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1 Introduction

The Java Message Service (JMS) supports asynchronous communication only. However, a request/response model similar to synchronous communication can be implemented using a reply queue mechanism and JMS Correlation ID/JMS Message ID.

According to the JMS specification, the usage of the JMS Correlation ID is not mandatory. In the following scenarios the JMS Correlation ID is used. Therefore, as a prerequisite the JMS Provider has to support it.

This guide shows how to map asynchronous JMS messages to synchronous communication. In general, two scenarios are considered:

- Sync/async
- Async/sync

The purely asynchronous case is not addressed here. For SAP XI3.0 SP18 and below, Business Process Management (BPM) as part of SAP Exchange Infrastructure (SAP XI) 3.0 has to be used, see chapters Error! Reference source not found. and Error! Reference source not found.. For SAP XI3.0 SP19 and above, the JMS adapter provides modules that support async/sync and sync/async communication, see chapters 2.3 and 2.4. In this case, BPM is not necessary.

In SAP XI 3.0 SP12 and higher, some JMS header data can be assigned to XI header data, and the other way around.

- In the JMS sender adapter, the XI Message ID can be defined as GUID, JMS Message ID, JMS Correlation ID, or JMS Property. The resulting ID must comply with ISO-11578. Furthermore, the JMS Provider has to ensure that the ID is unique, otherwise message processing will fail. The XI Conversation ID can be defined as JMS Message ID, JMS Correlation ID, JMS Property, or kept undefined (no value).
- In the JMS receiver adapter, the JMS Correlation ID can be defined as XI Message ID, XI Reference ID (RefToMessageID), XI Conversation ID, or kept undefined.

In SAP XI 3.0 SP15 and higher, the send step within BPM has been enhanced. While sending a message, it is possible to set the Conversation ID using XI header fields, payload data, or constants.

The sync/async bridge step within BPM is available in SAP XI 3.0 SP4 and higher. You can correlate the asynchronous JMS request and response messages by referencing either the payload data or the header fields. The former is available in SAP XI 3.0 SP0 and higher (in conjunction with the sync/async bridge in SAP XI 3.0 SP4 and higher). The latter uses the enhanced send step, as mentioned above, so it is supported in SAP XI 3.0 SP15 and higher only.

For the async/sync case, the JMS response message is correlated to the JMS request message using header-based correlation, that is, using the JMS Correlation ID. In the Communication Channel, it is only possible to assign XI header fields to the JMS Correlation ID, but no payload data (see below). However, if you want to put payload data into the JMS Correlation ID, you can do so by using the XI Conversation ID. There are two general mechanisms to configure the correlation within SAP XI, either using the XI Message ID or using the XI Conversation ID. The former is supported in SAP XI 3.0 SP12 and higher, but it is subject to restrictions with respect to the XI Message ID, as
mentioned above. The latter is supported in SAP XI 3.0 SP15 and higher. See also SAP Note 838894.

2 Scenarios

2.1 BPM Sync/Async Bridge

A synchronous request message is mapped to an asynchronous JMS request message by means of the sync/async bridge functionality of BPM. The synchronous call waits until the JMS provider sends a reply that is mapped to the corresponding synchronous response.

The JMS response message must be correlated to the JMS request message in order to assign both messages to the same BPM process instance. As stated above, the correlation can be established using either payload data or header fields. In general, the header-based approach uses the *XI Message ID* to create a unique correlation. Since the Business Process Engine (BPE) works with different message instances, the *XI Message ID* of the outbound message does not correspond to the *XI Message ID* that defines the correlation. Therefore, the approach does not work with the *XI Message ID* only, it requires the *XI Conversation ID* to be set within BPM.

Regarding the correlation on the JMS side, two possibilities are considered, either referencing the *XI Message ID* or the *JMS Message ID* of the request message.

💡 In SAP XI 3.0 SP16 and higher, the configuration of how to map the *JMS Message ID* to the *XI Conversation ID* has been changed. There is no need to use additional parameters, instead standard parameters are provided in the communication channels. However, the configuration settings made prior to SP16 will still be supported. For further details, refer to SAP Note 838894.

For the payload-based correlation, the following settings have to be made (see chapter 3.4):
- Define appropriate correlations in a BPM integration process.

For the header-based correlation with JMS response message referencing the *XI Message ID* of the request, the following settings have to be made (see chapter 3.1):
- Define a correlation for the response’s message interface using the *XI Conversation ID* as the correlation key.
- BPM integration process, send step (send JMS request): Activate the correlation using *XI Message ID* and set *XI Conversation ID* to *XI Message ID*.
- BPM integration process, receive step (receive JMS response): Use the correlation that you activated in the send step.
- JMS receiver communication channel (to send JMS request to JMS Provider): Set *JMS Correlation ID* to the *XI Conversation ID*.
- JMS sender communication channel (to send JMS response to SAP XI): Set *XI Message ID* to GUID, and *XI Conversation ID* to *JMS Correlation ID*.

For the header-based correlation with JMS response message referencing the *JMS Message ID* of the request, the following settings have to be made if using XI 3.0 SP15 and below (see chapter 3.2):
• Define a correlation for the message interface of the response using XI Conversation ID as correlation key.

• BPM integration process, send step (send JMS request):
  Activate the correlation using XI Message ID, and set XI Conversation ID to XI Message ID.

• BPM integration process, receive step (receive JMS response):
  Use the correlation that you activated in the send step.

• JMS receiver communication channel, correlation settings:
  Set JMS Correlation ID to XI Conversation ID.

• JMS receiver communication channel, additional JMS parameters:
  Maintain additional JMS parameter with Name XIMapConversationID and Value true to store a mapping between the request’s JMS Message ID and XI Conversation ID.

• JMS sender communication channel, correlation settings:
  Set XI Message ID to GUID, and XI Conversation ID to JMS Correlation ID.

• JMS sender communication channel, additional JMS parameters:
  Maintain additional JMS parameter with Name XIConversationID, and Value XI_COR_XIJMSMAP to map the response’s JMS Correlation ID (referencing the request’s JMS Message ID) to the original XI Conversation ID.

For the header-based correlation with JMS response message referencing the JMS Message ID of the request, the following settings have to be made if using XI 3.0 SP16 and above (see chapter 3.3):

• Define a correlation for the message interface of the response using XI Conversation ID as correlation key.

• BPM integration process, send step (send JMS request):
  Activate the correlation using XI Message ID, and set XI Conversation ID to XI Message ID.

• BPM integration process, receive step (receive JMS response):
  Use the correlation that you activated in the send step.

• JMS receiver communication channel, correlation settings:
  Set JMS Correlation ID to XI Conversation ID, and tick the Store JMSCorrelationId of request indicator in order to save the JMS Correlation ID of the request.

• JMS sender communication channel, correlation settings:
  Set XI Message ID to GUID, and XI Conversation ID to Stored JMSCorrelationId of request.
2.2 BPM Async/Sync Bridge

An asynchronous JMS request message is mapped to a synchronous request message. Within the BPM integration process, a synchronous call is executed. The return of the synchronous call is mapped to an asynchronous JMS response message.

Here, no correlation within the BPM integration process is required. Correlation is established by means of the JMS Correlation ID header field of the JMS response message that references the JMS request message.

As mentioned above, there are two general approaches for configuring the correlation within SAP XI, either using the XI Message ID or using the XI Conversation ID.

For the header-based configuration via XI Message ID, the following settings have to be made (see chapter 3.7):

- JMS sender communication channel (to send JMS request to SAP XI):
  Set the XI Message ID to JMS Message ID (or optionally to JMS Correlation ID).
- BPM integration process:
  Set the receiver from mode of asynchronous send step (to send JMS response) to Response to Message, and reference the request message.
- JMS receiver communication channel (to send JMS response to JMS Provider):
  Set JMS Correlation ID to XI Reference ID.
For the header-based configuration using the \textit{XI Conversation ID}, the following settings have to be made (see chapter 3.5):

- **JMS sender communication channel (to send JMS request to SAP XI):**
  Set the \textit{XI Message ID} to \textit{GUID} and \textit{XI Conversation ID} to \textit{JMS Message ID} (or optionally to \textit{JMS Correlation ID}).

- **BPM integration process:**
  Set the \textit{XI Conversation ID} of send step (to send JMS response) to the \textit{XI Conversation ID} of request message.

- **JMS receiver communication channel (to send JMS response to JMS provider):**
  Set \textit{JMS Correlation ID} to \textit{XI Conversation ID}.

To assign payload data of the request message to the \textit{JMS Correlation ID}, the following settings have to be made (see chapter 3.6):

- **In BPM integration process:**
  Set the \textit{XI Conversation ID} of send step (to send JMS response) to equal the appropriate payload field of request message.

- **JMS receiver communication channel (to send JMS response to JMS Provider):**
  Set \textit{JMS Correlation ID} to \textit{XI Conversation ID}.

In the case of the purely asynchronous case, a JMS request message is sent asynchronously to a receiver by using SAP XI. The reply has to be correlated to the JMS request. The implementation is similar to the async/sync case above. Even in this case, BPM is mandatory for the same reason as stated above: currently, it is not possible to assign payload data to the \textit{JMS Correlation ID} within a communication channel.
2.3 Sync/Async Bridge in the Receiver JMS Adapter

A synchronous call is mapped to asynchronous JMS request/response messages by means of the module processor in the JMS adapter. In the module processor of the JMS receiver adapter, the synchronous message is converted to an asynchronous request message and sent to a JMS queue. The synchronous call waits until the JMS provider sends a reply. In the module processor of the JMS sender adapter, the asynchronous response message is passed to the module processor of the receiver adapter, and sent as synchronous response of the waiting synchronous request.

The following settings have to be made (only supported as of SAP XI3.0 SP19 and above, see chapter 3.8):

- **JMS receiver communication channel, correlation settings:**
  Set JMS Correlation ID to XI Message ID, and tick the Store JMSCorrelationId of request indicator in order to save the JMS Correlation ID of the request.

- **JMS receiver communication channel, module settings:**
  Add module RequestOnewayBean to convert the synchronous request message to an asynchronous request message. Add module WaitResponseBean to wait for response message.

- **JMS sender communication channel, correlation settings:**
  Set XI Message ID to GUID, and XI Conversation ID to Stored JMSCorrelationId of request.

- **JMS sender communication channel, module settings:**
  Add module NotifyResponseBean to pass response message to the module processor of the receiver adapter.

2.4 Async/Sync Bridge in the Sender JMS Adapter

Asynchronous JMS request/response messages are mapped to a synchronous call by means of the module processor in the JMS adapter. In the module processor of the sender JMS adapter, the asynchronous request message is converted to a synchronous request message. The synchronous response message is converted to an asynchronous response message, and sent to the receiver JMS adapter.

The following settings have to be made (only supported as of SAP XI3.0 SP19 and above, see chapter 3.9):

- **JMS sender communication channel, correlation settings:**
  Set XI Message ID to GUID, and XI Conversation ID to JMS Message ID.

- **JMS sender communication channel, module settings:**
  Add module RequestResponseBean to convert the asynchronous request message to a synchronous request message. Add module ResponseOnewayBean to convert the synchronous response message to an asynchronous response message, and to send response to the receiver adapter.

- **JMS receiver communication channel, correlation settings:**
  Set JMS Correlation ID to XI Conversation ID.
3 The Step-By-Step Solution

3.1 BPM Header-Based Sync/Async Bridge – JMS Response Referencing XI Message ID of Request

1. Start the Integration Process Editor in the Integration Builder (Design).
   
   Create a receive step of mode "Opens S/A Bridge" to open the bridge.

2. Create a Correlation.
   
   Assign the XI Conversation ID of the JMS response message to this correlation.

3. Create an asynchronous send step to send the JMS request message.
   
   Assign the XI Message ID of the JMS request to both the Conversation ID and the correlation.
4. Create a receive step to fetch the JMS response message.

Use the correlation created beforehand. It is filled by the XI Conversation ID of the JMS response message.

5. Create a send step of mode Closes S/A Bridge to close the bridge, and refer to the receive step that opened the bridge.

6. Start the Integration Builder (Configuration).

In the receiver communication channel, set the JMS Correlation ID to the XI Conversation ID.
7. In the sender communication channel, set the **XI Conversation ID** to the **JMS Correlation ID**.

8. In the following, the settings are verified using different monitoring tools.

   Run the scenario by calling the process synchronously.

   Enter the Business Process Engine (BPE) Monitoring (transaction **SXMB_MONI_BPE**), and check the correlation. It must contain the **XI Message ID** of the JMS request message.

9. In the BPE Monitoring, check the **Conversation ID** of the JMS request message.
10. Start the **Runtime Workbench** (RWB) and navigate to Message Monitoring for the J2EE Adapter Engine.

In the Audit Log of the JMS request message, the correlation-related information is displayed.

11. Start the JMS Broker. Here, SonicMQ is used.

For the received message in the queue, the **JMS Correlation ID** contains the **XI Message ID** of the JMS request message.

12. Before sending the JMS response message to the reply queue, maintain the **JMS Correlation ID** accordingly. Here, the **JMS Correlation ID** of the JMS request message is used (references the **XI Message ID**).
In BPE Monitoring you can see that the JMS response message is correlated to the appropriate business process instance.
3.2 BPM Header-Based Sync/Async Bridge – JMS Response Referencing JMS Message ID of Request, prior to SP16

14. Use the same sync/async bridge as in variant 3.1, that is, keep the settings for the BPM process unchanged.

15. Start the Integration Builder (Configuration).

Maintain the Receiver Communication Channel as follows:

Set the JMS Correlation ID to the XI Conversation ID.

Select the Set Additional JMS Parameters or Replace Default Settings indicator, and maintain the parameter with Name XIMapConversationID, and Value true.
16. Maintain the Sender Communication Channel as follows:

Set the **XI Conversation ID** to the JMS Correlation ID.

Select the **Set Additional JMS Parameters or Replace Default Settings** indicator and maintain the parameter with **Name** XIConversationID, and **Value** XI_COR_XIJMSMAP.

17. Run the scenario as described above.

For the outbound JMS request message, the JMS Adapter stores the mapping between the **XI Conversation ID** and the JMS Message ID.

18. Before sending the response message to the reply queue, maintain the **JMS Correlation ID** accordingly. Here, the **JMS Message ID** of the JMS request message is used.
19. For the incoming JMS response message, the JMS Adapter maps the JMS Correlation ID (referencing the request's JMS Message ID) to the XI Conversation ID using the stored mapping.

As can be seen in Message Monitoring (transaction SXMB_MONI), the XI Conversation ID contains the request's XI Message ID that is used for the correlation within BPM.

20. If the JMS application sends back a response in which the JMS correlation ID is not set to the JMS message ID of the original request, the XI conversation ID cannot be determined. Instead, the JMS correlation ID is set as the XI conversation ID; however, the BPM process is then not able to assign the response correctly.
3.3  BPM Header-Based Sync/Async Bridge – JMS Response Referencing JMS Message ID of Request, as of SP16

Apart from the configuration of the receiver and sender communication channels, all settings keep unchanged compared to variant 3.2.

21. Start the Integration Builder (Configuration).

Maintain the Receiver Communication Channel as follows:

Set the JMS Correlation ID to the XI Conversation ID.

Set the Store JMSCorrelationId of request indicator in order to save the JMS Correlation ID of the request message.

22. Maintain the Sender Communication Channel as follows:

Set the XI Conversation ID to Stored JMSCorrelationId of request referring to the saved JMS Correlation ID of the request message.
3.4 BPM Payload-Based Sync/Async Bridge

23. Start the Integration Process Editor within the Integration Builder (Design).

   For the send step of the JMS request message, maintain a BPM correlation using appropriate payload data.

24. For the JMS response message, maintain the BPM correlation using appropriate payload data.
3.5  BPM Header-Based Async/Sync Bridge – Correlation by using the XI Conversation ID

25. Start the Integration Process Editor in the Integration Builder (Design).

For the send step of the JMS response message, set the Conversation ID to equal the Conversation ID of the JMS request message.

26. Start the Integration Builder (Configuration).

In the sender communication channel, set the XI Conversation ID to the JMS Message ID.

(Alternatively, you can set the XI Conversation ID to the JMS Correlation ID).
27. In the Receiver Communication Channel, set the **JMS Correlation ID** to the **XI Conversation ID**.

28. Send a request message to the sender queue.

(Alternatively, if you have chosen **JMS Correlation ID** in the Sender Communication Channel above, maintain a unique JMS Correlation ID before sending the request message to the sender queue)
29. The XI Conversation ID references the JMS Message ID of the JMS request message.

30. For the message in the receiver queue, the JMS Correlation ID references the JMS Message ID of the JMS request message.
3.6 BPM Payload-Based Async/Sync Bridge – Correlation by using the XI Conversation ID

31. Start the Integration Process Editor in the Integration Builder (Design).

For the send step of the JMS response message, set the Conversation ID to equal any payload field of the JMS request message.

32. Start the Integration Builder (Configuration).

In the Sender Communication Channel, you don’t need to map any JMS header fields to the XI Conversation ID. Choose No Value.

33. In the Receiver Communication Channel, set the JMS Correlation ID to the XI Conversation ID.
3.7 BPM Header-Based Async/Sync Bridge – Correlation by using the XI Message ID

34. Start the Integration Process Editor in the Integration Builder (Design).

For the send step of the JMS response message, set the mode to Response to Message and refer to the JMS request message.

35. Start the Integration Builder (Configuration).

In the Sender Communication Channel, set the XI Message ID to the JMS Correlation ID.

(Alternatively, you can set the XI Message ID to the JMS Message ID)

In any case, you have to ensure that the XI Message ID is unique and complies with ISO-11578. Otherwise messaging fails.
36. In the Receiver Communication Channel, set the JMS Correlation ID to the XI Reference ID (RefToMessageID).

37. For the message in the sender queue, enter a valid GUID (see above) in the JMS Correlation ID.

38. Start the RWB and navigate to Message Monitoring for the J2EE Adapter Engine.

   In the Audit Log of the JMS response message, you can see the correlation rule, the correlated property, and the correlation value.
39. For the message in the receiver queue, the JMS Correlation ID references the XI Message ID, and the JMS Correlation ID of the JMS request message, respectively.
3.8 Sync/Async Bridge in Receiver JMS Adapter

40. Start the Integration Builder (Configuration).

Maintain the Receiver Communication Channel as follows:

Set the JMS Correlation ID to the XI Message ID.

Set the Store JMSCorrelationId of request indicator in order to save the JMS Correlation ID of the request message.

41. Switch to tab Module to add respective modules in the module processor in the sequence as shown in figure on the right side.

Add AF_Modules/RequestOnewayBean module first in the module sequence.

For the AF_Modules/RequestOnewayBean, maintain parameter with name passThrough, and value true.

The synchronous request message is converted to an asynchronous request message, and passed to the next module in sequence.

Add AF_Modules/WaitResponseBean module last in the module sequence.

The module waits for a response message.
42. Maintain the Sender Communication Channel as follows:

Set the **XI Conversation ID to Stored JMSCorrelationId of request** referring to the saved JMS **Correlation ID** of the request message.

43. Switch to tab **Module** to add respective modules in the module processor in the sequence as shown in figure on the right side.

Replace the **CallSapAdapter** module by the **AF_Modules/NotifyResponseBean** module.

The asynchronous response message is passed to the **WaitResponseBean** of the receiver channel.

44. Start the **RWB**, and navigate to the Message Monitoring for the J2EE Adapter Engine.

According to the Audit Log for the synchronous request message, the message processing is as follows:

- In the **RequestOnewayBean** module the synchronous request message is converted to an asynchronous message.

- The asynchronous JMS request message is correlated to the respective XI message.

- The **WaitResponseBean** module is called to wait for the asynchronous response message. Upon receipt, the message is sent as synchronous response to the waiting synchronous request message.
45. The Audit Log for the asynchronous response message indicates that the NotifyResponseBean module has been called to pass the message to the module processor of the respective receiver channel.
3.9 Async/Sync Bridge in Sender JMS Adapter

46. Start the Integration Builder (Configuration).

In the JMS Sender Communication Channel, set the XI Conversation ID to the JMS Message ID.

47. Switch to tab Module to add respective modules in the module processor in the sequence as shown in figure on the right side.

Add AF_Modules/RequestResponseBean module before the CallSapAdapter module.

For the AF_Modules/RequestResponseBean, maintain parameter with name passThrough, and value true.

The asynchronous request message is converted to a synchronous request message, and passed to the next module in sequence, here CallSapAdapter.

Add AF_Modules/ResponseOnewayBean module after the CallSapAdapter module.

For the AF_Modules/ResponseOnewayBean, maintain parameters as follows:
- name receiverParty with value <name of receiver party>
- name receiverService with value <name of receiver party>
service>

- name=receiverChannel with value=<name of JMS receiver channel>

The synchronous response message is converted to an asynchronous message, and passed to the specified receiver channel.

48. In the JMS Receiver Communication Channel, set the JMS Correlation ID to the Xi Conversation ID.

49. Start the RWB, and navigate to the Message Monitoring for the J2EE Adapter Engine.

The Audit Log for the request message indicates that the RequestResponseBean module has been called, and a synchronous message has been passed to the messaging system.

50. The Audit Log for the response message indicates that the ResponseOnewayBean module has been called.
<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
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<td>Success</td>
<td>New IMS message will be correlated with the K message. Correlation rule: X1_CORRELATION, correlated property: IMS_CorrelationID, correlation value: 000E0F710BA0697F140DC07940</td>
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<tr>
<td>2008-12-21 15:16:40</td>
<td>Success</td>
<td>IMS message forwarded to IMS peer successfully</td>
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<tr>
<td>2008-12-21 15:16:51</td>
<td>Success</td>
<td>IMS message in binary format forwarded to IMS service successfully</td>
</tr>
<tr>
<td>2008-12-21 15:16:51</td>
<td>Success</td>
<td>IMS forwarding Request/Response/Disconnect</td>
</tr>
<tr>
<td>2008-12-21 15:16:51</td>
<td>Success</td>
<td>IMS disconnecting Request/Response/Disconnect</td>
</tr>
</tbody>
</table>