Building Custom Adapters

SAP Sybase Event Stream Processor 5.1 SP03

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Contents

CHAPTER 1 Introduction

SAP® Sybase® Event Stream Processor includes an extensive set of input and output adapters that you can use to subscribe to and publish data. Additional specialized adapters for Event Stream Processor are available from SAP® as optional add-ons. You can also write your own adapters to integrate into the ESP Server and design them to handle a variety of external requirements that the standard adapters cannot manage.

Event Stream Processor provides an adapter toolkit for building custom external (Java) adapters.

Event Stream Processor also provides a variety of SDKs that you can use to build custom external adapters in a number of programming languages, such as C, C++, Java, and .NET (C#, Visual Basic, and so on). For versions supported for SDKs, see the *Installation Guide*.

Finally, Event Stream Processor also provides an internal API that you can use to build custom internal adapters. However, it is recommended that you use the adapter toolkit instead of the internal API as:

- the adapter toolkit offers a quicker, easier, and more flexible method for creating custom adapters
- the adapter toolkit offers standard modules that you can re-use to create your own custom adapters
- internal adapters do not have any advantages over external adapters
- the internal adapter API is being deprecated

Input and Output Adapters

Input and output adapters enable Event Stream Processor to send and receive messages from dynamic and static external sources and destinations.

External sources or destinations can include:

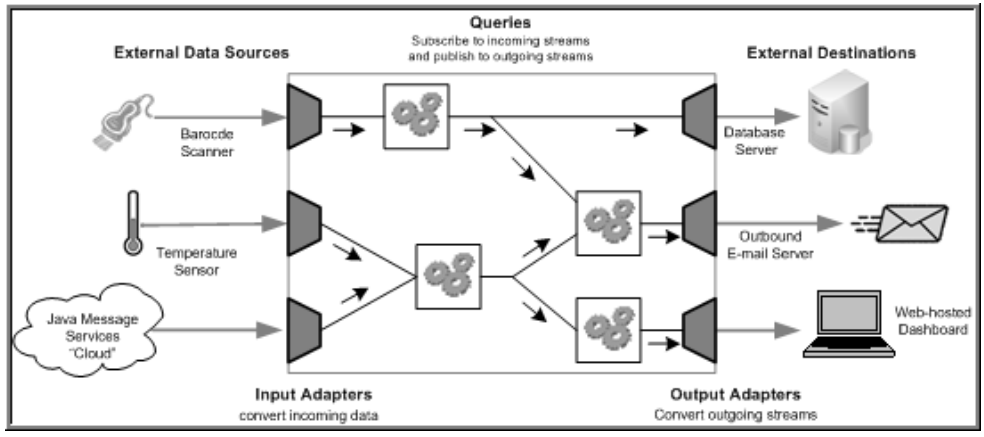
- Data feeds
- Sensor devices
- Messaging systems
- Radio frequency identification (RFID) readers
- E-mail servers
- Relational databases

Input adapters connect to an external datasource and translate incoming messages from the external sources into a format that is accepted by the ESP Server. Output adapters translate

rows published by Event Stream Processor into message formats that are compatible with external destinations and send those messages downstream.

The following illustration shows a series of input adapters that translate messages from a temperature sensor, bar code scanner, and a Java Message Service (JMS) cloud into formats compatible with Event Stream Processor. After the data is processed using various queries within Event Stream Processor, output adapters convert the result rows into updates that are sent to an external database server, e-mail server, and Web services dashboard.

Figure 1: Adapters in Event Stream Processor



Managed and Unmanaged Adapters

An external adapter can be developed and configured to support running in managed-only mode, unmanaged-only mode, or to support both modes.

Managed external adapters:

- are started and stopped by the ESP Server with an ESP project
- have a cnxml adapter configuration file that is configured within the ESP Studio
- are referenced in a (CCL) **ATTACH ADAPTER** statement

Unmanaged external adapters:

- start and stop independently of the ESP Server and ESP projects
- are configured independently
- are not referenced in a (CCL) **ATTACH ADAPTER** statement

Subscribing to Data with Input Adapters

Subscribe to data from an external datasource and use an input stream or window to send the data to Event Stream Processor.

When specifying paths, use forward slashes for both Windows and UNIX. If you use back slashes in a CCL file, an error displays because a back slash indicates a control character.

1. Assess the input data. Determine which sets or subsets of data you want to pull into Event Stream Processor.
2. Choose an input adapter suited for this task.

   If the datasource uses datatypes that are not supported by the ESP Server, the Server maps the data to an accepted datatype. Review the associated mapping description for your adapter in the *Adapters Guide*.
3. Create an input stream or window.
4. Use the **CREATE SCHEMA** statement to define the structure for incoming data within this stream or window.
5. (Skip this step if using an unmanaged adapter) Use the **ATTACH ADAPTER** statement to attach your adapter to the newly created stream or window, and specify values for the adapter properties.

   To declare default parameters for your adapter properties, use the **DECLARE** block and **parameters** qualifier to define default parameter values before you attach your adapter. Once you create the **ATTACH ADAPTER** statement, you can set the adapter properties to the parameter values you declared.

   Note: You can bind declared parameters to a new value only when a module or project is loaded.
6. Start the ESP project. If you are using an unmanaged adapter, start the adapter manually.

Next

For detailed information on configuring individual Event Stream Processor-supplied adapters, datatype mappings, and schema discovery, see the *Adapters Guide*. For detailed information on CCL queries and statements, such as the **ATTACH ADAPTER**,**CREATE SCHEMA**, and **DECLARE** statements, see the *Programmers Reference Guide*.

Publishing Data with Output Adapters

Use an output stream or window to publish data from Event Stream Processor to an external datasource.

When specifying paths, use forward slashes for both Windows and UNIX. If you use back slashes in a CCL file, an error displays because a back slash indicates a control character.

1. Assess the output data. Determine which sets or subsets of data you want to send to an external datasource.
2. Choose an output adapter suited for this task.

   If the output destination uses datatypes that are not supported by the ESP Server, the Server maps the data to an accepted datatype. Review the associated mapping description for your adapter in the *Adapters Guide* to ensure that the resulting datatype is permitted by the external data destination.
3. Create an output stream or window.
4. Use the **CREATE SCHEMA** statement to define the structure for outgoing data within this stream or window.
5. (Skip this step if using an unmanaged adapter) Use the **ATTACH ADAPTER** statement to attach your adapter to the output stream or window, and set values for the adapter properties.

   To declare default parameters for your adapter properties, use the **DECLARE** block and **parameter** qualifier to define default parameter values before you attach your adapter. Once you create the **ATTACH ADAPTER** statement, you can set the adapter properties to the parameter values you declared.

   Note: You can bind declared parameters to a new value only when a module or project is loaded.
6. Start the ESP project. If you are using an unmanaged adapter, start the adapter manually.

Next

For detailed information on configuring individual Event Stream Processor-supplied adapters, datatype mappings, and schema discovery, see the *Adapters Guide*. For detailed information on CCL queries and statements, such as the **ATTACH ADAPTER**,**CREATE SCHEMA**, and **DECLARE** statements, see the *Programmers Reference Guide*.

Editing Adapter Property Sets

Adapter property sets are reusable groups of properties that are stored in the project configuration file. Use the ESP Studio CCR Project Configuration editor to define adapter property sets and store them in the associated .ccr file.

Property sets appear in a tree format, and individual property definitions are shown as children to property sets.

1. In the CCR Project Configuration editor, select the **Adapter Properties** tab.
2. (Optional) To create a list of adapter property sets that correspond to the **ATTACH ADAPTER** statements in the main CCL file for the project, click **Add from CCL**.
3. To create a new adapter property node, click **Add**.
4. In the Property Set Details pane, define a name for the property node.
5. To add a new property to a property set, right-click the set and select **New** > **Property**.

   Note: You can add as many property items to a property set as required.
6. To configure a property:
   a) In the Property Details pane, define a name for the property.
   b) Enter a value for the property.
7. (Optional) To encrypt the property value:
   a) Select the property value and click **Encrypt**.
   b) Enter the required fields, including Cluster URI and credential fields.
   c) Click **Encrypt**.
   The value, and related fields are filled with randomized encryption characters.

   Note: To reset the encryption, click **Encrypt** beside the appropriate field. Change the values, as appropriate, then click **Reset**.
8. To remove items from the All Adapter Properties list:
   - Right-click a property set and select **Remove**, or
   - Right-click a property and select **Delete**.

Adapter Logging Configuration

Specific adapters currently available from SAP use the `log4j` API to log errors, warnings, and debugging messages.

Specify the location of the logging file you wish to use in the **Log4jProperty** parameter within the adapter configuration file. You can modify the logging levels within this file or the `%ESP_HOME%\adapters\<adapter-name>\config\log4j.properties` file,

which is used by default. Set the ADAPTER_CLASSPATH environment variable to point to the configuration directory of each adapter for which you are configuring logging.

The logging levels in `log4j.properties` are:

Level	Description
`OFF`	Logs no events.
`FATAL`	Logs severe errors that prevent the application from continuing.
`ERROR`	Logs potentially recoverable application errors.
`WARN`	Logs events that possibly lead to errors.
`INFO`	Logs events for informational purposes.
`DEBUG`	Logs general debugging events.
`TRACE`	Logs fine-grained debug messages that capture the flow of the application.
`ALL`	Logs all events.

Note: Setting the log level to `DEBUG` or `ALL` may result in large log files. The default value is `INFO`.

Here is a sample `log4j.properties` file:

```
# Set root logger level to INFO and set appenders to stdout, file and
email
log4j.rootLogger=INFO, stdout, R

# stdout appender
log4j.appender.stdout=org.apache.log4j.ConsoleAppender
log4j.appender.stdout.layout=org.apache.log4j.PatternLayout
log4j.appender.stdout.layout.ConversionPattern=%d{MM-dd-yyyy
HH:mm:ss.SSS} %p [%t] (%C{1}.%M) %m%n
log4j.appender.stdout.Threshold=INFO

# file appender
log4j.appender.R=org.apache.log4j.DailyRollingFileAppender
log4j.appender.R.File=logs/rtviewadapter.log
log4j.appender.R.DatePattern='.'yyyy-MM-dd
log4j.appender.R.layout=org.apache.log4j.PatternLayout
log4j.appender.R.layout.ConversionPattern=%d{MM-dd-yyyy
HH:mm:ss.SSS} %p [%t] (%C{1}.%M) %m%n
log4j.appender.R.Threshold=INFO

# email appender
log4j.appender.email=org.apache.log4j.net.SMTPAppender
log4j.appender.email.To=your.name@yourcompany.com
log4j.appender.email.From=alert.manager@yourcompany.com
log4j.appender.email.SMTPHost=yourmailhost
log4j.appender.email.BufferSize=1
```

```
log4j.appender.email.Subject=RTView Adapter Error
log4j.appender.email.layout=org.apache.log4j.PatternLayout
log4j.appender.email.layout.ConversionPattern=%d{MM-dd-yyyy
HH:mm:ss.SSS} %p [%t] (%C{1}.%M) %m%n
log4j.appender.email.Threshold=ERROR

log4j.logger.com.sybase.esp=INFO
```

The `log4j.rootLogger` option sets the default log behavior for all the sub-loggers in the adapter. In addition to the root logger, the adapter contains various sub-loggers that control logging for specific adapter functions.

Setting the `log4j.rootLogger` to any value more verbose than `info` may produce excess information. If you explicitly set the log level for a sub-logger, you overwrite the default setting for that particular logger. In this way, you can make sub-loggers more verbose than the default. The names for Event Stream Processor related loggers contain the string `com.sybase.esp`.

CHAPTER 2

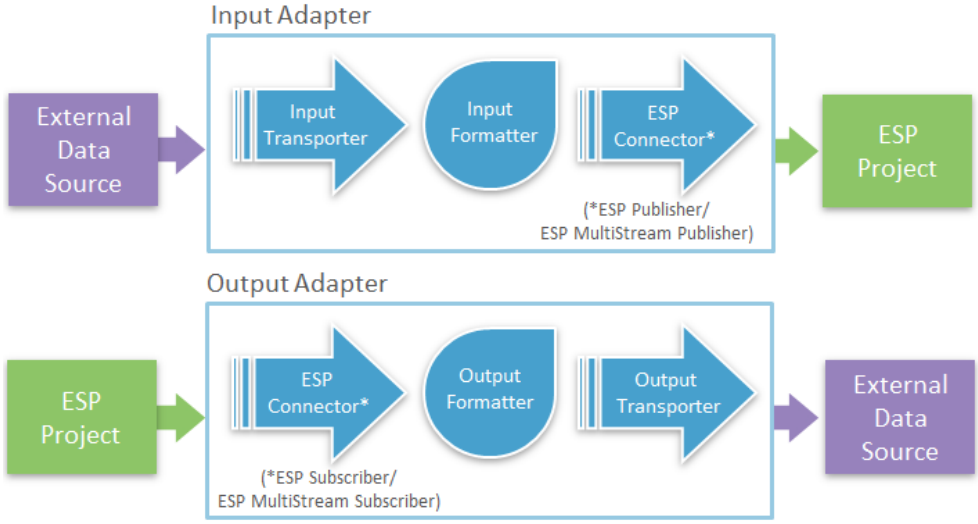
Event Stream Processor Adapter Toolkit

Use the Event Stream Processor adapter toolkit to quickly build custom external adapters using Java. Adapters built using the toolkit consist of various component modules configured together to deliver data to and publish data from Event Stream Processor. Module types include transporters (for interacting with external transports), formatters (for converting data from one format to another), and ESP connectors (for subscribing or publishing to ESP).

The toolkit includes numerous transporters, formatters, and ESP connectors out-of-the-box, which can be configured in various combinations by an administrator. You can also combine these out-of-the-box modules with custom modules created by a Java developer.

The adapter toolkit allows you to implement:

- an input adapter to act as a datasource for the ESP Server
- an output adapter to act as a data destination and deliver data from streams in ESP
- a dual direction adapter to act as both a datasource and data destination for Event Stream Processor
- guaranteed delivery (GD) to minimize loss of data during transfer of input data
- schema discovery to automatically discover schema for your custom input and output adapter



Preconfigured Adapters Included with the Adapter Toolkit

Event Stream Processor includes various preconfigured and ready for use external adapters that have been created using the adapter toolkit.

You can use these adapters as reference examples when creating your own adapters using the adapter toolkit. Additionally, you can reuse individual transporter and formatter modules from these adapters in your own custom adapters.

For more information on these adapters, see the *Adapters Guide*.

Table 1. External Input Adapters

Adapter Name	Description
File CSV Input	The File CSV Input adapter obtains CSV data from files on a local hard disk and publishes it to Event Stream Processor.
File JSON Input	The File JSON Input adapter takes JSON messages from JSON files, and publishes them to Event Stream Processor.
File XML Document Input	The File XML Document Input adapter loads data from an XML document into a project in Event Stream Processor.
File XML Record Input	The File XML Record Input adapter reads XML list text files and inputs this data into Event Stream Processor.
FTP CSV Input	The FTP CSV Input adapter obtains CSV data from an FTP server and publishes it to Event Stream Processor.
FTP XML Input	The FTP XML Input adapter reads data from an XML document on an FTP server into Event Stream Processor.
JDBC Input	The JDBC Input adapter receives data from tables in a database and inputs it into Event Stream Processor.
JMS CSV Input	The JMS CSV Input adapter reads CSV data from a JMS server ands outputs this data into Event Stream Processor.

Adapter Name	Description
JMS Object Array Input	The JMS Object Array Input adapter receives object array data from a JMS server and publishes it to Event Stream Processor.
JMS XML Input	The JMS XML Input adapter obtains XML list string messages from a JMS server and publishes them to Event Stream Processor.
Socket CSV Input	The Socket CSV Input adapter obtains CSV string data from a Socket server and publishes it to Event Stream Processor.
Socket JSON Input	The Socket JSON Input adapter obtains streaming data from the socket server, formats data into JSON format and inputs it into Event Stream Processor.
Socket XML Input	The Socket XML Input adapter obtains XML data from a Socket server and publishes it to Event Stream Processor.

Table 2. External Output Adapters

Adapter Name	Description
File CSV Output	The File CSV Output adapter reads rows from Event Stream Processor and writes this data into a specified CSV file.
File JSON Output	The File JSON Output adapter takes data from Event Stream Processor, formats it into JSON format, and sends it to a JSON file.
File XML Document Output	The XMLDocument Output adapter outputs data from a project in Event Stream Processor into an XML document.
File XML Record Output	The File XML Record Output adapter reads rows from Event Stream Processor ands writes this data into XML list files.
FTP CSV Output	The FTP CSV Output adapter takes data from Event Stream Processor, formats it to CSV format, and saves it to a file on an FTP server.

Adapter Name	Description
FTP XML Output	The FTP XML Output adapter reads XML data from an ESP project, writes it to an XML document, and uploads this file to the FTP server.
JDBC Output	The JDBC Output adapter sends data from Event Stream Processor to a database table.
JMS CSV Output	The JMS CSV Output adapter sends CSV data from Event Stream Processor to a JMS server.
JMS Object Array Output	The JMS Object Array Output adapter takes data from Event Stream Processor, formats it into object array format, and sends it to a JMS server.
JMS XML Output	The JMS XML Output adapter takes XML data from Event Stream Processor, formats it to XML list format, and sends it to a JMS server.
Socket CSV Output	The Socket CSV Output adapter takes data from Event Stream Processor, formats it into CSV format, and outputs it to a Socket server.
Socket JSON Output	The Socket JSON Output adapter takes JSON data from Event Stream Processor, formats it to ByteBuffer, and transports it to the Socket server in streaming format.
Socket XML Output	The Socket XML Output adapter takes data from Event Stream Processor, formats it to XML list format, and outputs it to a Socket server.

Create a Custom Adapter

Use the ESP adapter toolkit to create a custom adapter. You can do this by combining transporter and formatter modules that are provided with the adapter toolkit, by writing your own custom transporter and formatter modules, or by combining existing modules with custom ones.

1. *Building a Custom Transporter Module*

   Use the ESP adapter toolkit to build a custom transporter module to use within the adapter instance of your choice.
2. *Building a Custom Formatter Module*

Use the ESP adapter toolkit to build a custom formatter module to use within the adapter instance of your choice.

3. *Enabling Guaranteed Delivery for an Input Transporter*

   (Optional) Enable guaranteed delivery (GD) in a custom input transporter by implementing the com.sybase.esp.adapter.framework.event.AdapterRowEventListener interface, registering the GdAdapterEventListener class, and adding and setting the <GDMode> parameter to true for the EspPublisher or EspMultistreamPublisher.

4. *Implementing Schema Discovery in a Custom Adapter*

   (Optional) Use interfaces and functions from the adapter toolkit to implement schema discovery in a transporter and formatter module. There are two types of schema discovery: non-sampling and sampling. Use non-sampling schema discovery when the transporter can fully determine schema on its own. Use sampling schema discovery when the transporter cannot determine the schema and passes this data to the formatter to generate the schema.

5. *Configuring a New Adapter*

   Configure a new adapter by creating a configuration file for that adapter. The configuration file defines the adapter component chain through which data is processed, as well as the connection to Event Stream Processor.

6. *Creating a Cnxml File for a Custom Adapter*

   Create a cnxml configuration file for your custom external adapter so that you can configure the adapter in the ESP Studio, and start and stop it with an ESP project.

7. *Starting an Adapter*

   You can start an adapter either in standalone or managed mode. In standalone mode, the adapter is started separately from the ESP project, and in managed mode, the adapter is started with the ESP project.

8. *Stopping an Adapter*

   You can stop an adapter either in standalone or managed mode. In standalone mode, the adapter is stopped separately from the ESP project, and in managed mode, the adapter is stopped with the ESP project.

See also

- *Accessing Adapter Toolkit API Reference Information* on page 14
- *Debugging a Custom Adapter* on page 89
- *Formatter Modules* on page 37
- *Transporter Modules* on page 14
- *EspConnector Modules* on page 61

Accessing Adapter Toolkit API Reference Information

Detailed information on methods, functions, and other programming building blocks is provided in the API level documentation.

To access the API level documentation:

1. Navigate to `<Install_Dir/ESP-5_1/doc/adaptertoolkit`.
2. Launch `index.html`.

See also

- *Building a Custom Transporter Module* on page 34
- *Transporters Currently Available from SAP* on page 15
- *Building a Custom Formatter Module* on page 54
- *Formatters Currently Available from SAP* on page 37
- *Create a Custom Adapter* on page 12
- *Debugging a Custom Adapter* on page 89
- *Formatter Modules* on page 37
- *Transporter Modules* on page 14
- *EspConnector Modules* on page 61

Transporter Modules

A transporter module is the interface module that interacts with external data sources by obtaining data from a data source or outputting data to a data destination.

Event Stream Processor supports two types of transporters: row-based and stream-based.

Row-based transporters obtain and output data in row format, such as a database transporter. These transporters work with AdapterRow instances which are containers for one or more records or rows as they flow from one module (transporter, formatter, or ESP connector) to the next. You can add multiple records as objects within a List of a single AdapterRow object. The AdapterRow has a timestamp and block flags that control how its records are communicated to and from Event Stream Processor. See *Envelopes and Transactions* for additional details.

Stream-based transporters deal with streaming data, such as a socket transporter. These transporters work with ByteStream or ByteBuffer instances which represent a continuous stream of data.

See also

- *Formatter Modules* on page 37
- *EspConnector Modules* on page 61

- *Accessing Adapter Toolkit API Reference Information* on page 14
- *Create a Custom Adapter* on page 12
- *Debugging a Custom Adapter* on page 89

Transporters Currently Available from SAP

The adapter toolkit provides numerous transporter modules that come standard with Event Stream Processor. You can re-use these modules to create a custom adapter instance.

Input transporters obtain data from external data sources and output this data into Event Stream Processor. The format of this output data is specified in the Output Datatype column of the table below.

AdapterRow is a container for one or more records or rows as they flow from one module (transporter, formatter, or ESP connector) to the next. You can add multiple records as objects within a List of a single AdapterRow object. The AdapterRow has a timestamp and block flags that control how its records are communicated to and from Event Stream Processor. See *Envelopes and Transactions* for additional details.

AepRecord is the class that represents stream records. This is the type that the ESP publisher expects as the data member in the AdapterRow instances that it receives from the previous module. This is also the type used in the AdapterRow instances that the ESP subscriber passes on to the next module.

Table 3. Standard Input Transporters

Name	Mode (Streaming/ Row)	Output Datatype	Description
File Input Transporter	Can be both (depends on configuration)	`Java.lang.String` or `Java.nio.ByteBuffer`	In row mode, the transporter reads data from local files, wraps data with `string`, and sends it to the next module that is configured in the adapter configuration file. In streaming mode, the transporter reads data from local files, wraps it with ByteStream, and passes it to the next module that is configured in the adapter configuration file.

Name	Mode (Streaming/ Row)	Output Datatype	Description
FTP Input Transporter	Streaming	`Java.nio.ByteBuffer`	Reads binary data from files on an FTP server, wraps it up with ByteStream, and passes it to the next module that is configured in the adapter configuration file.
JDBC Input Transporter	Row	`Java.util.List<Java.lang.Object>`	Reads database records from a database using JDBC, and sends data records to the next module that is configured in the adapter configuration file.
JMS Input Transporter	Row	`Java.lang.String` or `AepRecord` or `Java.util.List<Java.lang.Object>`	Receives JMS messages from a JMS server, and sends this data to the next module that is configured in the adapter configuration file.
Socket Input Transporter	Streaming	`Java.nio.ByteBuffer`	Reads binary data from a socket interface, wraps it with ByteStream, and passes it to the next module that is configured in the adapter configuration file.

Output transporters obtain data from Event Stream Processor and output it to external data sources. The format of this input data is specified in the Input Datatype column of the table below.

Table 4. Standard Output Transporters

Name	Mode (Streaming/ Row)	Input Datatype	Description
File Output Transporter	Both (depends on configuration)	`Java.lang.String` or `Java.nio.ByteBuffer`	In row mode, the transporter obtains string data from the previous module configured in the adapter configuration file, and writes this data to a local file. In streaming mode, the transporter obtains ByteStream data from the previous module configured in the adapter configuration file, and writes this data to a local file.
FTP Output Transporter	Streaming	`Java.nio.ByteBuffer`	Obtains ByteStream data from the previous module that is configured in the adapter configuration file, and saves it to a file on an FTP server.
JDBC Output Transporter	Row	`Java.util.List<Java.lang.Object>`	Obtains row-based data from the previous module that is configured in the adapter configuration file, and saves it into a database table using JDBC.
JMS Output Transporter	Row	`Java.lang.String` or `AepRecord` or `Java.util.List<Java.lang.Object>`	Obtains data from the previous module that is configured in the adapter configuration file and sends it to a JMS server.

Name	Mode (Streaming/ Row)	Input Datatype	Description
Socket Output Transporter	Streaming	`Java.nio.ByteBuffer`	Obtains ByteStream data from the previous module that is configured in the adapter configuration file, and outputs it through a socket interface.

See also

- *Accessing Adapter Toolkit API Reference Information* on page 14
- *Building a Custom Transporter Module* on page 34

File Input Transporter Module Parameters

The File Input transporter reads data from local files, wraps the data with `string`, and sends it to the next module specified in the adapter configuration file. Set values for this transporter in the adapter configuration file.

The File Input transporter supports schema discovery.

Parameter	Description
Dir	Type: `string` (Required) Specify the absolute path to the data files which you want the adapter to read. For example, `<username>/<foldername>`. No default value. Use a forward slash for both UNIX and Windows paths.
File	Type: `string` (Required) Specify the file which you want the adapter to read or the regex pattern to filter the files on a given directory. See the **DynamicMode** parameter. No default value.

Parameter	Description
AccessMode	Type: `string` (Required) Specify an access mode. The adapter supports two modes: • **rowBased –** the adapter reads one text line at a time • **Streaming –** the adapter reads a pre-configured size of bytes into a buffer No default value.
DynamicMode	Type: `string` (Advanced) Specify a dynamic mode. The adapter supports three modes: • **Static –** the adapter reads the file specified in the **Dir** and **File** parameters • **dynamicFile –** the adapter reads the file specified in the **Dir** and **File** parameters and keeps polling the new appended content. The polling period is specified in the **PollingPeriod** parameter. • **dynamicPath –** the adapter polls all the new files under the **Dir** parameter. Also, the **File** parameter acts as a regex pattern and filters out the necessary files. The default value is Static. If the DynamicMode has been set to dynamicPath and you leave the **File** parameter empty, the adapter reads all the files under the specified directory. An example regex pattern is ".*\.txt". This filters to only files that end with ".txt". In regex patterns, an escape character, "\", is necessary prior to the meta chars if you wish to include them in the pattern string.

Parameter	Description
PollingPeriod	Type: `integer` (Advanced) Define the period, in seconds, to poll the specified file or directory. Set this parameter only if the value of the **DynamicMode** parameter is set to dynamicFile or dynamicPath. A value of <=0 turns off polling. The default value is 0.
RemoveAfterProcess	Type: `boolean` (Optional) If this property is set to true, the file is removed from the directory after the adapter processes it. If the value of the **DynamicMode** parameter is set to dynamicFile or dynamicPath, the file is not removed after the adapter processes it. The default value is false.
ScanDepth	Type: `integer` (Optional) Specify the depth of the schema discovery. The adapter reads the number of rows specified by this parameter value when discovering the input data schema. The default value is three.

File Output Transporter Module Parameters

The File Output transporter obtains data from the previous module specified in the adapter configuration file and writes it to local files. Set values for this transporter in the adapter configuration file.

Parameter	Description
Dir	Type: `string` (Required) Specify the absolute path to the data files that you want the adapter to write to. For example, `<username>/<foldername>`. The default value is ".", meaning the current directory in which the adapter is running. Use a forward slash for both UNIX and Windows paths.

Parameter	Description
File	Type: `string` (Required) Specify the file to which you want the adapter to write.
AccessMode	Type: `string` (Required) Specify an access mode. The adapter supports two modes: • **rowBased –** the adapter writes one text line at a time into the file • **Streaming –** the adapter writes the raw data in ByteBuffer into the file No default value.
AppendMode	Type: `boolean` (Optional) If set to true, the adapter appends the data into the existing file. If set to false, the adapter overwrites existing content in the file. Default value is false.

FTP Input Transporter Module Parameters

The FTP Input transporter reads binary data from files on an FTP server, wraps it up with ByteBuffer, and sends it to the next module that is configured in the adapter configuration file. Set values for this transporter in the adapter configuration file.

Parameter	Description
Host	Type: `string` (Required) Specify the server name or IP address of the FTP server to which you are connecting.
Port	Type: `integer` (Required) Specify the port address for the FTP server to which you are connecting. The default value is 21.
LoginType	Type: `enum` (Required) Specify the login type for the FTP server. There are two valid types: normal and anonymous.

Parameter	Description
User	Type: `string` (Required if **LoginType** is set to normal) Specify the login account for the FTP server.
Password	Type: `string` (Required if **LoginType** is set to normal) Specify the login password for the FTP server.
FtpFilePath	Type: `string` (Required) Specify the absolute path to the data files in the FTP server.
FtpFileName	Type: `string` (Required) Specify the filename of the data files in the FTP server.
MaxBlockSize	Type: `int` (Required) Specify the max data block size to transfer from the FTP server. The default value is 2048.
TransferMode	Type: `string` (Required) Specify the transfer mode for the FTP connection. There are two valid values: active or passive. The default value is active.
RetryPeriod	Type: `second` (Required) Specify the period of time, in seconds, to try and reconnect to the FTP server if you disconnect unexpectedly. The default value is 30.
RetryCount	Type: `integer` (Required) Specify the retry counts to try to reconnect to the FTP server if you disconnect unexpectedly. The default value is 0.

FTP Output Transporter Module Parameters

The FTP Output transporter obtains data from the previous module configured in the adapter configuration file, and saves it to files on the FTP server. Set values for this transporter in the adapter configuration file.

Parameter	Description
Host	Type: `string` (Required) Specify the server name or IP address of the FTP server to which you are connecting.
Port	Type: `integer` (Required) Specify the port address for the FTP server to which you are connecting. The default value is 21.
LoginType	Type: `enum` (Required) Specify the login type for the FTP server. There are two valid types: normal and anonymous.
User	Type: `string` (Required if **LoginType** is set to normal) Specify the login account for the FTP server.
Password	Type: `string` (Required if **LoginType** is set to normal) Specify the login password for the FTP server.
FtpFilePath	Type: `string` (Required) Specify the absolute path to the data files in the FTP server.
FtpFileName	Type: `string` (Required) Specify the filename of the data files in the FTP server.
MaxBlockSize	Type: `int` (Required) Specify the max data block size to transfer to the FTP server. The default value is 2048.

Parameter	Description
Overwrite	Type: `boolean` (Required) If set to true, the transporter overwrites the file on the FTP server, if it exists. If this parameter is set to false, the transporter appends the output to the end of the existing file. The default value is false.
TransferMode	Type: `string` (Required) Specify the transfer mode for the FTP connection. There are two valid values: active or passive. The default value is active.
RetryPeriod	Type: `second` (Required) Specify the period of time, in seconds, to try and reconnect to the FTP server if you disconnect unexpectedly. The default value is 30.
RetryCount	Type: `integer` (Required) Specify the retry counts to try to reconnect to the FTP server if you disconnect unexpectedly. The default value is 0.

JDBC Input Transporter Module Parameters

The JDBC Input transporter reads database records using JDBC and sends them to the next module specified in the adapter configuration file. Set values for this transporter in the adapter configuration file.

Parameter	Description
Host	Type: `string` (Required) Specify the server name of the database to which you are connecting the adapter.
Port	Type: `integer` (Required) Specify the port number for connecting to the database server.
Username	Type: `string` (Required) Specify the username you are using to connect to the database server.

Parameter	Description
Password	Type: `string` (Required) Specify the password for connecting to the database server. Includes an "encrypted" attribute indicating whether the password value is encrypted. If set to true, the password value is decrypted using the **RSAKeyStore**, **RSAKeyStorePassword**, and **RSAKeyStoreAlias** parameters.
DbName	Type: `string` (Required) Specify the database name of the database to which you want to connect.
DBType	Type: `string` (Required) Specify the database type of the database to which you want to connect.
DbDriver	Type: `string` (Required) Specify the JDBC driver class for your JDBC driver.
Table	Type: `string` (Optional) Specify the name of the table in the target database from which you want the adapter to read.
Query	Type: `string` (Optional) Specify which SQL query you want the adapter to execute. No default value. Set either the **Table** or **Query** parameter. If you define both parameters, the adapter only uses the **Query** parameter.
RSAKeyStore	Type: `string` (Dependent required) Specify the location of an RSA keystore file which contains the key used to encrypt or decrypt the password set in the **Password** parameter. This parameter is required if the password value is encrypted.

Parameter	Description
RSAKeyStorePassword	Type: `string` (Dependent required) Stores the password to the RSA keystore file specified in the **RSAKeyStore** parameter. This parameter is required if the password value is encrypted.
RSAKeyStoreAlias	Type: `string` (Dependent required) Specifies the keystore alias. This parameter is required if the password value is encrypted.

JDBC Output Transporter Module Parameters

The JDBC Output transporter obtains data from the previous module specified in the adapter configuration file and writes it into a database table using JDBC. Set values for this transporter in the adapter configuration file.

Parameter	Description
Host	Type: `string` (Required) Specify the server name of the database to which you are connecting the adapter.
Port	Type: `integer` (Required) Specify the port number for connecting to the database server.
Username	Type: `string` (Required) Specify the username you are using to connect to the database server.
Password	Type: `string` (Required) Specify the password for connecting to the database server. Includes an "encrypted" attribute indicating whether the password value is encrypted. If set to true, the password value is decrypted using the **RSAKeyStore**, **RSAKeyStorePassword**, and **RSAKeyStoreAlias** parameters.

Parameter	Description
DbName	Type: `string` (Required) Specify the database name of the database to which you want to connect.
DBType	Type: `string` (Required) Specify the database type of the database to which you want to connect.
DbDriver	Type: `string` (Required) Specify the JDBC driver class for your JDBC driver.
Table	Type: `string` (Optional) Specify the name of the table in the target database to which you want the adapter to write.
SqlInsert	Type: `string` (Optional) Specify which SQL clause you want the adapter to execute. No default value. Set either the **Table** or **SqlInsert** parameter. If you define both parameters, the adapter only uses the **SqlInsert** parameter.
RSAKeyStore	Type: `string` (Dependent required) Specify the location of an RSA keystore file which contains the key used to encrypt or decrypt the password set in the **Password** parameter. This parameter is required if the password value is encrypted.
RSAKeyStorePassword	Type: `string` (Dependent required) Stores the password to the RSA keystore file specified in the **RSAKeyStore** parameter. This parameter is required if the password value is encrypted.

Parameter	Description
RSAKeyStoreAlias	Type: `string` (Dependent required) Specifies the keystore alias. This parameter is required if the password value is encrypted.

JMS Input Transporter Module Parameters

The JMS Input transporter receives JMS messages from a JMS server, and sends it to the next module that is configured in the adapter configuration file. Set values for this transporter in the adapter configuration file.

The transporter sends different Java objects to the next module if different messages are received:

Message Type Received	Java Object to Send
TEXT (TextMessage)	String
OBJARRAY (ObjectMessage)	Object

Parameter	Description
ConnectionFactory	Type: `string` (Required) Specify the connection factory class name. No default value.
JndiContextFactory	Type: `string` (Required) Specify the context factory for JNDI context initialization. No default value.
JndiUrl	Type: `string` (Required) Specify the JNDI URL. No default value.
Destination Type	Type: `string` (Required) Specify the destination type. Valid values are: QUEUE and TOPIC. The default value is QUEUE.
DestinationName	Type: `string` (Required) Specify the destination name. No default value.

Parameter	Description
MessageType	Type: `string` (Required) Specify the message type you want the JMS transporter to process. These types are supported: • TEXT - for receiving and sending messages in text string • OBJARRAY - for receiving and sending messages in custom format No default value.
SubscriptionMode	Type: `string` (Optional) Specify the subscription mode for TOPIC (see the **Destination Type** parameter). Valid values are DURABLE and NONDURABLE. Default value is NONDURABLE.
ScanDepth	Type: `integer` (Optional) Specify the depth of the schema discovery. The adapter reads the number of rows specified by this parameter value when discovering the input data schema. The default value is three.
ClientID	Type: `string` (Required for DURABLE subscription mode only) Specifies the client identifier for a JMS client. Required for creating a durable subscription in JMS. Can be any string, but must be unique for each topic. No default value. Example: `client1` .

Parameter	Description
SubscriptionName	Type: `string` (Required for DURABLE subscription mode only) Specifies a unique name identifying a durable subscription. Required for creating a durable subscription in JMS. Can be any string, but must be unique within a given client ID. No default value. Example: `subscription1`.

JMS Output Transporter Module Parameters

The JMS Output transport obtains data from the previous module that is configured in the adapter configuration file, wraps it up, and sends it to a JMS server. Set values for this transporter in the adapter configuration file.

The transporter sends different JMS messages if it receives different datatypes from the previous module:

Datatype Received	JMS Message Type to Send
List<String>	TextMessage
AepRecord	ObjectMessage
Object (others)	ObjectMessage

Parameter	Description
ConnectionFactory	Type: `string` (Required) Specify the connection factory class name. No default value.
JndiContextFactory	Type: `string` (Required) Specify the context factory for JNDI context initialization. No default value.
JndiUrl	Type: `string` (Required) Specify the JNDI URL. No default value.
Destination Type	Type: `string` (Required) Specify the destination type. Valid values are: QUEUE and TOPIC. The default value is QUEUE.

Parameter	Description
DestinationName	Type: `string` (Required) Specify the destination name. No default value.
MessageType	Type: `string` (Required) Specify the message type you want the JMS transporter to process. These types are supported: • TEXT - for receiving and sending messages in text string • OBJARRAY - for receiving and sending messages in custom format No default value.
DeliveryMode	Type: `string` (Optional) Specify the delivery mode type. Valid values are: • PERSISTENT • NON_PERSISTENT Default value is PERSISTENT.

Socket Input Transporter Module Parameters

The Socket Input transporter reads binary data from the socket interface, wraps it with ByteBuffer, and sends it to the next module that is configured in the adapter configuration file. Set values for this transporter in the adapter configuration file.

Parameter	Description
Host	Type: `string` (Required if **EpFile** is set to null) If the transporter is acting as a socket client, specify the socket server name. If the transporter is acting as a socket server, do not set this parameter. No default value.

Parameter	Description
Port	Type: `integer` (Required if **EpFile** is set to null) Specify the socket server port. If you set this to -1, the adapter reads from the ephemeral port file which is specified in the **EpFile** parameter. The default value is 12345.
EpFile	Type: `string` (Required if **Host** and **Port** are set to null) Specify the file that contains the socket server name/IP and port number. No default value.
Retryperiod	Type: `integer` (Advanced) When the transporter is acting as a socket server, this parameter designates the length of time to wait for the first incoming connection before switching to the continuous state. When the transporter is acting as a socket client, this parameter designates the time period for attempting to re-establish an outgoing connection, in seconds. The default value is 0.
BlockSize	Type: `integer` (Advanced) Define the size of the data block when transporting data from the socket server to the socket client. The default value is 1024.
KeepAlive	Type: `boolean` (Advanced) If set to true, the adapter disconnects from the socket server if there are no data transports for the duration of time specified in your router configuration. For example, if you set your router configuration to two hours and there are no messages during that time, the adapter disconnects from the socket server. The default value is false.

Socket Output Transporter Module Parameters

The Socket Output transporter obtains data from the previous module configured in the adapter configuration file, and outputs it using the socket interface. Set values for this transporter in the adapter configuration file.

Parameter	Description
Host	Type: `string` (Required if **EpFile** is set to null) If the transporter is acting as a socket client, specify the socket server name. If the transporter is acting as a socket server, do not set this parameter. No default value.
Port	Type: `integer` (Required if **EpFile** is set to null) Specify the socket server port. If you set this to -1, the adapter reads from the ephemeral port file which is specified in the **EpFile** parameter. The default value is 12345.
EpFile	Type: `string` (Required if **Host** and **Port** are set to null) Specify the file that contains the socket server name/IP and port number. No default value.
Retryperiod	Type: `integer` (Advanced) When the transporter is acting as a socket server, this parameter designates the length of time to wait for the first incoming connection before switching to the continuous state. When the transporter is acting as a socket client, this parameter designates the time period for attempting to re-establish an outgoing connection, in seconds. The default value is 0.

Parameter	Description
KeepAlive	Type: `boolean` (Advanced) If set to true, the adapter disconnects from the socket server if there are no data transports for the duration of time specified in your router configuration. For example, if you set your router configuration to two hours and there are no messages during that time, the adapter disconnects from the socket server. The default value is false.

Building a Custom Transporter Module

Use the ESP adapter toolkit to build a custom transporter module to use within the adapter instance of your choice.

Prerequisites

(Optional) See the `$ESP_HOME/adapters/framework/examples/src` directory for source code for sample transporters.

Task

1. Create a class which extends the com.sybase.esp.adapter.framework.module.Transporter Java class that is included with the adapter toolkit.
2. Implement the **init()** function.

   Prepare your input or output transporter module for the actions it is responsible for performing. For example, create a database connection or obtain properties from the adapter configuration file.
3. Implement the **start()** function.

   Perform any necessary tasks when the adapter is started.
4. Implement the **execute()** function.

   When the adapter framework calls this method, it is expected to run continuously until the adapter is requested to stop or until the adapter completes its work. Therefore, the code excerpt below might be found within a loop, or inside a callback method invoked by the transport when an event occurs, or inside a listener monitoring transport events.

   AepRecord is a single record or row in ESP format and has an operation code that can be set. AdapterRow represents records as they flow from one module to the next. You can add multiple records as objects within a List of a single AdapterRow object. The AdapterRow has a timestamp, and block flags that control how its records are communicated to and from Event Stream Processor. See *Envelopes and Transactions* for additional details.

The actions performed by this function depend on whether the transporter is input (datasource) or output (data sink). For example, for an input transporter which gets data from “myDataSource”, the **execute()** function might look like this:

```
public void execute() throws Exception  {
    String value = myDataSource.getNextValue();

    AepRecord record = new AepRecord();
    record.getValues().add(value);
AdapterRow row = utility.createRow(record);
utility.sendRow(row);
}
```

For an output transporter which sends data to “myDataSink”, the **execute()** function might look like this:

```
public void execute() throws Exception  {

AdapterRow row = utility.getRow();
if(row != null)
{
AepRecord record = (AepRecord)row.getData(0);
if(record != null) {
    String value = record.getValues().toString();
    myDataSink.send(value);
}
}
```

The difference between input and output transporters is that input transporters call **utility.sendRow()** to send data to a formatter or ESP publisher, while output transporters call **utility.getRow()** to obtain data from a formatter or ESP subscriber.

For transporters that operate in streaming mode, call **utility.sendRowsBuffer()** (input) and **utility.getRowsBuffer()** (output).

See the `$ESP_HOME/adapters/framework/examples/src` directory for source code for sample transporters.

5. Implement the **stop()** function.

   Perform any necessary tasks when the adapter is stopped.

6. Implement the **destroy()** function.

   Perform any clean up tasks for your input or output transporter.

7. (Optional) Call one of the following functions within the functions listed in the steps above:

   - Call **utility.getParameters()** to get parameter which are defined in the adapter configuration file.
   - Call **utility.sendRow()** to send data to the next module which is defined in the adapter configuration file.
   - Call **utility.getRow()** to obtain data from the previous module which is defined in the adapter configuration file.

- Call **utility.isStopRequested()** to determine whether a stop command has been issued.

8. Register the implemented Java class to `$ESP_HOME/adapters/framework/config/modulesdefine.xml`. For example:

```
<TransporterDefn>
      <Name>MyOutputTransporter</Name>
      <Class>com.my.MyOutputTransporter</Class>
      <InputData>String</InputData>
    </TransporterDefn>
```

9. Add the schema definitions for any unique parameters of the newly created module to the `$ESP_HOME/adapters/framework/config/parametersdefine.xsd` file.

   If any of the parameters for the newly created module are the same as parameters for the standard transporter modules, you do not need to add schema definitions for these parameters.

10. Copy the .jar file containing the Java class you previously implemented and any other .jar files used by the custom adapter to `$ESP_HOME/adapters/framework/libj`.

11. (Optional) Start the adapter instance by issuing this command:

    $ESP_HOME/adapters/framework/bin/start.bat <config file>** or **$ESP_HOME/adapters/framework/bin/start.sh <config file>

    where <config file> is the adapter configuration file in which you specified the adapter instance using the newly created transporter module.

12. (Optional) Stop the adapter instance by issuing this command:

    $ESP_HOME/adapters/framework/bin/stop.bat <config file>** or **$ESP_HOME/adapters/framework/bin/stop.sh <config file>

    where <config file> is the adapter configuration file in which you specified the adapter instance using the newly created transporter module.

Refer to `$ESP_HOME/adapters/framework/examples` for additional details and transporter examples, as well as `$ESP_HOME/adapters/framework/examples/src` for the source code for these examples.

Next

Create an adapter configuration (.xml) file to define which adapter instance uses this newly created transporter module.

See also

- *Building a Custom Formatter Module* on page 54
- *Accessing Adapter Toolkit API Reference Information* on page 14
- *Transporters Currently Available from SAP* on page 15

Formatter Modules

A formatter module converts between the data format of the transporter module and Event Stream Processor.

Event Stream Processor supports two types of formatters: row-based and stream-based.

Row-based formatters obtain and output data in row format. These formatters work with AdapterRow instances which are containers for one or more records or rows as they flow from one module (transporter, formatter, or ESP connector) to the next. You can add multiple records as objects within a List of a single AdapterRow object. The AdapterRow has a timestamp and block flags that control how its records are communicated to and from Event Stream Processor. See *Envelopes and Transactions* for additional details.

Stream-based formatters deal with streaming data. These formatters work with ByteStream instances which represent a continuous stream of data.

See also

- *Transporter Modules* on page 14
- *EspConnector Modules* on page 61
- *Accessing Adapter Toolkit API Reference Information* on page 14
- *Create a Custom Adapter* on page 12
- *Debugging a Custom Adapter* on page 89

Formatters Currently Available from SAP

The adapter framework provides numerous formatter modules that come standard with Event Stream Processor. You can re-use these modules to create a custom adapter instance.

The Input Datatype column specifies the format of the incoming data, while the Output Datatype column specifies the format that the formatter translates this incoming data into.

AdapterRow is a container for one or more records or rows as they flow from one module (transporter, formatter, or ESP connector) to the next. You can add multiple records as objects within a List of a single AdapterRow object. The AdapterRow has a timestamp and block flags that control how its records are communicated to and from Event Stream Processor. See *Envelopes and Transactions* for additional details.

AepRecord is the class that represents stream records. This is the type that the ESP publisher expects as the data member in the AdapterRow instances that it receives from the previous module. This is also the type used in the AdapterRow instances that the ESP subscriber passes on to the next module.

Several of the formatters come with example data:

- CSV to ESP Formatter, see `$ESP_HOME/adapters/framework/instances/file_csv_input/data/input.csv`
- JSON String to ESP Formatter, see `$ESP_HOME/adapters/framework/instances/file_json_input/data/article_1.json`
- XML String to ESP Formatter, see `$ESP_HOME/adapters/framework/instances/file_xmllist_input/data/input.xml`
- XMLDoc Stream to ESP Formatter, see `$ESP_HOME/adapters/framework/instances/file_xmldoc_input/datetimeExample/data/data_1.xml`

Also, see `$ESP_HOME/adapters/framework/examples/stringlist_input` and `$ESP_HOME/adapters/framework/examples/stringlist_output` for examples containing the String List to ESP Formatter.

Name	Input Datatype	Mode (Streaming/Row)	Output Datatype	Description
CSV to ESP Formatter	`Java.lang.String`	Row	`AepRecord`	Translates CSV string data to AepRecord objects.
ESP to CSV Formatter	`AepRecord`	Row	`Java.lang.String`	Translates AepRecord objects to CSV string data.
ESP to JSON Formatter	`AepRecord`	Row	`Java.lang.String`	Translates AepRecord objects to JSON string data.
ESP to Object List Formatter	`AepRecord`	Row	`Java.util.List<Java.lang.Object>`	Converts AepRecord objects to Java object list.
ESP to String List Formatter	`AepRecord`	Row	`Java.util.List<Java.lang.String>`	Converts AepRecord objects to string list.
ESP to XML String Formatter	`AepRecord`	Row	`Java.lang.String`	Translates AepRecord objects to ESP XML string.

Name	Input Datatype	Mode (Streaming/ Row)	Output Datatype	Description
ESP to XMLDoc String Formatter	`AepRecord`	Row	`String`	Translates AepRecord objects to XML format string according to the schema file configured in the adapter configuration file.
JSON String to ESP Formatter	`Java.lang.String`	Row	`AepRecord`	Translates JSON string to AepRecord objects.
JSON Stream to JSON String Formatter	`InputStream`	Streaming	`Java.lang.String`	Splits ByteStream data into standalone JSON message string data.
Object List to ESP Formatter	`Java.util.List<Java.lang.Object>`	Row	`AepRecord`	Converts Java object list to AepRecord objects.
Stream to String Formatter	`InputStream`	Streaming	`Java.lang.String`	Splits ByteStream data into strings according to the value specified in the delimiter property.
String to Stream Formatter	`Java.lang.String`	Streaming	`OutputStream`	Merges strings into ByteStream data.
String List to ESP Formatter	`Java.util.List<Java.lang.String>`	Row	`AepRecord`	Converts string list to AepRecord objects.
XML String to ESP Formatter	`Java.lang.String`	Row	`AepRecord`	Translates ESP XML strings to AepRecord objects.

Name	Input Data-type	Mode (Streaming/ Row)	Output Data-type	Description
XMLDoc Stream to ESP Formatter	`Input-Stream`	Streaming	`AepRecord`	Parses XML strings, extracts data according to the schema file configured in the adapter configuration file, and translates the data to AepRecord objects.

See also

- *Accessing Adapter Toolkit API Reference Information* on page 14
- *Building a Custom Formatter Module* on page 54

CSV String to ESP Formatter Module Parameters

The CSV String to ESP formatter translates CSV strings to AepRecord objects. Set values for this formatter in the adapter configuration file.

This formatter is row-based and can connect two row-based transporters rather than streaming-based transporters.

Parameter	Description
ExpectStreamNameOpcode	Type: `boolean` (Required) If set to true, the adapter interprets the first two fields of the incoming CSV line as stream name and opcode respectively. The adapter discards messages with unmatched stream names. The accepted opcodes are: • i or I: INSERT • d or D: DELETE • u or U: UPDATE • p or P: UPSERT • s or S: SAFEDELETE The default value is false.

Parameter	Description
Delimiter	Type: `string` (Advanced) The symbols used to separate the column. The default value is a comma (,).
HasHeader	Type: `boolean` (Advanced) Determines whether the first line of the file contains the description of the fields. Default value is false.
DateFormat	Type: `string` (Advanced) The format string for parsing date values. For example, `yyyy-MM-dd'T'HH:mm:ss`.
TimestampFormat	Type: `string` (Advanced) Format string for parsing timestamp values. For example, `yyyy-MM-dd'T'HH:mm:ss.SSS`.

ESP to CSV String Formatter Module Parameters

The ESP to CSV String formatter translates AepRecord objects to CSV strings. Set values for this formatter in the adapter configuration file.

This formatter is row-based and can connect two row-based transporters rather than streaming-based transporters.

Parameter	Description
PrependStreamNameOpcode	Type: `boolean` (Optional) If set to true, the adapter prepends the stream name and the opcode in each row of data that is generated. The default value is false.
Delimiter	Type: `string` (Advanced) The symbols used to separate the column. The default value is a comma (,).
HasHeader	Type: `boolean` (Advanced) Determines whether the first line of the file contains the description of the fields. The default value is false.

Parameter	Description
DateFormat	Type: `string` (Advanced) The format string for date values. For example, `yyyy-MM-dd'T'HH:mm:ss`.
TimestampFormat	Type: `string` (Advanced) Format string for timestamp values. For example, `yyyy-MM-dd'T'HH:mm:ss.SSS`.

ESP to JSON Stream Formatter Module Parameters

The ESP to JSON Stream formatter translates AepRecord objects to JSON strings, and sends the JSON strings to next streaming output transporter that is configured in the adapter configuration file. Set values for this formatter in the adapter configuration file.

This formatter is streaming based and can connect two streaming based transporters rather than row based transporters.

Parameter	Description
ColsMapping	(Required) Section containing the **Column** parameter.
Column	Type: `complextype` (Required) Specify which columns of an ESP row you wish to map to JSON data. These values are matched by a pattern path expression. For example, [<Column>JSONPath expression</Column>]+. The first <Column/> is mapped to the first column of an ESP row, the second <Column/> is mapped to the second column of an ESP row, and so on.
DateFormat	Type: `string` (Advanced) The format string for date values. For example, `yyyy-MM-dd'T'HH:mm:ss`.
TimestampFormat	Type: `string` (Advanced) Format string for timestamp values. For example, `yyyy-MM-dd'T'HH:mm:ss.SSS`.

ESP to Object List Formatter Module Parameters

The ESP to Object List formatter converts an ESP row to an object list. Set values for this formatter in the adapter configuration file.

Parameter	Description
OutputAsSQLDatetimeFormat	Type: `boolean` (Optional) Specify whether the Event Stream Processor `date`, `timestamp`, and `bigdatetime` datatypes are output as `java.sql.Date` or `java.sql.Timestamp`. The default output is `java.util.Date`.

ESP to String List Formatter Module Parameters

The ESP to String List formatter converts an ESP row to a string list. Set values for this formatter in the adapter configuration file.

Parameter	Description
DateFormat	Type: `string` (Optional) The format string for date values from an ESP project. For example, `yyyy-MM-dd'T'HH:mm:ss.`
TimestampFormat	Type: `string` (Optional) Format string for timestamp values from an ESP project. For example, `yyyy-MM-dd'T'HH:mm:ss.SSS`.

ESP to XML String Formatter Module Parameters

The ESP to XML String formatter translates AepRecord objects to ESP XML string. Set values for this formatter in the adapter configuration file.

This formatter is row based and can connect two row based transporters rather than streaming based transporters.

Parameter	Description
DateFormat	Type: `string` (Optional) The format string for date values from an ESP project. For example, `yyyy-MM-dd'T'HH:mm:ss.`
TimestampFormat	Type: `string` (Optional) Format string for timestamp values from an ESP project. For example, `yyyy-MM-dd'T'HH:mm:ss.SSS`.

ESP to XMLDOC String Formatter Module Parameters

The ESP to XMLDOC String formatter translates AepRecord objects to XML format string according to the schema file specified in the adapter configuration file. Set values for this formatter in the adapter configuration file.

This formatter is streaming based and can connect two streaming based transporters rather than row based transporters.

Parameter	Description
XMLSchemaFilePath	Type: `string` (Required) The path to the XML schema file which the XML output document builds against. No default value.
GlobalElementLocalName	Type: `string` (Required) Specify a global element that you wish to use as the root element in the generated XML document. No default value.
ColsMapping	(Required) Section containing the **Column** parameter.

Parameter	Description
Column	Type: `string` (Required) Specify which attributes or child elements, that are generated by the global element, to match by a pattern path expression and map to columns of an ESP row. For example, [<Column>XPath expression</Column>]+. The XPath expression is any valid XPath expression specified by an XPath specification. The first <Column/> is mapped to the first column of an ESP row, the second <Column/> is mapped to the second column of an ESP row, and so on.

JSON String to ESP Formatter Module Parameters

The JSON String to ESP formatter translates JSON strings to AepRecord objects. Set values for this formatter in the adapter configuration file.

This formatter is row based and can connect two row based transporters rather than streaming based transporters.

Parameter	Description
ColumnMappings	(Required) Section containing the **ColsMapping** parameter.
ColsMapping	(Required) Section containing the **Column** parameter.

Parameter	Description
Column	Type: `string` (Required) Specify a value for the JSON data that you wish to map to ESP columns. This value is matched by a pattern path expression. For example, [<Column>JSONPath expression</Column>]. The first <Column/> is mapped to the first column of an ESP row, the second <Column/> is mapped to the second column of an ESP row, and so on. This parameter has two attributes: • **streamname –** Specify which stream to publish. • **rootpath –** Specify a rootpath for the JSON data. You can use one rootpath to publish more than one ESP row from one JSON data record.
DateFormat	Type: `string` (Advanced) The format string for parsing date values. For example, `yyyy-MM-dd'T'HH:mm:ss`.
TimestampFormat	Type: `string` (Advanced) Format string for parsing timestamp values. For example, `yyyy-MM-dd'T'HH:mm:ss.SSS`.

JSON Stream to JSON String Formatter Module Parameters

The JSON Stream to JSON String formatter reads data from InputStream, splits it into standalone JSON message strings, and sends these message strings to the next module that is

configured in the adapter configuration file. Set values for this formatter in the adapter configuration file.

Parameter	Description
CharsetName	Type: `string` (Optional) Specify the name of a supported charset. The default value is US-ASCII.

Object List to ESP Formatter Module Parameters

The Object List to ESP formatter converts an object list to an ESP row. Set values for this formatter in the adapter configuration file.

Parameter	Description
DateFormat	Type: `string` (Optional) The format string for parsing date values. For example, `yyyy-MM-dd'T'HH:mm:ss`.
TimestampFormat	Type: `string` (Optional) Format string for parsing timestamp values. For example, `yyyy-MM-dd'T'HH:mm:ss.SSS`.

Stream to String Formatter Module Parameters

The Stream to String formatter reads streaming data from an input stream, and splits it into Java strings. Set values for this formatter in the adapter configuration file.

Parameter	Description
Delimiter	Type: `string` (Required) Specify the symbol used to separate columns. The default value is "\n".
IncludeDelimiter	Type: `boolean` (Required) If set to true, the delimiter is part of current row. If set to false, the delimiter is not part of the current row. The default value is false.

Parameter	Description
AppendString	Type: `string` (Required if **IncludeDelimiter** is set to true) If set to true, specify the string to append to the end of each result row. No default value.
AppendPosition	Type: `string` (Required if **IncludeDelimiter** is set to true) Specify the position to which the **AppendString** parameter takes effect. There are two valid values: front and end. The default value is front.
IgnoreSpace	Type: `boolean` (Required) Specify whether to trim the space char. The default value is true.
CharsetName	Type: `string` (Advanced) Specify the name of a supported charset. The default value is US-ASCII.

String to Stream Formatter Module Parameters

The String to Stream formatter writes Java strings to output streams. Set values for this formatter in the adapter configuration file.

Parameter	Description
Delimiter	Type: `string` (Required) Specify the symbol used to separate columns. The default value is "\n".
IncludeDelimiter	Type: `boolean` (Required) If set to true, the delimiter is part of current row. If set to false, the delimiter is not part of the current row. The default value is false.
AppendString	Type: `string` (Required if **IncludeDelimiter** is set to true) If set to true, specify the string to append to the end of each result row. No default value.

Parameter	Description
AppendPosition	Type: `string` (Required if **IncludeDelimiter** is set to true) Specify the position to which the **AppendString** parameter takes effect. There are two valid values: front and end. The default value is front.
IgnoreSpace	Type: `boolean` (Required) Specify whether to ignore the space char. The default value is false.
CharsetName	Type: `string` (Advanced) Specify the name of a supported charset. The default value is US-ASCII.

String List to ESP Formatter Module Parameters

The String List to ESP formatter converts a string list to an ESP row. Set values for this formatter in the adapter configuration file.

Parameter	Description
DateFormat	Type: `string` (Optional) The format string for parsing date values. For example, `yyyy-MM-dd'T'HH:mm:ss`.
TimestampFormat	Type: `string` (Optional) Format string for parsing timestamp values. For example, `yyyy-MM-dd'T'HH:mm:ss.SSS`.

XML String to ESP Formatter Module Parameters

The XML String to ESP formatter translates ESP XML strings to AepRecord objects. Set values for this formatter in the adapter configuration file.

This formatter is row based and can connect two row based transporters rather than streaming based transporters.

Parameter	Description
DateFormat	Type: `string` (Optional) The format string for parsing date values. For example, `yyyy-MM-dd'T'HH:mm:ss`.
TimestampFormat	Type: `string` (Optional) Format string for parsing timestamp values. For example, `yyyy-MM-dd'T'HH:mm:ss.SSS`.

XMLDOC Stream to ESP Formatter Module Parameters

The XMLDOC Stream to ESP formatter parses XML format strings, extracts data according to the schema file specified in the adapter configuration file, and translates this data to AepRecord objects. Set values for this formatter in the adapter configuration file.

This formatter is streaming based and can connect two streaming based transporters rather than row based transporters.

Parameter	Description
XmlElemMappingRowPattern	Type: `string` (Required) Specify a pattern to determine which XML elements in the XML doc are processed by the formatter. The matched elements are mapped to ESP rows whose attributes and child elements are mapped as columns of an ESP row. The adapter ignores any XML elements that do not match this pattern. This pattern is a subset of the XPath expressions. The [/]?NCName[/NCName]* path expression is the only supported expression, where NCName (Non-Colonized Name) is the local name element without a prefix or namespace. If the elements in the path expression include a namespace URI (prefix), they belong to the same namespace. Provide the namespace in the **XmlElemNamespace** parameter. Here are some examples of valid path expressions: • /RootElement • ParentElement • ParentElement/ChildElement • /RootElement/ParentElement
XmlElemNamespace	Type: `string` (Required) Specify the namespace URI for elements that appear in the pattern path expression.
ColsMapping	(Required) Section containing the **Column** parameter.

Parameter	Description
Column	Type: `string` (Required) Specify which attributes or child elements of the XML elements, which are matched by pattern path expression, to map to columns of the ESP row. For example, [<Column>XPath expression</Column>]+. The XPath expression is any valid XPath expression specified by an XPath specification. The XPath expression can only begin from the last XML element that appears in the path pattern expression or its decedent elements. The first <Column/> is mapped to the first column of the ESP row, the second <Column/> is mapped to the second column of the ESP row, and so on.
DateFormat	Type: `string` (Optional) The format string for parsing date values. For example, `yyyy-MM-dd'T'HH:mm:ss`.
TimestampFormat	Type: `string` (Optional) Format string for parsing timestamp values. For example, `yyyy-MM-dd'T'HH:mm:ss.SSS`.

Datatype Mapping for Formatters

Mapping information for ESP to Java datatypes and Java to ESP datatypes.

Table 5. ESP to Java Objects Datatype Mappings

ESP Datatype	Java Datatype
`string`	`java.lang.String`
`boolean`	`java.lang.Boolean`
`integer`	`java.lang.Integer`
`long` or `interval`	`java.lang.Long`

ESP Datatype	Java Datatype
`double`	`java.lang.Double`
`timestamp`	`java.util.Date` or `java.sql.Timestamp` (if **OutputAsSQLDatetimeFormat** is set to true)
`date`	`java.util.Date` or `java.sql.Timestamp` (if **OutputAsSQLDatetimeFormat** is set to true)
`bigdatetime`	`java.lang.String` (the output format is yyy-MM-ddTHH:mm:ss:UUUUUU where U stands for microseconds and the timezone is in UTC) or `java.sqlTimestamp` (if **OutputAsSQLDatetimeFormat** is set to true)
`money`, `money01` - `money15`	`java.math.BigDecimal` (it has the same precision as corresponding `money(xx)` object
`binary`	`byte[]`

Table 6. Java Objects to ESP Datatype Mappings

Java Datatype	ESP Datatype
`Java.util.Date` (including its child classes)	`bigdatetime`
`byte[]`	`binary`
`Java.lang.Object` (including its child classes)	`string`
Any Java classes with the **toString()** method, and the result string is [true,false]	`boolean`
Any Java classes with the **toString()** method, and the result string can be used in **integer.valueOf(result)**	`integer`
Any Java classes with the **toString()** method, and the result string can be used in **Long.valueOf(result)**	`long` or `interval`

Java Datatype	ESP Datatype
Any Java classes with the **toString()** method, and the result string can be used in **Double.valueOf(result)**	`double`
Any Java classes with the **toString()** method. The result string consists of the decimal digits except that the first character may be an ASCII minus sign '-' ('\u002D') to indicate a negative value, or an ASCII plus sign '+' ('\u002B') to indicate a positive value, or the period may occur in the middle of the string. The part after the period is the implied precision and the precision matches with the ESP datatype.	`money`, `money01` - `money15`

Building a Custom Formatter Module

Use the ESP adapter toolkit to build a custom formatter module to use within the adapter instance of your choice.

Prerequisites

(Optional) See the `$ESP_HOME/adapters/framework/examples/src` directory for source code for sample formatters.

Task

1. Create a class which extends one of these Java classes:
   - (Row-based formatter) com.sybase.esp.adapter.framework.module.RowFormatter
   - (Streaming-based formatter) com.sybase.esp.adapter.framework.module.StreamingFormatter

   Make row-based formatters a subclass of RowFormatter, and stream-based formatters a subclass of StreamingFormatter. Use row-based formatters with row-based transporters, and stream-based formatters with stream-based transporters.
2. For row-based formatters, implement these functions:
   a) The **init()** function.

      Prepare your formatter module for converting between data formats, such as obtaining properties from the adapter configuration file and performing any required initialization tasks.
   b) The **destroy()** function.

      Perform clean up actions for your formatter.
   c) The **convert()** function.

      Here is a simple example of a **convert()** function which converts Java objects to strings:

```
public AdapterRow convert(AdapterRow in) throws Exception {
    Object obj = in.getData(0);
    in.setData(0, obj.toString());
    return in;
}
```

3. For stream-based formatters, implement these functions:
   a) The **init()** function.

      Prepare your formatter module for converting between data formats, such as obtaining properties from the adapter configuration file and performing any required initialization tasks.
   b) The **start()** function.

      Perform any necessary tasks when the adapter is started.
   c) The **execute()** function.

      Here is an example of the **execute()** function for a formatter which converts row-based data into stream-based:

```
public void execute() throws Exception {
    OutputStream output = utility.getOutputStream();
    while(!utility.isStopRequested())
    {
      AdapterRow row = utility.getRow();
        if(row != null)
        {
        AepRecord record = (AepRecord)row.getData(0);
        String str = record.getValues().toString() + "\n";
        output.write(str.getBytes());
        }
      }
    }
```

      For a formatter which converts from stream-based data into row-based, use:
      - **utility.getInputStream()** to obtain the InputStream
      - **utility.createRow()** to create the AdapterRow objects
      - **utility.sendRow()** to send the rows to the next module specified in the adapter configuration file
   d) The **stop()** function.

      Perform any necessary tasks when the adapter is stopped.
   e) The **destroy()** function.

      Perform clean up actions for your formatter.
4. (Optional) Call one of the following functions within the functions listed in the steps above:
   - Call **utility.getParameters()** to get parameter which are defined in the adapter configuration file.
   - Call **utility.sendRow()** to send data to the next module which is defined in the adapter configuration file.

- Call **utility.getRow()** to obtain data from the previous module which is defined in the adapter configuration file.
- Call **utility.isStopRequested()** to determine whether a stop command has been issued.

5. Register the implemented Java class to `$ESP_HOME/adapters/framework/config/modulesdefine.xml`. For example:

```
<FormatterDefn>
<Name>SampleFormatter</Name>
<Class>com.sybase.esp.adapter.formatters.SampleFormatter</Class>
<InputData>String</InputData>
<OutputData>ESP</OutputData>
<ParametersNodeName>SampleFormatterParameters</
ParametersNodeName>
</FormatterDefn>
```

   where <ParametersNodeName> is the optional node representing the formatter subnode name in the adapter configuration file.

6. Add the schema definitions for any unique parameters of the newly created module to the `$ESP_HOME/adapters/framework/config/parametersdefine.xsd` file.

   If any of the parameters for the newly created module are the same as parameters for the standard formatter modules, you do not need to add schema definitions for these parameters.

7. Copy the .jar file containing the class you previously implemented to `$ESP_HOME/adapters/framework/libj`.

8. (Optional) Start the adapter instance by issuing this command:

   $ESP_HOME/adapters/framework/bin/start.bat <config file>** or **$ESP_HOME/adapters/framework/bin/start.sh <config file>

   where <config file> is the adapter configuration file in which you specified the adapter instance using the newly created formatter module.

9. (Optional) Stop the adapter instance by issuing this command:

   $ESP_HOME/adapters/framework/bin/stop.bat <config file>** or **$ESP_HOME/adapters/framework/bin/stop.sh <config file>

   where <config file> is the adapter configuration file in which you specified the adapter instance using the newly created formatter module.

Refer to `$ESP_HOME/adapters/framework/examples` for additional details and formatter examples, as well as `$ESP_HOME/adapters/framework/examples/src` for the source code for these examples.

Next

Create an adapter configuration (.xml) file to define which adapter instance uses this newly created formatter module

See also

- *Building a Custom Transporter Module* on page 34
- *Enabling Guaranteed Delivery for an Input Transporter* on page 59
- *Accessing Adapter Toolkit API Reference Information* on page 14
- *Formatters Currently Available from SAP* on page 37

Batch Processing

Details on controlling how AdapterRow instances are sent and processed by Event Stream Processor.

Sending individual AdapterRow instances to Event Stream Processor results in minimal latency but can reduce overall throughput due to network overhead. Sending AdapterRow instances using batch processing or blocks can improve overall throughput with some reduction in latency. See *Batch Processing* in the *Programmers Guide* for additional details.

AdapterRow instances are published to ESP individually when the AdapterRow is not a part of a block. In this case, it is sent over the network to ESP when the **sendRow()** or **sendRowData()** method is invoked.

A block may be demarcated explicitly within the source code or implicitly using the adapter configuration file. A block is demarcated explicitly when either a BATCH_START flag (sends the block using envelopes) or a TRANS_START flag (sends the block using transactions) is set in the current or preceding AdapterRow instances. The end of a block is demarcated by an AdapterRow instance with a BLOCK_END flag, or when an AdapterRow is sent to ESP with the **sendEnd()** method instead of the **sendRow()** or **sendRowData()** methods.

If the AdapterRow instance is not explicitly part of a block and the optional EspPublisher module property **MaxPubPoolSize** is set to a value greater than 1, the adapter framework automatically uses blocks to transmit the records. The **MaxPubPoolSize** parameter specifies the maximum size of the record pool before all records in the pool are published. If the optional EspPublisher module property **MaxPubPoolTime** is configured, this also causes publishing of the record pool in blocks. **MaxPubPoolTime** specifies the maximum period of time, in milliseconds, for which records are pooled before being published. If the threshold value of either of these two parameters are reached, the record pool is published using blocks. A third optional configuration property, **UseTransactions**, controls whether the blocks are published using envelopes or transactions.

In the event blocks are not demarcated explicitly in the adapter code, and are not implicitly used based on the adapter configuration, records are published individually.

A typical transaction block using AdapterRow might look like this:

1. An AdapterRow with a block flag that is set to TRANS_START
2. Various AdapterRows with block flags that are set to BLOCK_DATA
3. An AdapterRow with a block flag set to BLOCK_END

For AdapterRow instances with no data and only the start or end flag, set each data position in the instance to null. See the `$ESP_HOME/adapters/framework/examples/src/com/sybase/esp/adapter/framework/examplemodules/ExampleRowInputTransporter.java` example for publishing AdapterRow instances in various ways.

Note that an AdapterRow instance cannot contain records from multiple transactions. If using blocks, records from an AdapterRow instance publish in one transaction or envelope.

See also

- *Event Stream Processor Publisher Module Parameters* on page 64

Schema Discovery

You can use the schema discovery feature to discover external schemas and create CCL schemas based on the format of the data from the datasource connected to an adapter.

Every row in a stream or window must have the same structure, or schema, which includes the column names, the column datatypes, and the order in which the columns appear. Multiple streams or windows may use the same schema, but a stream or window can only have one schema.

Rather than manually creating a new schema, you can use schema discovery to discover and automatically create a schema based on the format of the data from the datasource connected to your adapter. For example, for the Database Input adapter, you can discover a schema that corresponds to a specific table from a database the adapter is connected to.

While using discovery is a convenient way to create your CCL schema, pay particular attention to the datatypes your CCL columns inherit from the external data source. For example, whenever possible, discovery maintains the same level of precision or greater when mapping source data types to ESP data types. Some databases, such as SAP Sybase IQ, support microsecond precision for the `SQL_TIMESTAMP` and `SQL_TYPE_TIMESTAMP` data types. As such, discovery maps these types to the ESP data type `bigdatetime`, which also supports microsecond precision. If your ESP project does not require this level of precision, you can, after generating your schema through discovery, modify the schema to use a lower-precision data type such as `timestamp` (millisecond precision).

To discover a schema, you need to first configure the adapter properties. Each adapter that supports schema discovery has unique properties that must be set to enable schema discovery.

Implementing Schema Discovery in a Custom Adapter

(Optional) Use interfaces and functions from the adapter toolkit to implement schema discovery in a transporter and formatter module. There are two types of schema discovery: non-sampling and sampling. Use non-sampling schema discovery when the transporter can fully determine schema on its own. Use sampling schema discovery when the transporter cannot determine the schema and passes this data to the formatter to generate the schema.

1. Add the **x_winCmdDisc** (Windows) or **x_unixCmdDisc** (UNIX) parameters to the cnxml file for your custom adapter.

   See `$ESP_HOME/adapters/framework/examples/discover/ExampleAdapterForDiscovery.cnxml` for an example of a cnxml file with the discovery command.
2. Implement schema discovery in your custom modules:
   - (For transporter modules only) To implement non-sampling schema discovery, implement the com.sybase.esp.adapter.framework.discovery.TableDiscovery and com.sybase.esp.adapter.framework.discovery.ColumnDiscovery interfaces.
     For an example of an adapter with non-sampling schema discovery, see `$ESP_HOME/adapters/framework/examples/discover`. For the source code of a discoverable transporter module, see `$ESP_HOME/adapters/framework/examples/src/com/Sybase/esp/adapter/framework/examplemodules/ExampleDiscoverableInputTransporter.java`.
   - (For input adapters only) To implement sampling schema discovery:
     a. For the transporter module, implement the com.sybase.esp.adapter.framework.discovery.TableDiscoveryWithSample interface.
     b. For the formatter module, implement the com.sybase.esp.adapter.framework.discovery.ColumnDiscovery interface.

See also

- *Enabling Guaranteed Delivery for an Input Transporter* on page 59
- *Configuring a New Adapter* on page 70

Guaranteed Delivery

Guaranteed delivery (GD) is a delivery mechanism that guarantees data is processed from a stream to an adapter.

GD ensures that data continues to be processed when:

- The ESP Server fails.
- The destination (third-party server) fails.
- The destination (third-party server) does not respond for a period of time.

Input adapters support GD using facilities provided by the external datasource to which the input transporter connects.

Enabling Guaranteed Delivery for an Input Transporter

(Optional) Enable guaranteed delivery (GD) in a custom input transporter by implementing the com.sybase.esp.adapter.framework.event.AdapterRowEventListener interface,

registering the GdAdapterEventListener class, and adding and setting the **<GDMode>** parameter to true for the EspPublisher or EspMultistreamPublisher.

Prerequisites

Create a custom input transporter module.

Task

1. In the adapter configuration file, add the **<GDMode>** parameter and set it to true for the EspPublisher or EspMultiStreamPublisher:

   - For EspPublisher:

     ```
     <EspPublisherParameters>
       <ProjectName>EspProject1</ProjectName>
       <StreamName>MyInStream</StreamName>
       <GDMode>true</GDMode>
     </EspPublisherParameters>
     ```

   - For EspMultiStreamPublisher:

     ```
     <EspMultiStreamPublisherParameters>
       <Streams>
         <Stream>
           <ProjectName>EspProject1</ProjectName>
           <StreamName>MyInStream1</StreamName>
           <GDMode>true</GDMode>
         </Stream>
       </Streams>
     </EspMultiStreamPublisherParameters>
     ```

2. Implement the com.sybase.esp.adapter.framework.event.AdapterRowEventListener interface. For example,

   ```
   public class GdAdapterEventListener implements
   AdapterRowEventListener
   {
          public void adapterEventPerformed(AdapterRowEvent event) {
                    List<AdapterRow> rows = event.getAdapterRows();
                    switch(event.getType())
                    {
                    case  PUBLISH SUCCESS:
                            processPublishSuccess();
                            break;
                    case  PUBLISH FAILURE:
                            processPublishFailure();
                            break;
                    case  FORMAT FAILURE:
                            processFormatFailure();
                            break;
                    default:
                            break;
                    }
            }
   }
   ```

3. Create the class GdAdapterEventListener and register it to enable GD in the input transporter when it starts up. For example,

```
GdAdapterEventListener gdProcessor = new
GdAdapterEventListener();

utility.getAdapterUtility().registerRowEventListener(gdProcessor,
EventType.PUBLISH_SUCCESS);
utility.getAdapterUtility().registerRowEventListener(gdProcessor,
EventType.PUBLISH_FAILURE);
utility.getAdapterUtility().registerRowEventListener(gdProcessor,
EventType.FORMAT_FAILURE);
```

4. Ensure that you keep track of the last row successfully published to ESP, either by using your external datasource or the transporter itself.
   If using the input transporter, you can get the last row successfully published from the PUBLISH_SUCCESS message. If you are publishing in transactions or envelopes, the PUBLISH_SUCCESS message contains all rows in the last transaction or envelope to be successfully published. If you publish in single rows, the message contains the last single row that was successfully published.

See also

- *Building a Custom Formatter Module* on page 54
- *Implementing Schema Discovery in a Custom Adapter* on page 58

EspConnector Modules

The EspConnector modules are the modules responsible for connecting to Event Stream Processor. There are four EspConnector module types: EspSubscriber, EspMultiStreamSubscriber, EspPublisher, and EspMultiStreamPublisher.

The EspSubscriber module subscribes to a stream in an ESP project and outputs data to the next module configured in the adapter configuration file (for example, a formatter or transporter). The EspMultiStreamSubscriber module has the same functionality but can subscribe to multiple streams.

The EspPublisher module takes data from a transporter module and publishes it to a stream in an ESP project. The EspMultiStreamPublisher has the same functionality but can publish data to multiple streams.

See also

- *Formatter Modules* on page 37
- *Transporter Modules* on page 14
- *Accessing Adapter Toolkit API Reference Information* on page 14
- *Create a Custom Adapter* on page 12
- *Debugging a Custom Adapter* on page 89

Event Stream Processor Subscriber Module Parameters

Specify values for the Event Stream Processor Subscriber module in the adapter configuration file. Specify this module for an output adapter only.

Parameter	Description
ProjectName	Type: `string` (Required if running adapter in standalone mode; optional if running in managed mode) Specifies the unique project tag of the ESP project to which the adapter is connected. For example, EspProject2. This is the same project tag that you specify later in the adapter configuration file in the **Name** parameter of the Event Stream Processor (**EspProjects**) parameters section. If you are starting the adapter with the ESP project to which it is attached (running the adapter in managed mode), you do not need to set this property as the adapter automatically detects the project name.
StreamName	Type: `string` (Required if running adapter in standalone mode; optional if running in managed mode) Name of the ESP stream from which the adapter subscribes to data. If you are starting the adapter with the ESP project to which it is attached (running the adapter in managed mode), you do not need to set this property as the adapter automatically detects the stream name.

See also

- *Event Stream Processor MultiStream Subscriber Module Parameters* on page 63
- *Event Stream Processor Publisher Module Parameters* on page 64
- *Event Stream Processor MultiStream Publisher Module Parameters* on page 66
- *Event Stream Processor Parameters* on page 68
- *Configuring a New Adapter* on page 70

Event Stream Processor MultiStream Subscriber Module Parameters

Specify values for the ESP MultiStream Subscriber module in the adapter configuration file. This module is specified only for an output adapter.

Parameter	Description
Streams	(Required) Section containing the **Stream**, **ProjectName**, **StreamName**, and **ColumnMapping** parameters.
Stream	(Required) Section containing details for the target project and streams to which the adapter is connected. Contains the **ProjectName**, **StreamName**, and **ColumnMapping** parameters. You can specify multiple **Stream** elements.
ProjectName	Type: `string` (Required if running adapter in standalone mode; optional if running in managed mode) The name of the ESP project to which the adapter belongs. The same project as specified in the **Name** parameter of the ESP projects section of the adapter configuration file. If you are starting the adapter with the ESP project to which it is attached (running the adapter in managed mode), you do not need to set this property as the adapter automatically connects to the project that started it.
StreamName	Type: `string` (Required if running adapter in standalone mode; optional if running in managed mode) The name of the source stream to which the adapter connects. If you are starting the adapter with the ESP project to which it is attached (running the adapter in managed mode), you do not need to set this property as the adapter automatically connects to the stream to which it is attached within the project.

Parameter	Description
ColumnMapping	Type: `string` (Optional) The column list of the source stream to which the adapter connects. Separate the columns with a space char. This parameter contains the "enumtype" attribute which has two valid values: • **index –** the index of the column • **name –** the column name The default value is name.

See also

- *Event Stream Processor Subscriber Module Parameters* on page 62
- *Event Stream Processor Publisher Module Parameters* on page 64
- *Event Stream Processor MultiStream Publisher Module Parameters* on page 66
- *Event Stream Processor Parameters* on page 68
- *Configuring a New Adapter* on page 70

Event Stream Processor Publisher Module Parameters

Specify values for the Event Stream Processor Publisher module in the adapter configuration file. Specify this module for the input adapter only.

Parameter	Description
ProjectName	Type: `string` (Required if running adapter in standalone mode; optional if running in managed mode) Name of the ESP project to which the adapter is connected. For example, EspProject2. This is the same project tag that you specify later in the adapter configuration file in the **Name** parameter of the Event Stream Processor (**EspProjects**) parameters section. If you are starting the adapter with the ESP project to which it is attached (running the adapter in managed mode), you do not need to set this property as the adapter automatically detects the project name.

Parameter	Description
StreamName	Type: `string` (Required if running adapter in standalone mode; optional if running in managed mode) Name of the ESP stream to which the adapter publishes data. If you are starting the adapter with the ESP project to which it is attached (running the adapter in managed mode), you do not need to set this property as the adapter automatically detects the stream name.
MaxPubPoolSize	Type: `positive integer` (Optional) Specifies the maximum size of the record pool. Record pooling, also referred to as block or batch publishing, allows for faster publication since there is less overall resource cost in publishing multiple records together compared to publishing records individually. Block publishing (record pooling or batch publishing) is disabled if this value is set to 1. The default value is 256.
MaxPubPoolTime	Type: `positive integer` (Optional) Specifies the maximum period of time, in milliseconds, for which records are pooled before being published. If not set, pooling time is unlimited and the pooling strategy is governed by **maxPubPoolSize**. No default value.
UseTransactions	Type: `boolean` (Optional) If set to true, pooled messages are published to Event Stream Processor in transactions. If set to false, they are published in envelopes. Default value is false.

Parameter	Description
GDMode	Type: `boolean` (Optional) If set to true, the adapter runs in guaranteed delivery (GD) mode. See *Enabling Guaranteed Delivery for an Input Transporter* for additional details on enabling GD. Default value is false.

See also

- *Event Stream Processor Subscriber Module Parameters* on page 62
- *Event Stream Processor MultiStream Subscriber Module Parameters* on page 63
- *Event Stream Processor MultiStream Publisher Module Parameters* on page 66
- *Event Stream Processor Parameters* on page 68
- *Configuring a New Adapter* on page 70
- *Batch Processing* on page 57

Event Stream Processor MultiStream Publisher Module Parameters

Specify values for the ESP MultiStream Publisher module in the adapter configuration file. This module is specified only for an input adapter.

Parameter	Description
Streams	(Required) Section containing the **Stream**, **ProjectName**, **StreamName**, and **ColumnMapping** parameters.
Stream	(Required) Section containing details for the target project and streams to which the adapter is connected. Contains the **ProjectName** , **StreamName**, and **ColumnMapping** parameters. You can specify multiple **Stream** sections.
Filter	(Optional) Section containing the **MatchString** parameter.
MatchString	(Optional) Filters records with one or more column values. Contains a value attribute for specifying the value you wish to filter by. No default value.

Parameter	Description
ProjectName	Type: `string` (Required if running adapter in standalone mode; optional if running in managed mode) The name of the ESP project to which the adapter belongs. The same project as specified in the **Name** parameter of the ESP projects section of the adapter configuration file. If you are starting the adapter with the ESP project to which it is attached (running the adapter in managed mode), you do not need to set this property as the adapter automatically connects to the project that started it.
StreamName	Type: `string` (Required if running adapter in standalone mode; optional if running in managed mode) The name of the target stream to which the adapter connects. If you are starting the adapter with the ESP project to which it is attached (running the adapter in managed mode), you do not need to set this property as the adapter automatically connects to the stream to which it is attached within the project.
ColumnMapping	Type: `string` (Optional) The column index list in the source row to be published to the target stream. Separate the columns using space char. If you do not set this parameter, all columns are published to the target stream.
SafeOps	Type: `boolean` (Advanced) Converts the opcodes INSERT and UPDATE to UPSERT, and converts DELETE to SAFEDELETE. The default value is false.
SkipDels	Type: `boolean` (Advanced) Skips the rows with opcodes DELETE or SAFEDELETE. The default value is false.

See also

- *Event Stream Processor Subscriber Module Parameters* on page 62
- *Event Stream Processor MultiStream Subscriber Module Parameters* on page 63
- *Event Stream Processor Publisher Module Parameters* on page 64
- *Event Stream Processor Parameters* on page 68
- *Configuring a New Adapter* on page 70

Event Stream Processor Parameters

Event Stream Processor parameters configure communication between Event Stream Processor and the adapter instance. Define these parameters in the adapter configuration file.

Parameter	Description
EspProjects	(Required) Section containing parameters for connecting to Event Stream Processor.
EspProject	(Required) Section containing the **Name** and **Uri** parameters. Specifies information for the ESP project to which the adapter is connected.
Name	Type: `string` (Required) Specifies the unique project tag of the ESP project which the EspConnector (publisher/subscriber) module references.
Uri	Type: `string` (Required) Specifies the total project URI to connect to the ESP project. For example, `esp://localhost:19011/ws1/p1`.
Security	(Required) Section containing all the authentication parameters below. Specifies details for the authentication method used for Event Stream Processor.
User	Type: `string` (Required) Specifies the user name required to log in to Event Stream Processor (see **AuthType**). No default value.

Parameter	Description
Password	Type: `string` (Required) Specifies the password required to log in to Event Stream Processor (see **espAuthType**). Includes an "encrypted" attribute indicating whether the **Password** value is encrypted. Default value is false. If set to true, the password value is decrypted using **RSAKeyStore** and **RSAKeyStorePassword**.
AuthType	Type: `string` (Required) Specifies method used to authenticate to the Event Stream Processor. Valid values are: • **server_rsa –** RSA authentication using keystore • **kerberos –** Kerberos authentication using ticket-based authentication • **user_password –** LDAP, SAP BI, and Native OS (user name/password) authentication If the adapter is operated as a Studio plug-in, **AuthType** is overridden by the **Authentication Mode** Studio start-up parameter.
RSAKeyStore	Type: `string` (Dependent required) Specifies the location of the RSA keystore, and decrypts the password value. Required if **AuthType** is set to server_rsa, or the encrypted attribute for **Password** is set to true, or both.
RSAKeyStorePassword	Type:`string` (Dependent required) Specifies the keystore password, and decrypts the password value. Required if **AuthType** is set to server_rsa, or the encrypted attribute for **Password** is set to true, or both.
KerberosKDC	Type: `string` (Dependent required) Specifies host name of Kerberos key distribution center. Required if **AuthType** is set to kerberos.

Parameter	Description
KerberosRealm	Type: `string` (Dependent required) Specifies the Kerberos realm setting. Required if **AuthType** is set to kerberos.
KerberosService	Type: `string` (Dependent required) Specifies the Kerberos principal name that identifies an Event Stream Processor cluster. Required if **AuthType** is set to kerberos.
KerberosTicketCache	Type: `string` (Dependent required) Specifies the location of the Kerberos ticket cache file. Required if **AuthType** is set to kerberos.
EncryptionAlgorithm	Type: `string` (Optional) Used when the encrypted attribute for **Password** is set to true. If left blank, RSA is used as default.

See also

- *Event Stream Processor Subscriber Module Parameters* on page 62
- *Event Stream Processor MultiStream Subscriber Module Parameters* on page 63
- *Event Stream Processor Publisher Module Parameters* on page 64
- *Event Stream Processor MultiStream Publisher Module Parameters* on page 66
- *Configuring a New Adapter* on page 70

Configuring a New Adapter

Configure a new adapter by creating a configuration file for that adapter. The configuration file defines the adapter component chain through which data is processed, as well as the connection to Event Stream Processor.

Prerequisites

Create any custom transporters and formatters that you wish to use in this adapter instance.

Task

1. Create an <Adapter> element and include all the elements from the steps below within this element.
2. Add a <Name> element and specify a name for the adapter instance.
3. Add a <Description> element and specify the purpose of the adapter.
4. Add a <Modules> element that will contain all of the modules for your adapter instance.
5. For each module, specify:

Parameter	Description
InstanceName	Type: `string` (Required) Specify the instance name of the specific module you wish to use. For example, MyInputTransporter.
Name	Type: `string` (Required) The name of the module as defined in the `modulesdefine.xml` file. This should be a unique name. For example, My-CustomInputTransporter.
Next	Type: `string` (Required if another module follows this one) Specify the instance name of the module that follows this one.
BufferMaxSize	Type: `integer` (Advanced) Specify the capacity of the buffer queue between this module and the next. The default value is 10240.
Parallel	Type: `boolean` (Optional; applies to row-based formatters only) If set to true, the module runs as a separated thread. If set to false, the module shares thread with other modules. The default value is true.

Parameter	Description
Parameters	(Required) Specify parameters for the current module. For a custom module, the sub-element can reflect the name or type of the module, for example <MyCustomInputTransporterParameters>. The EspPublisher, EspMultiStreamPublisher, EspSubscriber, and EspMultiStreamSubscriber all have set parameters that need to be configured specified.

6. Configure one of these modules for your adapter:

   For the EspPublisher, add a <EspPublisherParameters> sub-element and specify:

Parameter	Description
ProjectName	Type: `string` (Required if running adapter in standalone mode; optional if running in managed mode) Name of the ESP project to which the adapter is connected. For example, EspProject2. This is the same project tag that you specify later in the adapter configuration file in the **Name** parameter of the Event Stream Processor (**EspProjects**) parameters section. If you are starting the adapter with the ESP project to which it is attached (running the adapter in managed mode), you do not need to set this property as the adapter automatically detects the project name.
EspPublisherParameters	(Required) Section containing parameters for the ESP publisher.

Parameter	Description
StreamName	Type: `string` (Required if running adapter in standalone mode; optional if running in managed mode) Name of the ESP stream to which the adapter publishes data. If you are starting the adapter with the ESP project to which it is attached (running the adapter in managed mode), you do not need to set this property as the adapter automatically detects the stream name.
MaxPubPoolSize	Type: `positive integer` (Optional) Specifies the maximum size of the record pool. Record pooling, also referred to as block or batch publishing, allows for faster publication since there is less overall resource cost in publishing multiple records together compared to publishing records individually. Block publishing (record pooling or batch publishing) is disabled if this value is set to 1. The default value is 256.
MaxPubPoolTime	Type: `positive integer` (Optional) Specifies the maximum period of time, in milliseconds, for which records are pooled before being published. If not set, pooling time is unlimited and the pooling strategy is governed by **maxPubPoolSize**. No default value.
UseTransactions	Type: `boolean` (Optional) If set to true, pooled messages are published to Event Stream Processor in transactions. If set to false, they are published in envelopes. Default value is false.
SafeOps	Type: `boolean` (Advanced) Converts the opcodes INSERT and UPDATE to UPSERT, and converts DELETE to SAFEDELETE. The default value is false.

Parameter	Description
SkipDels	Type: `boolean` (Advanced) Skips the rows with opcodes DELETE or SAFEDELETE. The default value is false.

For the EspMultiStreamPublisher, add a <EspMultiStreamPublisherParameters> subelement and specify:

Parameter	Description
Streams	(Required) Section containing the **Stream**, **ProjectName**, **StreamName**, and **ColumnMapping** parameters.
Stream	(Required) Section containing details for the target project and streams to which the adapter is connected. Contains the **ProjectName** , **StreamName**, and **ColumnMapping** parameters. You can specify multiple **Stream** sections.
Filter	(Optional) Section containing the **MatchString** parameter.
MatchString	(Optional) Filters records with one or more column values. Contains a value attribute for specifying the value you wish to filter by. No default value.
ProjectName	Type: `string` (Required) The name of the ESP project to which the adapter belongs. The same project as specified in the **Name** parameter of the ESP projects section of the adapter configuration file.
StreamName	Type: `string` (Required) The name of the target stream to which the adapter connects.

Parameter	Description
ColumnMapping	Type: `string` (Optional) The column index list in the source row to be published to the target stream. Separate the columns using space char. If you do not set this parameter, all columns are published to the target stream.

For the EspSubscriber, add a <EspSubscriberParameters> sub-element and specify:

Parameter	Description
ProjectName	Type: `string` (Required if running adapter in standalone mode; optional if running in managed mode) Specifies the unique project tag of the ESP project to which the adapter is connected. For example, EspProject2. This is the same project tag that you specify later in the adapter configuration file in the **Name** parameter of the Event Stream Processor (**EspProjects**) parameters section. If you are starting the adapter with the ESP project to which it is attached (running the adapter in managed mode), you do not need to set this property as the adapter automatically detects the project name.
StreamName	Type: `string` (Required if running adapter in standalone mode; optional if running in managed mode) Name of the ESP stream from which the adapter subscribes to data. If you are starting the adapter with the ESP project to which it is attached (running the adapter in managed mode), you do not need to set this property as the adapter automatically detects the stream name.

For the EspMultiStreamSubscriber, add a <EspMultiStreamSubscriberParameters> sub-element and specify:

Parameter	Description
Streams	(Required) Section containing the **Stream**, **ProjectName**, **StreamName**, and **ColumnMapping** parameters.
Stream	(Required) Section containing details for the target project and streams to which the adapter is connected. Contains the **ProjectName** , **StreamName**, and **ColumnMapping** parameters. You can specify multiple **Stream** elements.
ProjectName	Type: `string` (Required) The name of the ESP project to which the adapter belongs. The same project as specified in the **Name** parameter of the ESP projects section of the adapter configuration file.
StreamName	Type: `string` (Required) The name of the source stream to which the adapter connects.
ColumnMapping	Type: `string` (Optional) The column list of the source stream to which the adapter connects. Separate the columns with a space char. This parameter contains the "enumtype" attribute which has two valid values: • **index –** the index of the column • **name –** the column name The default value is name.

7. Specify a connection to Event Stream Processor:

Parameter	Description
EspProjects	(Required) Section containing parameters for connecting to Event Stream Processor.
EspProject	(Required) Section containing the **Name** and **Uri** parameters. Specifies information for the ESP project to which the adapter is connected.

Parameter	Description
Name	Type: `string` (Required) Specifies the unique project tag of the ESP project which the EspConnector (publisher/subscriber) module references.
Uri	Type: `string` (Required) Specifies the total project URI to connect to the ESP project. For example, `esp://localhost:19011/ws1/p1`.
Security	(Required) Section containing all the authentication parameters below. Specifies details for the authentication method used for Event Stream Processor.
User	Type: `string` (Required) Specifies the user name required to log in to Event Stream Processor (see **AuthType**). No default value.
Password	Type: `string` (Required) Specifies the password required to log in to Event Stream Processor (see **espAuthType**). Includes an "encrypted" attribute indicating whether the **Password** value is encrypted. Default value is false. If set to true, the password value is decrypted using **RSAKeyStore** and **RSAKeyStorePassword**.

Parameter	Description
AuthType	Type: `string` (Required) Specifies method used to authenticate to the Event Stream Processor. Valid values are: • **server_rsa –** RSA authentication using keystore • **kerberos –** Kerberos authentication using ticket-based authentication • **user_password –** LDAP, SAP BI, and Native OS (user name/password) authentication If the adapter is operated as a Studio plug-in, **AuthType** is overridden by the **Authentication Mode** Studio start-up parameter.
RSAKeyStore	Type: `string` (Dependent required) Specifies the location of the RSA keystore, and decrypts the password value. Required if **AuthType** is set to server_rsa, or the encrypted attribute for **Password** is set to true, or both.
RSAKeyStorePassword	Type:`string` (Dependent required) Specifies the keystore password, and decrypts the password value. Required if **AuthType** is set to server_rsa, or the encrypted attribute for **Password** is set to true, or both.
KerberosKDC	Type: `string` (Dependent required) Specifies host name of Kerberos key distribution center. Required if **AuthType** is set to kerberos.
KerberosRealm	Type: `string` (Dependent required) Specifies the Kerberos realm setting. Required if **AuthType** is set to kerberos.

Parameter	Description
KerberosService	Type: `string` (Dependent required) Specifies the Kerberos principal name that identifies an Event Stream Processor cluster. Required if **AuthType** is set to kerberos.
KerberosTicketCache	Type: `string` (Dependent required) Specifies the location of the Kerberos ticket cache file. Required if **AuthType** is set to kerberos.
EncryptionAlgorithm	Type: `string` (Optional) Used when the encrypted attribute for **Password** is set to true. If left blank, RSA is used as default.

8. (Optional) Add a GlobalParameters element. This node is visible to all modules configured within the adapter configuration file.
   a) Define XML schema for the GlobalParameter in the `$ESP_HOME/adapters/framework/parametersdefine.xsd` file.
   b) Call the **Utility.getGlobalParameterNode()** or **utility.getGlobalParameters()** function to get the XML object for this node.

Here is an example of a configuration file for the Socket JSON Input adapter:

```
<?xml version="1.0" encoding="utf-8"?>
<Adapter>
    <Name>socket_json_input</Name>
    <Description>An adapter which receives JSON message from socket
server,transforms to ESP data format, and publishes to ESP stream.</
Description>
    <Log4jProperty>./log4j.properties</Log4jProperty>
    <Modules>
        <Module type="transporter">
           <InstanceName>MyExampleSocketInTransporter</InstanceName>
            <Name>SocketInputTransporter</Name>
            <Next>MyJsonStreamToJsonStringFormatter</Next>
            <Parameters>
                <SocketInputTransporterParameters>
                    <Host>localhost</Host>
                    <Port>9998</Port>
                    <EpFile></EpFile>
                    <Retryperiod>60</Retryperiod>
                    <Blocksize>512</Blocksize>
                    <KeepAlive>true</KeepAlive>
                </SocketInputTransporterParameters>
            </Parameters>
        </Module>
```

```
        <Module type="formatter">
            <InstanceName>MyJsonStreamToJsonStringFormatter</
InstanceName>
            <Name>JsonStreamToJsonStringFormatter</Name>
            <Next>MyJsonInFormatter</Next>
            <Parameters />
        </Module>

        <Module type="formatter">
            <InstanceName>MyJsonInFormatter</InstanceName>
            <Name>JsonStringToEspFormatter</Name>
            <Next>MyInStream_Publisher</Next>
            <Parameters>
                <JsonStringToEspFormatterParameters>
                    <DateFormat>yyyy-MM-dd HH:mm:ss.SSS</DateFormat>
                    <TimestampFormat>yyyy/MM/dd HH:mm:ss</
TimestampFormat>
                    <ColumnMappings>
                        <ColsMapping streamname="EntityStream"
rootpath="entities">
                            <Column>display_text</Column>
                            <Column>domain_role</Column>
                            <Column>offset</Column>
                            <Column>length</Column>
                        </ColsMapping>
                    </ColumnMappings>
                </JsonStringToEspFormatterParameters>
            </Parameters>
        </Module>

        <Module type="espconnector">
            <InstanceName>MyInStream_Publisher</InstanceName>
            <Name>EspPublisher</Name>
            <Parameters>
                <EspPublisherParameters>
                    <ProjectName>EspProject1</ProjectName>
                    <StreamName>EntityStream</StreamName>
                    <MaxPubPoolSize>1</MaxPubPoolSize>
                    <UseTransactions>false</UseTransactions>
                    <SafeOps>true</SafeOps>
                    <SkipDels>true</SkipDels>
                </EspPublisherParameters>
            </Parameters>
        </Module>

    </Modules>

    <EspProjects>
        <EspProject>
            <Name>EspProject1</Name>
            <Uri>esp://localhost:19011/sample_workspace/
socket_json_input</Uri>
            <Security>
                <User></User>
                <Password encrypted="false"></Password>
```

```
                <AuthType>user_password</AuthType>
              <!-- <RSAKeyStore>/keystore/keystore.jks</RSAKeyStore>
<RSAKeyStorePassword>Sybase123</RSAKeyStorePassword> -->
                <!-- <KerberosKDC>KDC</KerberosKDC>
<KerberosRealm>REALM</KerberosRealm>
                 <KerberosService>service/instance</KerberosService>
<KerberosTicketCache>/tmp/krb5cc_user</KerberosTicketCache> -->
                <EncryptionAlgorithm>RSA</EncryptionAlgorithm>
            </Security>
        </EspProject>
    </EspProjects>
    <GlobalParameters></GlobalParameters>
</Adapter>
```

See also

- *Implementing Schema Discovery in a Custom Adapter* on page 58
- *Creating a Cnxml File for a Custom Adapter* on page 106
- *Event Stream Processor Subscriber Module Parameters* on page 62
- *Event Stream Processor MultiStream Subscriber Module Parameters* on page 63
- *Event Stream Processor Publisher Module Parameters* on page 64
- *Event Stream Processor MultiStream Publisher Module Parameters* on page 66
- *Event Stream Processor Parameters* on page 68

Starting an Adapter

You can start an adapter either in standalone or managed mode. In standalone mode, the adapter is started separately from the ESP project, and in managed mode, the adapter is started with the ESP project.

Mode	Steps
Standalone	1. Start the ESP node by running the `start_node.bat` or `start_node.sh` script in the adapter instance folder. 2. Start the adapter by running the `start_adapter.bat` or `start_adapter.sh`

Mode	Steps

Managed	**1.** Create a .cnxml file for your adapter.
	2. Add an ATTACH ADAPTER statement in the CCL file of your project to reference the adapter. For example,
	`ATTACH INPUT ADAPTER Generic_Input_Adapter__external_1 TYPE genericinputadapter to BaseInput PROPERTIES configFilePath = 'C:/sybase/ESP-5_1/adapters/framework/instances/file_csv_input/adapter_config.xml' ;`
	3. Start the node:
	Windows
	`cd %ESP_HOME%\cluster\nodes\<nodename> %ESP_HOME%\bin\esp_server --cluster-node <nodename>.xml`
	or
	UNIX
	`cd $ESP_HOME/cluster/nodes/<nodename> $ESP_HOME/bin/esp_server --cluster-node <nodename>.xml`
	4. Compile CCL to create CCX:
	Windows
	`%ESP_HOME%\bin\esp_compiler -i <modelname>.ccl -o <modelname>.ccx`
	or
	UNIX
	`$ESP_HOME/bin/esp_compiler -i <modelname>.ccl -o <modelname>.ccx`
	5. Deploy the project on the cluster:
	Windows
	`%ESP_HOME%\bin\esp_cluster_admin" --uri=esp://localhost:19011 --username=sybase --password=sybase --add_project --workspacename= <workspacename> --project-name=<projectname> --ccx=<modelname>.ccx`
	or
	UNIX
	`$ESP_HOME/bin/esp_cluster_admin" --uri=esp://localhost:19011 --username=sybase --password=sybase --add_project --workspacename=`

Mode	Steps

	`<workspacename> --project-name=<projectname> --ccx=<modelname>.ccx`
	6. Start the deployed project on the cluster:
	Windows
	`%ESP_HOME%\bin\esp_cluster_admin" --uri=esp://localhost:19011 --username=sybase --password=sybase --start_project --workspace-name=<workspacename> --project-name=<projectname>`
	or
	UNIX
	`$ESP_HOME/bin/esp_cluster_admin" --uri=esp://localhost:19011 --username=sybase --password=sybase --start_project --workspace-name=<workspacename> --project-name=<projectname>`

See also

- *Creating a Cnxml File for a Custom Adapter* on page 106
- *Stopping an Adapter* on page 83
- *Chapter 4, Adapter Integration Framework* on page 105
- *Adapter Toolkit: Sample Cnxml File for Output Adapters* on page 88
- *Adapter Toolkit: Sample Cnxml File for Input Adapters* on page 87

Stopping an Adapter

You can stop an adapter either in standalone or managed mode. In standalone mode, the adapter is stopped separately from the ESP project, and in managed mode, the adapter is stopped with the ESP project.

Mode	Steps
Standalone	**1.** Stop the ESP node by running the `stop_node.bat` or `stop_node.sh` script in the adapter instance folder. **2.** Stop the adapter by running the `stop_adapter.bat` or `stop_adapter.sh`

Mode	Steps

Managed	Prerequisites: Create a .cnxml file for your adapter, and add an ATTACH ADAPTER statement in the CCL file of your project to reference the adapter.
	1. Stop the project to which the adapter is attached:
	Windows
	`cd %ESP_HOME%\cluster\nodes\<node_name>`
	`esp_cluster_admin`
	`--uri=esp[s]://<host>:19011 --username=<name> --`
	`password=<pass> --`
	` stop project <workspace-name>/<project-name>`
	UNIX
	`cd $ESP_HOME/cluster/nodes/<node_name>`
	`esp_cluster_admin`
	`--uri=esp[s]://<host>:19011 --username=<name> --`
	`password=<pass> -- stop project <workspace-name>/`
	`<project-name>`
	You can also stop the adapter by issuing the **stop adapter** command from the **esp_client** tool, and restart it by issuing the **start adapter** command.

See also

- *Starting an Adapter* on page 81
- *Creating a Cnxml File for a Custom Adapter* on page 106
- *Chapter 4, Adapter Integration Framework* on page 105
- *Adapter Toolkit: Sample Cnxml File for Output Adapters* on page 88
- *Adapter Toolkit: Sample Cnxml File for Input Adapters* on page 87

Adapter Toolkit Examples

The `%ESP_HOME%/adapters/framework/examples` directory contains various example modules for the adapter toolkit.

Folder Name	Description
`discover`	Contains an example adapter that has schema discovery implemented. Before running this example, copy the `ExampleAdapterForDiscovery.cnxml` file to the `$ESP_HOME/ESP-5_1/lib/adapters` directory..

Folder Name	Description
`dual_direction_transporter`	Contains an example adapter which processes input and output data concurrently.
`esp_pipe`	Contains an example adapter that pipes two ESP projects together.
`multistream_publisher`	Contains an example adapter which uses the multistream publisher module.
`multistream_subscriber`	Contains an example adapter which uses multistream subscriber module.
`output`	Contains an example output adapter which outputs ESP stream data to the console.
`polling_input`	Contains an example of a polling input adapter.
`row_input`	Contains an example input adapter which publishes pooled messages in transactions.
`single_inputtransporter`	Contains an example adapter which has only two modules: a transporter and an espconnector.
`src`	Contains the source code for the example modules.
`streaming_input`	Contains an example streaming input adapter.
`streaming_output`	Contains an example streaming output adapter.
`stringlist_input`	Contains an example adapter which uses the String List to ESP Formatter.
`stringlist_output`	Contains an example adapter which uses the ESP to String List Formatter.

Running an Adapter Example

Use the sample content within the `$ESP_HOME/adapters/framework/examples` directory to run an adapter example.

Prerequisites

1. Stop any other external adapter that is using one of the transporter or formatter modules provided by SAP.
2. Back up the `$ESP_HOME/adapters/framework/config/modulesdefine.xml` file.

3. Copy the file `$ESP_HOME/adapters/framework/examples/modulesdefine.xml` to the `$ESP_HOME/adapters/framework/config` directory.
4. Edit the **set_example_env.bat** or **set_example_env.sh** script and the `adapter_config.xml` file for each example to specify correct values for the username and password parameters. Note that if you run the project against the node started by the **set_example_env.bat** or **set_example_env.sh** script, you can find the username and password in `$ESP_HOME%/cluster/examples/csi_local.xml`. The default user is sybase and the default password is sybase.

Task

These steps are applicable to all examples aside from the schema discovery example located in the `$ESP_HOME/adapters/framework/examples/discover` directory.

1. Start the cluster manager by executing **start_node.bat** or **start_node.sh**.
2. Start the ESP project by executing **start_project.bat** or **start_project.sh**.
3. Start a subscription by using one of the various **subscribe*.bat**/**subscribe*.sh** or **statistic_subscribe*.bat**/**statistic_subscribe*.sh** scripts to validate the results of the adapter.
4. Start the adapter by running the **start_adapter.bat** or **start_adapter.sh** commands.
5. Run one of the examples in the `$ESP_HOME/adapters/framework/examples` directory.

Next

Restore the `$ESP_HOME/adapters/framework/config/modulesdefine.xml` file.

Running the Schema Discovery Adapter Example

Use the sample content within the `$ESP_HOME/adapters/framework/examples/discover` directory to run the schema discovery adapter example.

Prerequisites

1. Stop any other external adapter that is using one of the transporter or formatter modules provided by SAP.
2. Back up the `$ESP_HOME/adapters/framework/config/modulesdefine.xml` file.
3. Copy the file `$ESP_HOME/adapters/framework/examples/modulesdefine.xml` to the `$ESP_HOME/adapters/framework/config` directory.

4. Copy the file `$ESP_HOME/adapters/framework/examples/discover/ExampleAdapterForDiscovery.cnxml` to the `$ESP_HOME/lib/adapters` directory.
5. Edit the **set_example_env.bat** or **set_example_env.sh** script and the `adapter_config.xml` file for each example to specify correct values for the username and password parameters. Note that if you run the project against the node started by the **set_example_env.bat** or **set_example_env.sh** script, you can find the username and password in `$ESP_HOME%/cluster/examples/csi_local.xml`. The default user is sybase and the default password is sybase.

Task

1. Start ESP Studio.
2. In the ESP Studio Authoring perspective, drag and drop the **Example Adapter for schema discovery** onto the canvas.
3. Edit the adapter's Adapter Directory Path property and point it to the directory where the discover example resides. For example, `$ESP_HOME/adapters/framework/examples/discover`.
4. Click the adapter's schema discovery icon and complete the steps in the discovery wizard to add a new element to the project matching the discovered schema.

Next

Restore the `$ESP_HOME/adapters/framework/config/modulesdefine.xml` file.

Adapter Toolkit: Sample Cnxml File for Input Adapters

Adapter type: toolkit_input. Sample cnxml file for an input adapter created using the adapter toolkit. You can use this file as reference for creating your own cnxml file for your custom adapter.

This file is located in the `$ESP_HOME/lib/adapters` directory. Cnxml files are required if you want to manage your custom external adapter using the ESP Server. Set these properties in the ESP Studio adapter properties dialog.

If you use the CCL **ATTACH ADAPTER** statement to attach an adapter, you must supply the adapter type.

Property Label	Description
Adapter Configuration File	Property ID: **configFilePath** Type: `filename` (Required) Specify the path to the adapter configuration file.

See also

- *Adapter Toolkit: Sample Cnxml File for Output Adapters* on page 88
- *Chapter 4, Adapter Integration Framework* on page 105
- *Starting an Adapter* on page 81
- *Creating a Cnxml File for a Custom Adapter* on page 106
- *Stopping an Adapter* on page 83

Adapter Toolkit: Sample Cnxml File for Output Adapters

Adapter type: toolkit_output. Sample cnxml file for an output adapter created using the adapter toolkit. You can use this file as reference for creating your own cnxml file for your custom adapter.

This file is located in the `$ESP_HOME/lib/adapters` directory. Cnxml files are required if you want to manage your custom external adapter using the ESP Server. Set these properties in the ESP Studio adapter properties dialog.

If you use the CCL **ATTACH ADAPTER** statement to attach an adapter, you must supply the adapter type.

Property Label	Description
Adapter Configuration File	Property ID: **configFilePath** Type: `filename` (Required) Specify the path to the adapter configuration file.

See also

- *Adapter Toolkit: Sample Cnxml File for Input Adapters* on page 87
- *Chapter 4, Adapter Integration Framework* on page 105
- *Starting an Adapter* on page 81
- *Creating a Cnxml File for a Custom Adapter* on page 106
- *Stopping an Adapter* on page 83

Debugging a Custom Adapter

Debug a custom Java adapter (that was built using the adapter toolkit) by starting it in debug mode and using an Integrated Development Environment (IDE) that supports remote debugging, such as Eclipse.

Prerequisites

- Install Java Runtime Environment (JRE) version 1.6 or 1.7.
- If debugging the adapter using Eclipse, install Eclipse version 3.7 (Indigo) or higher.

Task

The steps below describe how to debug a custom or an example adapter using an Eclipse IDE. You can use similar steps to debug a custom adapter using another IDE that supports remote debugging.

1. Choose an example adapter from `%ESP_HOME%\adapters\framework\examples` or another adapter of your choice.
2. Compile the transporter and formatter module Java files to .class files (debug version) and compress them to .jar files using the **jar.exe** tool.
3. Copy these debug files to the `%ESP_HOME%\adapters\framework\libj` directory.
4. Back up the `modulesdefine.xml` file in the `$ESP_HOME/adapters/framework/config` directory.
5. (Perform only if debugging an example adapter) Prepare the adapter configuration file:
   a) Copy the `$ESP_HOME/adapters/framework/examples/modulesdefine.xml` file to the `$ESP_HOME/adapters/framework/config`.
   b) Edit the `set_example_env.bat` or `set_example_env.sh` files and the adapter configuration file for the example adapter. Specify values for the username and password elements in the example adapter configuration file.
6. Start the ESP cluster node:

   Windows

   ```
   cd %ESP_HOME%\cluster\nodes\<nodename>
   %ESP_HOME%\bin\esp_server --cluster-node <nodename>.xml
   ```

   or

   UNIX

```
cd $ESP_HOME/cluster/nodes/<nodename>
$ESP_HOME/bin/esp_server --cluster-node <nodename>.xml
```

7. Deploy the ESP project on the cluster:

   Windows

   ```
   %ESP_HOME%\bin\esp_cluster_admin" --uri=esp://localhost:19011
   --username=sybase --password=sybase --add_project --
   workspacename=
   <workspacename> --project-name=<projectname> --
   ccx=<modelname>.ccx
   ```

   or

   UNIX

   ```
   $ESP_HOME/bin/esp_cluster_admin" --uri=esp://localhost:19011
   --username=sybase --password=sybase --add_project --
   workspacename=
   <workspacename> --project-name=<projectname> --
   ccx=<modelname>.ccx
   ```

8. Start the deployed project on the cluster:

   Windows

   ```
   %ESP_HOME%\bin\esp_cluster_admin" --uri=esp://localhost:19011
   --username=sybase --password=sybase --start_project --
   workspace-name=<workspacename> --project-name=<projectname>
   ```

   or

   UNIX

   ```
   $ESP_HOME/bin/esp_cluster_admin" --uri=esp://localhost:19011
   --username=sybase --password=sybase --start_project --
   workspace-name=<workspacename> --project-name=<projectname>
   ```

9. Modify the `start.bat` or `start.sh` script file in the `%ESP_HOME%\adapters\framework\bin` directory to set the **suspend** debug parameter to y.

   For example,

   ```
   set DEBUG_PARA=-Xdebug
            -
   Xrunjdwp:transport=dt_socket,address=8998,server=y,suspend=y
   ```

10. Start the adapter in debug mode:

    Windows

    ```
    %ESP_HOME%\adapters\framework\bin\start.bat
    <ADAPTER_EXAMPLE_CONFIG_FILE> -debug
    ```

    or

    ```
    $ESP_HOME/adapters/framework/bin/start.sh
    <ADAPTER_EXAMPLE_CONFIG_FILE> -debug
    ```

    where `<ADAPTER_EXAMPLE_CONFIG_FILE>` specifies the full path to the configuration file of the adapter you are debugging.

11. Launch Eclipse.
12. Select **Run > Debug Configurations**.
13. On the left-hand side of the Debug Configurations window, select **Remote Java Application**, then right-click and select **New** to create a connection to the adapter you wish to debug.
14. On the right-hand side of the Debug Configuration window, select the **Connect** tab:
    a) Specify the name of your adapter in the **Name** field.
    b) Use the **Browse...** button to select the ESP project to which your adapter is connected.
    c) Select **Standard (Socket Attach)** from the drop down menu for Connection Type.
    d) Specify localhost for the **Host** connection property.
    e) Specify 8998 for the **Port** connection property.
    f) Click **Apply**.
15. Select **Run > Toggle Breakpoint** to create a breakpoint at a specific line.

    Set all breakpoints before advancing to the next step.
16. Click **Debug**.

See also

- *Accessing Adapter Toolkit API Reference Information* on page 14
- *Create a Custom Adapter* on page 12
- *Formatter Modules* on page 37
- *Transporter Modules* on page 14
- *EspConnector Modules* on page 61

CHAPTER 3 Creating Custom External Adapters using SDKs

Follow general guidelines to create a custom external adapter using one of the SDKs (Java, C/C++, or .NET).

1. Obtain an SDK instance.
2. Create credentials for the required authentication type.
3. Connect to an ESP project using these credentials.
4. Create a publisher to publish data to the ESP Server.
5. Create a subscriber to subscribe to records from a project in the ESP Server.
6. Publish or subscribe to data in Event Stream Processor.

Java External Adapters

Use the Java SDK to build a custom Java external adapter.

Connecting to a Project

Connect to a project using your authentication credentials.

1. Get the project:

```
String projectUriStr = "esp://localhost:19011/ws1/p1";
Uri uri = new Uri.Builder(projectUriStr).create();
project = sdk.getProject(uri, credentials);
```

2. Connect to the project:

```
 project.connect(60000);
```

   Here, `60000` refers to the time in milliseconds that the Server waits for the connection call to complete before timing out.

Creating a Publisher

Create and connect to a publisher, then publish a message.

1. Create and connect to a publisher:

```
Publisher pub = project.createPublisher();
pub.connect();
```

2. To create and publish a message, call a stream and the stream name, call the message writer, call the row writer, and publish:

```
String streamName = "Stream1";
Stream stream = project.getStream(streamName);
MessageWriter mw = pub.getMessageWriter(streamName);
RelativeRowWriter writer= mw.getRelativeRowWriter();
mw.startEnvelope(0);  // can also  be mw.startTransaction() for
transactions.
for (int i = 0; i < recordsToPublish.length; i++) {
    addRow(writer, incomingRecords[i], stream);
}
mw.endBlock();
pub.publish(mw);
```

Sample Java Code for addRow

The addRow operation adds a single record row to messages published to the Server.

Opcodes are used to update the table with a new row.

```
Schema schema = stream.getEffectiveSchema();
DataType[] colTypes = schema.getColumnTypes();
rowWriter.startRow();
rowWriter.setOperation(Stream.Operation.UPSERT);
for (int fieldIndex = 0; fieldIndex < schema.getColumnCount();
fieldIndex++) {
    String name = (String) colNames[fieldIndex];
    attValue = record.get(fieldIndex);
switch(dataType){
    case BOOLEAN:     writer.setBoolean((Boolean) attValue); break;
    case INTEGER:     writer.setInteger((Integer) attValue); break;
          case TIMESTAMP:     writer.setTimestamp((Date) attValue);
break;
    }//switch
}//for loop
rowWriter.endRow();
```

Subscribing Using Callback

Perform callbacks for new data.

1. Create the subscriber options:

   ```
   SubscriberOptions.Builder builder = new
   SubscriberOptions.Builder();
   builder.setAccessMode(AccessMode.CALLBACK);
   builder.setPulseInterval(pulseInterval);
   SubscriberOptions opts = builder.create();
   ```

   Set the access mode to CALLBACK and the pulse interval for how often you wish to make the callback.

2. Create the subscriber and register the callback:

   ```
   Subscriber sub = project.createSubscriber(opts);
       sub.setCallback(EnumSet.allOf(SubscriberEvent.Type.class),
   this);
       sub.subscribeStream(streamName);
       sub.connect();
   ```

`sub.setCallback` is the class which implements the `processEvent` method and gets called by the callback mechanism.

3. Create the callback class, which is used to register with the subscriber.
   a) Implement `Callback<SubscriberEvent>`.
   b) Implement the `getName()` and `processEvent(SubsriberEvent)` methods.

```
     public void processEvent(SubscriberEvent event) {
         switch (event.getType()) {
           case SYNC_START:    dataFromLogstore=true;    break;
             case SYNC_END:     dataFromLogStore=false;
break;              case ERROR:     handleError(event);
break;
            case DATA:         handleData(event);         break;
             case DISCONNECTED: cleanupExit();        break;
        }
    }
```

A separate method named `handleData` is declared in this example, which is referenced in Step 4. The name of the method is variable.

Note: When the event is received, the callback mechanism calls `processEvent` and passes the event to it.

---

4. (Optional) Use `handleData` to complete a separate method to retrieve and use subscribed data. Otherwise, data can be directly processed in `processEvent`:

```
public void handleData(SubscriberEvent event) {
        MessageReader reader = event.getMessageReader();
         String streamName= event.getStream().getName();
        while ( reader.hasNextRow() ) {
             RowReader row = reader.nextRowReader();
             int ops= row.getOperation().code();
            String[] colNames=row.getSchema().getColumnNames();
            List record = new ArrayList<Object>();
            for (int j = 0; index = 0; j <
row.getSchema().getColumnCount(); ++j) {
              if ( row.isNull(j)) { record.add(index,null);  index
++;  continue;  }
                switch ( row.getSchema().getColumnTypes()[j]) {
                      case BOOLEAN: record.add(j,
row.getBoolean(j));break;
                      case INTEGER: record.add(j,
row.getInteger(j));break;
                      case TIMESTAMP: record.add(j,
row.getTimestamp(j)); break;
                }//switch
             }//for loop
             sendRecordToExternalDataSource(record);
        }//while loop
    }//handleData
```

The `handleData` event contains a message reader, gets the stream name, and uses the row reader to search for new rows as long as there is data being subscribed to. Datatypes are specified.

Subscribe Using Direct Access Mode

Direct access mode is recommended only for testing purposes.

```
Subscriber sub = p.createSubscriber(); sub.connect();
sub.subscribeStream("stream1");
while (true) {
    SubscriberEvent event = sub.getNextEvent();
    handleEvent(event);
}
```

Publish Using Callback

Publishing in callback mode can be used in special cases, but is not recommended.

```
PublisherOptions.Builder builder = new PublisherOptions.Builder();
builder.setAccessMode(AccessMode.CALLBACK);
builder.setPulseInterval(pulseInterval);
PublisherOptions opts = builder.create();
    Publisher pub = project.createPublisher(opts);
    pub.setCallback(EnumSet.allOf(PublisherEvent.Type.class), new
PublisherHandler(project));
    pub.connect();
```

`PublisherHandler` implements `Callback<PublisherEvent>`. It also implements two methods: `getName()` and `processEvent(PublisherEvent event)`.

The script for implementing `processEvent` should look like this:

```
public void processEvent(PublisherEvent event) {
     switch (event.getType()) {
         case CONNECTED:     mwriter =
event.getPublisher().getMessageWriter(mstr);
                rowwriter = mwriter.getRelativeRowWriter(); break;
         case READY: mwriter.startTransaction(0);
             for (int j = 0; j < 100; ++j) {
                    mrowwriter.startRow();
                     mrowwriter.setOperation(Operation.INSERT);
                  for (int i = 0; i < mschema.getColumnCount(); ++i)
{
                switch (mtypes[i]) {
                 case INTEGER: mrowwriter.setInteger(int_value+
+);break;
              case DOUBLE: mrowwriter.setDouble(double_value+=1.0);
break;
                }
                      }//columns
                      mrowwriter.endRow();
            }//for
             event.getPublisher().publish(mwriter);
         case ERROR: break;
        case DISCONNECTD:break;
    }//switch
}//processEvent
```

C/C++ External Adapters

Use the C/C++ SDK to build custom C/C++ external adapters.

Getting a Project

Create your authentication credentials, and use them to create a project.

All calls to SDK are available as external C calls.

1. Create a credentials object for authentication:

```
#include <sdk/esp_sdk.h>
#include <sdk/esp_credentials.h>
        EspError* error = esp_error_create();
         esp_sdk_start(error);
        EspCredentials * m_creds =
esp_credentials_create(ESP_CREDENTIALS_USER_PASSWORD, error);
        esp_credentials_set_user(espuser.c_str(),error);
        esp_credentials_set_password(m_creds,
esppass.c_str(),error);
```

2. Create a project:

```
 EspUri* m_espUri = NULL; EspProject* m_project = NULL;
    if ( isCluster){
        m_espUri = esp_uri_create_string(project_uri.c_str(),
error);
      m_project = esp_project_get(m_espUri, m_creds ,NULL,error);
        esp_project_connect (m_project,error);
```

Publishing and Subscribing

Create a publisher and subscriber, and implement a callback instance.

1. Create the publisher:

```
EspPublisherOptions* publisherOptions =
esp_publisher_options_create (error);
Int rc
EspPublisher * m_publisher = esp_project_create_publisher
(m_project,publisherOptions,error);
EspStream* m_stream = esp_project_get_stream (m_project,m_opts-
>target.c_str(),error);
rc = esp_publisher_connect (m_publisher,error);
```

2. Publish:

Note: The sample code in this step includes syntax for adding rows to messages.

```
EspMessageWriter* m_msgwriter   =   esp_publisher_get_writer
(m_publisher,m_stream,error);
 EspRelativeRowWriter* m_rowwriter =
esp_message_writer_get_relative_rowwriter(m_msgwriter, error);
    const EspSchema* m_schema = esp_stream_get_schema
```

```
(m_stream,error);
    int numColumns;
    rc = esp_schema_get_numcolumns (m_schema, &numColumns,error);
   rc = esp_message_writer_start_envelope(m_msgwriter, 0, error);
    rc = esp_relative_rowwriter_start_row(m_rowwriter, error);
   rc = esp_relative_rowwriter_set_operation(m_rowwriter, (const
ESP_OPERATION_T)opcode, error);
int32_t colType;
    for (int j = 0;j < numColumns;j++){
    rc = esp_schema_get_column_type (m_schema,j,&colType,error);
    switch (type){
        case ESP_DATATYPE_INTEGER:
            memcpy (&integer_val,(int32_t *)
(dataValue),sizeof(uint32_t));
            rc = esp_relative_rowwriter_set_integer(m_rowwriter,
integer_val, error);
            break;
        case ESP_DATATYPE_LONG:
            memcpy (&long_val,(int64_t *)
(dataValue),sizeof(int64_t));
            rc = esp_relative_rowwriter_set_long(m_rowwriter,
long_val, error);
            break;
        }
}//for
rc = esp_relative_rowwriter_end_row(m_rowwriter, error);
rc = esp_message_writer_end_block(m_msgwriter, error);
rc = esp_publisher_publish(m_publisher, m_msgwriter, error);
```

3. Create the subscriber options:

```
EspSubscriberOptions * m_subscriberOptions =
esp_subscriber_options_create (error);
    int rc = esp_subscriber_options_set_access_mode(options,
CALLBACK_ACCESS, m_error);
    EspSubscriber * m_subscriber = esp_project_create_subscriber
(m_project,m_subscriberOptions,error);
    rc = esp_subscriber_options_free(options, m_error);
    rc = esp_subscriber_set_callback(subscriber ,
ESP_SUBSCRIBER_EVENT_ALL,
            subscriber_callback, NULL, m_error);
     subscriber_callback is global function which will get called
up.
```

4. Subscribe using callback:

```
void subscriber_callback(const EspSubscriberEvent * event, void *
data) {
    uint32_t type;
    rc = esp_subscriber_event_get_type(event, &type, error);
     switch (type) {
                case ESP_SUBSCRIBER_EVENT_CONNECTED:
init(event,error);break;
        case ESP_SUBSCRIBER_EVENT_SYNC_START:     fromLogStore =
true; break;
              case ESP_SUBSCRIBER_EVENT_SYNC_END:   fromLogStore
= false; break;
```

```
                case ESP_SUBSCRIBER_EVENT_DATA:
handleData(event,error); break;
                case ESP_SUBSCRIBER_EVENT_DISCONNECTED:
cleanupaExit(); break;
                case ESP_SUBSCRIBER_EVENT_ERROR:
handleError(event,error); break;
    }
}//end subscriber_callback
```

handleData

Sample C/C++ code for the `handleData` method.

```
 EspMessageReader * reader = esp_subscriber_event_get_reader(event,
error);
     EspStream * stream = esp_message_reader_get_stream(reader,
error);
    const EspSchema * schema = esp_stream_get_schema(stream, error);
     EspRowReader * row_reader;
    int32_t int_value;   int64_t long_value; time_t date_value;
double double_value;
     int numcolumns, numrows, type;
     rc = esp_schema_get_numcolumns(schema, &numcolumns, error);
     while ((row_reader = esp_message_reader_next_row(reader,
error)) != NULL) {
         for (int i = 0; i < numcolumns; ++i) {
                rc = esp_schema_get_column_type(schema, i, &type,
error);
                switch(type){
            case ESP_DATATYPE_INTEGER:
                    rc = esp_row_reader_get_integer(row_reader, i,
&int_value, error);
                    break;
            case ESP_DATATYPE_LONG:
                    rc = esp_row_reader_get_long(row_reader, i,
&long_value, error);
                    break;
            case ESP_DATATYPE_DATE:
                    rc = esp_row_reader_get_date(row_reader, i,
&date_value, error);
                    break;
                }
        }
```

.Net External Adapters

Use the .Net SDK to build a custom .Net external adapter.

Connecting to the Event Stream Processor Server

Set credentials and .Net server options when you connect to the ESP Server.

1. Run the **NetEspError** command to create an error message store for these tasks:

```
NetEspError error = new NetEspError();
```

2. Set a new URI:

```
NetEspUri uri = new NetEspUri();
uri.set_uri("esp://cepsun64amd.mycompany.com:19011", error);
```

3. Create your credentials:

```
NetEspCredentials creds = new
NetEspCredentials(NetEspCredentials.NET_ESP_CREDENTIALS_T.NET_ESP
_CREDENTIALS_SERVER_RSA);
creds.set_user("pengg");
creds.set_password("1234");
creds.set_keyfile("..\\test_data\\keys\\client.pem");
```

4. Set options:

```
NetEspServerOptions options = new NetEspServerOptions();
options.set_mode(NetEspServerOptions.NET_ESP_ACCESS_MODE_T.NET_CA
LLBACK_ACCESS);
server = new NetEspServer(uri, creds, options);
int rc = server.connect(error);
```

Connecting to a Project

Use sample .Net code to connect to a project.

1. Get the project:

```
NetEspProject project = server.get_project("test", "test",
error);
```

2. Connect to the project:

```
project.connect(error);
```

Publishing

Create a publisher, add rows, and complete the publishing process.

1. Create a publisher:

```
NetEspPublisher publisher = project.create_publisher(null,
error);
```

2. Connect to the publisher:

```
Publisher.connect(error);
```

3. Get a stream:

```
NetEspStream stream = project.get_stream("WIN2", error);
```

4. Get the Message Writer:

```
NetEspMessageWriter writer = publisher.get_message_writer(stream,
error);
```

5. Get and start the Row Writer, and set an opcode to insert one row:

```
NetEspRelativeRowWriter rowwriter =
writer.get_relative_row_writer(error);
rowwriter.start_row(error);
rowwriter.set_opcode(1, error);
```

(Optional) If publishing in transaction mode, use these arguments to add multiple rows:

```
NetEspRelativeRowWriter rowwriter =
writer.get_relative_row_writer(error);
for(int i=0; i<100; i++){
    rowwriter.start_row(error);
//add row columns' values
rowwriter.end_row(error);
}
```

6. Publish data:

```
rc = publisher.publish(writer, error);
```

Connecting to a Subscriber

Create and connect to a new subscriber.

1. Create a subscriber:

```
NetEspSubscriberOptions options = new NetEspSubscriberOptions();
options.set_mode(NetEspSubscriberOptions.NET_ESP_ACCESS_MODE_T.NE
T_CALLBACK_ACCESS);
NetEspSubscriber subscriber = new NetEspSubscriber(options,
error);
```

2. Connect to the subscriber:

```
Subscriber.connect(error);
```

Subscribing Using Callback Mode

Perform callbacks for new data.

1. Set the subscriber options:

```
NetEspSubscriberOptions options = new NetEspSubscriberOptions();
options.set_mode(NetEspSubscriberOptions.NET_ESP_ACCESS_MODE_T.NE
T_CALLBACK_ACCESS);
NetEspSubscriber subscriber = new NetEspSubscriber(options,
error);
```

2. Create the callback instance:

```
NetEspSubscriber.SUBSCRIBER_EVENT_CALLBACK callbackInstance = new
NetEspSubscriber.SUBSCRIBER_EVENT_CALLBACK(subscriber_callback);
```

3. Create the callback registry:

```
subscriber.set_callback(NetEspSubscriber.NET_ESP_SUBSCRIBER_EVENT
.NET_ESP_SUBSCRIBER_EVENT_ALL, callbackInstance, null, error);
```

4. Connect to the subscriber:

```
subscriber.connect(error);
```

5. Subscribe to a stream:

```
subscriber.subscribe_stream(stream, error);
```

6. Implement the callback:

```
Public static void subscriber_callback(NetEspSubscriberEvent
event, ValueType
```

```
data) {
switch (evt.getType())
            {
                  case (uint)
(NetEspSubscriber.NET_ESP_SUBSCRIBER_EVENT.NET_ESP_SUBSCRIBER_EVE
NT_CONNECTED):
                     Console.WriteLine("the callback happened:
connected!");
                     break;
(uint)
( NetEspSubscriber.NET_ESP_SUBSCRIBER_EVENT.NET_ESP_SUBSCRIBER_EV
ENT_DATA):
```

7. (Optional) Use **handleData** to complete a separate method to retrieve and use subscribed data.

```
NetEspRowReader row_reader = null;
while ((row_reader = evt.getMessageReader().next_row(error)) !=
null) {
               for (int i = 0; i < schema.get_numcolumns(); ++i) {
                     if ( row_reader.is_null(i) == 1) {
                         Console.Write("null, ");
                         continue;
                     }
                     switch
(NetEspStream.getType(schema.get_column_type((uint)i, error)))
                     {
                         case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_INTEGER:
                        ivalue = row_reader.get_integer(i, error);
                             Console.Write(ivalue + ", ");
                             break;
                         case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_LONG:
                           lvalue = row_reader.get_long(i, error);
                             Console.Write(lvalue + ", ");
                             break;
                         case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_FLOAT:
                          fvalue = row_reader.get_float(i, error);
                             Console.Write(fvalue + ", ");
                             break;
                         case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_STRING:
                         svalue = row_reader.get_string(i, error);
                             Console.Write(svalue);
                             break;
                         case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_DATE:
                           dvalue = row_reader.get_date(i, error);
                             Console.Write(dvalue + ", ");
                             break;
                         case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_TIMESTAMP:
                             tvalue = row_reader.get_timestamp(i,
error);
```

```
                            Console.Write(tvalue + ", ");
                            break;
                        case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_BOOLEAN:
                           boolvalue = row_reader.get_boolean(i,
error);
                            Console.Write(boolvalue + ", ");
                            break;
                        case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_BINARY:
                            uint buffersize = 256;
                            binvalue = row_reader.get_binary(i,
buffersize, error);

Console.Write(System.Text.Encoding.Default.GetString(binvalue) +
", ");
                            break;
                        case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_INTERVAL:
                         intervalue = row_reader.get_interval(i,
error);
                            Console.Write(intervalue + ", ");
                            break;
                        case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_MONEY01:
                            mon = row_reader.get_money(i, error);
                       Console.Write(mon.get_long(error) + ", ");
                            break;
                        case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_MONEY02:
                         lvalue = row_reader.get_money_as_long(i,
error);
                            Console.Write(lvalue + ", ");
                            break;
                        case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_MONEY03:
                            mon = row_reader.get_money(i, error);
                       Console.Write(mon.get_long(error) + ", ");
                            break;
                        case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_MONEY10:
                            mon = row_reader.get_money(i, error);
                       Console.Write(mon.get_long(error) + ", ");
                            break;
                        case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_MONEY15:
                            mon = row_reader.get_money(i, error);
                       Console.Write(mon.get_long(error) + ", ");
                            break;
                        case
NetEspStream.NET_DATA_TYPE_T.NET_ESP_DATATYPE_BIGDATETIME:
                            bdt2 = row_reader.get_bigdatetime(i,
error);
                       long usecs = bdt2.get_microseconds(error);
                            Console.Write(usecs + ", ");
                            break;
```

```
                        }
                    }
                }
```

8. Disconnect from the subscriber:

```
                rc = subscriber.disconnect(error);
}
```

CHAPTER 4 Adapter Integration Framework

The ESP adapter integration framework provides a mechanism for integrating custom external adapters with the ESP Sever and ESP Studio.

A custom external adapter is essentially any application that publishes or subscribes to a stream or a set of streams in Event Stream Processor using the publisher and subscriber APIs from any of the Event Stream Processor SDKs.

To start and stop external adapters together with an ESP project or visually from within Studio, create an instance of the adapter plugin by creating a specialized cnxml configuration file for the adapter. Specify command lines that the ESP Server can invoke during various stages of adapter runtime and initialization within this configuration file.

See also

- *Adapter Toolkit: Sample Cnxml File for Output Adapters* on page 88
- *Adapter Toolkit: Sample Cnxml File for Input Adapters* on page 87
- *Starting an Adapter* on page 81
- *Creating a Cnxml File for a Custom Adapter* on page 106
- *Stopping an Adapter* on page 83

Cnxml Configuration File

The external adapter framework defines the structure of the external adapter configuration file (cnxml) file that contains the adapter properties.

The external adapter configuration file is an XML file that contains the properties and commands used by Event Stream Processor to start and stop the external adapter and to optionally run schema discovery, as well as other information that allows you to configure the adapter from the ESP Studio.

Here is the structure of a cnxml file:

```
<Adapter>
    type = Can be input or output
    external = True
    id = Required to be unique to the adapter
    label = The adapter's name in Studio
    descr = Description of adapter functionalities

<Library>
    file = simple_ext (Always use this for custom external adapters)
    type = Binary

<Special>
```

```
    <Internal>
        **These values are not configurable from Studio. simple_ext
has a function that parses this cnxml file and looks up the internal
fields to find particular commands and their default values**
    id = See $ESP_HOME/lib/adapters/simple_ext.cnxml.template
for a sample cnxml file that contains all possible internal
parameters and comment blocks indicating their usage.
    label = Description of function
    type = Datatype of function
    default = This is the command that simple_ext executes. For
example, if you are using x_unixCmdExec, it calls esp_convert with
targets you specify followed by an upload.

<Section>
    <Parameter>
    **These parameter values are visible (except for id) and
configurable in Studio.**
        id = The property id that you can reference to in <Internal>
command calls with $(id's name). This is what you reference when
writing an adapter in CCL.
        label = The property name which appears in Studio.
        descr = Description of adapter property.
        type = The property datatype.
      use = Whether the property is required, optional, or advanced.
In Studio, required properties appear in red and advanced ones appear
on a separate tab.
       default = Default value to use, if you do not set a value for
the property.
```

Creating a Cnxml File for a Custom Adapter

Create a cnxml configuration file for your custom external adapter so that you can configure the adapter in the ESP Studio, and start and stop it with an ESP project.

1. Specify attributes for the `Adapter` section:

Attribute	Description
type	(Required) Specify whether this is an input or output adapter.
external	(Required) Set the value to true as this is an external adapter.
id	(Required) Specify a unique identifier for your adapter. This value is listed in the type parameter within the ATTACH ADAPTER statement.
label	(Required) The name of your adapter. This name displays in ESP Studio if you hover over the adapter icon in the Visual Editor.

Attribute	Description
description	(Required) Specify the purpose of the adapter. This is also visible in ESP Studio.

2. Specify attributes for the `Library` section:

Attribute	Description
file	(Required) Specify "simple_ext" as the value. Always specify this for external adapters.
type	(Required) Specify "binary" as the value.

3. Specify internal parameters for the `Special` section. See the `$ESP_HOME/lib/adapters/simple_ext.cnxml.template` sample cnxml file for a complete list of internal parameters and details on their usage.
4. Specify adapter parameters for the `Section` section. These parameters are visible and configuration in ESP Studio.

   For each parameter, specify:

Parameter	Description
id	(Required) The property id that you can reference to in <Internal> command calls with $(id's name). This is what you reference when specifying adapter properties for an adapter in CCL.
label	(Required) The property name which appears in ESP Studio.
descr	(Required) A description of the adapter property.
type	(Required) The property datatype.
use	(Required) Whether the property is required, optional, or advanced. In ESP Studio, required properties appear in red and advanced ones appear on a separate tab.
default	(Optional) The default value to use, if you do not set a value for the property.

See also

- *Configuring a New Adapter* on page 70
- *Starting an Adapter* on page 81
- *Stopping an Adapter* on page 83
- *Chapter 4, Adapter Integration Framework* on page 105
- *Adapter Toolkit: Sample Cnxml File for Output Adapters* on page 88
- *Adapter Toolkit: Sample Cnxml File for Input Adapters* on page 87

Example Cnxml Configuration File

Example of a cnxml configuration file that uses four of the utilities shipped with Event Stream Processor (**esp_convert**, **esp_upload**, **esp_client**, and **esp_discxmlfiles**) to fully define a functional external adapter that supports browsing a directory of files, the creation of a source stream, and data loading.

In this example, long lines of script are split for readability and to avoid formatting issues. If you are using this to create your own external adapter configuration file, ensure that all command properties are on a single line, regardless of length.

```
<?xml version="1.0" encoding="UTF-8"?>

<Adapter type="input" external="true"
  id="simplified_xml_input_plugin"
  label="Simplified external XML file input plugin Adapter"
  descr="Example of uploading an XML file through a simple external
Adapter"
>
  <Library file="simple_ext" type="binary"/>

  <!--
     The special section contains the special internal parameters
     which are prefixed with "x_". Although these are parameters,
     the framework requires that you define these using the <Internal
      .../> element. They are hidden within ESP Studio.
  -->
  <Special>
    <Internal id="x_initialOnly"
      label="Does Initial Loading Only"
      descr="Do initial loading, or the continuous loading"
      type="boolean"
      default="true"
    />
    <Internal id="x_addParamFile"
      label="Add Parameter File"
      type="boolean"
      default="false"
    />
    <Internal id="x_killRetryPeriod"
      label="Period to repeat the stop command until the process
exits"
      type="int"
      default="1"
    />

    <!--
    Convert a file of xml record to ESP Binary format using
esp_convert;
        pipe into the esp_upload program, naming the upload
connection:
    $platformStream.$platformConnection
    -->
```

```
    <Internal id="x_unixCmdExec"
      label="Execute Command"
      type="string"
      default="$ESP_HOME/bin/esp_convert -p $platformCommandPort
&lt;&quot;$directory/$filename&quot; | $ESP_HOME/bin/esp_upload -m
$platformStream.$platformConnection -p $platformCommandPort"
    />
    <Internal id="x_winCmdExec"
      label="Execute Command"
      type="string"
     default="$+/{$ESP_HOME/bin/esp_convert} -p $platformCommandPort
&lt;&quot;$directory/$filename&quot; | $+/{$ESP_HOME/bin/esp_upload}
-m $platformStream.$platformConnection -p $platformCommandPort"
    />

    <!--
        use the esp_client command to stop an existing esp_upload
connection named:
        $platformStream.$platformConnection
    -->
    <Internal id="x_unixCmdStop"
      label="Stop Command"
      type="string"
     default="$ESP_HOME/bin/esp_client -p $platformCommandPort 'kill
every {$platformStream.$platformConnection}' &lt;/dev/null"
    />
    <Internal id="x_winCmdStop"
      label="Stop Command"
      type="string"
     default="$+/{$ESP_HOME/bin/esp_client} -p $platformCommandPort
&quot;kill every {$platformStream.$platformConnection}&quot;
&lt;nul"
    />

    <!--
    Use the esp_discxmlfiles command to do schema discovery.
    The command below will have '-o "<temp file>"' added to it. It
    writes the discovered schema in this file.
     -->
    <Internal id="x_unixCmdDisc"
      label="Discovery Command"
      type="string"
      default="$ESP_HOME/bin/esp_discxmlfiles -d &quot;
$directory&quot;"
    />
    <Internal id="x_winCmdDisc"
      label="Discovery Command"
      type="string"
      default="$+/{$ESP_HOME/bin/esp_discxmlfiles} -d &quot;$+/
{$directory}&quot;"
    />
  </Special>

  <Section>

    <!--
```

```
        Any parameter defined here is visible in the ESP Studio and
you can
    configure it at runtime in the data location explorer.
    These are defined according to the $ESP_HOME/etc/Adapter.xsd
    schema.
    -->

    <Parameter id="filename"
      label="File"
      descr="File to upload"
      type="tables"
      use="required"
    />
    <Parameter id="directory"
      label="path to file"
      descr="directory to search"
      type="directory"
      use="required"
    />
    <Parameter id="propertyset"
      label="propertyset"
      descr="to look up properties in project configuration"
      type="string"
      use="advanced"
      default=""/>
  </Section>
</Adapter>
```

External Adapter Properties

See `$ESP_HOME/lib/adapters/simple_ext.cnxml.template` for a sample cnxml file that may be copied and customized. It has all possible internal parameters embedded in it, and has comment blocks indicating their usage.

Property Id	Type	Description
x_addParamFile	`boolean`	Determines if the parameter file name is automatically appended to all **x_cmd*** strings. For example, if you specify the command as **cmd -f**, and this is set to true, the actual command is executed as **cmd -f <value of x_paramFile>**.
x_initialOnly	`boolean`	If true, does initial loading only. Set to false for continuous loading. Initial loading is useful for adapters that start, load some static data, then finish, which allows another adapter group to start-up in a staged loading scenario.

Property Id	Type	Description
x_killRetryPeriod	integer	If this parameter is >0 the **x_{unix,win}CmdStop** command is retried every **x_killRetry** seconds, until the framework detects that the **x_{unix,win}CmdExec** command has returned. If it is equal to zero, run the **x_{unix,win}CmdStop** command once and assume it has stopped the **x_{unix,win}CmdExec** command.
x_paramFile	string	Specifies the file name of the adapter framework, which writes all internal and user-defined parameters. It may use other internal parameters in specifying the file name. For example: `/tmp/mymodel.$platformStream.$platformConnection.$platformCommandPort.cfg`
x_paramFormat	string	Stops the adapter, and runs in a separate thread, which returns and stops processes created with **x_{unix,win}CmdExec**.
x_unixCmdClean/ **x_winCmdClean**	string	Specifies the command executed to perform cleanup after the adapter stops (**x_{unix,win}CmdExec** returns).
x_unixCmdConfig/ **x_winCmdConfig**	string	Specifies the command executed to pre-process the parameter file prior to starting the adapter, such as parsing and checking parameters. It may convert the parameters to real format, which is required by the execution command, by reading, parsing, and re-writing the parameter file. If the configure command fails (non-zero return), the adapter fails to start.
x_unixCmdDisc/ **x_winCmdDisc**	string	Specifies the command executed to perform discovery. This command adds `-o "<temporary disc filename>"` argument before it is executed, which writes the discovery XML to a file.
x_unixCmdExec/ **x_winCmdExec**	string	Specifies the command executed to start the adapter. If the command returns, the adapter is done running.
x_unixCmdStop/ **x_winCmdStop**	string	Specifies the command executed to stop the adapter. The stop command runs from a separate thread and stops all processes created with the **x_{unix,win}CmdExec** command, which returns the **x_{unix,win}CmdExec** command.

Note: Some of the commands have both Windows or Unix formats because their paths, environment variables, and script files differ. At runtime, ESP determines which command to use based on the operating system it is running on. All commands have substituted parameters and environment variables. When a command is passed to shell or `cmd.exe`, it runs its own round of substitution.

External Adapter Commands

External adapter commands fall into two categories: those that run on the same host as Studio, and those that run on the same host as the Server.

The discovery commands, **x_unixDiscCmd** and **x_winDiscCmd** always run on the Studio host. All other commands run on the Server host.

The Studio and Server are frequently run on the same host, so the development of all command and driving scripts for the custom adapter are straightforward. the configuration becomes more complex during remote execution when Studio and the Server are running on different hosts.

For example, if the Studio is running on a Windows host, and the Server is set up through Studio to execute on a remote Linux host, it implies that the discovery command and the discovery file name that the framework generates are running and are generated in a Windows environment. The path to the discovery file is a Windows-specific path with drive letters and '/' characters used as path separators. In this case, the developer of the connector should write the discovery command to run in a Windows environment while coding all other commands to remotely execute on the Linux box using a user-configured **ssh** or **rsh** command.

Command	Description
x_unixCmdConfig **x_winCmdConfig**	The configure command should do any required parsing and/or checking of the parameters. It may also convert the parameters into the real format expected by the execution command by reading, parsing, and re-writing the parameter file. If the configure command fails (non-zero return), it is reported as a `reset()` error, and the adapter fails to start.
x_unixCmdExec **x_winCmdExec**	When the Server starts the adapter, it executes this command with its ending indicating that the connector has finished.
x_unixCmdStop **x_winCmdStop**	The stop command runs from a separate thread; it should stop all processes created with the **x_{unix,win}CmdExec** command, thus causing the **x_{unix,win}CmdExec** to return.
x_unixCmdClean **x_winCmdClean**	The clean command runs after the Server has stopped the connection, that is, when **x_{unix,win}CmdExec** returns.

Command	Description

x_winDiscCmd	This command is for schema discovery. It should write a discovery file into the file name passed to it. The parameter **-o <temporary disc filename>** argument is appended to this command before it is executed.
	`<discover>`
	`  <table name="table_name_1" />`
	`  <column name="col_name_1" type="col_type_1"/>`
	`  .`
	`  .`
	`  .`
	`  <column name="col_name_k" type="col_type_k"/>`
	`  </table>`
	`  .`
	`  .`
	`  .`
	`  <table name="table_name_n" />`
	`  <column name="col_name_1" type="col_type_1"/>`
	`  .`
	`  .`
	`  .`
	`  <column name="col_name_1" type="col_type_1"/>`
	`  </table>`
	`</discover>`

User-Defined Parameters and Parameter Substitution

Internal parameters and any number of user-defined parameters can be created in the cnxml file.

All system and user-defined parameters can be referenced in the command or script arguments. These parameters behave in a similar way to shell substitution variables. The simple example shows long lines that have been split for readability:

```
    <Internal id="x_unixCmdExec"
      label="Execute Command"
      type="string"
      default="$ESP_HOME/bin/esp_convert
                    -p $platformCommandPort &lt;&quot;$directory/
$filename&quot; | $ESP_HOME/bin/esp_upload
                     -m $platformStream.$platformConnection
                     -p $platformCommandPort"
    />
```

External environment variables, such as ESP_HOME, may be expanded, as well as internal system parameters (**platformCommandPort**) and user-defined parameters (filename). The full semantics for parameter expansion are:

```
$name
${name}
${name=value?substitution[:substitution]}
${name<>value?substitution[:substitution]}
${name!=value?substitution[:substitution]}
${name==value?substitution[:substitution]}
${name<value?substitution[:substitution]}
${name<=value?substitution[:substitution]}
${name>value?substitution[:substitution]}
${name>=value?substitution[:substitution]}
```

All forms with `{}` may have a + added after `$` (for example, `$+{name}`). The presence of + means that the result of the substitution is parsed again and any values in it are substituted. The `\` symbol escapes the next character and prevents any special interpretation.

The conditional expression compares the value of a parameter with a constant value and uses either the first substitution on success or the second substitution on failure. The comparisons == and != try to compare the values as numbers. The = comparisons and <> try to compare values as strings. Any characters like `?`, `:` and `}` in the values must be shielded with `\`. The characters `{` and `}` in the substitutions must be balanced, all unbalanced braces must be shielded with `\`. The quote characters are not treated as special.

This form of substitution, `$+{...}`, may contain references to other variables. This is implemented by passing the result of a substitution through one more round of substitution. The consequence is that extra layers of `\` may be needed for shielding. For example, the string `$+{name=?\\\\}` produces one `\` if the parameter **name** is empty. On the first pass each pair of backslashes is turned into one backslash, and then on the second pass `\\` turns into a single backslash.

Special substitution syntax for Windows convenience:

`$/{value}` `$+/{value}`	Replaces all the forward slashes in the value by backslashes, for convenience of specifying the Windows paths that otherwise would have to have all the slashes escaped.
`$%{value}` `$+%{value}`	Replaces all the `%` with `%%` as escaping for Windows.

If the resulting string is passed to shell or `cmd.exe` for execution, shell or `cmd.exe` would do its own substitution too.

Here is an example using some of the more powerful substitution features to define the execution command as in the simple example. However, you may make use of the conditional features to support optional authentication and encryption and an optional user-defined date format.

```
<Internal id="x_unixCmdExec"
        label="Execute Command"
     type="string"
```

```
  default="$ESP_HOME/bin/esp_convert
          ${platformSsl==1?-e}
       $+{dateFormat<>?-m '$dateFormat'}
                 -c '$+{user=?user:$user}:$password'
                 -p $platformCommandPort
                    <"$directory/$filename" |
                    $ESP_HOME/bin/esp_upload
                    ${platformSsl==1?-e}
    -m $platformStream.$platformConnection
                 -c '$user:$password'
    -p $platformCommandPort"
/>
```

Auto-Generated Parameter Files

The basic external adapter framework, when started, writes its set of parameters (system and user-defined) to a parameter file.

This file is written in either:

- Java properties
- Shell assignments
- Simple XML format

Commands then have full access to the parameter file.

There is an example of parameters in the `simplified_xml_input_plugin.cnxml` file.

```
             <Internal id="x_paramFile"
               label="Parameter File"
               type="string"
               default="/tmp/PARAMETER_FILE.txt"
             />
          <Internal id="x_paramFormat"
            label="Parameter Format"
            type="string"
            default="prop"
        />
     <Internal id="x_addParamFile"
       label="Add Parameter File"
       type="boolean"
       default="false"
/>
```

The parameter file is written to `/tmp/PARAMETER_FILE.txt`.

```
            directory=/home/sjk/work/aleri/cimarron
            /branches/3.1/examples/input/xml_tables
            filename=trades.xml
            platformAuth=none
            platformCommandPort=31415
            platformConnection=Connection1
            platformHost=sjk-laptop
            platformSqlPort=22200
```

```
platformSsl=0
platformStream=Trades
```

or a full list of parameters, in the Java properties format. Note the format can be specified as `shell` for shell assignments, or as `xml` for a simple XML format.

When **x_addParamFile** is specified as true,

```
<Internal id="x_addParamFile"
      label="Add Parameter File"
   type="boolean"
      default="true"
    />
```

the argument `/tmp/PARAMETER_FILE.txt` is added to all commands prior to being executed.

configFilename Parameter

The **configFilename** parameter enables you to specify user-editable configuration files in the Studio.

If you create a user-defined **confgFilename** parameter, clicking in the value portion of this field in Studio produces a file selector dialog, allowing you to choose a file on the local file system. Right-clicking on the read-only name brings up a different dialog, allowing you to modify file contents. This provides you with a way to specify user-editable configuration files.

CHAPTER 5 Appendix A: Adapter Parameters Datatypes

A comprehensive list of datatypes you can use with adapters supplied by Event Stream Processor, or any custom internal or external adapters you create.

Some exceptions for custom external adapters are noted in the datatype descriptions.

Note: This table includes all the adapter related datatypes supported by Event Stream Processor. For more information on specific datatypes supported by an adapter, as well as its datatype mapping description, see the section on that adapter.

Datatype	Description
`boolean`	Value is true or false. The format for values outside of the allowed range for `boolean` is 0/1/false/true/y/n/on/off/yes/no, which is case insensitive.
`choice`	A list of custom values from which a user would select one value.
`configFilename`	Variable-length character string, with byte values encoded in UTF-8. Maximum string length is platform-dependent, but no more than 65535 bytes.
`directory`	Variable-length character string, with byte values encoded in UTF-8. Maximum string length is platform-dependent, but no more than 65535 bytes.
`double`	Floating point value. The range of allowed values is 2.22507e-308 to 1.79769e+308
`filename`	Variable-length character string, with byte values encoded in UTF-8. Maximum string length is platform-dependent, but no more than 65535 bytes.
`int`	A signed 32-bit integer value. The range of allowed values is -2147483648 to +2147483647 (-23^1 to 2^31-1). Constant values that fall outside of this range are automatically processed as long datatypes. To initialize a variable, parameter, or column with the lowest negative value, specify (-2...7) -1 instead to avoid CCL compiler errors. For example, specify (-2147483647) -1 to initialize a variable, parameter, or column with a value of -2147483648.

Datatype	Description
`password`	Variable-length character string, with byte values encoded in UTF-8. Maximum string length is platform-dependent, but no more than 65535 bytes. While entering value for this field, user can see '*' for every character.
`permutation`	Variable-length character string, with byte values encoded in UTF-8. Maximum string length is platform-dependent, but no more than 65535 bytes. This datatype is not supported for custom external adapters.
`range`	An integer value for which user can define lower and upper limits. e.g. `<Parameter id="port" label="KDB Port" descr="IP port of the database listener" type="range" rangeLow="0" rangeHigh="65535" default="5001" use="required" />`
`query`	A string value Studio creates from the tablename. This datatype is not supported for custom external adapters.
`runtimeDirectory`	Variable-length character string, with byte values encoded in UTF-8. Maximum string length is platform-dependent, but no less than 65535 bytes. This datatype is not supported for custom external adapters.
`runtimeFilename`	Runtime file name, if different from discovery time file name. Variable-length character string, with byte values encoded in UTF-8. Maximum string length is platform-dependent, but no more than 65535 bytes. This datatype is not supported for custom external adapters.
`string`	Variable-length character string, with byte values encoded in UTF-8. Maximum string length is platform-dependent, but no more than 65535 bytes.
`tables`	This is list of choices returned by **getTables()** defined in adapter.
`text`	A value capable of storing multiline text. This datatype is not supported for custom external adapters.
`uint`	Positive integer value. The range of allowed values is 0 to 0xffffffff.

CHAPTER 6

Appendix B: Date and Timestamp Formats for Input Adapters

SAP supports numerous formats for date and timestamp datatypes.

Use the info below to create a custom format for your date and timestamp datatypes.

Character	Description
%a	The day of the week, using the locale's weekday names. You can specify either the abbreviated or full name.
%A	Equivalent to %a.
%b	The month, using the locale's month names. You can specify either the abbreviated or full name.
%B	Equivalent to %b.
%c	The locale's appropriate date and time representation.
%C	The century number [00,99]. Leading zeros are permitted but not required.
%d	The day of the month [01,31]. Leading zeros are permitted but not required.
%D	The date as %m / %d / %y.
%e	Equivalent to %d.
%h	Equivalent to %b.
%H	The hour (24-hour clock) [00,23]. Leading zeros are permitted but not required.
%I	The hour (12-hour clock) [01,12]. Leading zeros are permitted but not required.
%j	The day number of the year [001,366]. Leading zeros are permitted but not required.
%m	The month number [01,12]. Leading zeros are permitted but not required.
%M	The minute [00,59]. Leading zeros are permitted but not required.
%n	Any white space.

Character	Description
%p	The locale's equivalent of a.m or p.m.
%r	12-hour clock time using the AM/PM notation.
%R	The time as %H : %M.
%S	The seconds [00,60]. Leading zeros are permitted but not required.
%t	Any white space.
%T	The time as %H : %M : %S.
%U	The week number of the year (Sunday as the first day of the week) as a decimal number [00,53]. Leading zeros are permitted but not required.
%w	The weekday as a decimal number [0,6], with 0 representing Sunday. Leading zeros are permitted but not required.
%W	The week number of the year (Monday as the first day of the week) as a decimal number [00,53]. Leading zeros are permitted but not required.
%x	The date, using the locale's date format.
%X	The time, using the locale's time format.
%y	The year within the century. When a century is not otherwise specified, values in the range [69,99] shall refer to years 1969 to 1999 inclusive, and values in the range [00,68] shall refer to years 2000 to 2068 inclusive. Leading zeros are permitted but not required.
%Y	The year, including the century. For example, 1988.
%%	Replaced by %.

CHAPTER 7

Appendix C: Date and Timestamp Formats for Output Adapters

SAP supports numerous formats for date and timestamp datatypes.

Use the info below to create a custom format for your date and timestamp datatypes.

Character	Description
%a	The locale's abbreviated weekday name.
%A	The locale's full weekday name.
%b	The locale's abbreviated month name.
%B	The locale's full month name.
%c	The locale's appropriate date and time representation.
%C	The year divided by 100, and truncated to an integer as a decimal number [00,99].
%d	The day of the month as a decimal number [01,31].
%D	Equivalent to %m / %d / %y.
%e	The day of the month as a decimal number [1,31]. A single digit is preceded by a space.
%F	Equivalent to %Y - %m - %d. This is the ISO 8601:2000 standard date format.
%g	The last 2 digits of the week-based year, as a decimal number [00,99].
%G	The week-based year as a decimal number. For example, 1977.
%h	Equivalent to %b.
%H	The hour (24-hour clock) as a decimal number [00,23].
%I	The hour (12-hour clock) as a decimal number [01,12].
%j	The day of the year as a decimal number [001,366].
%m	The month as a decimal number [01,12].
%M	The minute as a decimal number [00,59].

Character	Description
%n	A <newline>.
%p	The locale's equivalent of either a.m. or p.m.
%r	The time in a.m. and p.m. notation.
%R	The time in 24-hour notation (%H : %M).
%S	The second as a decimal number [00,60].
%t	A <tab>.
%T	The time in the following format %H : %M : %S.
%u	The weekday as a decimal number [1,7], with 1 representing Monday.
%U	The week number of the year as a decimal number [00,53]. The first Sunday of January is the first day of week 1, and days in the new year before this are in week 0.
%V	The week number of the year (Monday as the first day of the week) as a decimal number [01,53]. If the week containing 1 January has four or more days in the new year, then it is considered week 1. Otherwise, it is the last week of the previous year, and the next week is week 1. Both January 4th and the first Thursday of January are always in week 1.
%w	The weekday as a decimal number [0,6], with 0 representing Sunday.
%W	The week number of the year as a decimal number [00,53]. The first Monday of January is the first day of week 1, and days in the new year before this are in week 0.
%x	The locale's appropriate date representation.
%X	The locale's appropriate time representation.
%y	The last two digits of the year as a decimal number [00,99].
%Y	The year as a decimal number. For example, 1997.
%z	The offset from UTC in the ISO 8601:2000 standard format (+hhmm or -hhmm), or by no characters if no time zone is determinable. For example, "-0430" means 4 hours 30 minutes behind UTC (west of Greenwich).
%Z	The time zone name or abbreviation, or by no bytes if no time zone information exists.
%%	Replaced by %.

CHAPTER 8 Appendix D: Internal Adapter API

If the adapters available from SAP do not meet your needs, Event Stream Processor provides an internal adapter API that you can use to build internal adapters. However, with the addition of the ESP adapter toolkit, the internal API is being deprecated and may be removed in future releases of Event Stream Processor. It is highly recommended that you get familiar with and use the ESP adapter toolkit instead.

As part of creating a custom internal adapter, you must also create a custom adapter library. This library uses the Event Stream Processor shared utility library to help convert external data to ESP Server format.

You can implement life cycle and information management functions for your custom adapter using the C APIs provided by the adapter shared utility library. You can use the C interface to implement your custom adapter in C or C++ without any compiler restrictions.

The header file, `GenericAdapterInterface.h`, contains the import declarations that are required to call utility functions in the adapter shared utility library.

The Adapter Shared Utility Library

The adapter shared utility library provides the utility functions required for a custom adapter implementation, including data conversion, data manipulation, and data management.

The header file, `GenericAdapterInterface.h`, contains the import declarations required to call utility functions in the adapter shared utility library.

When calling functions, each data utility requires a unique handle. The adapter shared utility library is labeled `esp_adapter_util_lib.dll` for Windows installations, and `libesp_adapter_util_lib.so` for Linux installations.

When calling functions in the adapter shared utility shared, each data utility requires a unique handle. For example, you can use the **ConnectionRow** function by calling **CreateConnectionRow**. This call returns a unique handle in the form of a void pointer. You can then pass this pointer back when making calls to any other APIs under **ConnectionRow**.

Sample Model File

Sample syntax you can use to build a basic model file.

This model represents a schema with two columns of string data. The model also defines an input connection that references a sample custom adapter implementation.

```
CREATE  MEMORY  STORE "memory" PROPERTIES  INDEXTYPE ='tree',
INDEXSIZEHINT =8;

CREATE INPUT WINDOW Custom
SCHEMA (column1 STRING, column2 STRING)
PRIMARY KEY (column1)
STORE "memory";
ATTACH INPUT ADAPTER Connection1
TYPE custom_in
TO Custom
PROPERTIES RowCount=15;
```

The Adapter Configuration File

The internal adapter configuration file is an XML file (`.cnxml`) that contains the properties and commands used by ESP to start and stop the internal adapter, as well as other information that allows the internal adapter to be configured from the ESP Studio.

The adapter configuration file also constructs the name for your custom adapter DLL file. The library name is referenced when you load your adapter.

This is sample code for naming the custom adapter DLL file:

```
<?xml version="1.0" encoding="UTF-8"?>
<Adapter type="input"
  id="custom_in"
  label="Custom Input"
  descr="Dummy Custom Input Adapter"
>
<Library file="custom_in" type="binary"/>
<Special>
</Special>
<Section>
    <Parameter id="RowCount"
      label="RowCount"
      descr="How many rows to generate"
      type="uint"
      use="required"
      default="10"/>
 </Section>
</Adapter>
```

Note: The `.cnxml` file adheres to the `Adapter.xsd` file.

Once the `.cnxml` and custom adapter DLL files are ready, copy them to the `ESP_HOME/lib/adapters` folder.

DLL Export Functions

The DLL export functions define how a custom internal adapter controls its life cycle and communicates with the ESP Server. These functions must be implemented and exported in the DLL.

Custom adapter implementation is bundled in a separate DLL. When building a custom internal adapter, an adapter developer must implement the DLL Export functions found in the DLL.

Adapter Setup Functions

The ESP Server uses information management functions to complete the adapter implementation process.

These functions are used for both input and output adapters.

API	Description
void* createAdapter();	Returns a unique handle that the ESP Server uses to make subsquent calls to the adapter. This is the first call the ESP Server makes when creating an adapter.
void* deleteAdapter(void* adapter);	Deletes an adapter using the unique handle returned by the `createAdapter` API. This is the last call the ESP Server makes concerning a given adapter.
void setCallBackReference(void*adapter,void* connectionCallBackReference);	Gives the adapter implementation a unique handle that corresponds to the connectionCallBack-object on the ESP Server side. Use this handle as a parameter when making callbacks to the ESP Server.
void setConnectionRowType(void* adapter,void* connectionRowType);	Provides the adapter implementation with information related to schema.
void setConnectionParams(void* adapter, void* connectionParams);	Provides the adapter implementation with information related to connection parameters.

Adapter Life Cycle Functions

All adapters follow a set of adapter life cycle events.

API	Description
bool reset(void* adapters);	Initializes both input and output adapters.
void start(void* adapter);	Processes data specific to the adapter implementation. Call this API immediately after reset for both input and output adapters.
void* getNext(void* adapter);	Reads data and returns a pointer to the data in a format the ESP Server understands. The adapter shared utility library provides data conversion functions. Call this API for input adapters only.
void putNext(void* adapter,void* stream);	Converts presented data into a format the ESP Server understands, and writes it according to the specified adapter implementation. The adapter shared utility library provides data conversion functions. Call this API for output adapters only.
void stopRequested(void* adapter);	Sets a flag to indicate that a request has been sent to stop the adapter. Call this API for both input and output adapters.
void stop(void* adapter);	Stops an adapter. Call this API for both input and output adapters.
void cleanup(void* adapter);	Performs clean-up activities after an adapter is stopped.
void commitTransaction(void* adapter);	Notifies an output adapter when a transaction ends and pushes any buffered data into the target. Call this API for output adapters only.
void putStartSync(void* adapter);	Notifies the adapter implementation that the base data is being sent. Call this API for output adapters only.
void putEndSync(void* adapter);	Notifies the adapter implementation that the base data has been sent. Call this API for output adapters only.
void purgePending)void* adapter);	Instructs an output adapter to purge pending data. Call this API for output adapters only.

API	Description
bool isOutBase(void* adapter);	Determines whether the adapter expects to receive the output for the base contents of the stream. Call this API for output adapters only.

Miscellaneous Functions

Descriptions of miscellaneous APIs supported for Event Stream Processor adapters.

API	Description
in64_t getNumberOfGoodRows(void* adapter);	Retrieves information from the adapter implementation about the number of good rows processed by the adapter.
int64_t getNumberOfBadRows(void* adapter);	Retrieves information from the adapter implementation about the number of bad rows processed by the adapter.
int64_t getTotalRowsProcessed(void* adapter);	Retrieves information from the adapter implementation about the total number of rows processed by the adapter.
bool canDiscover(void* adapter);	Retrieves information from the adapter implementation about whether it supports schema discovery functionality.
bool hasError(void* adapter);	Retrieves information from the adapter implementation about whether there were any errors during the processing of data.
void getError(void* adapter, charerrorString);**	Retrieves error information from the adapter implementation.
void getStatistics(void* adapter, AdapterStatistics* adapterStatistics)	Retrieves custom statistics information from an adapter. The Server uses this to periodically update the _esp_adapter_statistics metadata stream. Enable the time-granularity project option to update the _esp_adapter_statistics metadata stream. The adapter stores its statistics in key value format within the AdapterStatistics object. The AdapterStatistics object is populated using the **void addAdapterStatistics(void* adapterStatistics, const char* key, const char* value)** API, which is available in the adapter utility library.

API	Description
int64_t getLatency(void* adapter)	Retrieves latency information from the adapter, in microseconds, and uses this information to periodically update the latency column in the _esp_connectors metadata stream. Enable the time-granularity project option to update the _esp_connectors metadata stream.

Schema Discovery for Internal Custom Adapters

Use extern "C" functions to enable your custom internal adapter for schema discovery.

Method	Description
extern "C" DLLEXPORT bool canDiscover(void* adapter)	Checks whether an adapter supports discovery. This is the first API called when an adapter is running schema discovery. Adapters that support discovery return a value of true.
extern "C" DLLEXPORT void setDiscovery(void* adapter)	Tells the adapter that it is running in discovery mode.
extern "C" DLLEXPORT int getTableNames(void* adapter, char* tables)**	Points to an array of strings that populates tables. The function returns table names when discovering tables in a database, or file names when discovering particular types of files in a directory.
extern "C" DLLEXPORT int getFieldNames(void* adapter, char* names, const char* tableName)**	Retrieves field names.
extern "C" DLLEXPORT int getFieldTypes(void* adapter, char* types, const char* tableName)**	Retrieves field types.
extern "C" DLLEXPORT int getSampleRow(void* adapter, char* row, const char* tableName, int pos)**	Retrieves sample rows.

DLL Import Functions

A custom internal adapter can import DLL import functions, which provide useful functionalities for implementing a custom adapter.

The DLL import functions are various API import declarations listed in the `GenericAdapterInterface.h` file. These APIs are all optional.

Error Handler Functions

Describes various error handler utility APIs used by custom internal adapters.

These functions are used for both input and output adapters.

API	Description
void* createConnectionErrors();	Creates a ConnectionsErrors object and its related ConnectionErrorsWrapper object.
bool empty(void* connectionErrors);	Checks whether two parameters pair without errors.
size_t sizeConnectionErrors(void* connectionErrors);	Measures the size of a parameter pair and its error message and returns a measurement sum.
void clearConnectionErrors(void* connectionErrors);	Clears the parameter pair created by the ConnectionErrors object and any error messages the pair generated.
void addParam(void* connectionErrors, const char *param, const char *error);	Adds a parameter-value pair into the ConnectionErrors object.
void addGeneral(void* connectionErrors, const char* error);	Adds a general error message into the ConnectionErrors object.
void getAdapterError(void* connectionErrors, char errorString);**	Retrieves the stored parameter-value pair and the general error message created by the `addParam` and `addGeneral` APIs and places them into the errorString object.

Parameter Handler Functions

Describes various parameter handler utility APIs used by custom internal adapters.

These functions are used for both input and output adapters.

API	Description
void addConnectionParam(void* connectionParam, const char* key, const char* val);	Populates the ConnectionParam object with a key-value pair.
int getConnectionParamInt64_t(void* connectionParams, const char* key);	Retrieves a parameter value as a `long` datatype.

API	Description
const char* getConnectionParamString(void* connectionParams, const char* key);	Retrieves a parameter value as a `string` data-type.
const char* substitute(void* connectionParam, const char *where, const char *paramPrefix="", int depth=0);	Substitutes the specified environment variables and parameters in `string` format.
DLLIMPORT int getConfiguredSections(void* connectionParams);	Determines the number of existing configuration sections.

Data Conversion Functions

The ESP Server uses these APIs to convert data within the custom internal adapter implementation.

These functions are used for both input and output adapters.

API	Valid Row-Type	Description
void* createConnectionRow(const char *type);	All	Creates a ConnectionRow object of a given type and its related ConnectionRowWrapper object. The valid values for **type** are: • **RowByName** – Stores data internally as name-value pairs. • **RowByOrder** – Stores data internally as an indexed vector.
void deleteConnectionRow(void* connectionRow);	All	Deletes a ConnectionRow object and its related ConnectionRowWrapper object.
void clear(void* connectionRow);	All	Clears the contents of a ConnectionRow object and prepares the object for reuse. If the ConnectionRowType is owned by the given ConnectionRow, all data, including the type, is cleared. If the ConnectionRowType is not owned by the given ConnectionRow, only the internal data store is cleared and the type remains the same. The ownership of a type is decided by the parameter **own**, located in the API `setStreamType`.

API	Valid Row-Type	Description
void clearData(void* connectionRow);	All	Clears all data from the internal data store of a ConnectionRow object, leaving only the stream information.
void* createNew(void* connectionRow);	All	Creates a new ConnectionRow object of the same subtype as the one specified.
void setDateFormat(void* connectionRow, const char *fmt);	All	Sets the date format using a representative string.
void setTimestampFormat(void* connectionRow, const char *fmt);	All	Sets the timestamp format using a representative string.
void setStreamName(void* connectionRow, const char *sname);	All	Specifies a unique name for the stream.
const char* getStreamName(void* connectionRow);	All	Retrieves the name of the given stream.
void setStreamType(void* connectionRow, void *connectionRowType, bool own);	All	Specifies a preparsed stream type and sends stream row definition information contained in the ConnectionRowType object to the ConnectionRow object. To apply the row schema, the ESP Server calls this API after the ConnectionRow object is created. The **own** parameter specifies ownership of a type object and therefore deletion responsibility, as seen in the `clear` API.
void *getStreamType(void* connectionRow);	All	Retrieves stream row definition information contained in the ConnectionRowType object.
bool getFieldAsStringWithKey(void *connectionRow, const char *fname, const char **val);	**Row-By-Name**	Retrieves a column value from the ConnectionRow object using the given column name.
bool setFieldAsStringWithKey(void *connectionRow, const char *fname, const char* val);	**Row-By-Name**	Updates the value of the column with the specified name, or creates a new column with the specified name and value.

API	Valid Row-Type	Description
bool getFieldAsStringWithIndex(void *connectionRow, int fn, const char **val);	**RowByOrder**	Retrieves a column value from the ConnectionRow object using the column index.
bool setFieldAsStringWithIndex(void* connectionRow, int fn, const char *val);	**RowByOrder**	References a column index and updates or appends the relevant column.
bool appendFieldAsString(void* connectionRow, const char *val);	**RowByOrder**	Appends a new column to the given ConnectionRow object and populates it with the given value.
char getOp(void* connectionRow);	**RowByOrder**	Retrieves operation type information.
void setOp(void* connectionRow, char op);	**RowByOrder**	Sets the operation type of the ConnectionRow object. Valid values are: • **i** or **I** (insert) • **d** or **D** (delete) • **u** or **U** (update) • **p** or **P** (upsert)
const char *getFlagsAsString(void* connectionRow);	**RowByOrder**	Retrieves flag information in string format.
bool setFlagsAsString(void* connectionRow, const char * flags);	**RowByOrder**	Sets up the flag information in string format and subscribes with shine through, if possible. Therefore, when an update contains no new data for previously received fields, information for those fields is retained.
int size(void* connectionRow);	**RowByOrder**	Determines the number of existing fields.
void* toRow(void* connectionRow, size_t rowNo, void* connectionErrorMsgs);	All	Converts an existing ConnectionRow into an ESP StreamRow.

API	Valid Row-Type	Description
bool fromRow(void* connectionRow, void* streamRow, size_t rowNo, void* connectionErrorMsgs);	All	Converts an existing ESP StreamRow into a ConnectionRow.

Callback Functionality

An adapter implementation can use callback functions to log on to the ESP Server, retrieve information related to schemas, and convey state information to the ESP Server.

Callback functions are contained in the `esp_server_lib.lib` file for Windows installations, and in the `libesp_server_lib.so` file for Linux and Solaris installations.

These functions are used for both input and output adapters, unless otherwise noted.

API	Description
void postEndSync(void* callBackReference);	Notifies the adapter implementation that the base data flow has ended. Call this API for output adapters only.
void logMessage(void* callBackReference,int level,const char* message);	Logs a message with the adapter implementation. The valid values for the the severity level are: • L_EMERG • L_ALERT • L_CRIT • L_ERR • L_WARNING • L_NOTICE • L_INFO • L_DEBUG
void postStartSync(void* callBackReference);	Notifies the adapter implementation that the base data is about to be sent. Call this API for output adapters only.

API	Description
void notifyConnState(void* callBackReference, int oldSt, int st);	Notifies the ESP Server that the adapter state has changed. The valid values for adapter state are: • RS_READY - ready to start • RS_INITIAL - performing start-up activities • RS_CONTINUOUS - ready to continuously receive data • RS_IDLE - timeout • RS_DONE - no more incoming data, ready to exit • RS_DEAD - stopped receiving data, is not active
int getColumnCount(void* connectionRowType);	Retrieves the number of existing columns of a given row type from the adapter implementation.
const char* getColumnName(void* connectionRowType, int pos);	Retrieves a column name using the column's position in the adapter implementation.
void* getTimeContext(void* callBackReference);	Retrieves information contained in the TimeContext object from ESP Server.
const char* getStreamName(void* connectionRowType);	Retrieves the name of the stream specified by the given ConnectionRowType.
void deactivateOutput(void* callBackReference);	Tells a stream to temporarily suspend output data flow.
void activateOutput(void* callBackReference, bool sendBase);	Requests the stream to start sending output data. This is indicated by the sendBase flag.
void setAdapterState(void* callBackReference, int state);	Sets up a running state for the adapter implementation.
int getAdapterState(void* callBackReference);	Retrieves running state information from the adapter implementation.
int getColumnDatatype(void* callBackReference, int pos);	Retrieves the type of a field using the field's position in the CallBackReference object.
void addAdapterStatistics(void* adapterStatistics, const char* key, const char* value);	Populates the AdapterStatistics object with a custom statistics item in key-value format.

Adapter Run States

Adapters progress through a set of run states (RS) as they interact with Event Stream Processor.

- RS_READY – indicates that the adapter is ready to be started.
- RS_INITIAL – indicates that the adapter is performing start-up and initial loading. An adapter enters the RS_INITIAL state when the reset function is called.
- RS_CONTINUOUS – indicates that the adapter is continuously waiting for additional data. If the RS_CONTINUOUS state is set in the reset method, input adapters return from reset with data to process, and output adapters return from reset prepared to accept data.
- RS_IDLE – indicates that the adapter has timed out or is attempting to restore a broken socket.
- RS_DONE – indicates when the adapter no longer returns data and can no longer retrieve data following the poll period.
- RS_DEAD – indicates that the adapter has entered the exited state. The adapter does not operate until you call the restart function.

When polling is enabled, an input adapter may change states from RS_CONTINUOUS to RS_IDLE. Change the adapter state back to RS_CONTINUOUS to retry data retrieval after a certain amount of time.

Sample Custom Internal Adapter Implementation

Sample syntax you can use to build your custom internal adapter implementation. This implementation incorporates extern "C" methods that enable schema discovery in a custom adapter.

```
/*
 * CustomAdapterInterface.cpp
 *
 *      Author: sample
 */

#include "GenericAdapterInterface.h"
#include <vector>
#include <sstream>
#include <iostream>
#include <string>

using namespace std;

struct InputAdapter
{
    InputAdapter();
    void* connectionCallBackReference;
    void* schemaInformation;
```

```
    void* parameters;
    void* rowBuf;
    void* errorObjIdentifier;
    int64_t _badRows;
    int64_t _goodRows;
    int64_t _totalRows;
    int getColumnCount();
    void setState(int st);
    bool discoverTables();
    bool discover(string tableName);
    vector<string> _discoveredTableNames;
    vector<string> _discoveredFieldNames;
    vector<string> _discoveredFieldTypes;
    vector<vector<string> > _discoveredRows;
    vector<string> _row1;
    vector<string> _row2;
    bool _discoveryMode;
    int64_t _rowCount;
};

InputAdapter::InputAdapter()
{
    rowBuf = NULL;
    _badRows = 0;
    _goodRows = 0;
    _totalRows = 0;
    _discoveryMode = false;
    _discoveredTableNames.clear();
    _discoveredFieldNames.clear();
    _discoveredFieldTypes.clear();
    _discoveredRows.clear();
    _row1.clear();
    _row2.clear();
    _rowCount = 0;
}

int InputAdapter::getColumnCount()
{
    return ::getColumnCount(schemaInformation);
}

void InputAdapter::setState(int st)
{
    ::setAdapterState(connectionCallBackReference, st);
}

extern "C" DLLEXPORT
void* createAdapter()
{
    return new InputAdapter();
}

extern "C" DLLEXPORT
void setCallBackReference(void *adapter,void
*connectionCallBackReference)
{
```

```
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
    inputAdapterObject->connectionCallBackReference =
connectionCallBackReference;
}

extern "C" DLLEXPORT
void setConnectionRowType(void *adapter,void *connectionRowType)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
    inputAdapterObject->schemaInformation = connectionRowType;
}

extern "C" DLLEXPORT
void  setConnectionParams(void* adapter,void* connectionParams)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
    inputAdapterObject->parameters = connectionParams;
}

extern "C" DLLEXPORT
void* getNext(void *adapter)
{
    StreamRow streamRow = NULL;
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
    int n = inputAdapterObject->getColumnCount();
    std::stringstream ss;
    if(inputAdapterObject->_totalRows <inputAdapterObject-
>_rowCount){

        for (int column = 0; column < n; column++) {
            ss.str("");
            ss << inputAdapterObject->_totalRows;
            std::string tempString;
            tempString = ss.str();
            std::string row = "ROW";
            row.append(tempString);
            ss.str("");
            ss << column;
            tempString = ss.str();
            std::string columnString = "COLUMN";
            columnString.append(tempString);
            row.append(columnString);
            ::setFieldAsStringWithIndex(inputAdapterObject->rowBuf,
column, row.c_str());

        }

        inputAdapterObject->_totalRows++;
        streamRow = ::toRow(inputAdapterObject->rowBuf,
inputAdapterObject->_totalRows, inputAdapterObject-
>errorObjIdentifier);
        if( streamRow )
        {
            inputAdapterObject->_goodRows++;
        } else
        {
```

```
            inputAdapterObject->_badRows++;
        }


    } else {
        inputAdapterObject->setState(RS_DONE);
    }
    return streamRow;

}

extern "C" DLLEXPORT
bool reset(void *adapter)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
    inputAdapterObject->_rowCount
= ::getConnectionParamInt64_t(inputAdapterObject-
>parameters,"RowCount");
    if(inputAdapterObject->rowBuf)
        deleteConnectionRow(inputAdapterObject->rowBuf);
    string type = "RowByOrder";
    inputAdapterObject->rowBuf
= ::createConnectionRow(type.c_str());
    ::setStreamType(inputAdapterObject->rowBuf, inputAdapterObject-
>schemaInformation, false);
    inputAdapterObject->errorObjIdentifier
=::createConnectionErrors();
    inputAdapterObject->setState(RS_CONTINUOUS);
    return true;
}

extern "C" DLLEXPORT
int64_t getTotalRowsProcessed(void *adapter)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
    return inputAdapterObject->_totalRows;
}

extern "C" DLLEXPORT
int64_t getNumberOfBadRows(void *adapter)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
    return inputAdapterObject->_badRows;
}

extern "C" DLLEXPORT
int64_t getNumberOfGoodRows(void *adapter)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
    return inputAdapterObject->_goodRows;
}

extern "C" DLLEXPORT
bool hasError(void *adapter)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
```

```
    return !(::empty(inputAdapterObject->errorObjIdentifier));
}

extern "C" DLLEXPORT
void getError(void *adapter, char** errorString)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
    ::getAdapterError(inputAdapterObject->errorObjIdentifier,
errorString);
}

extern "C" DLLEXPORT
void  start(void* adapter){}

extern "C" DLLEXPORT
void  stop(void* adapter){}

extern "C" DLLEXPORT
void  cleanup(void* adapter){}

extern "C" DLLEXPORT
bool  canDiscover(void* adapter){return true;}

extern "C" DLLEXPORT
void deleteAdapter(void* adapter)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
    delete inputAdapterObject;
}

extern "C" DLLEXPORT
void commitTransaction(void *adapter){}



extern "C" DLLEXPORT
int getTableNames(void* adapter, char*** tables)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;

    if(!inputAdapterObject->discoverTables())
    {
        return 0;
    }

    (*tables) = (char**) malloc(sizeof(char*)*inputAdapterObject-
>_discoveredTableNames.size());

    for(int index=0; index < inputAdapterObject-
>_discoveredTableNames.size(); index++)
    {
        size_t tableNameSize = inputAdapterObject-
>_discoveredTableNames[index].size() + 1 ;
        char* tableName = new char [tableNameSize ];
        strncpy(tableName, inputAdapterObject-
>_discoveredTableNames[index].c_str(),tableNameSize);
```

```
        (*tables)[index] = tableName;
    }

    return inputAdapterObject->_discoveredTableNames.size();
}

extern "C" DLLEXPORT
int getFieldNames(void* adapter, char*** names, const char*
tableName)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;

    string table (tableName);

    if(!inputAdapterObject->discover(table))
    {
        return 0;
    }

    (*names) = (char**) malloc(sizeof(char*)*inputAdapterObject-
>_discoveredFieldNames.size());

    for(int index=0; index < inputAdapterObject-
>_discoveredFieldNames.size(); index++)
    {
        size_t fieldNameSize = inputAdapterObject-
>_discoveredFieldNames[index].size() + 1;
        char* fieldName = new char [ fieldNameSize ];
        strncpy(fieldName, inputAdapterObject-
>_discoveredFieldNames[index].c_str(),fieldNameSize);
        (*names)[index] = fieldName;
    }

    return inputAdapterObject->_discoveredFieldNames.size();

}

extern "C" DLLEXPORT
int getFieldTypes(void* adapter, char*** types, const char*
tableName)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;

    string table (tableName);

    if(!inputAdapterObject->discover(table))
    {
        return 0;
    }

    (*types) = (char**) malloc(sizeof(char*)*inputAdapterObject-
>_discoveredFieldTypes.size());


    for(int index=0; index < inputAdapterObject-
>_discoveredFieldTypes.size(); index++)
```

```
    {
        size_t fieldTypeSize = inputAdapterObject-
>_discoveredFieldTypes[index].size() + 1;
        char* fieldType = new char [ fieldTypeSize ];
        strncpy(fieldType, inputAdapterObject-
>_discoveredFieldTypes[index].c_str(), fieldTypeSize);
        (*types)[index] = fieldType;
    }

    return inputAdapterObject->_discoveredFieldTypes.size();
}

extern "C" DLLEXPORT
int getSampleRow(void* adapter, char*** row, const char* tableName,
int pos)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;

    string table (tableName);

    if(!inputAdapterObject->discover(table))
    {
        return 0;
    }

    vector<string> vals;

    if (pos < (int)inputAdapterObject->_discoveredRows.size())
    {
        vals = inputAdapterObject->_discoveredRows[pos];

        (*row) = (char**) malloc(sizeof(char*)*vals.size());

        for(int index=0; index < vals.size(); index++)
        {
            size_t columnSize = vals[index].size() + 1;
            char* column = new char [ columnSize ];
            strncpy(column, vals[index].c_str(),columnSize);
            (*row)[index] = column;
        }
    }

    return vals.size();

}

extern "C" DLLEXPORT
void setDiscovery(void* adapter)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
    inputAdapterObject->_discoveryMode = true;
}

bool InputAdapter::discoverTables()
{
    _discoveredTableNames.push_back("Table1");
```

```
    _discoveredTableNames.push_back("Table2");
    _discoveredTableNames.push_back("Table3");
    _discoveredTableNames.push_back("Table4");
    _discoveredTableNames.push_back("Table5");
    return true;
}

bool InputAdapter::discover(string tableName)
{
    _discoveredFieldNames.clear();
    _discoveredFieldTypes.clear();
    _row1.clear();
    _row2.clear();
    _discoveredRows.clear();
    _discoveredFieldNames.push_back("Column1");
    _discoveredFieldNames.push_back("Column2");
    _discoveredFieldNames.push_back("Column3");
    _discoveredFieldNames.push_back("Column4");
    _discoveredFieldNames.push_back("Column5");
    _discoveredFieldTypes.push_back("integer");
    _discoveredFieldTypes.push_back("string");
    _discoveredFieldTypes.push_back("string");
    _discoveredFieldTypes.push_back("float");
    _discoveredFieldTypes.push_back("float");
    _row1.push_back("1");
    _row1.push_back("A");
    _row1.push_back("B");
    _row1.push_back("1.1");
    _row1.push_back("2.2");
    _row2.push_back("2");
    _row2.push_back("X");
    _row2.push_back("Y");
    _row2.push_back("3.3");
    _row2.push_back("4.4");
    _discoveredRows.push_back(_row1);
    _discoveredRows.push_back(_row2);
    return true;
}

extern "C" DLLEXPORT
void getStatistics(void* adapter, AdapterStatistics*
adapterStatistics)
{
    InputAdapter *inputAdapterObject = (InputAdapter*)adapter;
    const char* key;
    ostringstream value;
    value.str("");
    key = "Total number of rows";
    value << inputAdapterObject->_totalRows;
    addAdapterStatistics(adapterStatistics, key,
value.str().c_str());
    value.str("");
    key = "Total number of good rows";
    value << inputAdapterObject->_goodRows;
    addAdapterStatistics(adapterStatistics, key,
value.str().c_str());
```

```
    value.str("");
    key = "Total number of bad rows";
    value << inputAdapterObject->_badRows;
    addAdapterStatistics(adapterStatistics, key,
value.str().c_str());
}

extern "C" DLLEXPORT
int64_t getLatency(void* adapter)
{
    return 100;
}
```

Sample Makefile for a Sample Custom Internal Adapter

Use a makefile to build and install a sample custom internal adapter.

For Linux environments, use:

```
All:
    gcc -c CustomInputAdapterInterface.cpp -fPIC
    gcc -shared -o libesp_adapter_custom_in_lib.so
CustomInputAdapterInterface.o -l stdc++ -L. ../../lib/adapters/
libesp_adapter_util_lib.so -L. ../../lib/libesp_server_lib.so
    cp libesp_adapter_custom_in_lib.so ../../lib/adapters
    cp custom_in.cnxml ../../lib/adapters
```

For Windows environments, use:

```
All:
    cl.exe /EHs /D_USRDLL /D_WINDLL
CustomInputAdapterInterface.cpp ../../lib/adapters/
esp_adapter_util_lib.lib ../../lib/static/esp_server_lib.lib /link /
DLL /OUT:esp_adapter_custom_in_lib.dll
    cp esp_adapter_custom_in_lib.dll ../../lib/adapters/
esp_adapter_custom_in_lib.dll
    cp esp_adapter_custom_in_lib.lib ../../lib/adapters/
esp_adapter_custom_in_lib.lib
    cp custom_in.cnxml ../../lib/adapters/custom_in.cnxml
```

Building a Sample Custom Internal Adapter

Use the makefile to build a sample custom internal adapter.

Prerequisites

Create the sample makefile.

Task

1. Copy the makefile, custom internal adapter implementation file, and the custom cnxml file to the `$ESP_HOME/include/adapter` folder.
2. Set the appropriate environment variables for your compiler.
3. Use **make** to build the adapter.

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