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Multi-Channel MQ Support

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Introduction

Looking for a way to improve the current Data Feed process

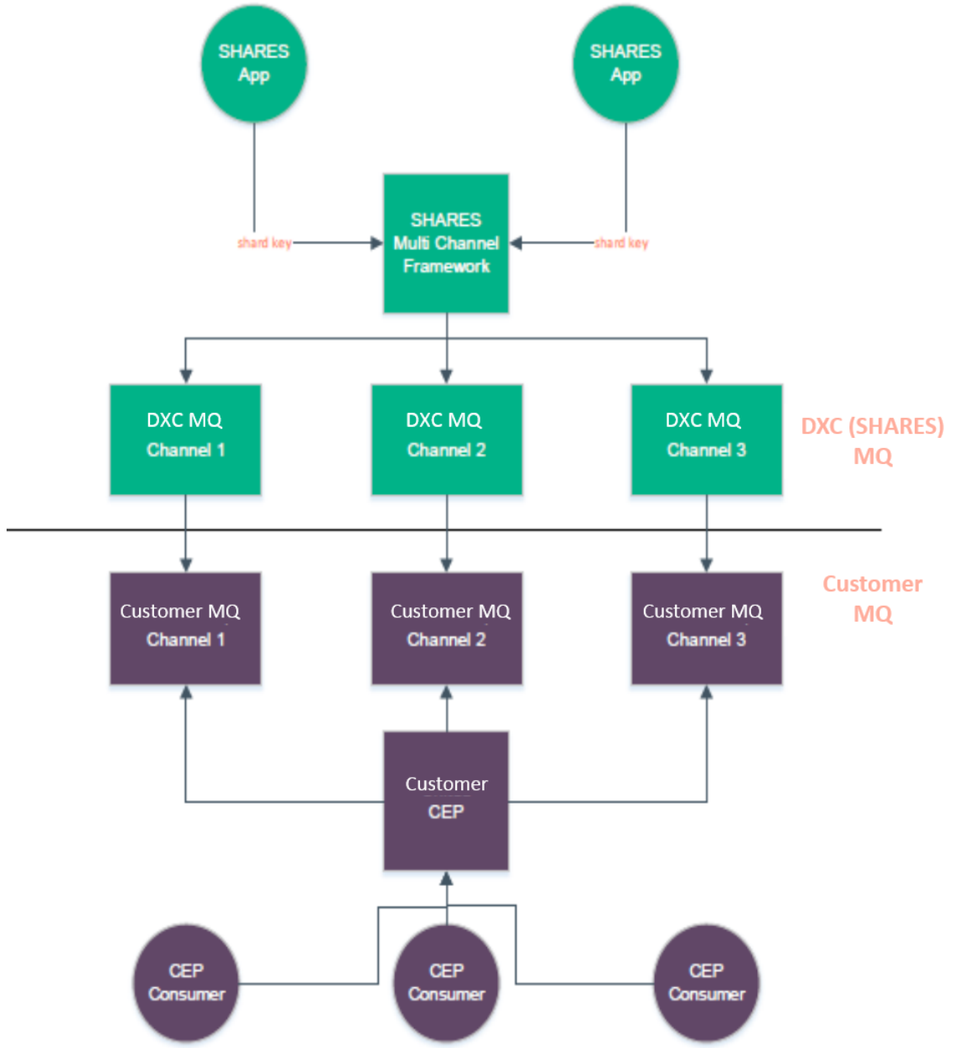
- Reduce the perceived throughput performance issues
- Improvements to the messaging platform in relation to volume handling through deployment of Multi-Channel MQ approach
- Migrate existing Feeds to use Multi-Channel MQ framework

With the implementation of the Multi-Channel MQ framework, we are one step closer to improving the messaging between the PSS Host platform and the larger PSS Eco-system.

Multi-Channel MQ Interface

In order to increase the capacity of the current single channel interface, the multi-channel interface distributes the data over multiple MQ channels.

- To facilitate the ability to transmit the message on multiple channels, a shard key needs to be passed from SHARES applications to SHARES TPF COMMS.
  - The shard key will be used to determine which MQ channel to put the message.
  - This ensures that all related messages are sent over the same MQ channel, eliminating the need for sequencing messages from different channels on the receiving side.
- An example from the Ticketing Feed project is that the shard key is the ticket number in hexadecimal format.



Sample MQ Multi-Channel Table Displays

The next few slides are some example entries displaying the MQ Multi-Channel Table.

ZZMQM DISPLAY

```
MQMC0020I 14.08.36 MQ MULTI-CHANNEL TABLE SUMMARY DISPLAY
-------------------------------------------------------
APPL LINK      MESSAGE  CURRENT      MAX    ERROR      LINK
NAME NUM         COUNT    DEPTH    DEPTH    COUNT    STATUS _
-------------------------------------------------------
UTXX 001         93002        0        0        0       ACT _
UTXX 002         92566        0        0        0       ACT
UTXX 003         92364        0        0        0       ACT

-------------------------------------------------------
TOTAL NUMBER OF ITEMS: 6
END OF DISPLAY+
```

ZZMQM DISPLAY NAME-UTXX DETAIL-Y

```
MQMC0032I 14.10.02 MQ MUTLI-CHANNEL TABLE
APPLICATION ITEM DETAIL DISPLAY
-------------------------------------------------------------
Application Name  - UTXX          Links Defined  -      003
Status            - Active        Links Active   -      003 _
-------------------------------------------------------------
Status Change Options:
   Application    - All Links Down
   Link           - Queue Depth

General Options:
   Load Balance   - Hash
   Logging        - None

Core Address      - 0251C540
-------------------------------------------------------------
END OF DISPLAY+
```

Sample MQ Multi-Channel Table Displays

ZZMQM DISPLAY NAME-UTXX

```
MQMC0030I 14.11.06 MQ MULTI-CHANNEL TABLE
APPLICATION ITEM SUMMARY DISPLAY
-------------------------------------------------------------
Application Name  - UTXX          Links Defined  -      003
Status            - Active        Links Active   -      003
-------------------------------------------------------------
APPL LINK      MESSAGE  CURRENT      MAX    ERROR      LINK
NAME NUM         COUNT    DEPTH    DEPTH    COUNT    STATUS
-------------------------------------------------------------
UTXX 001         93007        0        0        0       ACT
UTXX 002         92567        0        0        0       ACT
UTXX 003         92368        0        0        0       ACT

-------------------------------------------------------------
TOTAL MESSAGE COUNT:  277942
END OF DISPLAY+
```

ZZMQM DISPLAY NAME-UTXX NUMBER-1

```
MQMC0040I 14.13.13 MQ MULTI-CHANNEL TABLE
APPLICATION LINK ITEM DETAIL DISPLAY
-------------------------------------------------------------
Application Name  - UTXX          Link Number    -      001
Status            - ACT

Message Count     - 93014         Current Depth  - 0
Interim Count     - 93014         Max Depth      - 0
Error Count       - 0             MQ Reason Code - 0

Core Address      - 02522960

MQ Alias          - MC.UTXX.01
MQ ReplyTo Queue  - MC.UTXX.01.QL
MQ Remote Queue   -
MQ Transmit Queue -
MQ Channel Name   -
MQ Channel Status - To Be Determined

Last Activated    - Sat Sep 23 07:05:55 2017

Last Inactivated  - Sat Sep 23 07:05:37 2017

-------------------------------------------------------------
END OF DISPLAY+
```

Channel Status Table

Problem: Multi-Channel MQ Support requires the ability to check the channel status programmatically, but IBM does not provide an MQ channel access API.

Two possible solutions were identified.

- Channel Event Queue
  - By defining a system event queue, the event messages are generated automatically whenever a channel starts or stops
  - This allows us to build our own Channel Status Table to feed the Multi-Channel MQ support
- Internal Terminal Emulation
  - i-SHARES has a Terminal Emulation page that can be used internally
  - Pulling that process into a reusable new C++ class, eTerm, we can issue a time-initiated MQ Channel Status Display, “ZMQSC DIS CHS-ALL” to gather the output in heap storage and parse the contents for the current status of all channels

Channel Status Table

Solution: Multi-Channel MQ Support requires the ability to check the channel status programmatically.

It was determined that the best solution was a combination of both solutions.

- If a 1 second time-initiation were to be used the Channel Status Table would be updated only every 1 second. For a multi-channel MQ connection that processes 1,000 messages per second, an update period of 1 second is too long to notice a problem with a channel. By including the channel event messages, a channel would be brought into and out of use as the status changes.
- Building and Updating the Channel Status Table
  - The table is initialized during cycle-up
  - The entire table is built within 1 minute of cycle-up
  - Post cycle-up, the table is kept up-to-date by:
    - Channel event messages
    - 1 minute time-initiated refresh using eTerm terminal emulation

Sample Channel Status Table Displays

The next few slides are some example entries displaying the Channel Status Table

- ZZCHS D

```
CSMP0097I 09.29.42 CPU-A SS-BSS  SSU-CO   IS-01  SA0
01/18/2018 09.29.42  MQ3MC Channel Status Table Display --
64-bit system heap _MCHSTUS @ A87D40000, Log-NORMAL, CRET-YES
Items Active/Max 90/250, Last Refreshed 01/18 09.29.18
Health Checks:
** Good Last Refreshed in  LESS   THAN 2 minutes
** Good eTerm open-Y, run-Y
** Good HMQ2 entry in the CRET-SEC table EXIST-Y, ECBS-1, TIME-36
** Good SYSTEM.ADMIN.CHANNEL.EVENT queue EXIST-Y, DEPTH-0
------------------------------------------------------------
Channel Name          Type Status   Depth   XMITQ
--------------------- ---- -------- ------- --------------------
AIRCOM_SIN.A1Y1PSHA   RCVR RUNNING  0
AIRCOM_YUL.A1Y1PSHA   RCVR RUNNING  0
AMX2.A1Y1PSHA.01      RCVR RUNNING  0
AMX2.A1Y1PSHA.02      RCVR RUNNING  0
AVFINITY.A1Y1PSHA.1   RCVR RUNNING  0
A1Y1PSHA.AIRCOM_SIN   SDR  RUNNING  0       XMITQ.SITA.AGM.SIN.QL
A1Y1PSHA.AIRCOM_YUL   SDR  RUNNING  0       XMITQ.SITA.AGM.YUL.QL
A1Y1PSHA.AMX2.01      SDR  RUNNING  0       XMITQ.ARINC.TYPEA.QL
A1Y1PSHA.AMX2.02      SDR  RUNNING  0       XMITQ.ARINC.TYPEB.QL
A1Y1PSHA.A1Y1PSHB.01 SDR  RUNNING  0       XMITQ.SASB.TYPEB.QL
...
STARTDT.A1Y1PSHA      RCVR RUNNING  0
UNP1.A1Y1PSHA         RCVR RUNNING  0
END OF DISPLAY - 88 ITEMS / 2 Items DELETED
```

Sample Channel Status Table Displays

ZZCHS D L

```
CSMP0097I 09.30.18 CPU-A SS-BSS  SSU-CO   IS-01  SA0
01/18/2018 09.30.18  MQ3MC Channel Status Table Display --
64-bit system heap _MCHSTUS @ A87D40000, Log-NORMAL, CRET-YES
Items Active/Max 90/250, Last Refreshed 01/18 09.29.18
Health Checks:
** Good Last Refreshed in  LESS   THAN 2 minutes
** Good eTerm open-Y, run-Y
** Good HMQ2 entry in the CRET-SEC table EXIST-Y, ECBS-1, TIME-60
** Good SYSTEM.ADMIN.CHANNEL.EVENT queue EXIST-Y, DEPTH-0
-------------------------------------------------------------------------------------------------------
Channel Name         Type Status   Depth   XMITQ                Last Stop Time  Last Start Time    Remote IP
-------------------- ---- -------- ------- -------------------- --------------- --------------- ---------------
AIRCOM_SIN.A1Y1PSHA  RCVR RUNNING  0                           12/11 11.14.55  12/11 13.01.00  10.77.135.116
AIRCOM_YUL.A1Y1PSHA  RCVR RUNNING  0                           12/11 11.17.28  12/11 13.00.53  10.250.136.14
AMX2.A1Y1PSHA.01     RCVR RUNNING  0                           01/02 23.00.41  01/16 21.51.56  10.28.2.3
AMX2.A1Y1PSHA.02     RCVR RUNNING  0                           01/16 21.50.49  01/16 21.50.52  10.28.2.9
...
STARTDT.A1Y1PSHA     RCVR RUNNING  0                           12/04 20.09.04  12/04 21.08.19  10.29.218.145
UXP1.A1Y1PSHA        RCVR RUNNING  0                           12/16 07.25.18  12/16 07.25.28  10.10.32.89
END OF DISPLAY - 88 ITEMS / 2 Items DELETED
```

Summary

To increase the Data Feed processing of MQ messages, DXC developed the Multi-Channel MQ Support

In developing this support was have built the valuable and reusable eTerm class that can be used in future projects that need information that is not readily available.

Thank you.