# MQ SMF Formatting – How to Use and Analyse (or Analyze) the Data

Mark Taylor
*marke_taylor@uk.ibm.com*
IBM Hursley

Lyn Elkins
*elkinsc@us.ibm.com*
IBM Washington Systems Center

# speaker.setName(Lyn)

# What is SMF

- Not the Sacramento International Airport
- SMF is the z/OS System Management Facility
  - A common utility for all z/OS subsystems to report activity
  - What they report and when they report it is up to them
- Each subsystem is assigned one or more SMF Types
  - MQ uses:
    - SMF 115 – or MQ Statistics records
    - SMF 116 – or MQ Accounting records
- SMF data is (1) collected, (2) dumped to a data set, then (3) **formatted and analysed**

# How do you collect data (1)

- Collecting MQ SMF is controlled two ways:
- SYSP Macro
  - SMFSTAT attribute owns the Statistical (SMF 115) record production
    - This should be on all the time, set to (01,04) for all queue managers
  - SMFACCT attribute owns the Accounting (SMF 116) record production
    - Typically not on all the time, controlled by the START TRACE command

# How do you collect data (2)

- Collecting MQ SMF is controlled two ways:
- START TRACE command
  - +cpf START TRACE(A) CLASS(?)
- Starting and stopping the accounting trace is typically dynamic
  - CLASS(3) controls production of  the Task Accounting (including queue) data
  - CLASS(4) controls production of the Channel Accounting data
  - CLASS(1) is no longer used
  - The classes are not inclusive, so if you want both Task and Channel accounting you need to turn on both 3 and 4

# Dumping records to SMF output data set

- Once SMF data has been collected, it must be sent to output data sets
  - These can be considered an intermediate state
  - IFASMFDP copies data from SMF data sets to a sequential data set
  - IFASMFDL copies data from SMF logstreams to a sequential data set
- Options filter which records are copied to the output data set
  - Once the output data set is created, then it can be formatted

# SMF Streaming

- New capability with z/OS 2.x via PTF OA49263
- “Live” access to SMF buffers without needing to dump for offline processing
  - Can then process data for real-time analytics
- Tool described here does not exploit that. But the SQL examples could be used

# Working with the data

- Various tools have been around for a while
- CSQ4SMFD is a sample program provided with MQ
  - Dumps records from the data sets created by IFASMFDP/L jobs in a readable but unconsumable format
- SupportPac MP1B – free tool to create reports from records
- Other commercially available tools for interpretation
  - Sometimes do not keep up with changes
  - Do not capture/use some critical data
  - This column means what?

# CSQ4SMFD Output – Message Manager

```
 message manager statistics data
--Q-M-S-T---H-E-X---P-R-I-N-T----
Address  = 13B2AC08
00000000 : D40F0048 D8D4E2E3 00000001 00000001 <M...QMST........>
00000010 : 00000013 00000003 00000000 00000002 <................>
00000020 : 00000000 00000000 00000000 00000000 <................>
00000030 : 00000000 00000000 00000001 00000008 <................>
00000040 : 00000000 00000000                   <........        >
--Q-M-S-T---F-O-R-M-A-T-T-E-D----
qmstid   = d40f
qmstll   = 0072
qmsteyec = QMST
qmstopen = 00000001
qmstclos = 00000001
qmstget  = 00000019
qmstput  = 00000003
qmstput1 = 00000000
qmstinq  = 00000002
```

# Challenges

- Tools sometimes broke with different MQ levels
- Calculations were not always clear, or correct
- Difficult to validate they were doing the right thing
- Filled up JES spool with reports

# JES Spool Example

| SMF Record Type | Number of records |
|---|---|
| 2 | 1 |
| 3 | 1 |
| 115 | 66 |
| 116 | 2,684,149 |

$HASP375 ELKINSE1 ESTIMATE EXCEEDED BY 167,100,000

| Output file name | Number of Lines |
|---|---|
| BUFF | 316 |
| BUFFCSV | 57 |
| LOG | 326 |
| TASK | 163M |

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# Challenges

- Would get calls asking how formatters actually worked
  - As I could see source code
- Not always able to understand it
  - But could see inconsistencies

# Solution

- I decided I had to learn how to process SMF
- Investigation ...
- Found various tools and toolkits but none suitable
  - Java code that only runs on z/OS because of I/O
  - Parser using DFDL for IIB records

# As a Distributed person

- I know how to develop code that runs on Unix and Windows
  - Editors, compilers, debuggers etc

- Lyn wanted to import to spreadsheets which run on those platforms
  - And different programs were better able to handle large data
  - So formatting SMF on these platforms made sense

# Project Goal

- Develop a tool that did not get in the way of analyses
- Format all the data and nothing but the data
- Syntax. Not semantics.

# Some issues

- Formatting RDW
  - z/OS data sets are structured (embedded record lengths)
  - Files on Unix/Windows are mostly byte-streams
  - Need to be able to deal with the Record Descriptor Words
    - ftp options can keep RDW bytes when transferring bytes
    - > QUOTE SITE RDW
    - > BINARY

# Yet more issues

- C headers and Assembler macros did not always match
- Incompatible changes made across some versions
  - Fields inserted in middle of structures
- Data formats not always cross-platform C-friendly
  - Assumptions about data type sizes
  - Assumptions about bit fields
  - Assumptions about endian-ness
  - Assumptions about padding
  - Structures not always complete/overlap

# SMF not as self-describing as advertised

- Despite claims, SMF is not really self-describing
  - Unlike MQ's PCF
  - Model is header followed by “triplets” which say where each real element is, how long it is, and how many there are
- MQ SMF has some undocumented triplets, or skipped fields
  - Can’t tell without reading docs and looking at the sample source code (and sometimes verifying in product source code)
  - Not everything has an eyecatcher (newest CHIN records)
- A whole class of subtypes seems undocumented

# Starting on the formatter

- Started with RDW record reader, hex and EBCDIC dumper
  - Similar to the raw output from CSQ4SMFD
- To ensure I was processing one complete record at a time
  - One SMF record may be split across multiple dataset records
- Program evolved …
  - Simple structure for formatting MQ structures such as QPST
  - Adding the V9 pageset statistics took minutes
  - Might choose a different approach (Java?) if restarting
- Adding other record types (AMS is 180) is feasible

# Post Processing Challenges

- Formatting the output data also had “opportunities”

- Spreadsheets try to be clever when importing CSVs
  - Date, time formats
  - Treating strings as numbers
  - And sometimes get it wrong
- So this formatter went through several iterations testing with Excel and LibreOffice to ensure data could be imported
  - Compromises needed on timestamp formats

# Unexpected popularity

- After first version running, mentioned it at Interconnect 2016
- “How many people interested”
  - Expected only the co-presenter to raise hand
  - Rather more than that did
- So quickly got a version on github

# Github project

**http://github.com/ibm-messaging/mq-smf-csv**

# Downloading data

```
$ ftp winmvs41
Connected to 9.20.1.1
User (winmvs41:(none)): met
331 Send password please.
Password:
230 MET is logged on. Working directory is "MET.".
ftp> BINARY
200 Representation type is Image
ftp> QUOTE SITE RDW
200 SITE command was accepted
ftp> GET 'MET.SMF.DATA' c:\smf\data\test.bin
200 Port request OK
125 Sending data set MET.SMF.DATA
250 Transfer completed successfully
ftp: 792532 bytes received in 0.30 Seconds 2641.77Kbytes/sec.
ftp> quit
```

# Running the program

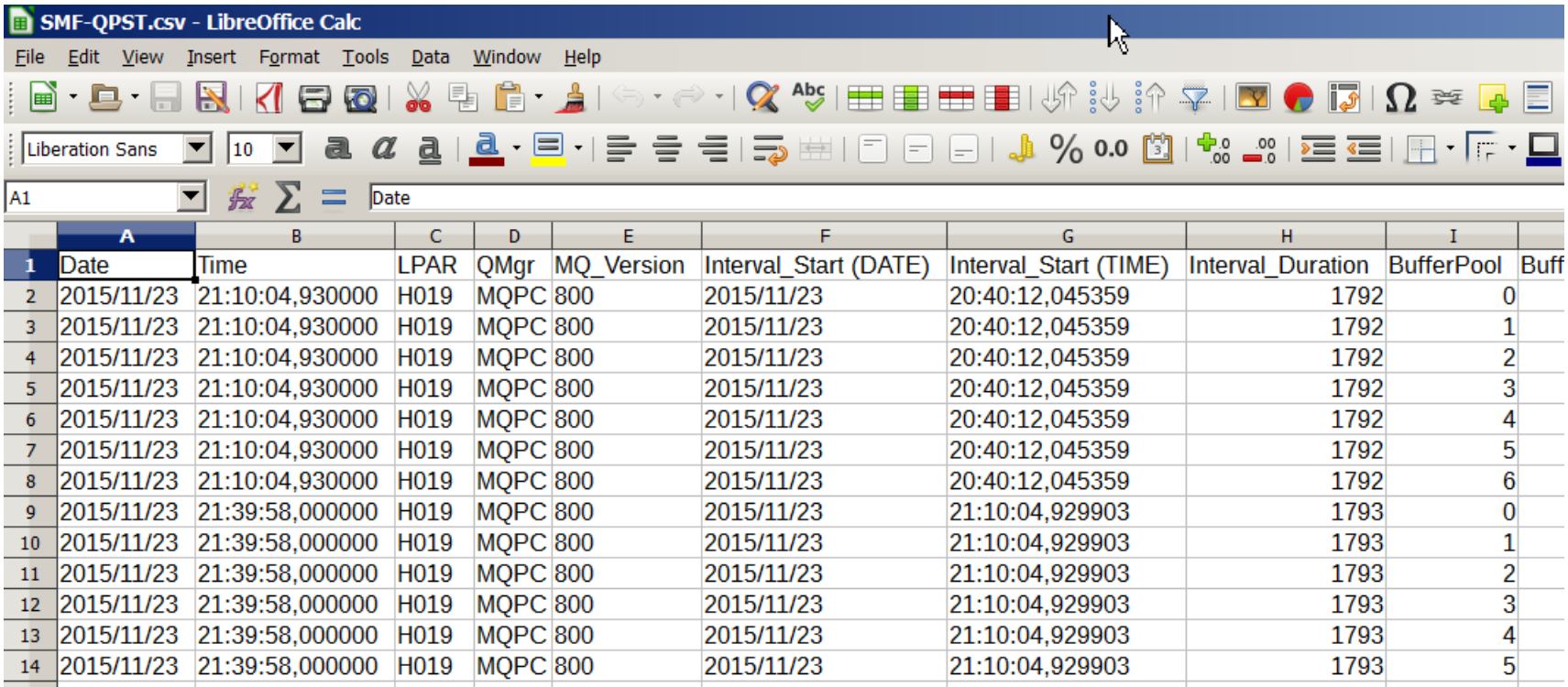
```
C:\smf>mqsmfcsv -i c:\smf\data\test.bin –o c:\smf\out -m 200  -s

MQ SMF CSV - Build Jul 17 2016 11:45:19
Swapping bytes in input records
Processed 146 records total
  Ignored                      record count: 2
  Formatted 115 subtype   1 record count: 48
  Formatted 115 subtype   2 record count: 48
  Formatted 115 subtype 215 record count: 48
```

# A raw formatted CSV file

```
Date,Time,LPAR,QMgr,MQ_Version,Interval_Start (DATE),Interval_Start (TIME),Inter
val_Duration,BufferPool,Buffer_Count,Lowest_Stealable,Current_Stealable,Getp_Old
_Requests,Getp_New_Requests,DASD_Read,Set_Write_Pages,Pages_Written,DASD_Write,S
ync_Writes,Defer_Write_THold_Reached,Sync_Write_THold_Reached,Buffer_Steals,Buff
er_Steals_Hash_Changes,Suspend_No_Buffers,LOC,FIX,
"2015/11/23","21:10:04,930000","H019","MQPC",="800","2015/11/23","20:40:12,04535
9",1792,0,50000,49981,49984,966636,0,0,966532,84,31,17,0,0,0,0,0,"Above","Paged"
,
"2015/11/23","21:10:04,930000","H019","MQPC",="800","2015/11/23","20:40:12,04535
9",1792,1,100000,42308,99487,1771124,328513,0,1736279,111053,6993,41,0,0,0,0,0,"
Above","Paged",
"2015/11/23","21:10:04,930000","H019","MQPC",="800","2015/11/23","20:40:12,04535
9",1792,2,50000,49999,49999,221,0,0,13,13,13,13,0,0,0,0,0,"Above","Paged",
"2015/11/23","21:10:04,930000","H019","MQPC",="800","2015/11/23","20:40:12,04535
9",1792,3,100000,98961,99385,284845,56959,0,280496,4117,276,13,0,0,0,0,0,"Above"
,"Paged",
"2015/11/23","21:10:04,930000","H019","MQPC",="800","2015/11/23","20:40:12,04535
9",1792,4,50000,49999,49999,741,0,0,13,13,13,13,0,0,0,0,0,"Above","Paged",
"2015/11/23","21:10:04,930000","H019","MQPC",="800","2015/11/23","20:40:12,04535
9",1792,5,100000,99393,99393,516284,103803,0,508323,828,71,13,0,0,0,0,0,"Above",
"Paged",
"2015/11/23","21:10:04,930000","H019","MQPC",="800","2015/11/23","20:40:12,04535
9",1792,6,100000,99992,99999,2229,167,0,764,36,19,13,0,0,0,0,0,"Above","Paged",
@
"SMF-QPST.csv" 553 lines, 87171 characters
```

# Imported to a spreadsheet




| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Date | Time | LPAR | QMgr | MQ_Version | Interval_Start (DATE) | Interval_Start (TIME) | Interval_Duration | BufferPool |
| 2 | 2015/11/23 | 21:10:04,930000 | H019 | MQPC | 800 | 2015/11/23 | 20:40:12,045359 | 1792 | 0 |
| 3 | 2015/11/23 | 21:10:04,930000 | H019 | MQPC | 800 | 2015/11/23 | 20:40:12,045359 | 1792 | 1 |
| 4 | 2015/11/23 | 21:10:04,930000 | H019 | MQPC | 800 | 2015/11/23 | 20:40:12,045359 | 1792 | 2 |
| 5 | 2015/11/23 | 21:10:04,930000 | H019 | MQPC | 800 | 2015/11/23 | 20:40:12,045359 | 1792 | 3 |
| 6 | 2015/11/23 | 21:10:04,930000 | H019 | MQPC | 800 | 2015/11/23 | 20:40:12,045359 | 1792 | 4 |
| 7 | 2015/11/23 | 21:10:04,930000 | H019 | MQPC | 800 | 2015/11/23 | 20:40:12,045359 | 1792 | 5 |
| 8 | 2015/11/23 | 21:10:04,930000 | H019 | MQPC | 800 | 2015/11/23 | 20:40:12,045359 | 1792 | 6 |
| 9 | 2015/11/23 | 21:39:58,000000 | H019 | MQPC | 800 | 2015/11/23 | 21:10:04,929903 | 1793 | 0 |
| 10 | 2015/11/23 | 21:39:58,000000 | H019 | MQPC | 800 | 2015/11/23 | 21:10:04,929903 | 1793 | 1 |
| 11 | 2015/11/23 | 21:39:58,000000 | H019 | MQPC | 800 | 2015/11/23 | 21:10:04,929903 | 1793 | 2 |
| 12 | 2015/11/23 | 21:39:58,000000 | H019 | MQPC | 800 | 2015/11/23 | 21:10:04,929903 | 1793 | 3 |
| 13 | 2015/11/23 | 21:39:58,000000 | H019 | MQPC | 800 | 2015/11/23 | 21:10:04,929903 | 1793 | 4 |
| 14 | 2015/11/23 | 21:39:58,000000 | H019 | MQPC | 800 | 2015/11/23 | 21:10:04,929903 | 1793 | 5 |
| 15 | 2015/11/23 | 21:39:58,000000 | H019 | MQPC | 800 | 2015/11/23 | 21:10:04,929903 | 1793 | 6 |

# Job done?

- Project goals had been met
- "Customer" requirements all implemented

- But …

# Import to SQL tables

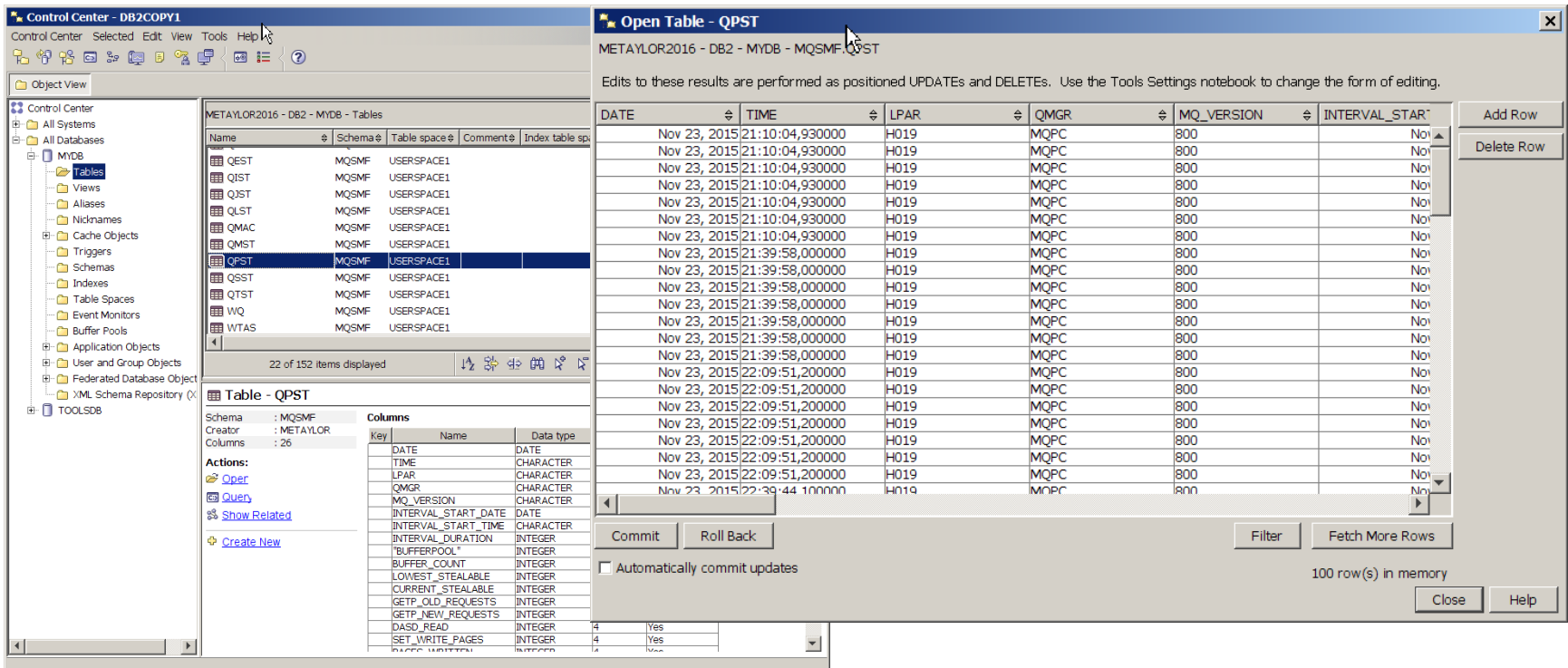
- After working with just CSV, Lyn tried importing data to DB2
  - For very large data volumes that challenge spreadsheets
- But DB2 cannot simply import CSV files
  - Needs tables to be created with columns and datatypes
  - Unlike MS Access, which does it automatically
- Tried creating tables by hand
  - Was easier to do it in code to cover all tables
  - Get simple DDL to define columns with appropriate types

# Some DDL

```
DROP   TABLE MQSMF.QPST;
CREATE TABLE MQSMF.QPST (
  Date   DATE
, Time   CHAR(16)
, LPAR   CHAR(4)
, QMgr   CHAR(4)
, MQ_Version     CHAR(3)
, Interval_Start_Date     DATE
, Interval_Start_Time     CHAR(19)
, Interval_Duration       INTEGER
, BufferPool      INTEGER
, Buffer_Count    INTEGER
, Lowest_Stealable        INTEGER
, Current_Stealable       INTEGER
, Getp_Old_Requests       INTEGER
, Getp_New_Requests       INTEGER
, DASD_Read       INTEGER
, Set_Write_Pages         INTEGER
, Pages_Written           INTEGER
, DASD_Write      INTEGER
, Sync_Writes     INTEGER
, Defer_Write_THold_Reached       INTEGER
, Sync_Write_THold_Reached        INTEGER
, Buffer_Steals           INTEGER
, Buffer_Steals_Hash_Changes      INTEGER
, Suspend_No_Buffers      INTEGER
, LOC     CHAR(6)
, FIX     CHAR(6)
);
```

Date = Date
Time = String

# How it looks in DB2



# Job done?

# Regular further enhancements

- Support input files without RDW
  - Many sites disabling "ftp"; other protocols may not do RDW
- Current levels of SMF structure
- Checkpoints for resumption when processing very large files
  - Lyn's disk would often fill up so this should speed recovery

- Link WQ and WTAS correlators

- Continual discovery of undocumented features

# Output format extensions

- Write data as JSON

- Default INDEX creation in DDL
  - Based on queries shown to be valuable but slow
- MySQL option
  - To enable fully-free SQL analysis

# SMF as JSON

mqsmfcsv -i <input file> -f json


```
{
"recordType" : 116,
"recordSubType" : 0,
"structure" : "QMAC",
"date" : "2015/11/23",
"time" : "11:00:00.020000",
"lpar" : "H019",
"qmgr" : "MQPC",
"mqVersion" : "800",
"authorisationId" : "IMS     ",
"correlId" : "F0F2F3F6C2C3F1E4C4D6C340",
"connectionName" : "PRDC    ",
"operatorId" : "PLN1231 ",
"applicationType" : "IMS MPP/BMP",
"accountingToken" :
"00000000000000000000000000000000000000000000",
"networkId" :
"D7D9C4C340404040044E0A0800000001",
...
```

# And now some examples of using the data

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# How do I use this?

- Use MP1B and mqsmfcsv together for fuller picture

- MP1B
  - Looking at messages
  - Examine complete task record
    - What queues used
- MQSMFCSV
  - Looking for specifics

# Some Common Analysis

- Bufferpool issues:

| QMgr | MQ_Versi | Interva | Inte | Interval_D | BufferPoo | Buffer_Co | Lowest_St | Current_St | Getp_Old_Req | Getp_New | DASD_Rea | Set_Write_ | Pages_Wri | DASD_Wri | Sync_Writ | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QML1 | 800 | ##### | 09:0 | 2352 | 0 | 10000 | 9974 | 9975 | 5559431 | 0 | 0 | 5559392 | 27 | 8 | 4 | |
| QML1 | 800 | ##### | 09:0 | 2352 | 1 | 15000 | 14692 | 14694 | 221325 | 44412 | 0 | 217085 | 226 | 18 | 3 | |
| QML1 | 800 | ##### | 09:0 | 2352 | 2 | 15000 | 2180 | 3236 | 12546086 | 2893875 | 613685 | 12578779 | 615763 | 38488 | 3 | |
| QML1 | 800 | ##### | 09:0 | 2352 | 3 | 15000 | 11298 | 11902 | 49210 | 7789 | 3145 | 47718 | 3703 | 237 | 3 | |
| QML1 | 800 | ##### | 09:0 | 2352 | 4 | 15000 | 12827 | 13874 | 5710808 | 1140222 | 0 | 5674805 | 1611 | 105 | 4 | |
| QML1 | 800 | ##### | 10:0 | 1798 | 0 | 10000 | 9974 | 9975 | 4118894 | 0 | 0 | 4118864 | 5 | 4 | 2 | |
| QML1 | 800 | ##### | 10:0 | 1798 | 1 | 15000 | 14691 | 14692 | 174429 | 35017 | 0 | 171216 | 156 | 13 | 2 | |
| QML1 | 800 | ##### | 10:0 | 1798 | 2 | 15000 | 2205 | 3579 | 9290884 | 2150664 | 478006 | 9302808 | 479682 | 29982 | 2 | |
| QML1 | 800 | ##### | 10:0 | 1798 | 3 | 15000 | 11061 | 11863 | 37386 | 6145 | 2525 | 36203 | 2376 | 151 | 2 | |
| QML1 | 800 | ##### | 10:0 | 1798 | 4 | 15000 | 13873 | 14073 | 4186589 | 835675 | 0 | 4159757 | 569 | 40 | 3 | |
| QML1 | 800 | ##### | 11:0 | 28928 | 0 | 10000 | 9972 | 9975 | 57745022 | 0 | 0 | 57744539 | 294 | 92 | 48 | |
| QML1 | 800 | ##### | 11:0 | 28928 | 1 | 15000 | 14687 | 14694 | 2688933 | 539818 | 0 | 2638670 | 2285 | 189 | 31 | |
| QML1 | 800 | ##### | 11:0 | 28928 | 2 | 15000 | 2200 | 3506 | 26619240 | 29014948 | 8186300 | 1.27E+08 | 8011007 | 500717 | 31 | |
| QML1 | 800 | ##### | 11:0 | 28928 | 3 | 15000 | 2240 | 3096 | 560717 | 123511 | 41705 | 564050 | 60376 | 3820 | 33 | |
| QML1 | 800 | ##### | 11:0 | 28928 | 4 | 15000 | 13031 | 14475 | 54915056 | 10960000 | 0 | 54557571 | 6975 | 487 | 38 | |
| QML1 | 800 | ##### | 19:0 | 1584 | 0 | 10000 | 9975 | 9975 | 2142890 | 0 | 0 | 2142863 | 3 | 2 | 1 | |
| QML1 | 800 | ##### | 19:0 | 1584 | 1 | 15000 | 14693 | 14694 | 164143 | 32961 | 0 | 161439 | 55 | 5 | 1 | |
| QML1 | 800 | ##### | 19:0 | 1584 | 2 | 15000 | 3505 | 3506 | 3834660 | 1002494 | 0 | 3835563 | 1 | 1 | 1 | |
| QML1 | 800 | ##### | 19:0 | 1584 | 3 | 15000 | 9002 | 9674 | 20267 | 3600 | 1470 | 19101 | 1983 | 125 | 1 | |
| QML1 | 800 | ##### | 19:0 | 1584 | 4 | 15000 | 14474 | 14595 | 1857590 | 370519 | 0 | 1844758 | 127 | 10 | 2 | |

# Some Common Analysis

- Who is using the bufferpool?

| BASE_NAME | PAGESET_ | BUFFERPOOL_ID |
|---|---|---|
| XMITQ1 | 2 | 2 |
| SYSTEM.ADMIN.CHANNEL.EVENT | 2 | 2 |
| REPLY_Q_1 | 2 | 2 |

# Some Common Analysis

- Long Latching:

| A | B | C | D | E | F |
|---|---|---|---|---|---|
| QMGR | LONGEST_LATCH | MAX_LATCH_WAIT_ | MAX_LATCH_WAIT_II | START_TIME_TIME | |
| QML1 | 0000000045702C28 | 938725 | 24 | 13:19:20,816071 | |
| QML1 | 0000000045702C28 | 929327 | 24 | 13:19:26,184211 | |
| QML1 | 0000000045702C28 | 928027 | 24 | 13:19:27,066160 | |
| QML1 | 000000007E7684A8 | 855952 | 24 | 13:19:20,327533 | |
| QML1 | 0000000045702C28 | 837519 | 24 | 13:19:22,095385 | |
| QML1 | 0000004806A00920 | 835626 | 24 | 13:19:24,936686 | |
| QML1 | 0000000045702C28 | 767101 | 24 | 13:19:39,856699 | |
| QML1 | 0000000045702C28 | 684788 | 24 | 13:19:21,996386 | |
| QML1 | 0000000045702C28 | 596139 | 24 | 13:19:35,333268 | |
| QML1 | 0000000045702C28 | 496932 | 24 | 13:19:23,312622 | |
| QML1 | 0000000045702C28 | 481161 | 24 | 13:19:46,452283 | |
| QML1 | 0000000045702C28 | 471263 | 24 | 13:19:21,597983 | |
| QML1 | 0000000045702C28 | 396968 | 24 | 13:19:30,589287 | |

# Queries against the data

- Reading a million-plus row report for potential issues is impossible
  - With V7.0.1 we developed a series of searches that worked well against the task report
  - Quit working with V7.1 because the format changed dramatically
- Using queries to find things which might be problems

# Some queries I have found useful (to date)

- Looking for skipped or expired messages?
  - SELECT  LPAR, QMgr, Correlation,Base_Name from MQSMF.WQ WHERE Get_Messages_Skipped_Count >0;
  - SELECT  LPAR, QMgr, Correlation,Base_Name from MQSMF.WQ WHERE Get_Messages_Expired_Count >0;

- Put to waiting getter active on a queue?
  - SELECT * from MQSMF.WQ   WHERE LPAR = ‘MPX1' AND "Base_Name" = ‘LYNS.TEST.QUEUE' AND "Put_Waiting_Getter_Count" > 0 ;

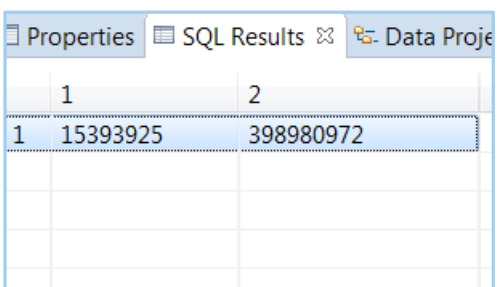
# Some queries I have found useful (to date)

- How many transactions had unfulfilled MQGETs?
  - SELECT QMGR, Base_Name, Get_Valid, Get_Count, Get_Invalid from MQSMF.WQ where ( GET_Valid < Get_Count and Base_Name= ‘LYN.TEST.Q2');

| QMGR | BASE_NAME | GET_VALID | GET_COUNT | GET_INVALID |
|---|---|---|---|---|
| QML2 | LYN.TEST.Q2 | 897 | 21529 | 0 |
| QML2 | LYN.TEST.Q2 | 929 | 21328 | 0 |
| QML2 | LYN.TEST.Q2 | 920 | 21419 | 0 |
| QML2 | LYN.TEST.Q2 | 1012 | 23133 | 0 |
| QML2 | LYN.TEST.Q2 | 329 | 13718 | 0 |
| QML2 | LYN.TEST.Q2 | 1099 | 23601 | 0 |
| QML2 | LYN.TEST.Q2 | 1070 | 23942 | 0 |
| QML2 | LYN.TEST.Q2 | 1043 | 23624 | 0 |

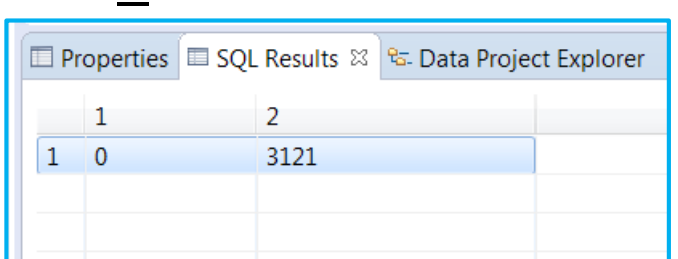
# Some queries I have found useful (to date)

- How many valid MQGETs were from a queue?
  - SELECT SUM(Get_Valid), SUM(Get_Count) from MQSMF.WQ where ( GET_Valid < Get_Count and Base_Name= ‘LYNE.QUEUE.2');
  - Results - Column 1 the number of valid gets, Column 2 is total get requests:



# Some queries I have found useful (to date)

- What was my largest message size retrieved for this queue?
  - SELECT MAX(Get_Max_Msg_Size) from MQSMF.WQ where (Base_Name= ‘LYNS.TEST.QUEUE');
  - Result was 11,189 (application people insisted it was 3,800)
- How many MQPUTs and MQPUT1s were completed?
  - SELECT SUM ( Put_Count), SUM (Put1_Count) from MQSMF.WQ where ( Base_Name = ‘LYNS.TEST.QUEUE' );
  - Results:



# Useful Queries - How much are my puts and gets costing?

- Query to get total costs for MQGETs and MQPUTs
  - SELECT SUM (Get_Count), SUM (Get_CT_us), SUM (Total_Valid_Gets),
    SUM (Total_Bytes_Get),
    SUM (Put_Count), SUM (Put_CT_us), SUM (Put1_Count),
    SUM (Put1_CT_us), SUM (Total_Valid_Puts), SUM (Total_Bytes_Put)
    FROM MQSMF.WQ
    WHERE (Base_Name = 'ELKINSC.SHARED.QUEUE' AND
    QMGR = 'QML1');

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 204808121 | 1181322809 | 9173709 | 15415705192 | 0 | 0 | 0 | 0 | 0 | 0 |

# Useful Queries - How much are my puts and gets costing?

- The raw sums are not all that useful by themselves
- But when averaged and used for comparisons, they can be

| Queue Name | Queue Manager | Queue Type | Average CPU for Valid MQGET | Average CPU for Valid MQPUT |
|---|---|---|---|---|
| ELKINSC.SHARED.QUEUE | QML1 | SHARED | 128.77 | 0 |
| ELKINSC.SHARED.QUEUE | QML2 | SHARED | 245.67 | 0 |
| ELKINSC.SHARED.QUEUE | QML3 | SHARED | 0 | 18.42 |
| ELKINSC.SHARED.QUEUE | QML4 | SHARED | 0 | 30.83 |
| | | | | |
| Sum FOR SHARED QUEUE | | | 176.01 | 24.6 |
| | | | | |
| SYSTEM.CLUSTER.TRANSMIT.QUEUE | QML1 | PRIVATE | 21.15 | 51.76 |
| SYSTEM.CLUSTER.TRANSMIT.QUEUE | QML2 | PRIVATE | 13.13 | 45.85 |
| SYSTEM.CLUSTER.TRANSMIT.QUEUE | QML3 | PRIVATE | | |
| SYSTEM.CLUSTER.TRANSMIT.QUEUE | QML4 | PRIVATE | | |
| | | | | |
| SUM FOR CLUSTER TRANSMIT QUEUE | | | 17.91 | 49.37 |

# And can surprise you!

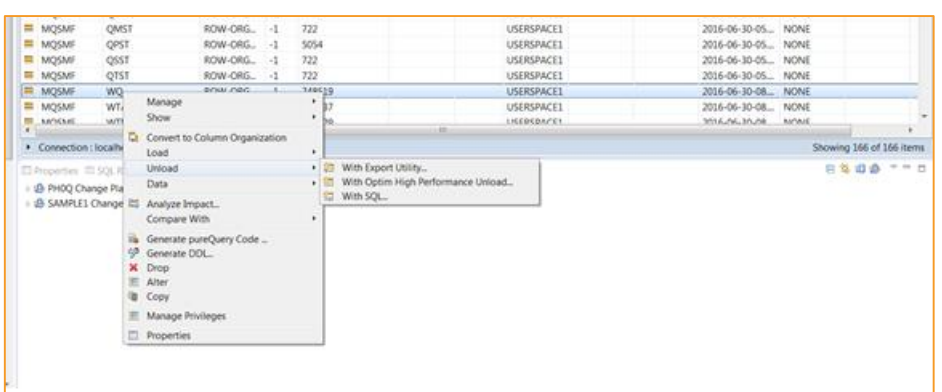
- SELECT QMgr, Interval_Start_Date, Interval_Start_Time,
  Interval_Duration, Checkpoints, Log_CI
  FROM MQSMF.QJST;

Properties | SQL Results | Data Project Explorer

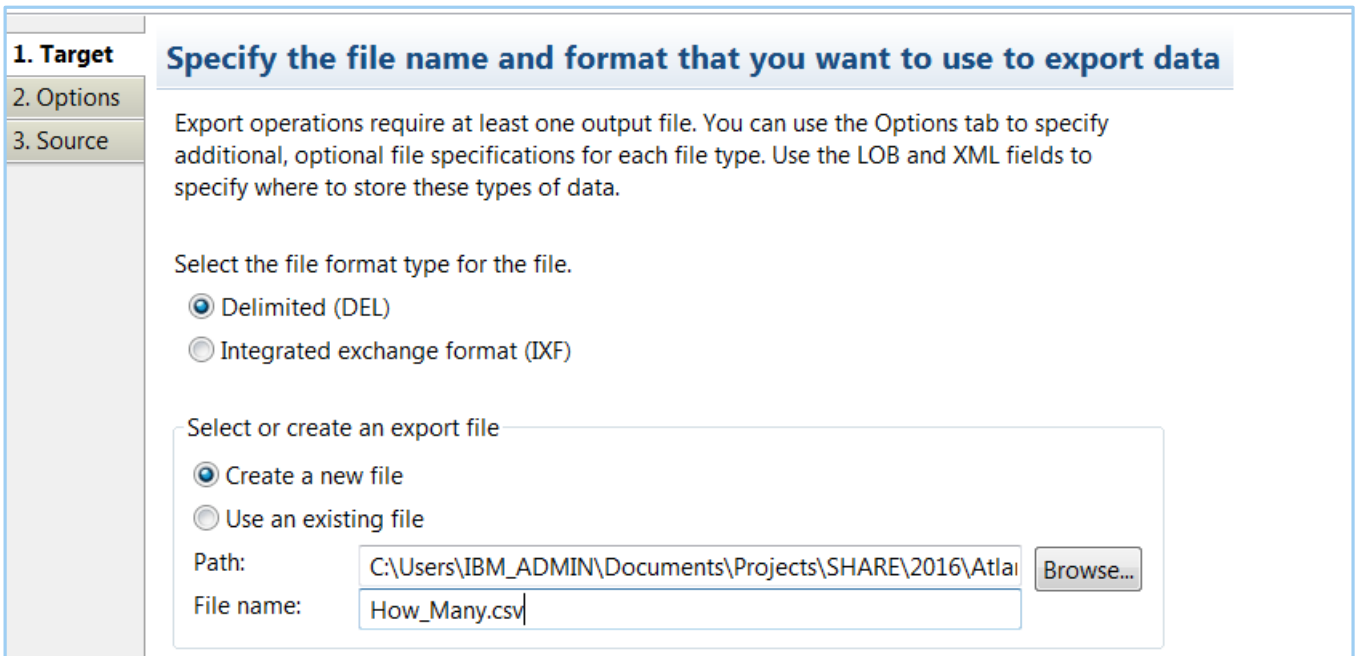
| | QMGR | INTERVAL_START_DATE | INTERVAL_START_TIME | INTERVAL_DURATION | CHECKPOINTS | LOG_CI |
|---|---|---|---|---|---|---|
| 1 | QML1 | 2016-09-12 | 11:29:55,926548 | 59 | 1 | 7709 |
| 2 | QML1 | 2016-09-12 | 11:30:55,695439 | 59 | 52 | 243762 |
| 3 | QML1 | 2016-09-12 | 11:31:55,464300 | 59 | 53 | 242837 |
| 4 | QML1 | 2016-09-12 | 11:32:54,742262 | 60 | 52 | 247384 |
| 5 | QML1 | 2016-09-12 | 11:33:55,002061 | 59 | 53 | 242765 |
| 6 | QML1 | 2016-09-12 | 11:34:54,417852 | 60 | 51 | 241894 |
| 7 | QML1 | 2016-09-12 | 11:35:54,539833 | 59 | 0 | 0 |
| 8 | QML1 | 2016-09-12 | 11:36:54,308729 | 59 | 0 | 0 |

# Queries – warnings and lessons learned

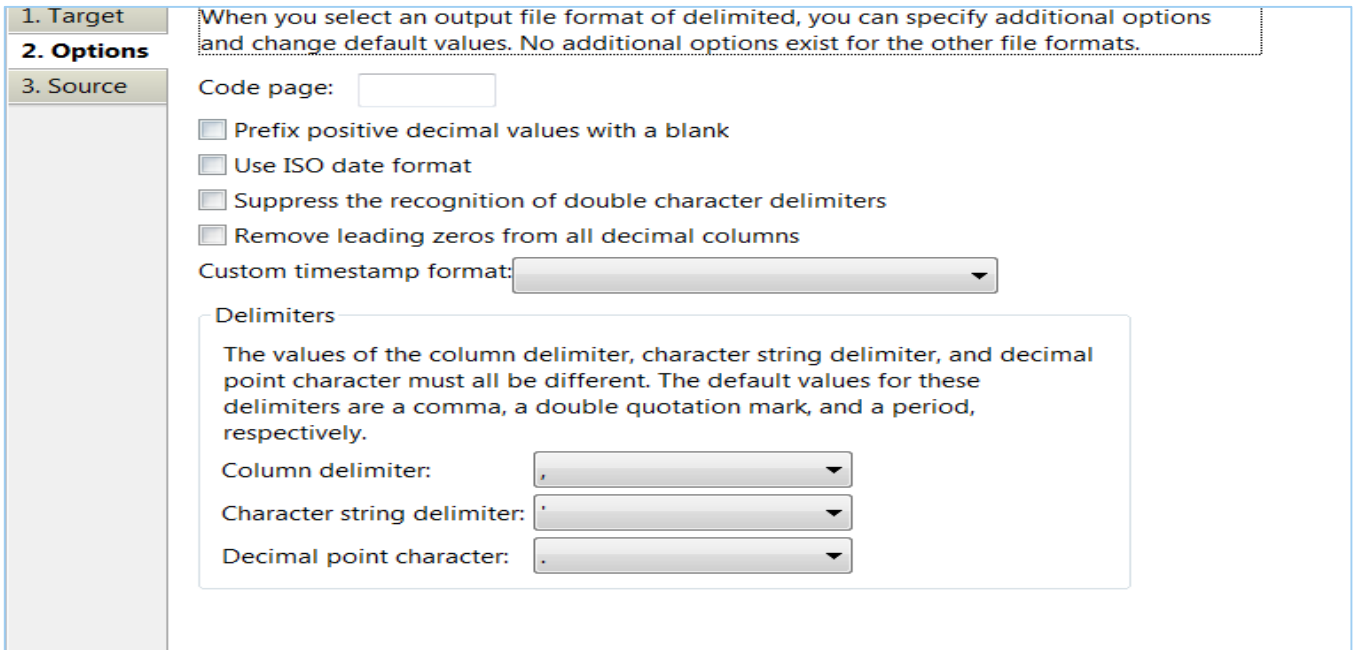
- Using Data Studio
  - Makes things easy for those of us who are not very SQL literate
  - Single quotes are typically used for literals
  - A query defaults to 500 rows
    - If you need to see more, use an EXPORT
- Using an EXPORT



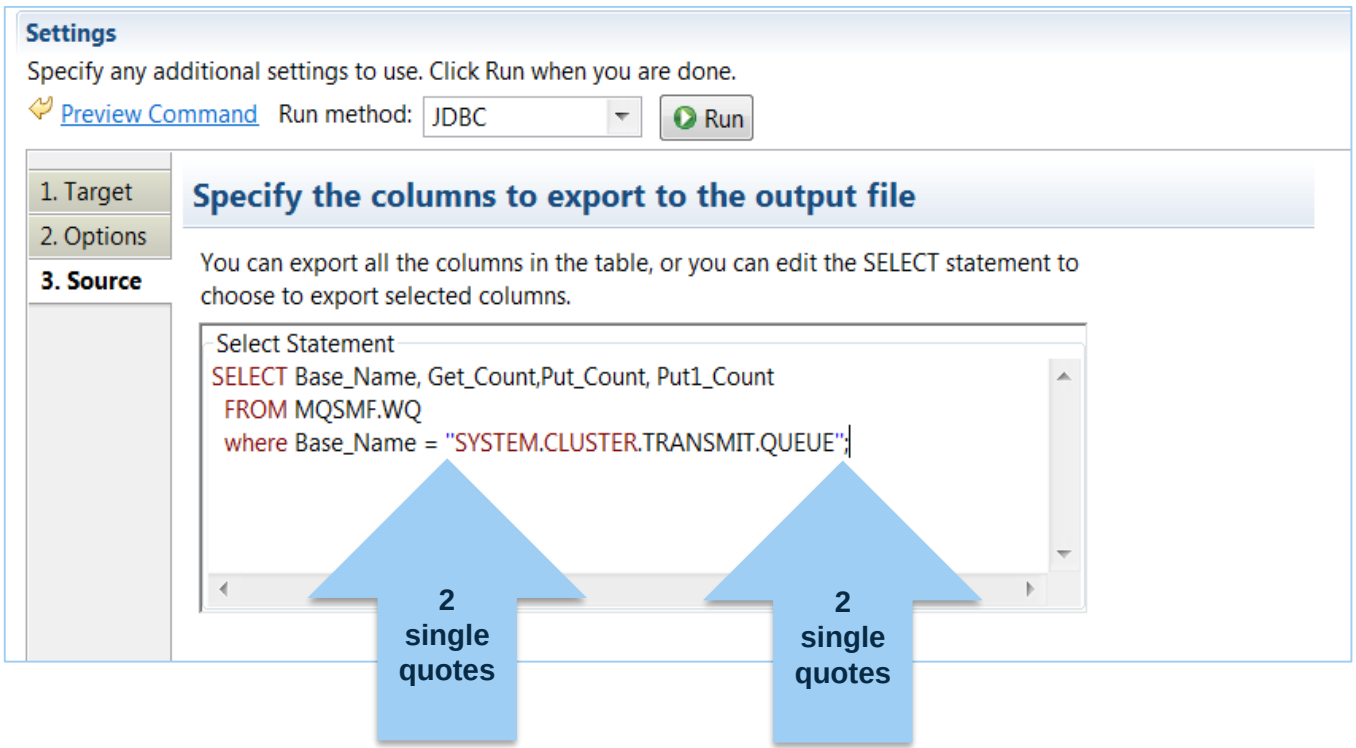
# Using an Export - continued



# Using an Export - continued



# Using an Export - continued



# The Export Command generated

```
CALL SYSPROC.ADMIN_CMD(
'EXPORT TO "C:\Users\IBM_ADMIN\Documents\Projects\SHARE\2016\Atlanta\How_Many.csv"
OF DEL MODIFIED BY COLDEL, CHARDEL'''' DECPT.
MESSAGES ON SERVER
SELECT Base_Name, Get_Count,Put_Count, Put1_Count
  FROM MQSMF.WQ
  where Base_Name = ''SYSTEM.CLUSTER.TRANSMIT.QUEUE'';' );
```

# Results of the export (end of CSV file)

| | | | | |
|---|---|---|---|---|
| 52432 | 'SYSTEM.CLUSTER.TRANSMIT.QUEUE ' | 0 | 1263 | 0 |
| 52433 | 'SYSTEM.CLUSTER.TRANSMIT.QUEUE ' | 6047 | 0 | 0 |
| 52434 | 'SYSTEM.CLUSTER.TRANSMIT.QUEUE ' | 6184 | 0 | 0 |
| 52435 | 'SYSTEM.CLUSTER.TRANSMIT.QUEUE ' | 6154 | 0 | 0 |
| 52436 | 'SYSTEM.CLUSTER.TRANSMIT.QUEUE ' | 6062 | 0 | 0 |
| 52437 | 'SYSTEM.CLUSTER.TRANSMIT.QUEUE ' | 0 | 432 | 0 |
| 52438 | 'SYSTEM.CLUSTER.TRANSMIT.QUEUE ' | 0 | 709 | 0 |
| 52439 | 'SYSTEM.CLUSTER.TRANSMIT.QUEUE ' | 0 | 1081 | 0 |
| 52440 | 'SYSTEM.CLUSTER.TRANSMIT.QUEUE ' | 0 | 468 | 0 |
| 52441 | 'SYSTEM.CLUSTER.TRANSMIT.QUEUE ' | 0 | 1174 | 0 |
| 52442 | 'SYSTEM.CLUSTER.TRANSMIT.QUEUE ' | 0 | 784 | 0 |

# New - Queries used to generate ‘report like’ sheets

- To generate a bufferpool report spreadsheet:

```
Select Date,
 Time,  LPAR,  QMgr,  MQ_Version,  Interval_Start_Date, Interval_Start_Time, Interval_Duration,
 BufferPool,  Buffer_Count,  Lowest_Stealable,

 /* The next statement calulates the greatest number of pages used during the interval. */
 INT(Buffer_Count - Lowest_Stealable) AS Highest_Used,

 /* The next statement calculates the highest used pages as a percentage of the total allocated for the SMF interval */
 DEC( (Buffer_Count - Lowest_Stealable) * 100.0 /DEC(Buffer_Count,8,2),8,2) AS Highest_Used_Percent,

 Current_Stealable, Getp_Old_Requests, Getp_New_Requests, DASD_Read, Set_Write_Pages,
 Pages_Written,  DASD_Write,  Sync_Writes,
 Defer_Write_THold_Reached, Sync_Write_THold_Reached,
 Buffer_Steals,  Buffer_Steals_Hash_Changes,
 Suspend_No_Buffers,
 LOC,
 FIX
FROM MQSMF.QPST
WHERE (QMGR = ''QML1'' and Buffer_Count>0)
```

# Buffer Manager spreadsheet – some of the data

| Interval Duration (seconds) | Bufferpool | Buffer Count | Lowest Stealab | Highest Used | Higest used (Percentage) | Current Stealab | Getpage Old reques | Getpage New reques | DASD Reads | Set Write Pages | Pages Written | DASD Writes | Sync Writes | Deferred Write Threshold reache |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1800 | 1 | 90000 | 13359 | 76641 | 85.15 | 14786 | 4528574 | 3097442 | 1175012 | 4942446 | 1597943 | 99908 | 35 | 902 |
| 1787 | 1 | 90000 | 13370 | 76630 | 85.14 | 18304 | 3755002 | 3063077 | 549347 | 4102442 | 1049826 | 66061 | 466 | 635 |
| 1769 | 1 | 90000 | 13380 | 76620 | 85.13 | 87546 | 3550094 | 2257593 | 950213 | 3077643 | 772478 | 48757 | 504 | 410 |
| 1788 | 1 | 90000 | 13381 | 76619 | 85.13 | 20338 | 4060327 | 3150003 | 1128696 | 4132427 | 1317630 | 83030 | 714 | 932 |
| 1788 | 1 | 90000 | 13382 | 76618 | 85.13 | 14804 | 3953180 | 3073483 | 863273 | 4265688 | 1277742 | 80317 | 483 | 935 |
| 1802 | 1 | 90000 | 13384 | 76616 | 85.12 | 18698 | 4225953 | 2587521 | 1406145 | 4008608 | 1254734 | 78460 | 37 | 793 |
| 1800 | 1 | 90000 | 13393 | 76607 | 85.11 | 14790 | 3681075 | 2733307 | 617118 | 4240813 | 1252508 | 78716 | 459 | 725 |
| 1811 | 1 | 90000 | 13394 | 76606 | 85.11 | 20949 | 4020174 | 2449481 | 1387535 | 3733815 | 1181575 | 73877 | 29 | 734 |
| 1786 | 1 | 90000 | 13399 | 76601 | 85.11 | 18320 | 3753811 | 2499659 | 1187206 | 3694460 | 1202872 | 75232 | 51 | 722 |
| 1783 | 1 | 90000 | 13399 | 76601 | 85.11 | 15555 | 4379280 | 2523709 | 1196764 | 4348455 | 1226417 | 76688 | 33 | 940 |

# New - Queries used to generate ‘report like’ sheets

- To generate a log manager report spreadsheet:

```
SELECT
LPAR,  QMgr,  MQ_Version,  Interval_Start_Date, Interval_Start_Time,
Interval_Duration,
Unavailable_Buffer_Count, Log_Read_Output_Buffer, Log_Read_Active_Log, Log_Read_Archive_Log,

/* The next statement calculates the total number of log reads completed during the interval */
INT(Log_Read_Output_Buffer + Log_Read_Active_Log + Log_Read_Archive_Log) AS TOTAL_LOG_READS,

Tape_Contention_Delays, Checkpoints, Log_CI,

/* The next statement calculates the MB per second written during the interval */
DEC(ROUND((((Log_CI*4)/(1024.00))/(Interval_Duration)),2),6,2),

IO_Total_Time_1_1_us, IO_Total_Suspend_Time_1_1_us, IO_Max_Duration_1_1_us,
IO_Max_Log_ID_1_1, IO_Max_Suspend_Dur_1_1_us, IO_Max_Suspend_Time_1_1_Date,
IO_Max_Suspend_Time_1_1_Time,IO_Max_Suspend_Log_ID_1_1,
IO_Total_Time_1_2_us, IO_Total_Suspend_Time_1_2_us,
IO_Max_Duration_1_2_us, IO_Max_Log_ID_1_2,
IO_Max_Suspend_Dur_1_2_us, IO_Max_Suspend_Time_1_2_Date,
IO_Max_Suspend_Time_1_2_Time, IO_Max_Suspend_Log_ID_2_1
FROM MQSMF.QJST
WHERE (QMGR = "QML1")
```

# Log Manager spreadsheet – some of the data

| INTERVAL_DURATION | UNAVAILABLE_BUFFER_COUNT | LOG_READ_OUTPUT_BUFFER | LOG_READ_ACTIVE_LOG | LOG_READ_ARCHIVE_LOG | TOTAL_LOG_READS | TAPE_CONTENTION_DELAYS | CHECKPOINTS | LOG_CI | MB_PER_SECOND |
|---|---|---|---|---|---|---|---|---|---|
| 1795 | 0 | 623 | 4461 | 0 | 5084 | 0 | 10 | 2821634 | 6.14 |
| 1789 | 0 | 417 | 3337 | 0 | 3754 | 0 | 9 | 2825604 | 6.17 |
| 1796 | 0 | 540 | 2638 | 0 | 3178 | 0 | 12 | 3453542 | 7.51 |
| 1792 | 0 | 511 | 2307 | 0 | 2818 | 0 | 10 | 2972254 | 6.48 |
| 1789 | 0 | 449 | 2082 | 0 | 2531 | 0 | 10 | 2818718 | 6.15 |
| 1773 | 0 | 392 | 1952 | 0 | 2344 | 0 | 12 | 3445866 | 7.59 |
| 1798 | 0 | 424 | 1835 | 0 | 2259 | 0 | 10 | 3061346 | 6.65 |
| 1787 | 0 | 518 | 1725 | 0 | 2243 | 0 | 8 | 2460906 | 5.38 |
| 1797 | 0 | 381 | 1824 | 0 | 2205 | 0 | 14 | 4037442 | 8.78 |
| 1797 | 0 | 581 | 1597 | 0 | 2178 | 0 | 9 | 2778470 | 6.04 |
| 1791 | 0 | 306 | 1841 | 0 | 2147 | 0 | 11 | 3259292 | 7.11 |
| 1791 | 0 | 424 | 1689 | 0 | 2113 | 0 | 8 | 2451898 | 5.35 |

# New - Queries used to generate ‘report like’ sheets

- To generate a message manager report spreadsheet:

```
Select Date,
 Time, LPAR, QMgr, MQ_Version, Interval_Start_Date, Interval_Start_Time, Interval_Duration,
 Open , Close ,  Get ,  Put , Put1 ,

 /* The next statement calulates the total number of put-type requests during the itnerval. */
 INT(Put + Put1) AS Total_Puts,

 Inq,  Inql, Set, Endw, Close_Handles , Sub , SubReq , CB ,  CTL , Status ,  Pubs  ,

/* The next statement calulates the total number of API requests during the itnerval. */

INT(Open + Close + Get + Put + Put1 + Inq + Inql + Set + Endw + Close_Handles + Sub +
    SubReq + CB + CTL + Status + Pubs) AS Total_APIs
FROM MQSMF.QMST
WHERE (QMGR = ''QML1'')
```

# Message Manager spreadsheet – some of the data

| Interval Start Time | Interval Duration (seconds) | Opens | Closes | Gets | Puts | Put1s | Total Put and Put1 | Inq | Inq1 | Sets | Endws | Close Handles | Subs | Subrqs | Callbacks | CTLs | Status | Pubs | Total API Requests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| '17:26:25 | 1788 | 133418 | 130388 | 531761 | 436343 | 0 | 436343 | 801 | 0 | 0 | 0 | 0 | 0 | 0 | 17702 | 51084 | 0 | 0 | 1301497 |
| '19:25:55 | 1800 | 122757 | 119906 | 516266 | 466991 | 0 | 466991 | 1035 | 0 | 0 | 0 | 0 | 0 | 0 | 17039 | 49662 | 0 | 0 | 1293656 |
| '17:50:40 | 1791 | 135043 | 131332 | 515275 | 420723 | 0 | 420723 | 936 | 0 | 0 | 0 | 0 | 0 | 0 | 20885 | 59920 | 0 | 0 | 1284114 |
| '17:56:13 | 1796 | 123061 | 120178 | 538814 | 439458 | 0 | 439458 | 929 | 0 | 0 | 0 | 0 | 0 | 0 | 14517 | 41819 | 0 | 0 | 1278776 |
| '17:15:23 | 1786 | 134208 | 131756 | 513848 | 423742 | 0 | 423742 | 1058 | 0 | 0 | 0 | 0 | 0 | 0 | 15296 | 44041 | 0 | 0 | 1263949 |
| '21:55:19 | 1790 | 119423 | 116761 | 552011 | 407681 | 0 | 407681 | 1131 | 0 | 0 | 0 | 0 | 0 | 0 | 15278 | 45281 | 0 | 0 | 1257566 |
| '21:25:25 | 1794 | 123045 | 120359 | 526620 | 413822 | 0 | 413822 | 978 | 0 | 0 | 0 | 0 | 0 | 0 | 17198 | 49550 | 0 | 0 | 1251572 |
| '17:20:52 | 1787 | 126553 | 123691 | 515540 | 425578 | 0 | 425578 | 943 | 0 | 0 | 0 | 0 | 0 | 0 | 14095 | 40276 | 0 | 0 | 1246676 |
| '17:45:10 | 1790 | 127985 | 124277 | 502269 | 409181 | 0 | 409181 | 1229 | 0 | 0 | 0 | 0 | 0 | 0 | 20140 | 58516 | 0 | 0 | 1243597 |
| '16:56:25 | 1800 | 121192 | 118505 | 523428 | 418266 | 0 | 418266 | 931 | 0 | 0 | 0 | 0 | 0 | 0 | 12798 | 37570 | 0 | 0 | 1232690 |

# Other discoveries – Or why didn't I know this?

- I routinely ignored the 'seconds' fields on a lot of queries because for the vast majority of the time the time was not creeping into seconds…but….
  - When I added seconds on latches I found extraordinary things

| CORREL | LONGEST_LATCH (Addr) | MAX_LATCH_WAIT_TIME_S | MAX_LATCH_WAIT_TIME_US | MAX_LATCH_WAIT_ID |
|---|---|---|---|---|
| D1EDA3C4 | 0000004807D690E | 5 | 731717 | 19 |
| D1EDA3C4 | 000000480691180 | 3 | 394963 | 19 |
| D1EDA3C4 | 0000004807B9C0 | 2 | 769386 | 19 |
| D1E9EABI | 000000480690BD | 2 | 701325 | 19 |
| D1E9EABI | 000000480690BD | 2 | 701325 | 19 |
| D1E9EABI | 000000480690BD | 2 | 701325 | 19 |
| D1ECF994 | 000000480690BD | 1 | 701842 | 19 |
| D1ECF994 | 000000480690BD | 1 | 701842 | 19 |
| D1ECF994 | 000000480690BD | 1 | 701842 | 19 |
| D1ECF994 | 000000480690BD | 1 | 701842 | 19 |

# New: Performance and Tuning Workshop

- New 2-day workshop using mqsmfcsv and MP1B
  - "Alpha" was run recently
- For deeper analysis of MQ on z/OS
- To help you do your own analysis

Workshop outline:

- Introduction
- Looking into the JES logs
- The MQ Statistics data, interpretation and use
- The MQ Accounting data, interpretation and use
- Tools used for processing the data

# Summary

- MQ’s SMF provides much insight for tuning and planning
- Experience has been needed to analyse data
- The discussion of tooling and queries here should enable better self-service

**Any questions?**