webMethods EntireX

EntireX Listener for IBM® MQ

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1 About this Documentation

Document Conventions

Convention	Description
Bold	Identifies elements on a screen.
`Monospace font`	Identifies service names and locations in the format *`folder.subfolder.service`*, APIs, Java classes, methods, properties.
`Italic`	Identifies: Variables for which you must supply values specific to your own situation or environment. New terms the first time they occur in the text. References to other documentation sources.
`Monospace font`	Identifies: Text you must type in. Messages displayed by the system. Program code.
{ }	Indicates a set of choices from which you must choose one. Type only the information inside the curly braces. Do not type the { } symbols.
|	Separates two mutually exclusive choices in a syntax line. Type one of these choices. Do not type the | symbol.
[ ]	Indicates one or more options. Type only the information inside the square brackets. Do not type the [ ] symbols.
...	Indicates that you can type multiple options of the same type. Type only the information. Do not type the ellipsis (...).

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2 Introduction to the Listener for IBM MQ

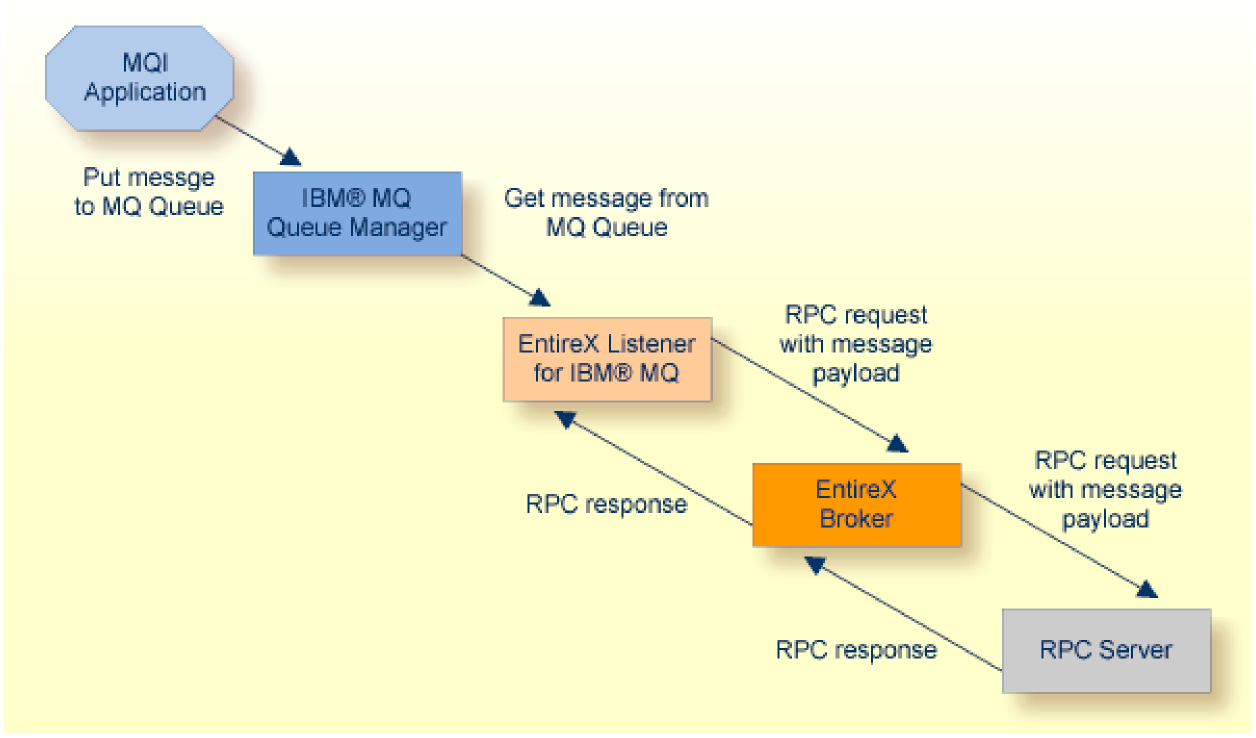
The EntireX Listener for IBM® MQ runs as a listener on an IBM MQ queue and passes messages to an RPC server. It is used to send messages received from an IBM MQ queue to an RPC server application. This means that existing RPC servers can be used for communication with IBM MQ.

Overview

The EntireX Listener for IBM® MQ receives asynchronous and synchronous messages from an IBM MQ queue and calls a standard RPC server. The Listener for IBM MQ uses the IBM® MQ base Java classes from IBM. It can connect to an IBM MQ either as an IBM MQ client using TCP/IP (*client mode*) or in so-called *bindings mode* where it is connected directly to IBM® MQ running on the same machine. Note that on z/OS, only bindings mode is supported. If the Listener for IBM MQ wants to connect in client mode via TCP/IP to an MQ server on z/OS, the *client attachment feature* needs to be installed on the target queue manager.

The Listener for IBM MQ runs as a listener on an MQ queue and processes MQ messages. It receives an MQ message and sends the message to an RPC server. A synchronous scenario is possible if the MQ message is a request message that specifies a reply queue. In this case the result returned by the RPC server is sent back as an MQ message to the reply queue. For possibilites on how MQ messges are mapped to RPC data see ***Mapping RPC Data to the MQ Message Buffer***. The image below illustrate message transport when receiving MQ messages.

Listening for Messages on an MQ Queue


MQI Application
Put messge to MQ Queue
IBM® MQ Queue Manager
Get message from MQ Queue
EntireX Listener for IBM® MQ
RPC request with message payload
RPC response
EntireX Broker
RPC request with message payload
RPC response
RPC Server

Note: All messages retrieved by the Listener for IBM MQ from the MQ listen queue are passed to the same RPC service. Messages are retrieved in the order they appear on the queue.

3 Mapping RPC Data to the MQ Message Buffer

Mapping XML MQ Messages to IDL

IDL is mapped to XML format using the *XML Mapping Editor*. The outcome of this process is an XML mapping file (Designer file with extension xmm). This resulting XMM file has to be specified by the configuration property `entirex.bridge.xmm`.

Note: EntireX configuration parameters (see *Listener for XML/SOAP* under *Writing Advanced Applications with the XML/SOAP Wrapper*) inside the XML payload are ignored.

Mapping Text MQ Messages to IDL

MQ messages in text format use an IDL file, which describes the message layout. The IDL file has to be specified by the configuration property `entirex.bridge.idl`. The program name is taken from the `applicationIdData` field of the incoming MQ message. If this field is empty and the IDL file has only one program, this program will be called. A custom logic (e.g. using the first n bytes of the MQ message payload) can be implemented in the user exit.

The Listener for IBM MQ uses the predefined mapping of IDL data types to the MQ message buffer. See below. If your programs use arrays of groups, set the property `entirex.bridge.marshalling` to "Natural" or "COBOL". If your programs do *not* use arrays of groups, do not set `entirex.bridge.marshalling`.

Data Type	Description	Format	Note
`A`*`number`*	Alphanumeric	*`number`* bytes, encoding the characters.	
`AV`	Alphanumeric variable length	Bytes up to the end of the buffer.	1, 4
`AV`*`number`*	Alphanumeric variable length with maximum length	Bytes up to the end of the buffer, maximum length *`number`*.	1
`B`*`number`*	Binary	`byte[]`	5
`BV`	Binary variable length		5
`BV`*`number`*	Binary variable length with maximum length		5
`K`*`number`*	Kanji	Same as data type `A`.	
`KV`	Kanji variable length	Same as data type `AV`.	1, 4
`KV`*`number`*	Kanji variable length with maximum length	Same as data type `AV`*`number`*.	1
`F4`	Floating point (small)		5
`F8`	Floating point (large)		5
`I1`	Integer (small)	*`sign`* (+, -) and 3 bytes (digits).	
`I2`	Integer (medium)	*`sign`* (+, -) and 5 bytes (digits).	

Data Type	Description	Format	Note
I4	Integer (large)	*sign* (+, -) and 10 bytes (digits).	
N*number1*[.*number2*]	Unpacked decimal	*sign* (+, -), *number1* bytes (digits) [*number2*] bytes (digits), no decimal point.	
NU*number1*[.*number2*]	Unpacked decimal unsigned		5
P*number1*[.*number2*]	Packed decimal	*sign* (+, -), *number1* bytes (digits) [*number2*] bytes (digits), no decimal point.	
PU*number1*[.*number2*]	Packed decimal unsigned		5
L	Logical	1 byte: X for true, all other false.	
D	Date	*YYYYMMDD*.	2
T	Time	*YYYYMMDDhhmmssS*.	3
U*number*	Unicode		5
UV	Unicode variable length		5
UV*number*	Unicode variable length with maximum length		5

See also the hints and restrictions valid for all languages under *IDL Data Types* in the IDL Editor documentation.

Notes:

1. Only as last value.
2. *YYYY* year, *MM* month, *DD* day.
3. *YYYY* year, *MM* month, *DD* day, *hh* hour, *mm* minute, *ss* second, *S* tenth of a second.
4. Not possible when using COBOL.
5. Data type not supported.

4 Administering the EntireX Listener for IBM® MQ

The EntireX Listener for IBM® MQ runs as a listener on an IBM MQ queue and passes messages to an RPC server. It is used to send messages received from an IBM MQ queue to an RPC server application. This means that existing RPC servers can be used for communication with IBM MQ.

Customizing the Listener for IBM MQ

To set up the Listener for IBM MQ, there is a configuration file and there are scripts to start the Listener for IBM MQ.

The Listener for IBM MQ is contained in *entirex.jar*. There are two parts: the RPC side and the IBM® MQ side.

The Listener for IBM MQ uses the IBM® MQ base Java classes from IBM. To run the Listener for IBM MQ, you need either the base Java classes or a full installation of IBM® MQ. Prerequisites for all EntireX components are described centrally. See *Prerequisites for RPC Server and Listener for IBM® MQ* in the respective section of the EntireX Release Notes for the required JAR file(s). The IBM® MQ environment variables `MQ_JAVA_LIB_PATH` and `MQ_JAVA_INSTALL_PATH` must be set.

Make sure that either the local IBM® MQ installation or the IBM® MQ Java classes are accessible.

The default name for the configuration file is *entirex.wmqbridgelistener.properties*. The Listener for IBM MQ searches for this file in the current working directory. You can set the name of the configuration file with `-Dentirex.server.properties=` *`your file name`*. Use the slash "/" as file separator. The configuration file contains the configuration for both parts of the Listener for IBM MQ.

Alternatively, use script `wmqbridgelistener.bsh` (UNIX) or `wmqbridgelistener.bin` in the *bin* directory to start the Listener for IBM MQ. Both scripts use the configuration file *entirex.wmqbridgelistener.properties* in the *etc* directory, and both can be customized.

Configuring the RPC Server Side

Properties

The Listener for IBM MQ converts an MQ message into an RPC request to an RPC server. The RPC server is defined using the following properties.

Name	Default Value	Explanation	Mo
`entirex.bridge.marshalling`		Define the type of marshalling (Natural or COBOL). Must be set only if the IDL file contains arrays of groups.	*M D M Bı*
`entirex.server.brokerid`	`localhost`	Broker ID.	*Uı Bı* Eı A(Pı dc
`entirex.server.serveraddress`	`RPC/SRV1/CALLNAT`	Server address	
`entirex.server.userid`	`mqListener`	The user ID for access to the broker.	*Us Bı Rı ID*
`entirex.server.libname`		By default the library name sent to the RPC server is retrieved from the IDL file (see `library-definition` under *Software AG IDL Grammar* in the IDL Editor documentation). The library name can be overwritten. This is useful if communicating with a Natural RPC server.	
`entirex.server.naturallogon`	`no`	Enable to send the RPC user ID/password pair.	*Us Bı Rı ID*
`entirex.server.reliableRPC`	`no`	If set to "yes", use reliable RPC for the call to the RPC server.	
`entirex.server.rpcuser`		The RPC user ID sent to the RPC server.	*Us Bı Rı ID*
`entirex.server.rpcpassword`		The RPC password sent to the RPC server.	

Name	Default Value	Explanation	More Inform
`entirex.server.retrycycles`	`15`	Number of retry attempts if the call to the RPC server is not successful. If all attempts fail, the MQ message will not be committed and the Listener for IBM MQ will terminate. If a dead-letter queue has been specified, the message will be put to that queue and committed and the Listener will not stop.	
`entirex.server.retryinterval`	`20`	Retry interval (in seconds) if the call to the RPC server is not successful.	

`entirex.server.compresslevel`	`0 (no compression)`	Permitted values (you can enter the text or the numeric value):
		`BEST_COMPRESSION` `9`
		`BEST_SPEED` `1`
		`DEFAULT_COMPRESSION` `-1`, mapped to `6`
		`DEFLATED` `8`
		`NO_COMPRESSION` `0`
		`N` `0`
		`Y` `8`	

	`-help`	Display usage of the command-line parameters.	
`entirex.server.logfile`		Name of the log file, the default is standard output.	
`entirex.server.password`	`yes`	The password for secured access to the broker. The password is encrypted and written to the property `entirex.server.password.e`. To change the password, set the new password in the properties file. To disable password encryption, set `entirex.server.passwordencrypt=no`.	***Using the Broker an RPC User ID/Passw***
`entirex.server.properties`	`entirex.wmqbridgelistener.properties`	The file name of the property file.	
`entirex.server.security`	`no`	no/yes/auto/Name of BrokerSecurity object.	
`entirex.server.logfile`		Name of the log file, the default is standard output.	
`entirex.server.waitserver`	`60S`	Wait time for the call to the RPC server.	
`entirex.timeout`	`20`	TCP/IP transport timeout.	*Setting the Transport Timeout ur Writing Advanced*

Name	Default Value	Explanation	Mo
			Ap *En* *A(*
`entirex.trace`	0	Trace level (1,2,3).	

Using the Broker and RPC User ID/Password

EntireX supports two user ID/password pairs: a broker user ID/password pair and an (optional) RPC user ID/password pair sent from RPC clients to RPC servers. With EntireX Security, the broker user ID/password pair can be checked for authentication and authorization.

The RPC user ID/password pair is designed to be used by the receiving RPC server. This component's configuration determines whether the pair is considered or not. Useful scenarios are:

- Credentials for Natural Security
- Impersonation in the respective RPC Server documentation
- Web Service Transport Security with the RPC Server for XML/SOAP, see *XML Mapping Files*
- Service execution with client credentials for EntireX Adapter Listeners, see *Configuring Listeners*
- etc.

Sending the RPC user ID/password pair needs to be explicitly enabled by the RPC client. If it is enabled but no RPC user ID/password pair is provided, the broker user ID/password pair is inherited to the RPC user ID/password pair.

With the parameter `entirex.server.naturallogon` (see `naturallogon` under ***Configuring the RPC Server Side***) sending the RPC user ID/password pair is enabled for the Listener for IBM MQ. If you do so, we strongly recommend using SSL/TLS. See ***Using SSL/TLS***.

To use the broker and RPC user ID/password

1. Specify a broker user ID with parameter `entirex.server.userid`.
2. Optional. Specify broker password with parameter `entirex.server.password`.
3. Enable to send the RPC user ID/password pair with parameter `entirex.server.naturallogon`.
4. If different user IDs and/or passwords are used for broker and RPC, use the parameters `entirex.server.rpcuser` and `entirex.server.rpcpassword` to provide a different RPC user ID/password pair.
5. By default the library name sent to the RPC server is retrieved from the IDL file (see `library-definition` under *Software AG IDL Grammar* in the IDL Editor documentation). The library name can be overwritten. This is useful if communicating with a Natural RPC server. Specify a library in property `entirex.server.libname`.

Configuring the IBM MQ Side

These properties are used to configure the connection to the IBM® MQ queue manager.

Name	Default Value	Explanation
`entirex.wmqbridge.host`		If host is not specified, bindings mode is used to connect to the local MQ Server. Otherwise specify the hostname or IP address of the MQ Server.
`entirex.wmqbridge.port`	`1414`	Port of the MQ Server. Not used in bindings mode.
`entirex.wmqbridge.channel`	`SYSTEM.DEF.SVRCONN`	Channel name used to the MQ Server. Not used in bindings mode.
`entirex.wmqbridge.queuemanager`		Name of the (local or remote) queue manager. If not specified, a connection is made to the default queue manager.
`entirex.wmqbridge.listenqueue`		Name of the queue from which messages are retrieved.
`entirex.wmqbridge.userid`		User ID for MQ Server.
`entirex.wmqbridge.password`		Password for MQ Server.
`entirex.wmqbridge.userexit`		Class name for WMQBridge user exit.
`entirex.wmqbridge.userexit.classpath`		URL of the classpath for WMQBridge user exit (optional).
`entirex.wmqbridge.ccsid`	platform encoding	Coded Character Set Identification used by the Listener for IBM MQ (which acts as an MQ client), unused in bindings mode. Enable character conversion in the broker by setting the service-specific attribute `CONVERSION` to "`SAGTRPC`". See also *Configuring ICU Conversion* under *Configuring Broker for Internationalization* in the platform-specific Administration documentation. More information can be found under *Internationalization with EntireX*.

Name	Default Value	Explanation
`entirex.wmqbridge.mqtrace`	0	MQ tracing enabled if parameter > 0.
`entirex.bridge.idl`		Name of a Software AG IDL file; messages to/from MQ are in plain text.
`entirex.bridge.xmm`		Name of XMM (XML mapping) file; messages to/from MQ will be converted to XML.
`entirex.bridge.xml.encoding`		Encoding of the reply XML document.
`entirex.wmqbridge.environment.sslCipherSuite`		Configuration for SSL connection to MQ Server. See the IBM® MQ documentation for details.
`entirex.wmqbridge.environment.sslFipsRequired`		Configuration for SSL connection to MQ Server. See the IBM® MQ documentation for details.
`entirex.wmqbridge.priority`		Message priority for messages sent to MQ (different from the default priority of the destination queue).
`entirex.wmqbridge.deadletterqueue`		Name of the queue that will receive unprocessed messages.

Starting the Listener for IBM MQ

Use start script `mqListener.bsh` (UNIX) or `mqListener.bat` (Windows) in the *bin* directory to start the Listener for IBM MQ. You may customize this file. See also *Prerequisites for RPC Server and Listener for IBM® MQ* in the respective section of the EntireX Release Notes.

The start scripts contain references to JAR files in the WS-Stack directory. If you update these JAR files, you may need to customize the JAR file names in the script files.

Stopping the Listener for IBM MQ

Use CTRL-C to stop the Listener for IBM MQ.

Using SSL/TLS with the Listener for IBM MQ

To use SSL with the Listener for IBM MQ, you need to configure two sides:

- **IBM® MQ Side**
  See parameters `entirex.wmqbridge.environment.sslCipherSuite` and `entirex.wmqbridge.environment.sslFipsRequired` under *Configuring the IBM MQ Side*.
- **RPC Server side**
  RPC servers can use Secure Sockets Layer/Transport Layer Security (SSL/TLS) as the transport medium. The term "SSL" in this section refers to both SSL and TLS. RPC-based servers are always SSL clients. The SSL server can be either the EntireX Broker, Broker SSL Agent, or Direct RPC in webMethods Integration Server (IS inbound). For an introduction see *SSL/TLS and Certificates with EntireX* in the Platform-independent Administration documentation.

To use SSL

1. To operate with SSL, certificates need to be provided and maintained. Depending on the platform, Software AG provides default certificates, but we strongly recommend that you create your own. See *SSL/TLS Sample Certificates Delivered with EntireX* in the EntireX Security documentation.
2. Set up the Listener for IBM MQ for an SSL connection.

   Use the *URL-style Broker ID* with protocol `ssl://` for the Broker ID. If no port number is specified, port 1958 is used as default. Example:

   ```
   ssl://localhost:22101?trust_store=C:\SoftwareAG\EntireX\etc\ExxCACert.jks&verify_server=no
   ```

   If the SSL client checks the validity of the SSL server only, this is known as *one-way SSL*. The mandatory `trust_store` parameter specifies the file name of a keystore that must contain the list of trusted certificate authorities for the certificate of the SSL server. By default a check is made that the certificate of the SSL server is issued for the hostname specified in the Broker ID. The common name of the subject entry in the server's certificate is checked against the hostname. If they do not match, the connection will be refused. You can disable this check with SSL parameter `verify_server=no`.

   If the SSL server additionally checks the identity of the SSL client, this is known as *two-way SSL*. In this case the SSL server requests a client certificate (the parameter `verify_client=yes` is defined in the configuration of the SSL server). Two additional SSL parameters must be specified on the SSL client side: `key_store` and `key_passwd`. This keystore must contain the private key of the SSL client. The password that protects the private key is specified with `key_passwd`.

   The ampersand (&) character cannot appear in the password.

SSL parameters are separated by ampersand (&). See also *SSL/TLS Parameters for SSL Clients*.

3. Make sure the SSL server to which the RPC side connects is prepared for SSL connections as well. The SSL server can be EntireX Broker, Broker SSL Agent, or Direct RPC in webMethods Integration Server (IS inbound). See:
   - *Running Broker with SSL/TLS Transport* in the platform-specific Administration documentation
   - *Settting up and Administering the EntireX Broker SSL Agent* in the UNIX and Windows Administration documentation
   - *Support for SSL/TLS* in the EntireX Adapter documentation (for Direct RPC)

Activating Tracing for the Listener for IBM MQ

The trace level for the EntireX RPC part is controlled by the usual `entirex.trace` property. It can be set in the configuration file.

Tracing of the IBM® MQ classes can be influenced with the property `entirex.wmqbridge.mqtrace`.

Redirect the trace to a file with the property `entirex.server.logfile`. Set this to the file name of the log file.

5 Advanced Listener for IBM MQ Functionality

Support for Request/Reply Scenarios

The Listener for IBM MQ provides support for a synchronous request/reply scenario. In this case the remote procedure call usually has both `INPUT` and `OUTPUT` parameters, or at least one `INOUT`. A request/reply scenario is automatically detected by the Listener for IBM MQ if the MQ message specifies the `ReplyToQueue` field. Also, if the property `entirex.wmqbridge.check.msgtype` has been set, the message type must be "`MQMT_REQUEST`".

The `correlationId` of the reply is set to the `correlationId` of the request if the `report` field of the request has the flag `MQRO_PASS_CORREL_ID` set. Otherwise the `correlationId` of the reply is set to the `messageId` of the request.

The `messageId` of the reply is set to the `messageId` of the request if the `report` field of the request has the flag `MQRO_PASS_MSG_ID` set. Otherwise a new `messageId` is created.

Character Encoding Issues

If the payload of the MQ message is in XML format (property `entirex.bridge.xmm` has been set), the Listener for IBM MQ converts the XML payload to an RPC request, using the default platform encoding of the Java virtual machine. If the Listener for IBM MQ sends back a reply message, the XML payload of this message will be UTF-8 encoded. A different encoding can be used by setting the property `entirex.bridge.xml.encoding`.

If the payload of the MQ message is of type text (property `entirex.bridge.idl` has been set), the Listener for IBM MQ converts the payload to an RPC request, using the default platform encoding of the Java virtual machine. If the Listener for IBM MQ sends back a reply message, the Listener converts the payload of the message to the encoding specified by the CCSID (Coded Character Set IDentification) of the MQ queue manager.

Note: The default platform encoding of the JVM can be changed by setting the system property `file.encoding` in the startup script of the Listener.

User Exit for Message Processing

IBM® MQ does not have a clearly defined message layout, it is basically a stream of bytes. In general it is up to the MQ application to know the exact semantics of an MQ message. This might include application-specific headers and formatting rules. The Listener for IBM MQ supports a general but simplified model of message processing.

To better handle application specific message layout details, a user exit (or callback routine) can be used. The user exit works on the IBM® MQ Java representation of an MQ message (class `com.ibm.mq.MQMessage`) and can change the MQ message. The user exit gets control:

1. after an MQ message has been read from an MQ queue and before it is processed by the Listener for IBM MQ
2. after an MQ message has been constructed by the Listener for IBM MQ and before the message is put to the MQ queue.

The user exit can be used, for example, for an application-specific processing of the MQRFH, MQRFH2 or even custom headers.

To enable a user exit, use the property `entirex.wmqbridge.userexit` to specify the class name of the user exit implementation. The class will be loaded using the standard classpath. You can specify a separate classpath with the property `entirex.wmqbridge.userexit.classpath`. Note that for the classpath a file or HTTP URL must be specified. Your user exit class must implement the Java interface *com.softwareag.entirex.rpcbridge.wmqBridgeExit*. This Java interface has the following methods:

```
/**
 ** This method is called after the message has been created by the
 ** WMQBridge and before the message is sent to an MQ queue (MQPUT).
 ** The Message object and/or the MessageOptions object can be changed.
 **
 ** @param msg The MQ message object.
 ** @param pmo The MQPutMessageOptions object.
 **/
public void beforePut(com.ibm.mq.MQMessage msg, com.ibm.mq.MQPutMessageOptions pmo);
/**
 ** This method is called before a message is retrieved from an MQ
 ** queue (MQGET). The MessageOptions object can be changed.
 **
 ** @param gmo The MQGetMessageOptions object.
 **/
public void beforeGet(com.ibm.mq.MQGetMessageOptions gmo);
/**
 ** This method is called after a message has been retrieved from an
 ** MQ queue (MQGET) and before the message will be processed by the
 *  WMQBridge.
 ** The Message object can be changed.
 **
 ** @param msg The MQ message object.
 **/
public void afterGet(com.ibm.mq.MQMessage msg);
```

Transactional Behavior

The Listener for IBM MQ always works transactionally. A message is retrieved from the queue and then passed to the RPC server application. If no error occurs, the message is committed by the Listener for IBM MQ. If the call to the RPC server is not successful, the call is retried as specified by properties `entirex.server.retrycycles` and `entirex.bridge.retryinterval`. If all retry attempts fail, the message is rolled back and the Listener for IBM MQ terminates. If a dead-letter queue has been specified by the property `entirex.server.deadletterqueue`, the message will be put to that queue and committed, and the Listener will not stop.