Fixed Income Clearing Corporation EPN MQ Implementation Guide

Securing Today. Shaping Tomorrow.®

EPN MQ Implementation

1. Client Onboarding to MQ

Please refer to DTCC onboarding documentation for the onboarding procedures.

Using the above documentation with DTCC onboarding team, identify the Local and Remote queue that you will use for your organization communication via MQ.

2. Client Changes for MQ

Update client code to add the MQ functionality to allow you to enqueue and dequeue message to MQ using the created remote and local queues from 2.5.1. In the MQ Payload add the message header and EPN message for outbound message, see further details below. For inbound message parse the payload extracting the message header and EPN message.

3. MQ Message Header

The MQ Message Header specifies the sending and receiving parties of the message. MBSD has added a password to this header to provide an additional level of security – password value is existing EPN password (any existing EPN connection password used in the legacy Log On message can be used). The MQ Message Header is the first component of every message and is part of the message body and not the MQMD Header. EPN requires that the fields in the header have a fixed format. The header is populated as a continuous string of data, which terminates as a regular data field (with a carriage return line feed "CRLF") input.

When members receive messages, the password field mentioned would be our password and we would not populate it leaving the field as blanks.

4. Client Sends an MQ Message to EPN Server – Inbound Message

Block/Tag	Notes	
Message Header	**Each message must contain a message header. All header fields are mandatory fixed format with trailing blanks, where required.**	
Password	12!c	A password will be pre-assigned by EPN. Left justified, padded with blanks Note: Existing EPN users sending MQ messages can use any of their existing EPN connections passwords that they use for legacy Logon Messages.
Receiver	8!c	MBSEPN System will be the recipient of the inbound messages. Left justified, padded with blanks
Sender	8!c	MBSD account ID of the Participant sending the message. Left justified, padded with blanks
Sender's Submission Business Date	8!c	Sender's submission business date in format MMDDYYYY
Message	**This is the normal EPN messages body defined in "MBS EPN Message Layouts.pdf" Doc.**	

Inbound Example Payload for MQ:
The @ symbol represents one, single blank space in the following example block

Field	Value/Default Value
Password[1]	123456789012
Receiver[2]	MBSEPN@@
Sender	ABCD@@@@
Sender's Submission Business Date	02032020

[1]Password should be left justified and padded with spaces if the password length is less than 12 characters
[2]Hardcoded field with the value MBSEPN

For the above example, the message header would look like the following line:

```
123456789012MBSEPN@@ABCD@@@@02032020
```

The message body should be constructed using the current message layout as defined in "MBS EPN Message Layouts.pdf" Doc. Following is a sample of a complete message that includes the EPN MQ header on line 1 and the EPN message body starting on line 2.

```
123456789012MBSEPN  ABCD    02032020
```

```
ON00000300201231234ABCDAAAA01F123456 90000000000
1000000000000001030120190312201904282019I123456756          0000          671
TRID=1234567890=              00012       0BM381000152587705000006012031 671
4832                          000999999830655360710314O
040120180001000999999830000015277800100152761
```

Note that Start message indicator and End message indicator is not included in this example, because they are non-printable characters. Please ensure both are in the message body i.e. line 2.

5. Client Receives an MQ Response from EPN Server – Outbound Message

Block/Tag	Notes	
Message Header	**Each message must contain a message header. All header fields are mandatory fixed format with trailing blanks, where required.**	
Password	12!c	Password will be blank filled on all response messages from MBSD. Left justified, padded with blanks
Sender	8!c	MBSEPN System will always be the sender of the outbound messages. Left justified, padded with blanks
Receiver	8!c	MBSD account ID of the Participant receiving the message. Left justified, padded with blanks
Sender's Submission Business Date	8!c	Sender's submission business date in format MMDDYYYY
Original Submission Business Date	8!c	Submission date of original message in format MMDDYYYY. Defaulted to current business date. For example, if a client sends a message with the Sender's Submission business date of 02032020 after EPN was shutdown Feb 3rd 2020, EPN will process the message on Feb 4th and populate 02032020 in this field in its response back to the client indicating the submission business date of the original message.
Message	**This is the normal EPN messages body defined in "MBS EPN Message Layouts.pdf" Doc.**	

Outbound Example Payload for MQ:

The @ symbol represents one, single blank space in the following example block

Field	Value/Default Value
Password[1]	@@@@@@@@@@@@
Sender[2]	MBSEPN@@
Receiver	ABCD@@@@
Sender's Submission Business Date	02032020
Original Submission Date	02032020

[1]Password should be left justified and padded with spaces if the password length is less than 12 characters
[2]Hardcoded field with the value MBSEPN

For the above example, the message header would look like the following line.

@@@@@@@@@@@@MBSEPN@@ABCD@@@@02032020 02032020

Example 1: Complete message response for a Valid incoming MQ message header

The output message body from EPN will be constructed using the current message layout as defined in "MBS EPN Message Layouts.pdf" Doc. The following is a sample of a complete AA message that includes the header on line 1 and the message body starting on line 2.

```
                MBSEPN   ABCD     0203202002032020
AA0003780020435143502010000 8        20190222000 0200 020010211800
```

Note that Start message indicator and End message indicator is not included in this example, because they are non-printable characters.

Example 2: Complete message response for an Invalid incoming message

In the event the inbound MQ header fails validation or authentication or empty date or invalid date format, EPN will send a negative AA message with the ACK code 0250. EPN will handle the inbound and outbound sequence numbers as described in the "Message Sequence Numbering and Gap Detection" section of the EPN Implementation guide.

```
                MBSEPN   ABCD     0203202003feb2020
AA0003780020435143502010000 8        20190222000 0250 020010211800
```

Example 3: Complete message response for incoming message that does not contain current business date

In the event the inbound MQ header fails validation with submission date is not current business date, EPN will send a negative AA message with the ACK code 0251. EPN will handle the inbound and outbound sequence numbers as described in the "Message Sequence Numbering and Gap Detection" section of the EPN Implementation guide.

```
                MBSEPN   ABCD     0203202002012020
AA0003780020435143502010000 8        20190222000 0251 020010211800
```

6. Legend of Message Format

Char	Meaning	Format	Example Usage
a	Upper Case Alpha Characters	6a	ABCDEF
c	Alphanumeric Characters (upper case only)	6c	AB12EF
d	Decimal Number (decimal period)	15d	2035.45
e	Space	1e	(1blank space)
n	Numeric Characters	8n	19950131
x	Any Printable ASCII Symbol	20x	Anytime &
/	The literal "/" as a separator	6a/2a	AABny12plEacFe/N Y
[	Optional element format	[/4c]	[optional data]
] [-]	Optional "sign" (negative) format	[-]	: "total_funds":"-
!	Fixed length field	12!c	ABCDEFGHIJKL

7. Channel used for inbound and outbound message

The acknowledge response will be sent to the client on the same channel on which EPN has received the response independent of the connection id used in the message. In the case of forwarding the valid business message to the counterparty, EPN checks, if the account id has been migrated to MQ. If it has been migrated to MQ, the business message will get redirected to the counterparty on MQ channel. Else, EPN will forward the message in TCP channel. Please refer the below tables.

Receiving Channel for Acknowledgement from EPN:

For messages sent by account, the acknowledge will be sent on the same channel in which EPN has received the message.

Acknowledge Message				
Message Sent By	Type of Message	Channel Used by Client	Acknowledge Sent to	Response Channel Used
ACC1	Admin Message	TCP	ACC1	TCP
ACC1	Admin Message	MQ	ACC1	MQ
ACC1	Business Message	TCP	ACC1	TCP
ACC1	Business Message	MQ	ACC1	MQ

8. Migration Strategies and considerations with respect to EPN Connection ID

FICC suggests using a separate connection ID for the MQ connection and TCP connection. SR/RR/LS message retrieves the details for the Connection ID. By using the concept of separate connection ID for channel, client can ensure that the SR/RR/LS message sent through MQ will retrieve details for the MQ connection only. And the same will hold true for TCP.
Clients who opt for communicating with EPN through MQ will have the ability to receive all of their incoming messages originating from EPN into multiple queues to support resiliency/DR requirements. This will work the same way as the existing setup that is in place for responding to TBA trade acknowledgements from MBS RTTM. Clients can work with the DTCC onboarding team at the time of MQ onboarding to configure multiple subscriptions and destinations as needed. Messages will be delivered to those destinations on an all or nothing basis. i.e. clients will not have the ability to choose what message type gets delivered to what destination (Example: AA to connection ID 1000 and ON to connection ID 2000 will not be supported).

As far as EPN connection IDs are concerned, for clients who migrate to MQ, FICC recommends that client choose a single connection ID. Having multiple connection IDs will result in duplicate messages delivered from EPN to the clients on the same MQ channel.

The following are the migration recommendations with different combination of account ID and connection ID:

Scenario	Account	Connection ID	Migration Recommendation	Example
1	One	One	If an EPN client has one account that uses a single connection id, our recommendation is: - Enable MQ at the account level - Clients should ensure that their CTCI & MQ communications are not active simultaneously - Use the existing connection id to communicate with EPN for sending messages. - EPN will in turn use the same connection id to messages sent back to the clients.	**CTCI Setup:** - Client uses connection id 1200 to submit messages to EPN for account ACC1 - EPN uses connection id 1200 to respond to messages for account ACC1 **MQ Setup:** Remains the same - Client uses connection id 1200 to submit messages to EPN for account ACC1 - EPN uses connection id 1200 to respond to messages for account ACC1
2	One	Many	If an EPN client has one account that uses many connection ids, our recommendation is: - Enable MQ at the account level - Keep a single connection id (the lowest numbered connection id) and disable others. - Use the one remaining connection id to communicate with EPN for sending messages. - EPN will in turn use the same connection to send messages back to the clients.	**CTCI Setup:** - Client has three connections 1200, 1201, 1202 mapped to account ACC1 - Client uses connection id 1200 submit ON messages and connection id 1201 to submit all other messages to EPN for account ACC1 - EPN uses connection id 1202 to respond to all messages for account ACC1 **MQ Setup:** - Client uses connection id 1200 to submit all messages to EPN for account ACC1 - EPN uses connection id 1200 to respond to all messages for account ACC1

3	Many	One	If an EPN client has many accounts that use one connection id as a shared connection, our recommendation is: - Enable MQ at the account level - Create a new connection id that will be exclusively used for MQ submissions/receipt. - Migrate accounts that are designated for MQ submission to the new connection id in batches or all at once based on client preference. - Use the new MQ specific connection id to communicate with EPN for sending messages. - EPN will in turn use the same connection to messages sent back to the clients. - EPN will disable the old CTCI connection id once all client accounts are moved to MQ i.e. the new connection id. Reference the Gap Detection Recommendations section for solutions to out of sequence scenarios.	**CTCI Setup:** - Client has one connections 1200 mapped to multiple accounts ACC1, ACC2 and ACC3 - Client uses connection id 1200 submit all messages for accounts ACC1, ACC2 and ACC3 - EPN uses connection id 1200 to respond to all messages for account ACC1, ACC2 and ACC3 **MQ Setup:** - Client uses new connection id 1300 to submit all messages to EPN for accounts ACC1, ACC2 and ACC3 - EPN uses connection id 1300 to respond to all messages for accounts ACC1,ACC2 and ACC3
4	Many	Many	If an EPN client has many accounts that each use many connection ids as a shared connection, our recommendation is: - Enable MQ at the account level - Create a new connection id that will be exclusively used for MQ submissions/receipt. - Migrate accounts that are designated for MQ submission to the new connection id in batches or all at once based on client preference. - Use the new MQ specific connection id to communicate with EPN for sending messages. - EPN will in turn use the same connection to messages sent back to the clients. - EPN will disable the old CTCI connection id once all client accounts are moved to MQ i.e. the new connection id. Reference the Gap Detection Recommendations section for solutions to out of sequence scenarios.	**CTCI Setup:** - Client uses connection id 1200 to submit ON messages for multiple accounts ACC1, ACC2 and ACC3. - Client uses connection id 1201 to submit all other messages for multiple accounts ACC1, ACC2 and ACC3 - EPN uses connection id 1202 to respond to all messages for account ACC1, ACC2 and ACC3 **MQ Setup:** - Client uses new connection id 1300 to submit all messages to EPN for accounts ACC1, ACC2 and ACC3 - EPN uses connection id 1300 to respond to all messages for accounts ACC1,ACC2 and ACC3

GAP Detection Recommendations

There exists a possibility in both CTCI and MQ systems where there could be out of sequence EPN outbound sequence numbers on messages. The primary reason for this is that EPN uses the concept of connection ids (a CTCI construct) as the namespace for generating sequence numbers. This scenario would occur when many account ids are mapped to the same connection id. To address the aforementioned scenario with respect to the migration of accounts from CTCI to MQ, FICC suggests using one of the following options:

1. **Disable Gap Detection** - Remove existing gap detection functionality. Originally, clients implemented this measure for the legacy CTCI system. The measure was built to address the inherent unreliability of the CTCI transport mechanism. However, with MQ, messages are delivered FIFO and are persistent. This guarantees that messages produced by EPN, once written to MQ, will not get lost.
2. **One Connection Id per Account Symbol** - Setup a separate connection id for each account. This will ensure that messages belonging to the same account are partitioned at the account level and the outbound sequences will be in order. Having multiple connection IDs will result in duplicate messages delivered from EPN to the clients on the same MQ channel.
   SR/RR/LS message retrieves the details for the Connection ID. By using the concept of separate connection ID for MQ channel, clients can ensure that the SR/RR/LS message sent through MQ will retrieve details for the MQ connection only. And the same will hold true for TCP.
3. **Implement Gap Detection Tolerance Over a Window of Time** - Implement gap detection to work over a window of time (e.g. 5 mins). Over a small window of time, EPN will deliver all messages, but there may be a noticeable gap. If there is still a gap after the preset window of time elapses, clients can send an RR message.

9. Message Flow

a. For every message received via MQ the EPN performs the following steps:
   - Parse the payload – the payload should have 2 lines, the first should be the message header the second should be the normal EPN message. The MQ message header is populated as a continuous string of data, which terminates as a regular data field (with a carriage return line feed "CRLF").
   - Validate the formatting and contents of all the fields in the MQ message header
   - If MQ message header is successfully validated and authenticated, the MQ message body will be processed and validated based on the formatting and validation rules described in the EPN Implementation guide.

b. If the MQ message header fails validation or authentication, the message will be rejected. EPN will send a negative AA with ACK code of 0250 regardless of the type of the original message, as described above in example 2 under section 5.

   Following are the possible failure scenarios related to the MQ message header and body and how EPN will handle them

Scenario Detail				EPN's Handling of the Scenario	
#	MQ Header Validation	Message Body Validation	Identifiable Source (Account)	Sequence Handling	Response Sent
1	Failed	Failed	No	No Sequences will be updated	No
2	Failed	Failed	Yes	Input and Output sequences will be updated	Yes
3	Failed	Successful	Yes	Input and Output sequences will be updated	Yes
4	Successful	Failed	No	No Sequences will be updated	No
5	Successful	Failed	Yes	Input and Output sequences will be updated	Yes
6	Successful	Successful	Yes	Input and Output sequences will be updated	Yes

c. For every message sent out:
   - EPN will add a message header at the beginning of the payload as described in section 5.
   - The recipient should parse the payload and extract the MQ message header before processing the MQ message body based on the rules laid out in the **MBS EPN Message Layouts** and **EPN Implementation** guide.

10. New Reject code for MQ Header validation failures.

Value	Ack Reason	Comments
0250	Invalid MQ Message header	EPN will send an AA message with ACK code 0250 in the event the MQ message header failed validation and/or authentication
0251	Invalid current business date	EPN will send an AA message with ACK code 0251 in the event the submission date in header is not current business date.

11. New Start of Day TX message

For all clients who have converted to MQ, EPN will send out a TX message first thing in the morning. This message will include the current business date in the MMDDYYYY format.
The type of the TX message will be 22 and the sequence number will be 000001. The content of the Message Text field will be of the format: "START OF BUSINESS DAY MMDDYYYY"

Following is a sample TX message that will be sent out.

```
            MBSEPN  ABCD    02032020 2
TX00000100203841384 22START OF BUSINESS DAY 02032020
```

Note: Existing TCP (CTCI) clients will not receive this TX message.

MQ Messages sent to EPN after the close of business for a given business day will get queued up[1].
When EPN opens for business on the following business day, EPN will first send out the Start of day TX message as described above. It will then begin processing the messages available in the queue. EPN will check the EPN MQ message headers of the queued messages for the current business day. If the previous business date is found within the MQ Message Header, the message will be rejected for reason code 0251 (INVALID CURRENT BUSINESS DATE). All remaining messages submitted for the current business day will be validated and processed as per the normal validation rules.
EPN will handle the inbound and outbound sequence numbers as described in the "Message Sequence Numbering and Gap Detection" section of the EPN Implementation guide.

12. Deprecated Message Types

As mentioned in the EPN MQ FAQ documentation, the following non-business EPN legacy message types will no longer be needed through the MQ channel due to the reliability and durability guaranteed by the MQ infrastructure.

- Heartbeat Primary (HP)
- Heartbeat Acknowledgement (HA)
- Logon (LO)

[1] Refer to the MBSD Processing Schedule and Timeframes on DTCC.com for the EPN System Availability

EPN will continue to process and respond back to these messages during initial implementation but we recommend MQ clients not to use these messages as these will be deprecated in the future.

13. References

- EPN MQ User/FAQ document
  http://www.dtcc.com/~/media/Files/Downloads/Clearing-Services/FICC/MBSD/EPN-MQ-User-Document.pdf

- EPN Implementation Guide
  http://www.dtcc.com/~/media/Files/Downloads/Clearing-Services/FICC/MBSD/EPN-Implementation-Guide.pdf

- MBS EPN Message Layouts
  http://www.dtcc.com/~/media/Files/Downloads/Clearing-Services/FICC/MBSD/EPN_Message_Layout_011008a.pdf

- MBS EPN Guidelines and Codes
  http://www.dtcc.com/~/media/Files/Downloads/Clearing-Services/FICC/MBSD/EPN_General_Guidelines_Codes_011608a.pdf