table* values for a Web method, the name of the proxy table must be new. If there is already a proxy table with the name specified in *proxy_table*, an error results, and none of the Web methods specified in the add option are mapped to proxy tables.

The output from the add option lists the methods that have been successfully mapped to proxy tables as well as those that have not been mapped. The name of a proxy table for an unmapped Web method is indicated as NULL in the output from the add option.

Note The columns used for input and output vary for proxy tables generated for RPC/encoded Web methods and document/literal Web methods. A proxy table representing an RPC/encoded Web method contains a column for each input and output parameter. A proxy table representing a document/literal Web method contains two columns, _inxml and outxml.

Note For information on datatype mappings, see Appendix C, "SOAP and Adaptive Server Enterprise Datatype Mapping."

help

The help option provides instructions and examples illustrating how to use the sp_webservices stored procedure.

Syntax

```
sp_webservices help [, 'option']
```

Parameters

- *option*

  The option for which to provide detailed instructions. Valid values are add, list, remove, and modify.

Usage

If no value is specified for *option*, the help option prints a brief syntax description for the add, addalias, deploy, dropalias, list, listalias, listudws, modify, remove, and undeploy options.

list

The list option is used to list Web methods described in a WSDL file.

Syntax

```
sp_webservices 'list' [, 'wsdl_uri'] [, sds_name]
```

Parameters

- *wsdl_uri*

  The URI for the mapped WSDL file. If no value is specified for *wsdl_uri*, the list option displays information about all Web methods that have been mapped to proxy tables.

- *sds_name*

The name of the SDS server specified for the ASE Web Services Engine in the *interfaces* or *sql.ini* file. The default value is ws. If no entry exists in the sysattributes table, an error results.

If neither the *wsdl_uri* nor the *sds_name* parameter is specified, all entries in the sysattributes table are listed, ordered by wsdlid.

Usage

If the Web methods described in the WSDL file have already been mapped to proxy tables, the list option prints information about each proxy table. If the Web methods described in the WSDL file have not already been mapped to proxy tables, the list option prints SQL that can be used to create proxy tables.

modify

The modify option is used to modify the attribute information for a WSDL file.

Syntax

sp_webservices 'modify', '*wsdl_uri',* 'timeout=*time*'

Parameters

- *wsdl_uri*

  The URI of the WSDL file for which attribute information is to be changed.

- *time*

  The interval in seconds during which a Web method must respond before the operation is aborted.

remove

The remove option is used to remove a proxy table mapping for a Web method.

Syntax

sp_webservices 'remove', '*wsdl_uri*' [, *sds_name*]

Parameters

- *wsdl_uri*

  The URI of the WSDL file for which the proxy table is to be removed.

- *sds_name*

  The name of the SDS server specified for the ASE Web Services Engine in the *interfaces* or *sql.ini* file. The default value is ws. If no entry exists in the sysattributes table, an error results.

Invoking a Web service

To invoke a Web service using the ASE Web Services Engine, use the following procedure:

❖ **Invoking a Web service**

1. Start the ASE Web Services Engine.
2. Use the add option of sp_webservices to map the Web service to a proxy table in Adaptive Server Enterprise.
3. Use sp_help to determine the input and output parameters needed to invoke the Web method.
4. Invoke the Web method with a select statement on the proxy table.

Examples

Example 1 Invokes an RPC/encoded Web method to display the exchange rate between two currencies.

Use the add option of sp_webservices to map Web methods to proxy tables:

```
1> sp_webservices 'add',
'http://www.xmethods.net/sd/2001/CurrencyExchangeService.wsdl'
2> go
```

The Web method getRate is mapped to a proxy table of the same name.

Invoke the Web method by selecting from the proxy table:

```
1> select * from getRate where _country1 ='usa' and _country2 = 'india'
2> go
```

The results returned for the previous select show the exchange rate for the specified parameters:

```
Result          _country1       _country2
43.000000       usa             india
(1 row affected)
```

Example 2 This example invokes a Web method to display stock information within an XML document.

Use the add option of sp_webservices to map Web methods to proxy tables:

```
1> sp_webservices "add" , "http://www.webservicex.net/stockquote.asmx?WSDL"
2> go
```

The Web method GetQuote1 is mapped to a proxy table of the same name.

Invoke the Web method by selecting the outxml column of the GetQuote1 proxy table:

```
1> select outxml from GetQuote1 where _inxml = '<?xml version="1.0"
encoding="utf-8"?>
2>     <GetQuote1 xmlns="http://www.webserviceX.NET/">
3>       <symbol>SY</symbol>
4>     </GetQuote1>'
5> go
```

The results for the previous select display quote information within an XML document:

```
 outxml

<?xml version="1.0" encoding="UTF-8" ?><GetQuote1Response
xmlns="http://www.webserviceX.NET/"><GetQuoteResult><StockQuotes><Stock><S
ymb
ol>SY</Symbol><Last>21.48</Last><Date>7/21/2005</Date><Time>4:01pm</Time><
Cha
nge>+1.72</Change><Open>20.00</Open><High>21.60</High><Low>19.91</Low><Vol
ume
>2420100</Volume><MktCap>1.927B</MktCap><PreviousClose>19.76</PreviousClos
e><
PercentageChange>+8.70%</PercentageChange><AnnRange>12.75 -
20.44</AnnRange><Earns>0.706</Earns><P-E>27.99</P-E><Name>SYBASE
INC</Name></Stock></StockQuotes></GetQuoteResult></GetQuote1Response>

(1 row affected)
```

Example 3 This example invokes the GetQuote1 Web method, mapped to a proxy table in the previous example, through a view to display stock information.

To use this Web service, you must create a table to hold symbols representing stocks:

```
1> create table stocksymbol(symbol varchar(100))
2> go
```

Insert data into the stocksymbol table:

```
1> insert stocksymbol values("SY")
2> insert stocksymbol values("ORCL")
3> go
```

Now create a view that invokes the GetQuote1 Web method:

```
1> CREATE VIEW getstockvw as
2> select Symbol = xmlextract('//Stock/Symbol/text()',outxml returns
varchar(5)),
3>   Name = xmlextract('//Stock/Name/text()',outxml returns varchar(20)),
4>   Time = xmlextract('//Stock/Time/text()',outxml returns varchar(10)),
```

```
5>   Date = xmlextract('//Stock/Date/text()',outxml returns date),
6>   High = xmlextract('//Stock/High/text()',outxml returns decimal(15,2)),
7>   Low = xmlextract('//Stock/Low/text()',outxml returns decimal(15,2))
8> FROM GetQuote1 ,stocksymbol
9> WHERE _inxml = '<GetQuote1
xmlns="http://www.webserviceX.NET/"><symbol>'+symbol+'</symbol></GetQuote1
>'
10> go
```

Select from the getstockvw view to view output from the GetQuote1 method:

```
1> select * from getstockvw
2> go
```

The results for the previous select display quote information for the parameters specified by the view definition:

```
Symbol   Name            Time      Date           High     Low
-------  -------------   -------   ------------   ------   ------
SY       SYBASE INC      4:01pm    Jul 21 2005    21.60    19.91
ORCL     ORACLE CORP     4:00pm    Jul 21 2005    14.05    13.54
MSFT     MICROSOFT CP    4:00pm    Jul 21 2005    26.48    26.19

(3 rows affected)
```

Using user-defined Web services

This section describes functionality specific to user-defined Web services and covers the following topics:

- Commands for user-defined Web services
- Using sp_webservices with user-defined Web services
- Security for user-defined Web services
- Auditing for user-defined Web services

Commands for user-defined Web services

You can create, drop, and alter user-defined Web services using the following commands:

- create service
- drop service

create service

The create service command wraps the supplied SQL statement in a stored procedure with the specified name and parameters. Except for the following differences, the resulting stored procedure behaves the same as a stored procedure created with the create procedure command, follows existing stored procedure rules for execution, replication, sp_helptext, and recompilation, and is executable from isql:

- The resulting stored procedure can be dropped only with the drop service command, not the drop procedure command.
- The syscomments table is populated with DDL necessary to recreate the create service command.
- The specified service name may not create a stored procedure group.

Note To make a user-defined Web service available through the ASE Web Services Engine, you must use the deploy option of sp_webservices. However, the stored procedure for a user-defined Web service is accessible from isql, even if it has not been deployed. For information on the deploy option of sp_webservices, see "deploy" on page 48 in "Using sp_webservices."

Syntax

```
create service service-name [secure security_options ] [, userpath path]
        [, alias alias-name]
    type { xml | raw | soap }
    [[(@parameter_name datatype [(length ) | (precision  [, scale ])]
        [= default][output]
    [, @parameter_name datatype [(length ) | (precision  [, scale ])]
        [= default][output]]...[)]]
as SQL_statements

security_options ::= (security_option_item [security_option_item])
```

Parameters

- *service-name* – the name for the user-defined Web service. This name can be any name that is valid for a stored procedure. When the drop service command is invoked with this service name, the corresponding stored procedure is dropped. If you specify the name of an existing service, an exception results.
- *security_option_item* – either clear or ssl:
  - clear indicates that HTTP is used to access this Web service.
  - ssl indicates HTTPS is used to access this Web service
- *path* – a character-string literal specifying the user-defined path to be appended to the URL accessing the Web service. This path is null by default.
- *alias-name* – a character-string-literal specifying the user-defined Web service alias.
- *parameter_name* – the name of an argument to the user-defined Web service. The value of this parameter is supplied when the Web service is executed. Parameter names must be preceded by the @ sign and conform to the rules for identifiers. These conditions are the same as for the *parameter_name* parameter of the create procedure command.
- *SQL_statements* – the actions the user-defined Web service is to take. Any number and kind of SQL statements can be included, with the exception of create view, create default, create rule, create procedure, create trigger, and use. These conditions are the same as for the *SQL_statements* parameter of the create procedure command.
- type – can be soap, raw, or xml:
  - soap implies an HTTP POST request and must be compliant with all the SOAP rules. The data is returned in SQL/XML format.
  - raw indicates that the output is to be sent without any alteration or reformatting. This implies an HTTP GET request. The invoked stored procedure can specify the exact output.

- xml indicates that the result set output is returned in SQL/XML format. This implies an HTTP GET request.

Note For datatype mappings between ASE stored procedures and SOAP user-defined Web services, see "ASE-to-SOAP datatype mappings for the create service command" in Appendix C, "SOAP and Adaptive Server Enterprise Datatype Mapping."

Example 1

In this example, a user-defined Web service, rawservice, of type raw is created to return the version of the current database. The create service command is entered from the isql command line for the pubs2 database:

```
1> use pubs2
2> go
1> create service rawservice type raw as select
'<html><h1>' + @@version + '</h1></html>'
2> go
```

The newly created user-defined Web service must then be deployed:

```
1> sp_webservices 'deploy', 'all'
2> go
```

For example, if the sample file is named *testraw.html* and it is copied to *$SYBASE/WS-15_0/producer* (*%SYBASE%\WS-15_0\producer* on Windows), you can access the page at https://myhost:8182/testraw.html, where the *username*, *password*, and *database* are bob, bob123, and pubs2, respectively. Click "Access rawservice" to display the result.

Note For details on the deploy option for sp_webservices, see "Using sp_webservices with user-defined Web services" on page 47.

The WSDL for the newly created user-defined Web service can be found at the following URL:

```
https://myhost:8182/services/pubs2?wsdl
```

The output, an Adaptive Server Enterprise version string, is displayed in an HTML <h1> tag in the browser window:

```
<html>
   <head>
     <meta http-equiv="Content-Type" content="text/html; charset=windows-
1252">
     <title>Inovke version</title>
     <link rel="stylesheet" type="text/css" href="ws.css">
```

```
    </head>
    <body>
      <form method="POST" action=services>
        <p>Username: <input type="text" name="username"</p>
        <p>Password: <input type="text" name="password"</p>
        <p>Database: <input type="text" name="dboralias"</p>
        <p><input type="hidden" value="rawservice" name="method"</p>
        <p><input type="submit" value="Access rawservice" name="B2">
      </form>
    </body>
</html>
```

Example 2

In this example, a user-defined Web service, xmlservice, of type xml is created to return the version of the current database. The create service command is entered from the isql command line for the pubs2 database:

```
1> use pubs2
2> go
1> create service xmlservice userpath "testing" type xml
as select @@version
2> go
```

The newly created user-defined Web service must then be deployed:

```
1> sp_webservices 'deploy', 'xmlservice'
2> go
```

Note For details on the deploy option for sp_webservices, see "Using sp_webservices with user-defined Web services" on page 47.

The WSDL for user-defined Web service can be found at the following URL:

```
https://localhost:8182/services/pubs2/testing?wsdl
```

For example, if the HTML page is named *testxml.html*, and you copy the the HTML file to *$SYBASE/WS-15_0/producer* (*%SYBASE%\WS-15_0\producer* on Windows). Access the page at https://myhost:8182/testxml.html and input these parameters:

- bob – the user ID
- bob123 – the password
- pubs2/testing – the database

Click "Retrieve Version" to display the result.

```
<html>
  <head>
```

```
    <meta http-equiv="Content-Type" content="text/html; charset=windows-
1252">
    <title>Inovke version</title>
    <link rel="stylesheet" type="text/css" href="ws.css">
   </head>
   <body>
    <form method="POST" action=services>
      <p>Username: <input type="text" name="username"</p>
      <p>Password: <input type="text" name="password"</p>
      <p>Database: <input type="text" name="dboralias"</p>
      <p><input type="hidden" value="xmlservice" name="method"</p>
      <p><input type="submit" value="Retrieve Version" name="B1">
    </form>
   </body>
</html>
```

Example 3

In this example, a user-defined Web service is made available to a SOAP client to execute the stored procedure sp_who. One argument is supplied, and the optional userpath token is specified:

```
create service sp_who_service userpath
'myservices/args' type soap @loginname varchar(30) as
exec sp_who @loginname
```

The Web service is created as sp_who_service in the pubs2 database and, after being deployed, it is accessible at the following URL:

```
http://localhost:8181/pubs2/myservices/args/sp_who_service
```

The WSDL for the service is available at the following URL:

```
http://localhost:8181/pubs2/myservices/args?wsdl
```

The signature for the Web method, described in the WSDL file, is as follows:

```
DataReturn[] sp_who_service (xsd:string username,
xsd:string password, xsd:string loginname)
```

The new service is invoked by a SOAP client with one parameter, loginname, of type varchar(30).

drop service

The drop service command removes a user-defined Web service from the current database. Both the metadata and the corresponding stored procedure are removed.

Note You must undeploy a user-defined Web service before you can drop it. For details on the undeploy option for sp_webservices, see "Using sp_webservices with user-defined Web services" on page 47.

Syntax

drop service *service-name*

Parameters

- *service-name* – the name for the user-defined Web service. This name can be any name that is valid for a stored procedure. If you specify the name of an service that does not exist, an exception results. Also, you cannot drop a service that is currently in use by another session.

Example

This example drops the user-defined Web service named sp_who_service:

```
drop service sp_who_service
```

Using sp_webservices with user-defined Web services

The following sp_webservices options are used for user-defined Web services:

- addalias – creates a database alias.
- deploy – deploys a user-defined Web service.
- dropalias – drops a database alias.
- listudws – lists the proxy tables mapped to a WSDL file.
- listalias – lists a database alias or aliases.
- undeploy – undeploys a user-defined Web service.

addalias

The add alias option is used to create an alias representing a database name.

Syntax

```
sp_webservices 'addalias' alias_name , database_name
```

Parameters

- *alias_name*

The alias for the specified database. This parameter is required. If you define an alias name for a specific database, the producer displays the alias name instead of the database name. If you have not defined an alias name, Webservices uses dboralias as the database name.

- *database_name*

  The name of the database for which the alias is specified. This parameter is required.

Examples

Adds marketing_alias as the alias name for database marketing_db:

```
sp_webservices 'addalias', marketing_alias,
marketing_db
```

Usage

An alias provides greater control in specifying the portion of the URL representing the database name. Used with the userpath option of the create service command, an alias provides complete control over the URL used to access a user-defined Web service.

deploy

The deploy option is used to deploy a user-defined Web service, making it accessible to the ASE Web Services Engine through HTTPS.

Note Only HTTP POST requests are supported to access deployed services because these commands embed all arguments within the URL for GET HTTP requests, which cannot be encrypted. You must enable HTTPS to encrypt the HTTP POST request.

Syntax

sp_webservices 'deploy', ['all' | '*service_name*']

Parameters

- all

  Specifies that all user-defined Web services are to be deployed for the current database.

- *service_name*

  The name of the user-defined Web service to be deployed.

Usage

The deploy and undeploy options are used to control when user-defined Web services are available. The webservices_role privilege is required for this option.

If the all parameter is specified, the ASE Web Services Engine deletes its internal cache of user-defined Web services and rereads all metadata about user-defined Web services from Adaptive Server Enterprise.

Note You cannot drop or rename a user-defined Web service that is currently deployed.

dropalias

The dropalias option is used to drop an alias representing a database name.

Syntax

```
sp_webservices 'dropalias' alias_name
```

Parameters

- *alias_name*

  The alias to be dropped.

Example

Drops the marketing_alias alias:

```
sp_webservices 'dropalias', marketing_alias
```

Usage

An alias cannot be dropped if it is being referenced by a deployed user-defined Web service. To drop the alias, you must first undeploy the user-defined Web service that references the alias.

listudws

The listudws option is used to list user-defined Web services for the current database.

Syntax

```
sp_webservices 'listudws' [, 'service_name']
```

Parameters

- *service_name*

  The name of the user-defined Web service to be listed.

Usage

If the *service_name* parameter is not specified, all user-defined Web services are listed.

listalias

The listalias option is used to list all aliases.

Syntax

```
sp_webservices 'listalias'
```

Usage

All aliases are listed.

undeploy

The undeploy option is used to make a user-defined Web service inaccessible to the ASE Web Services Engine through HTTPS.

Syntax

```
sp_webservices 'undeploy', ['all' | 'service_name']
```

Parameters

- all

  Specifies that all user-defined Web services are to be undeployed for the current database.

- *service_name*

  The name of the user-defined Web service to be undeployed.

Usage

The deploy and undeploy options are used to control when user-defined Web services are available. The webservices_role privilege is required for this option.

Security for user-defined Web services

The system role webservices_role has been added to Adaptive Server Enterprise for the Web Services feature. This role is required to use the deploy and undeploy options for sp_webservices. To execute a user-defined Web service, a valid login and permissions to execute the corresponding stored procedure are required.

To create, drop, and execute user-defined Web services, you need the same privileges as are necessary to create, drop, and execute stored procedures in Adaptive Server Enterprise. See the Adaptive Server Enterprise *Security Administration Guide* for details on how to set the proper privileges using the grant and revoke commands.

Note For the most current information on security in ASE Web Services, see the Adaptive Server Enterprise *Release Bulletin*.

Auditing for user-defined Web services

User-defined Web services are modeled as stored procedures within Adaptive Server Enterprise. In manipulating user-defined Web services, Adaptive Server Enterprise generates the following events using the existing auditing coverage

for stored procedures:

- The creation of a user-defined Web service – Event 11 named "Create Procedure" is generated
- The dropping of a user-defined Web service – Event 28 named "Drop Procedure" is generated
- The execution of a user-defined Web service – Event 38 named "Execution of Stored Procedure" is generated

For detailed information on existing auditing functionality, see the Adaptive Server Enterprise *Security Administration Guide*.

In addition to existing auditing functionality, Adaptive Server Enterprise provides two audit events for the deploy and undeploy options of sp_webservices.

Audit records are stored in the sysaudits system table. You can enable auditing for Web services with the following command:

```
sp_audit "security", "all", "all", "on"
```

Auditing sp_webservices 'deploy'

Audit event number 110 corresponds to the deploy option of sp_webservices.

Example 1

This example shows an audit table entry for the following command entered in the pubs2 database by the user bob:

```
sp_webservices 'deploy', 'all'
```

The corresponding audit table entry lists 110, bob, and pubs2 as values in the event, loginname, and dbname columns, respectively. The extrainfo column contains the following:

```
webservices_role; deploy_all; ; ; ; ; bob/ase;
```

Example 2

This example shows an audit table entry for the following command entered in the pubs2 database by the user bob:

```
sp_webservices 'deploy', 'rawservice'
```

The corresponding audit table entry lists 110, bob, and pubs2 as values in the event, loginname, and dbname columns, respectively. The extrainfo column contains the following:

```
webservices_role; deploy; ; ; ; ; bob/ase;
```

For a full description of sysaudits table columns, see the Adaptive Server Enterprise *Security Administration Guide*.

Auditing sp_webservices 'undeploy'

Audit event number 111 corresponds to the undeploy option of sp_webservices.

Example 1

This example shows an audit table entry for the following command entered in the pubs2 database by the user bob:

```
sp_webservices 'undeploy', 'all'
```

The corresponding audit table entry lists 111, bob, and pubs2 as values in the event, loginname, and dbname columns, respectively. The extrainfo column contains the following:

```
webservices_role; undeploy_all; ; ; ; ; bob/ase;
```

Example 2

This example shows an audit table entry for the following command entered in the pubs2 database by the user bob:

```
sp_webservices 'undeploy', 'rawservice'
```

The corresponding audit table entry lists 111, bob, and pubs2 as values in the event, loginname, and dbname columns, respectively. The extrainfo column contains the following:

```
webservices_role; deploy; ; ; ; ; bob/ase;
```

For a full description of sysaudits table columns, see the Adaptive Server Enterprise *Security Administration Guide*.

ASE Web Services logging

By default, ASE Web Services logs only informational and error messages. For details on how to log more detailed information, contact Sybase Technical Support.

ASE Web Services logs activity in these logs:

- *webservice.log* – contains information and error messages for the Web Services producer and consumer.
- *http.log* – contains all HTTPS requests in the NCSA Request Log format. An HTTPS request exists for each Web method invoked

Rolling over log files

Logging is implemented in ASE Web Services using the Apache log4j framework. For information on specific log4j parameters and implementing a rollover policy, see the Apache Web site at http://jakarta.apache.org/log4j/docs/.

Using Sybase Central

The Sybase Central plug-in for ASE Web Services enables you to perform the following tasks:

- Configure Web Services from Sybase Central
- Consume a Web service
- Execute a Web service
- Delete a Web method
- Add a user-defined Web service
- Add an alias
- Display properties for a Web method

For details, refer to the online help for ASE Web Services in Sybase Central.

CHAPTER 5

Sample Applications

This chapter discusses the following:

Tools are provided under the *samples* directory to create and run sample clients. This chapter documents sample applications provided for the ASE Web Services Engine.

Apache sample client

This section describes the sample client and script found in the *$SYBASE/WS-15_0/samples/apacheclient* directory in UNIX, or in the *%SYBASE%\WS-15_0\samples\apacheclient* directory in Windows.

Note If you intend to run the Apache sample client on a machine other than the one on which ASE Web Services is installed, you must copy the contents of the */apacheclient/lib* directory to that machine.

Creating the sample client

To use the sample script provided, you must first create the sample client.

Make sure the JRE variable points to your JRE by changing, if necessary, the variable definitions in all scripts in the *apacheclient* directory. You must use JRE version 1.4.2 or later. By default, the JRE supplied in the UNIX *$SYBASE_JRE* or Windows *%SYBASE_JRE%* directory is used.

Once you have created an ASE Web Services client, you can run the sample script to execute stored procedures and SQL statements. This script can be found in the *apacheclient* directory.

Using runexecute

The *runexecute* script executes a stored procedure or Transact-SQL statement on Adaptive Server Enterprise through ASE Web Services. This sample application invokes the execute Web method.

Syntax

runexecute "*web_service_URL*" *aseServerName user_ID password* "*SQLX_option*" *output_class count* "*sql_statement*"

Parameters

- *web_service_URL*

  The location of the Web service being used.

- *aseServerName*

  SOAP string indicating the name of the Adaptive Server Enterprise server in the *interfaces* file or LDAP server.

- *user_ID*

  The user ID needed to log in to the Adaptive Server Enterprise.

- *password*

  The password needed to log in to the Adaptive Server Enterprise.

- *SQLX_option*

  String indicating one or more option parameters. These parameters specify characteristics of the SQLX result set. The following are valid option parameters:

  - binary={hex | base64}
  - columnstyle={element | attribute}
  - format={yes | no}
  - header={yes | no}
  - nullstyle={attribute | omit}
  - prefix="*value*"
  - root={yes | no}
  - rowname="*value*"
  - schemaloc="*value*"
  - statement={yes | no}
  - tablename="*value*"
  - targetns="*value*"

You must provide values for *value*. For more information on SQLX functions and options, see *XML Services in Adaptive Server Enterprise*.

- *output_class*

  The kind of output desired. The following are valid values for this parameter:

  - schema – returns an XML schema.
  - dtd – returns an XML DTD.
  - data – returns a result set.
  - all – returns schema, DTD, and data.

- *count*

  The number of times to execute the statement. If the value of count is greater than 1, a session is created, and a persistent connection is used.

- *sql_statement*

  The statement to be executed on Adaptive Server Enterprise. This statement must be delimited by double quotes.

Example 1

This example checks the version number for Adaptive Server Enterprise using a select statement.

```
runexecute "http://johndoe-sun:8183/services/ase"
johndoe-sun sa nopasswordspecified "tablename=ws" all 1
"select @@version"
```

ASE Web Services returns an XML schema, a DTD, and a result set containing the result of the executed statement.

Example 2

This example executes a stored procedure called booksales on the pubs2 database. The stored procedure returns the number of copies sold for a specified book title ID.

```
runexecute "http://johndoe-sun:8183/services/ase"
johndoe-sun sa nopasswordspecified
"columnstyle=attribute,format=no,rowname=wsrow,prefix=
Unnamedcol,nullstyle=attribute,header=yes" all 1
"execute booksales MC2222"
```

ASE Web Services returns an XML schema, a DTD, and a result set containing the result of the executed statement.

This is the result set returned:

```
<?xml version="1.0" ?>
<resultset
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<wsrow title="Silicon Valley Gastronomic Treats"
total_sales="2032" Unnamedcol1="Books sold"/>
</resultset>
```

This is the DTD returned:

```
<!DOCTYPE ws [
<!ELEMENT resultset (row*)>
<!ELEMENT row (title, total_sales, Unnamedcol1)>
<!ELEMENT title (#PCDATA)>
<!ELEMENT total_sales (#PCDATA)>
<!ELEMENT Unnamedcol1 (#PCDATA)>
]>
```

This is the schema returned:

```
<?xml version="1.0" ?>
<xsd:schema
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:sqlxml="http://www.iso-standards.org/mra/9075/
sqlx">
 <xsd:import
  namespace="http://www.w3.org/2001/XMLSchema"
  schemaLocation="http://www.iso-standards.org/mra/
9075/sqlx.xsd" />
 <xsd:complexType
  name="RowType.resultset">
  <xsd:attribute name="title"
   type="VARCHAR_80" use="required"/>
  <xsd:attribute name="total_sales" type="INTEGER"
   use="optional"/>
```

```
 <xsd:attribute name="Unnamedcol1"
  type="VARCHAR_24" use="optional"/>
</xsd:complexType>
<xsd:complexType
 name="TableType.resultset">
 <xsd:sequence>
  <xsd:element name="wsrow"
   type="RowType.resultset"  minOccurs="0"
   maxOccurs="unbounded"/>
 </xsd:sequence>
</xsd:complexType>
<xsd:simpleType name="VARCHAR_80">
 <xsd:restriction base="xsd:string">
 <xsd:maxLength value="80"/>
 </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="INTEGER">
 <xsd:restriction base="xsd:integer">
  <xsd:maxInclusive value="2147483647"/>
  <xsd:minInclusive value="-2147483648"/>
 </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="VARCHAR_24">
 <xsd:restriction base="xsd:string">
  <xsd:maxLength value="24"/>
 </xsd:restriction>
  </xsd:simpleType>
<xsd:element name="resultset"
 type="TableType.resultset"/>
</xsd:schema>
```

Example 3

This example executes a SQL query on the pubs2 database. The query returns the last names and cities of residence for authors who do not live in the same city as their publisher.

```
runexecute "http://johndoe-sun:8183/services/ase"
johndoe-sun sa nopasswordspecified
"tablename=ws,header=yes,schemaloc='http://www-
edm/remote/svr/xmltestdir/resultset.xsd',targetns='htt
p://www-edm/remote/svr/xmltestdir/'" data 1 "select
distinct au_lname, authors.city from publishers,
authors where authors.city not in (select city from
publishers where authors.city = publishers.city)"
```

ASE Web Services returns a result set containing the result of the executed statement.

Microsoft .NET sample client

This section describes the sample client and script found in the *$SYBASE/WS-15_0/samples/ms.net/Execute/bin/Release* directory in UNIX, or in the *%SYBASE%\WS-15_0\samples\ms.net\Execute\bin\Release* directory in Windows.

Downloads for Microsoft .NET can be found at the following URL:

http://msdn.microsoft.com/library/default.asp?url=/downloads/list/netdevframework.asp

Note This URL is current as of the date of publication for this document but may change over time.

Creating the sample client

To use the sample script provided, you must first create the sample client. Once you have created the sample client, you can run the sample script documented in this section. This script can be found in the *Release* directory.

Using Execute.exe

Execute.exe executes a stored procedure or Transact-SQL statement on Adaptive Server Enterprise through ASE Web Services. This sample application invokes the execute Web method.

Syntax

Execute.exe "*web_service_URL*" *aseServerName user_ID password* "*SQLX_option*" *output_class count* "*sql_statement*"

Parameters

- *web_service_URL*

  The location of the Web service being used.

- *aseServerName*

  SOAP string indicating the name of the Adaptive Server Enterprise server in the *sql.ini* file or LDAP server.

- *user_ID*

  The user ID needed to log in to the Adaptive Server Enterprise.

- *password*

The password needed to log in to the Adaptive Server Enterprise.

- *SQLX_option*

  String indicating one or more option parameters. These parameters specify characteristics of the SQLX result set. The following are valid option parameters:

  - binary={hex | base64}
  - columnstyle={element | attribute}
  - format={yes | no}
  - header={yes | no}
  - nullstyle={attribute | omit}
  - prefix="*value*"
  - root={yes | no}
  - rowname="*value*"
  - schemaloc="*value*"
  - statement={yes | no}
  - tablename="*value*"
  - targetns="*value*"

  You must provide values for *value*. For more information on SQLX functions and options, see *XML Services in Adaptive Server Enterprise*.

- *output_class*

  The kind of output desired. The following are valid values for this parameter:

  - schema - returns an XML schema.
  - dtd - returns an XML DTD.
  - data - returns a result set.
  - all - returns schema, DTD, and data.

- *count*

  The number of times to execute.

- *sql_statement*

The statement to be executed on Adaptive Server Enterprise. This statement must be delimited by double quotes.

Example 1

This example checks the version number for Adaptive Server Enterprise.

```
Execute.exe "http://johndoe-sun:8183/services/ase"
johndoe-sun sa nopasswordspecified "tablename=ws" all 1
"select @@version"
```

ASE Web Services returns an XML schema, a DTD, and a result set containing the result of the executed statement.

Example 2

This example executes a stored procedure called booksales on the pubs2 database. The stored procedure returns the number of copies sold for a specified book title ID.

```
Execute.exe "http://johndoe-sun:8183/services/ase"
johndoe-sun sa nopasswordspecified
"columnstyle=attribute,format=no,rowname=wsrow,prefix=
Unnamedcol,nullstyle=attribute,header=yes" all 1
"execute booksales MC2222"
```

ASE Web Services returns an XML schema, a DTD, and a result set containing the result of the executed statement.

Example 3

This example executes a SQL query on the pubs2 database. The query returns the last names and cities of residence for authors who do not live in the same city as their publisher.

```
Execute.exe "http://johndoe-sun:8183/services/ase"
johndoe-sun sa nopasswordspecified
"tablename=ws,header=yes,schemaloc='http://www-
edm/remote/svr/xmltestdir/resultset.xsd',targetns='htt
p://www-edm/remote/svr/xmltestdir/'" data 1 "select
distinct au_lname, authors.city from publishers,
authors where authors.city not in (select city from
publishers where authors.city = publishers.city)"
```

ASE Web Services returns a result set containing the result of the executed statement.

CHAPTER 6

Troubleshooting

This chapter discusses the following:

Troubleshooting issues

The following are issues that can assist you in troubleshooting ASE Web Services.

Remote server class definition setting

Issue

The sp_webservices add command may return the following error when generating proxy tables:

```
Warning: Row size (3347 bytes) could exceed row size limit, which is 1962
bytes.
Msg 208, Level 16, State 1:
Server 'JMALVARADO', Line 1:
tempdb..ws_4338e6e122cd4ef0a not found. Specify owner.objectname or uses to
check whether the object exists (sp_help may produce lots of output).
No proxy tables were created for the WSDL URL:
[http://www.xignite.com/xquotes.asmx?WSDL]
(return status = 0)
```

This error occurs because the remote server representing the ASE Web Services Engine has been added using sp_addserver with a class other than “sds.” To verify that this is so, use sp_helpserver in isql:

```
sp_helpserver ws
```

Here, *ws* is the name of the ASE Web Services Engine. This is the default. The remote server class is returned in the indicated column of the result:

```
name network_name class ...
---- ------------ ----- ...
ws   ws           null  ...
```

User action — Change the class of the remote server to “sds” by using sp_dropserver and sp_addserver in isql:

```
sp_dropserver ws_name
...
sp_addserver ws_name, sds, ws_name
```

Here, *ws_name* is the name chosen for the ASE Web Services Engine.

Unmapped RPC/encoded Web method

Issue — If an RPC/encoded Web method has no input or output parameters, it cannot be mapped to a proxy table. A proxy table for a Web method without parameters would have no columns. A table with no columns cannot be created in Adaptive Server Enterprise.

User action — Modify the Web method to include an input or output parameter.

Issue — Only simple types are mapped to columns. Complex types or arrays used in RPC/encoded Web methods result in the Web method not being mapped to a proxy table.

User action — Modify the Web method to use only simple types and arrays.

Truncated document/literal results

Issue — If a Web service returns more data than the value of the @@textsize global variable, the data is truncated to the size specified by @@textsize. Consequently, the data returned may not form a valid XML document.

User action — No error is raised because this is the expected behavior for Adaptive Server Enterprise when text or image data is truncated with a select command. However, a warning is logged for the ASE Web Services Engine, so check your *consumer.log* file.

Starting ASE Web Services Engine

Issue — The *runws* script does not successfully start a ASE Web Services Engine.

User action

1 Make sure the port you are attempting to use is not already in use by another process.

2 Make sure you have the correct JRE installed. ASE Web Services requires JRE 1.4.2 or later.

   To check your JRE version, enter the following at your command prompt:

```
java -version
```

3 If you want Web Services to run with a properties file other than *ws.properties*, you must specify the absolute path for the file. For example, to run the ASE Web Services Engine with a different properties file:

```
C:\sybase\WS-15_0\bin\runws -f
C:\sybase\WS-15_0\props\myfile.properties
```

Issue

The ASE Web Services Engine finds the specified *ase_service_name* in the *interfaces* file, but the *producer.log* shows the following error messages:

```
INFO [main] - Error locating libtcl.cfg file.
INFO [main] - java.io.FileNotFoundException: LDAP
config File does not exist
```

Locating WSDL

Issue

A client connecting to the ASE Web Services Engine through a Web browser cannot find the WSDL file, or the ASE Web Services Engine cannot find the WSDL file to perform proxy-table mapping.

User action

Verify that the ASE Web Services Engine is running. If you are using the ASE Web Services Engine through a browser, make sure the browser URL indicates `https://` for an SSL connection and `http://` for a standard connection.

Specifying entries in ws.properties

Issue

Because the backslash (\) symbol is used as an escape character, entries that use single backslash symbols are not interpreted correctly. For example:

```
com.sybase.ase.ws.interfaces = d:\sybase\ini\sql.ini
```

User action

Escape the backslash with another backslash:

```
com.sybase.ase.ws.interfaces = d:\\sybase\\ini\\sql.ini
```

You can also use forward slashes:

```
com.sybase.ase.ws.interfaces = d:/sybase/ini/sql.ini
```

Windows NT command-line arguments

Issue

Scripts do not run on Windows NT when no space is placed between arguments and argument values. For example, the following invocation of the *configssl* script will not execute the script:

```
configssl -dhostname
```

User action

Place a space between an argument and its value:

```
configssl -d hostname
```

Run or stop scripts fail

Issue

The *runws* or *stopws* script fails to execute.

User action

If either of these scripts fail to execute, do the following:

- Verify that your Adaptive Server Enterprise is running.
- Make sure that the user name and password you specified are valid to log in to your Adaptive Server Enterprise.
- Check the *producer.log* or *consumer.log* file for any error messages.
- Verify that the *ase_service_name* provided can be found on an LDAP server pointed to by the *libtcl.cfg* file or in the *interfaces* file for Adaptive Server Enterprise.

  Note On Windows systems, the *interfaces* file is named *sql.ini*.

- Verify that the user name has *sa_role* privileges.

Null passwords

Issue

The password for an Adaptive Server Enterprise user may be set to a null string.

User action

Use the token `nopasswordspecified` anywhere the password is required, including the *runws* and *stopws* scripts.

Specifying SOAP endpoints with SSL

Issue

ASE Web Services methods or sample applications do not return results with the *aseServerName* specified at invocation.

User action

Make sure the *aseServerName* name is a valid SOAP endpoint. If you are using a DNS alias, make sure the alias resolves to a valid SOAP endpoint. If you are using SSL, make sure the endpoint specified by *aseServerName* is the same name you supplied in creating an SSL certificate with the *configssl* script. For example:

```
configssl -d mydomainhostname -h 8182
```

Here, the value of *aseServerName* supplied when invoking an ASE Web Services method or sample application must be "https://mydomainhostname:8182". The method or sample application will not return results if you substitute "localhost" or an IP address for *aseServerName* when using SSL.

Abnormal termination of sp_webservices 'add'

Issue

Proxy tables created during execution of the sp_webervices 'add' option remain after an abnormal termination of sp_webservices, as with a Ctrl+C interrupt or an Adaptive Server Enterprise crash.

User action

Use the remove option to delete any proxy tables created by the add option when sp_webservices terminated abnormally.

Web Services proxy table restrictions

Issue

A proxy table with the same name as a Web Services proxy table generated through execution of the add option of sp_webservices may be erroneously designated as a Web Services proxy table. Joins are processed for Web Services proxy tables differently than joins for regular proxy tables.

User action

Confine Web Services proxy tables to a unique database.

Issue

The reserved word or is not supported in the where clause for a query involving Web Services proxy tables. This may result in errors for queries that are translated internally into queries that use the reserved word or. For example, the following query selects from the Web Services proxy table testint:

```
select * from testint where _in0 in (1, 2)
```

This query is translated internally into the following:

```
select * from testint where _in0 = 1 or _in0 = 2
```

Because the internal translation uses the reserved word or, the user-submitted query results in an error.

User action

Alter the query so that its internal translation does not use the reserved word or. For example, the user-submitted query just described can be altered with the use of temporary tables:

```
create table a (col int)
insert into a values (1)
insert into a values (2)
select * from testint where _in0 in (select col from a)
```

sysattributes table entry

Issue

The following error occurs when sp_webservices 'add' is executed:

```
Msg 5629, Level 16, State 1:
Line 1:
Cannot start a remote distributed transaction
participant as the local server is not named. Please
contact a user with System Administrator role.
```

User action

You must have an entry for your Adaptive Server Enterprise in the sysattributes table. To provide an entry, use the sp_addserver stored procedure:

```
sp_addserver ase_entry, local, ase_entry
```

where *ase_entry* is the local name for your Adaptive Server Enterprise from your *interfaces* or *sql.ini* file. Then, restart Adaptive Server Enterprise.

Diagnostic tools

ASE Web Services provides detailed logging for diagnostics and JDBC-level tracing to help identify connectivity problems.

Detailed logging

To enable detailed logging for diagnostics, modify the *logging.properties* file in the *props* directory as appropriate, and then restart the ASE Web Services Engine.

The following is an example of the content of the *logging.properties* file as it is delivered with ASE Web Services:

```
# Set logging level for ASE Web Services Consumer
log4j.logger.com.sybase.ase.ws.sds=INFO, C
#log4j.logger.com.sybase.ase.ws.sds=DEBUG, C
log4j.additivity.com.sybase.ase.ws.sds=false

# Set logging level for ASE Web Services Producer
log4j.logger.com.sybase.ase.ws.producer=INFO, P
#log4j.logger.com.sybase.ase.ws.producer=TRACE, P
log4j.additivity.com.sybase.ase.ws.producer=false
```

For detailed, diagnostic logging, modify *logging.properties* as follows:

```
# Set logging level for ASE Web Services Consumer
#log4j.logger.com.sybase.ase.ws.sds=INFO, C
log4j.logger.com.sybase.ase.ws.sds=DEBUG, C
log4j.additivity.com.sybase.ase.ws.sds=false

# Set logging level for ASE Web Services Producer
#log4j.logger.com.sybase.ase.ws.producer=INFO, P
log4j.logger.com.sybase.ase.ws.producer=TRACE, P
log4j.additivity.com.sybase.ase.ws.producer=false
```

Enabling JDBC-level tracing

To enable JDBC-level tracing, refer to the appropriate jConnect documentation.

Messages

Table 6-1 lists messages for ASE Web Services.

Table 6-1: ASE Web Services messages

Message number	Message text
15200	No web methods mapped to proxy tables for the WSDL URI [%s].
15201	WSDL URI in most cases has the suffix ?WSDL. Please verify WSDL URI.
15202	Web Method [%s] not mapped to proxy table because of unsupported datatype.
15203	Received request to execute an unknown procedure [%s].
15204	Caught IOException. This usually indicates an error in communications between ASE and the ASE Web Services Engine.\nDetails: [%s].
15205	Caught SQLException. This usually indicates an error retrieving meta data from ASE.\nDetails: [%s].
15206	Caught an Unknown Exception: Details: [%s].
15207	Caught Remote Web Method Exception (AxisFault). This indicates an error in the remote web method.\nDetails: [%s].
15208	Caught Mapping Exception. This indicates an error in mapping the web method arguments to ASE types.\n Details: [%s].
15209	Caught Service Exception. This usually indicates an incorrect WSDL file.\n Details: [%s].
15210	Received XML input to the webmethod that was is not well formed.
15211	Error in invoking web method (MalformedURL) Details: [%s].
15212	Caught RemoteException. This usually indicates an error in the network transmission.\n Details: [%s].
15213	Error in invoking web method (Unknown Exception): Details [%s].
15214	Aborting invocation of web method [%s] from proxy table [%s] because the web method expects [%s] arguments and [%s] were received.
15215	Parameter count/type mismatch. Check the number and types of the parameters passed to the built-in function, ws_admin.
15220	A user-defined Web service by that name already exists.
15221	Cannot drop alias when it is being referenced by a service.
15216	Unknown operation, '%.*s', specified to built-in function ws_admin. Check parameter spelling and placement.
15217	Failure during update/insert/delete from sysattributes.
15218	Cannot retrieve current database name.
15219	Cannot retrieve object ID for '%.*s'.
19307	Generating proxy tables using sds [%1!] for WSDL URI: [%2!].
19308	Found WSDL Match for [%1!].
19309	The WSDL URI [%1!] was not found in the system.

Message number	Message text
19310	Updating timeout entries for WSDL URI [%1!] with [%2!].
19311	Removing all web service meta data....
19312	Deleting entries for WSDL URI [%1!].
19313	To remove a webservice, a valid SDS server must be supplied. The SDS server [%1!] was not found. Please use sp_addserver to add the SDS server.
19319	To add a webservice, a valid SDS server must be supplied. \n The SDS server [%1!] was not found. \nPlease use sp_addserver to add the SDS server.
19320	Verify that the ASE Web Services Engine is running.
19321	To add a webservice, a valid WSDL URI must be specified.
19322	The WSDL URI [%1!] specified is already in the system. \n Please use sp_webservices remove first.
19323	To list information about a webservice not loaded in the system, a SDS server must be supplied. The SDS server [%1!] was not found. \n Please use sp_addserver to add the SDS server.
19324	Must specify a specific wsdl uri to modify.
19325	Must specify something to change for modify.
19326	[%1!] is not a valid option for sp_webservices modify.
19327	Must specify item=value syntax for modify.
19408	Cannot drop alias because it does not exist.
19409	Specify the name of the alias to add.
19410	Specify the database name associated with this alias.
19412	Cannot rename a deployed service.

For help information for sp_webservices, enter sp_webservices help at the isql command line.

APPENDIX A

Installation Contents

This appendix describes the contents of the ASE Web Services installation.

ASE Web Services directory tree

ASE Web Services is installed at the same level as the root directory for Adaptive Server Enterprise. The ASE Web Services root directory is named *WS-15_0* and consists of these subdirectories:

Table A-1: ASE Web Services directories

Directory name	Contents
bin	Scripts for configuring and running ASE Web Services.
lib	Java libraries and packages used by ASE Web Services.
logs	Default location for log files.
producer	Files and subdirectories for ASE Web Services Engine at runtime.
props	Files for ASE Web Services properties.
samples	Sample scripts for building and running a sample client with the ASE Web Services Engine.

Table A-2 describes the contents of the bin directory.

Table A-2: bin directory contents

File/Directory name	Function
configssl	Configures SSL.
getpass.exe	Used for Adaptive Server Enterprise login. This file is only available on Windows.
installws	Installs sp_webservices stored procedure.
runtcpmon	Creates a monitor to trace SOAP messages.
runws	Starts the ASE Web Services Engine.
stopws	Stops the ASE Web Services Engine.

Note The Windows versions of these files have a *.bat* suffix.

Table A-3 describes the contents of the *lib* directory.

Table A-3: lib directory contents

File/Directory name	Function
axis.jar	Apache Axis file
commons-discovery.jar	Apache Axis file
commons-logging.jar	Apache Axis file
javax.servlet.jar	Servlet library
jaxrpc.jar	Apache Axis file
log4j-1.2.4.jar	log4j logger
mail.jar	Apache Axis file
org.mortbay.jetty.jar	HTTP server
saaj.jar	Apache Axis file
sqlx.jar	SQLX file
tools.jar	Java tools (for example, the javac compiler)
ws.jar	Code for ASE Web Services Engine
ws_debug.jar	Debugger Code for ASE Web Services Engine
wsdl4j.jar	Apache Axis file
xercesImpl.jar	Xerces parser
xmlParserAPIs.jar	Xerces parser

Table A-4 describes the contents of the *logs* directory.

Table A-4: logs directory contents

File/Directory name	Function
webservices.log	contains information and error messages for Web Services producers and consumers
http.log	Logs Web server activity.

Table A-5 describes the contents of the *producer* directory.

Table A-5: producer directory contents

File/Directory name	Function
index.html	Home page for the Web services browser interface.
keystore	Holds encryption keys.
ui	Directory structure for Web services browser interface.
WEB-INF	Directory structure required for Jetty.

File/Directory name	Function
wscertificate.cer	Auto-generated certificate for SSL. This file is present only the *configssl* script has been run.

Table A-6 describes the contents of the *props* directory.

Table A-6: props directory contents

Directory name	Function
logging.properties	Configuration file for log4j
ws.properties	All configuration parameters for ASE Web Services Engine
wsmsg.properties	Configuration file for messages

The samples directory contains precompiled and source code for both Apache and Microsoft .NET. You can use source code in your own applications. Table A-7 describes the contents of the *samples* directory.

Table A-7: samples directory contents

Directory name	Function
apacheclient	Directory containing sample scripts for compiling and running the sample client
ms.net	Directory containing samples for .NET

APPENDIX B

Configuration Properties

This appendix discusses the following:

ws.properties

The *ws.properties* file contains the following configuration settings for ASE Web Services.

Table B-1: ws.properties entries

`com.sybase.ase.ws.producer.httpport` Indicates the port on which the ASE Web Services Engine should listen for an HTTP connection. The default entry is `8181`.
`com.sybase.ase.ws.consumer.cisport` Indicates the port on which the ASE Web Services Engine should listen for TDS. The default entry is `8183`.
`com.sybase.ase.ws.logfilename` Indicates where the log file for the ASE Web Services Engine should be placed. The default location for UNIX is *$SYBASE/WS-15_0/logs/webservice.log*, or *%SYBASE%\WS-15_0\logs\webservice.log* for Windows.
`com.sybase.ase.ws.producer.jettylogfile` Indicates where the log file for HTTP requests should be placed. The default location is for UNIX is *$SYBASE/WS-15_0/logs/http.log*, or *%SYBASE%\WS-15_0\logs\http.log* for Windows.
`com.sybase.ase.ws.producer.jettylogRetainDays` Indicates the number of days the log is retained. The default is 90
`com.sybase.ase.ws.producer.jettylogAppend` Indicates whether you can append to the log file. The default is true.

`com.sybase.ase.ws.producer.jettylogExtended = false` Indicates whether to log more detailed information about external HTTP requests. The default is false.
`com.sybase.ase.ws.producer.jettylogTimeZone = GMT` Indicates the time zone in which the log is created. The default is GMT.
`com.sybase.ase.ws.interfaces` Indicates the location of the *interfaces* or *sql.ini* file for Adaptive Server Enterprise. The default location for UNIX is *$SYBASE/interfaces*, or *%SYBASE%\ini\sql.ini* for Windows.
`com.sybase.ase.ws.libtcl` Indicates the location of the *libtcl.cfg* file used to identify LDAP servers. The default location for 32-bit platforms for UNIX is *$SYBASE/$SYBASE_OCS/config/libtcl.cfg*, or *%SYBASE%\%SYBASE_OCS%\ini\libtcl.cfg* for Windows. The default location for 64-bit platforms for UNIX is *$SYBASE/$SYBASE_OCS/config/libtcl64.cfg*, or *%SYBASE%\%SYBASE_OCS%\ini\libtcl64.cfg* for Windows.
`com.sybase.ase.ws.maxpostsize` Determines the maximum size of an incoming SOAP request. The default entry is 20000.
`com.sybase.ase.ws.ui.activate` Determines whether the Web-based user interface is activated. The user interface is available at https://*hostname*:*https_port*. The default entry is true.
`com.sybase.ase.ws.producer.tuning.maxthreads` Indicates the maximum number of threads in the thread pool servicing the HTTP port. The default entry is 250.
`com.sybase.ase.ws.producer.tuning.minthreads` Indicates the minimum number of threads in the thread pool servicing the HTTP port. The default entry is 45.
`com.sybase.ase.ws.producer.tuning.maxidletime` Indicates the maximum time in milliseconds a thread may remain idle. The default entry is 60000.
`com.sybase.ase.ws.producer.tuning.ssl.maxthreads` Indicates the maximum number of threads in the thread pool servicing the HTTPS port. The default entry is 250.
`com.sybase.ase.ws.producer.tuning.ssl.minthreads` Indicates the minimum number of threads in the thread pool servicing the HTTPS port. The default entry is 45.
`com.sybase.ase.ws.producer.tuning.ssl.maxidletime` Indicates the maximum time in milliseconds a thread may remain idle. The default entry is 60000.

`com.sybase.ase.ws.producer.ssl.keypassword`
Indicates the password for the SSL certificate. No default is provided.
`com.sybase.ase.ws.producer.ssl.keystore`
Indicates the location of the keystore for SSL. The default location for UNIX is *$SYBASE/WS-15_0/producer/keystore*, or *%SYBASE%\WS-15_0\producer\keystore* for Windows.
`com.sybase.ase.ws.producer.ssl.httpsport`
Indicates the port on which the ASE Web Services Engine should listen for an HTTPS connection. The default entry is `8182`.
`com.sybase.ase.ws.producer.ssl.password`
Indicates the keystore password for SSL. No default is provided.

myres.properties

The *myres.properties* file is created when the Sybase Central plug-in performs configuration tasks for ASE Web Services. The *myres.properties* file contains the following configuration settings for ASE Web Services.

Table B-2: myres.properties entries

Web Services – Set the following entries to configure Web Services.
`ws.ini`
Indicates the location of the *interfaces* or *sql.ini* file for Adaptive Server Enterprise. The default location for UNIX is *$SYBASE/interfaces*, or *%SYBASE%\ini\sql.ini* for Windows.
`ws.libtcl`
Indicates the location of the *libtcl.cfg* file used to identify LDAP servers. The default location for 32-bit platforms for UNIX is *$SYBASE/$SYBASE_OCS/config/libtcl.cfg*, or *%SYBASE%\%SYBASE_OCS%\ini\libtcl.cfg* for Windows. The default location for 64-bit platforms for UNIX is *$SYBASE/$SYBASE_OCS/config/libtcl64.cfg*, or *%SYBASE%\%SYBASE_OCS%\ini\libtcl64.cfg* for Windows.
`ws.producer.port`
Indicates the port for the ASE Web Services Engine.
`ws.producer.log`
Indicates the location of the *producer.log* file.
`ws.producer.jettylogfile`
Indicates where the log file for HTTP requests should be placed. The default location is for UNIX is *$SYBASE/WS-15_0/logs/http.log*, or *%SYBASE%\WS-15_0\logs\http.log* for Windows.

SSL – Set the following entries to configure SSL.
`ws.ssl.host` Indicates the name of the SSL host to be accessed.
`ws.ssl.keystorelocation` Indicates the location of the keystore for SSL. The default location for UNIX is *$SYBASE/WS-15_0/producer/keystore*, or *%SYBASE%\WS-15_0\producer\keystore* for Windows.
`ws.ssl.certificatepassword` Indicates the password for the SSL certificate. No default is provided.
`ws.ssl.keystorepassword` Indicates the keystore password for SSL. No default is provided.
`ws.consumer.name` Indicates the name of the ASE Web Services Engine as specified in the *interfaces* or *sql.ini* file.
`ws.consumer.host` Indicates the host machine of the ASE Web Services Engine.
`ws.consumer.port` Indicates the port number for the ASE Web Services Engine process.
`ws.consumer.log` Indicates the location of the *consumer.log* file.
installws – Set the following entries to run the *installws* script:
`ws.sqlsrv.server_name` Indicates the name of the Adaptive Server Enterprise on which to run *installws*.
`ws.sqlsrv.sa_login` Indicates the user login for the Adaptive Server Enterprise.
`ws.sqlsrv.sa_password` Indicates the password for the Adaptive Server Enterprise.

Specifying properties file entries

Because the backslash "\" symbol is used as an escape character, entries that use single backslash symbols are not interpreted correctly. For example:

```
com.sybase.ase.ws.interfaces = d:\sybase\ini\sql.ini
```

To work around this, escape the backslash with another backslash. For example:

```
com.sybase.ase.ws.interfaces = d:\\sybase\\ini\\sql.ini
```

You can also use forward slashes. For example:

```
com.sybase.ase.ws.interfaces = d:/sybase/ini/sql.ini
```

APPENDIX C

SOAP and Adaptive Server Enterprise Datatype Mapping

This appendix documents SOAP and Adaptive Server Enterprise datatypes.

Datatype mapping

The following sections describe datatype mappings between SOAP and Adaptive Server Enterprise with respect to the Web Services feature.

SOAP-to-ASE datatype mappings

The following table shows SOAP datatypes and their corresponding types in Adaptive Server Enterprise. These are used when mapping RPC/encoded Web services to proxy tables in Adaptive Server Enterprise.

SOAP datatype	Adaptive Server Enterprise datatype
string	varchar – Length depends on Adaptive Server Enterprise page size
boolean	smallint
float	real
double	double precision
decimal	float
duration	datetime
dateTime	datetime
time	datetime
date	datetime
gYearMonth	datetime
gYear	datetime
gMonthDay	datetime
gDay	datetime

SOAP datatype	Adaptive Server Enterprise datatype
gMonth	datetime
hexBinary	Unsupported
base64Binary	Unsupported
anyURI	varchar – length depends on Adaptive Server Enterprise page size
QName	varchar – length depends on Adaptive Server Enterprise page size
NOTATION	varchar – length depends on Adaptive Server Enterprise page size
normalizedString	varchar – length depends on Adaptive Server Enterprise page size
token	varchar – length depends on Adaptive Server Enterprise page size
language	varchar – length depends on Adaptive Server Enterprise page size
NMTOKEN	varchar – length depends on Adaptive Server Enterprise page size
Name	varchar – length depends on Adaptive Server Enterprise page size
NCName	varchar – length depends on Adaptive Server Enterprise page size
ID	varchar – length depends on Adaptive Server Enterprise page size
IDREF	varchar – length depends on Adaptive Server Enterprise page size
ENTITY	varchar – length depends on Adaptive Server Enterprise page size
integer	integer
nonPositiveInteger	integer
negativeInteger	integer
long	integer
int	integer
short	smallint
byte	tinyint
nonNegativeInteger	integer
unsignedLong	integer
unsignedInt	integer
unsignedShort	smallint
unsignedByte	tinyint
positiveInteger	integer
soap arrays	Not supported
soap complex datatypes	Not supported

ASE-to-SOAP datatype mappings for the *create service* command

The following table defines the relationship between datatypes available as a type to a stored procedure and the datatype used for a SOAP user-defined Web service.

Note For a Web service accessed through the HTTP GET method, which corresponds to Web services of type http or raw, all parameters are mapped to a type of xsd:string.

ASE datatype	SOAP parameter type
tinyint	xsd:int
smallint	xsd:int
int	xsd:int
bigint	xsd:decimal
numeric (p,s)	xsd:decimal
decimal (p,s)	xsd:decimal
float (precision)	xsd:float
double (precision)	xsd:double
real	xsd:double
smallmoney	xsd:int
money	xsd:int
smalldatetime	xsd:datetime
datetime	xsd:datetime
date	xsd:datetime
time	xsd:datetime
char(n)	xsd:string
varchar(n)	xsd:string
unichar	xsd:string
univarchar	xsd:string
nchar	xsd:string
nvarchar	xsd:string
binary	xsd:byte[]
varbinary	xsd:byte[]
xml	xsd:string
text	Not supported
image	Not supported
Java Data Type	Not supported

Glossary

ASE Web Services Engine	The component of ASE Web Services that acts as a producer and consumer of Web services. The ASE Web Services Engine enables a client application to access Adaptive Server Enterprise stored procedures and SQL as Web methods. The ASE Web Services Engine also maps Web methods to proxy tables, allowing a client application to invoke the Web method through a SQL select statement.
document/literal	A type of Web method for which communicating parties specify the data being transmitted and formatted according to XML schemas incorporated into the WSDL file.
DTD	Document Type Definition, used to define the legal building blocks of an XML document. A DTD can be declared within an XML document or referenced externally.
HTTP	Hypertext Transfer Protocol, part of the application layer of the Internet Protocol suite and is the primary means of exchanging information in the World Wide Web.
HTTPS	HTTP with SSL or TLS encryption.
LDAP	Lightweight Directory Access Protocol, an application-level protocol for Internet-based directory services.
RPC/encoded	A type of Web method invoked with SOAP messages containing an XML element for each method parameter.
schema	An outline defining the structure, content, and semantics of an XML document.
SDS	Specialty Data Store, used as a Component Integration Service (CIS) to map a Web method to a proxy table.
SOAP	Simple Object Access Protocol, a standard for XML-based messaging across a network.
SQLX	SQL/XML, an ANSI and ISO standard that provides support for using XML in the context of a SQL database system.

UDDI	Universal Description Discovery and Integration.
URI	Uniform Resource Identifier, a string of characters that identify an Internet Resource. The most common URI is the Uniform Resource Locator (URL), which identifies an Internet address. A less common URI is the Universal Resource Name (URN).
URL	Uniform Resource Locator, one type of URI.
User-defined Web service	An arbitrary SQL statement named by the end user and executed with a SOAP client or through a Web browser.
W3C	World Wide Web Consortium, which produces the software standards for the World Wide Web.
Web method	A function described by WSDL and invoked through SOAP message.
Web service	One or more Web methods described by a WSDL file.
WSDL	Web Services Description Language, which describes the public interface to a Web service.
Xerces	The Apache open-source XML parser.
XML	Extensible Markup Language, a markup language standardized by W3C.
XML schema	A description of an XML document consisting of structure and content constraints.
XPath	XML Path Language, a language for addressing parts of an XML document.
XQL	XML Query Language, a precursor of XQuery.

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