MQPERF1

MQ Statistics and MP1B – More detail on some traditional areas

MP1B

- This SupportPac processes the MQ SMF data into:
  - Report format
  - CSV files
- Format of the output has changed over the years
- Originally owned and managed by Colin Paice (now retired)
- Now kept by Gwydion Tudur

MP1B – Contents

- Three programs
  - MQSMF
    - Formats the MQ SMF records into reports and CSV files
    - Produces messages about issues spotted in the SMF data
      - Very helpful for first time users
    - Source is not delivered
  - OEMPUT
    - Sample MQ program to exercise most of the APIs and track costs
    - Very helpful after upgrades, new implementations, big changes to infrastructure
    - Source not delivered
  - MQCMD
    - Sample program to issue MQ commands and capture response

MQSMF – the SMF Post processing Program

- This is the place we all start!
- The output from MQSMF looks like there (there are more files)

SDSF JOB DATA SET DISPLAY - JOB ELKINS3Q (JOB06020) LINE 1-18 (53)
COMMAND INPUT ===> SCROLL ===> CSR

NP	DDNAME	StepName	ProcStep	DSID	Owner	C	Dest	Rec-Cnt	Page
	JESMSGLG	JES2		2	ELKINSC	O	LOCAL	20	
	JESJCL	JES2		3	ELKINSC	O	LOCAL	70	
	JESYSMSG	JES2		4	ELKINSC	O	LOCAL	165	
	MESSAGE	S1		102	ELKINSC	O	LOCAL	430	
	BUFF	S1		103	ELKINSC	O	LOCAL	49,415	
	BUFFCSV	S1		104	ELKINSC	O	LOCAL	9,722	
	DATA	S1		105	ELKINSC	O	LOCAL	1,526	
	CF	S1		106	ELKINSC	O	LOCAL	49	
	CFCSV	S1		107	ELKINSC	O	LOCAL	13	
	DB2	S1		108	ELKINSC	O	LOCAL	2,507	
	EOJ	S1		109	ELKINSC	O	LOCAL	407	
	LOCK	S1		110	ELKINSC	O	LOCAL	246	
	LOG	S1		111	ELKINSC	O	LOCAL	1,549	
	LOGCSV	S1		112	ELKINSC	O	LOCAL	32	
	MSGM	S1		113	ELKINSC	O	LOCAL	2,836	
	MSGMCSV	S1		114	ELKINSC	O	LOCAL	811	
	SMDS	S1		116	ELKINSC	O	LOCAL	15,414	
	TASKSUM	S1		117	ELKINSC	O	LOCAL	24	

MP1B – the Message Output

- When you begin looking at the MQ SMF data, looking at the MESSAGE output file can be helpful
  - The messages produced may vary based on the settings used
  - As an example these messages indicate bufferpool stress that needs investigation

```
MQQPST00W MPX1,QML3,2018/09/05,16:03:04,VRM:900, BP 10 Many(5979) buffers writte
MQQPST02S MPX1,QML3,2018/09/05,16:03:04,VRM:900, BP 10 Filled many(373) times.
l may be too small
MQQPST04E MPX1,QML3,2018/09/05,16:03:04,VRM:900, BP 10 Many (6022) pages read fr
ffer pool may be too small
MQQJST11W MPX1,QML5,2018/09/05,16:03:05,VRM:905, logging rate is low  0 < 50 MB/
```

MP1B – SYSPRINT

- This output file has the MQSMF runtime characteristics

```
Compiled Aug 12 2015 16:50:51.
buffer: SMF_Interval_time 1
buffer: Debug 1
buffer: Detail 20
kw UseTaskLocalTime          0 -Convert task start times to local time
kw SMDSWriteTime          1000 -SMDS average Write time theshold in microseconds
kw SMDSReadTime           1000 -SMDS average Read time theshold in microseconds
```

- A copy of some of the serious messages

```
6021 MQTASK36W Did BP 11 fill up for puts to ELKINSC.TEST.PS11
6023 MQTASK16E long latch wait       1854, Name BMXL3    |CFMTODO  |SRH1_L1
6023 MQTASK15W longest latch wait address 0000000013bbbb10 000000001854
6075 MQTASK16S long latch wait      66039, Name BMXL3    |CFMTODO  |SRH1_L1
6075 MQTASK15S longest latch wait address 0000000013bbbb10 000000066039
6075 MQTASK36W Did BP 20 fill up for puts to ELKINSC.TEST.PS20
6129 MQTASK16E long latch wait       1443, Name BMXL2    |RMCRMST  |RLMARQC
6129 MQTASK16S long latch wait      54356, Name BMXL3    |CFMTODO  |SRH1_L1
6129 MQTASK15S longest latch wait address 0000000013bbbb10 000000054356
```

MP1B – SYSPRINT Continued

- Finally the number, type and subtype of the MQ SMF records processed

```
Summary of MQ SMF records and subtypes found
============================================
SMF type 115 subtype   1, record count     405 System statistics(1)
SMF type 115 subtype   2, record count     405 System statistics(2)
SMF type 115 subtype   5, record count     404 Storage statistics
SMF type 115 subtype   6, record count     404 Storage detail statistics
SMF type 115 subtype   7, record count     405 Storage summary statistics
SMF type 115 subtype 201, record count     405
SMF type 115 subtype 215, record count     405 Buffer manager extension
SMF type 115 subtype 231, record count     401 Chinit statistics
SMF type 116 subtype   0, record count      66 Accounting class(1)
SMF type 116 subtype   1, record count    3356 Accounting class(3)
SMF type 116 subtype  10, record count      78 Channel accounting data
******************************** BOTTOM OF DATA ********************************
```

MP1B – SMF Data output

- Output files ending in CSV are the comma separated values form of the data

```
MVS,QM,Date,Time,BP,size,lowest_free,highest_used,used_now,%hfull,SOS,#_sync_wri
ites,#_write_I/Os,Location,PageClas
MPX1,QML3,2018/09/05,14:03:28,   0,50000,49983,    17,    17,     0,     0,     0,
MPX1,QML3,2018/09/05,14:03:28,   1,20000,19999,     1,     1,     0,     0,     0,
MPX1,QML3,2018/09/05,14:03:28,   2,50000,49996,     4,     4,     0,     0,     0,
MPX1,QML3,2018/09/05,14:03:28,   3,20000,  4793,15207,15207,    76,     0,     0,
```

- Output files without the CSV are the report format

```
Buffer statistics
MPX1,QML3,2018/09/05,14:03:28,VRM:900,
  From 2018/09/05,14:02:27.567654 to 2018/09/05,14:03:28.385141, duration    61
= BPool    0, Size    50000,%full now  0, Highest %full  0, Disk reads     0
 > 00 Buffs     50000  Low     49983  Now     49983  Getp        10  Getn         0
   00 Rio           0  STW         8  TPW         0  WIO          0  IMW          0
   00 DWT           0  DMC         0  STL         0  STLA         0  SOS          0
   00 Below the bar   PAGECLAS 4KB
```

MP1B – A couple of warnings

- Each time MQ adds or alters the SMF data, MP1B must be updated to reflect those changes
  - Historically that has often meant that there can be a year (or more) between a new version of MQ and a new version of MP1B
    - HINT: It does no one any good for me to complain about this, customers need to!
  - Updated versions of MP1B continue to work with older (supported) MQ versions
  - Each new release of MP1B may change the layout and/or add output files for new SMF data
    - Occasionally this has happened between releases as well
    - You may see messages in SYSPRINT indicating missing DD statements when using a new version of MP1B

Looking at the Message Manager Output

- The Message Manager data does not usually indicate problems
  - It is helpful to track trends of use and capacity planning
    - Are the total MQPUT & MQPUT1 requests rising, and if so what is the rate?
    - Are my peak processing periods changing?
    - Are new verbs being used?
  - It is helpful when you inherit a queue manager and are unsure how it is being used.

```
MPX1,QML3,2018/11/13,13:13:09,VRM:900,
  From 2018/11/13,13:11:42.889304 to 2018/11/13,13:13:09.322980, duration    86 seconds.
   MQOPENs        35,   MQCLOSEs        34,   MQGETs   1640706,   MQPUTs       102
   MQPUT1s   1640625,   MQINQs         53,   MQSETs         0,   C ALL H        0
   MQSUBs          0,   MQSUBRQs        0,   MQCBs         34
   MQCTLs        242,   MQSTATs         0,   Publish        0
MPX1,QML3,2018/11/13,13:13:09,VRM:900, Get rate 19077/sec  Put+put1 rate 19078/sec
```

Message Manager CSV output

- The CSV output file contains the same data, but in a CSV format
  - Can be downloaded and used to create charts, etc.
  - Typically we look at the
    - Total PUTs (MQPUT + MQPUT1)
    - Check the ratio of MQPUT1 to MQPUT
      - MQPUT1 Abuse can be a CPU hog
    - Check the ratio of MQOPEN to MQPUTs
      - Some applications SHOULD be using MQPUT1 to save CPU
    - Total API Requests
    - Total GETs/PUTs
      - Excessive MQGETs can indicate polling style applications
        - MQGET with an appropriate wait interval can…you guessed it save CPU!!!
    - ‘New’ verbs
      - Some MQ for z admins have been surprised to discover they are doing Pub/Sub!
      - No indication in the statistics of Selector (Message Properties) use

Buffer Manager Output

- The Buffer Manager report has groups like this for each bufferpool defined to the queue manager:

```
= BPool  10, Size     1000,%full now 81, Highest %full 81, Disk reads     0
 > 10 Buffs     1000  Low      189  Now      189  Getp        1  Getn        0
   10 Rio          0  STW        0  TPW        0  WIO         0  IMW         0
   10 DWT          0  DMC        0  STL        0  STLA        0  SOS         0
   10 Below the bar   PAGECLAS 4KB
```

Buffer Manager CSV

- The buffer manager CSV file contains the same data in a CSV format
  - Useful for spreadsheet processing

So how do I know when I have a problem with Bufferpools?

- Even if the bufferpools are above the bar, there can still be issues
- Tuning is a matter of I/O avoidance when possible
- Short On Storage
  - The SOS (QPSTSOS) value is greater than zero
  - Zero free pages are available
  - Access to the bufferpool is suspended, until pages are freed
- Immediate Write
  - The immediate write count (QPSTIMW) is greater than zero
  - This is the number of actual write operations
- Synchronous Write Threshold
  - The synchronous write threshold (QPSTDMC) is greater than zero
  - The bufferpool is at 5% free pages or fewer
  - This is the number of time the condition is hit during the interval

So how do I know when I have a problem with Bufferpools?

- Asynchronous write threshold reached
  - The asynchronous write threshold (QPSTDWT) count is not zero
  - The threshold is at 15% free pages
  - For an on-line bufferpool, this can be an issue as I/O avoidance is the name of the game
  - For a batch bufferpool, this is expected

So how do I anticipate a problem with Bufferpools?

- Make sure there is adequate head room in the bufferpool
  - If an online bufferpool is approaching the asynchronous write threshold (15% free pages) regularly, then it may need to be expanded or queues moved
    - One ‘bad day’ for a single queue could mean trouble for any application using that pool
  - If ANY bufferpool is approaching the synchronous write threshold (5% free pages) regularly, it needs to be expanded or queues moved
  - A lightly loaded bufferpool is a happy bufferpool!
- Planning tips:
  - Look out for a change in message sizes
    - Sometimes not well communicated from application development
      - Does not typically cause an error
  - Look out for changes in usage patterns
    - Adding new locations
    - Connecting client application directly to z/OS
    - New applications

Log Manager Report

- The log manager report is incredibly detailed
- Just a part of the report from one interval looks like this

```
MPX1,QML1,2018/11/12,08:39:18,VRM:900,
  From 2018/11/12,08:38:08.821259 to 2018/11/12,08:39:18.054993, duration    69 seconds.
   Wait for buffers(should be 0):              0 out of         0, 0%
   Total Number of pages written:              4
   Number of pages written/sec:                0
   Amount of data written/sec:                 0 MB/Sec                          MPX1,QML1,2018/
   Total Number of write requests:             4
   Number of write requests/sec:               0
   Pages written per I/O:                      1
   Total number of read requests:              0
   Write_Wait          0, Write_Nowait        26, Write_Force          0, WTB          0
   Read_Stor           0, Read_Active          0, Read_Archive         0, TVC          0
   BSDS_Reqs           0, CIs_Created          0, BFWR                 4, ALR          0
   ALW                 0, CIs_Offload          0, LLCheckpoints        0
   Read delayed        0, Tape Lookahead       0, Lookahead Mount      0
   Write_Susp          4, Write_Reqs           4, CI_Writes            4
   Write_Serl          0, Write_Thrsh          0, Buff_Pagein          0
```

Log Manager Report – the fields and issues

- Wait for buffers – QJSTWRF – documented as ‘should be zero’
  - However, for many busy queue managers that count is almost never zero for a peak period
  - I (Lyn Elkins) tend not to take this so seriously, unless the number exceeds 100
- Reads
  - Reading the buffers, active and archive logs indicates that transactions are backing out work
  - And while logs are being read, there is no writing going on!
  - If this is rare, it can safely be ignored
  - If it is typical, investigation required
    - May need to gather the task accounting data to determine what task is doing this
    - Recently saw an issue with a new client attached application that was experiencing regular channel time outs
- Checkpoints
  - LOGLOAD – the queue manager attribute that controls the number of log records written before taking an internal checkpoint
  - Prior to V9, the number of checkpoints was only the count of those instances
  - Post V9, the number of checkpoints is the LOGLOAD generated checkpoints AND the log switch generated checkpoints
- Buff_Pagein – QJSTBPAG – number of times a log buffer had to be paged in
  - This is an indication that there is CPU constraint in the LPAR

QMGR Health – Log Manager – example from MQSMFCSV

- This view of the log manager data is emphasizing the number of READs, an indication of applications backout out an inflight transaction
  - In this sample, there were both buffer reads and active log reads
    - Need to look into applications to see why this is being done so often
  - Also examine high number of checkpoints

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

Log Manager Report - Continued

```
 _____,__ write requests,        CIs, Average I/O , After I/O   , pages/IO
                                      time in uSec, time in uSec,
 Log 1, 1 page          4,          4,         269,            1,        1 MPX1,QML1,2018/11/12,08:39:18,VRM:900,
 Standard deviation of first log, 1 page per I/O, response time +-      154
 Log 1, 1 page Longest I/O         275 at 2018/11/12,12:38:08.825946 UTC
 Log 1, 1 page Longest Request     277 at 2018/11/12,12:38:08.825946 UTC
Log write rate       0MB/s per copy                                    MPX1,QML1,2018/11/12,08:39:18,VRM:900,
Logger I/O busy : 0.00%
Logger task busy: 0.00%
```

Log Manager Report – the fields and issues

- Logger Task Busy
  - Information about how many microseconds the logger task was idle was added in V8, QJSTSLPTU
  - The task busy percentage is calculated based on the interval duration and QJSTSLPTU
  - If consistently above 95%, then workload should be examined
- Longest I/O time
  - This is the longest time it took to complete an I/O to the log
  - If this number is out of line with expectation and history, it should be investigated.

QMGR Health – More on Log I/O – example from MQSMFCSV

- In this example there are a number of very long log I/O response times
- Reported in microseconds, this is going as high an 1.4+ seconds – impacting persistent message speed.
- The average I/O time over the week was around 65,000 microseconds – so these are well out of line
- Not shown here was the log number, the long I/Os were not always on the same log - but many were
- This needs to be investigated by the folks who manage the I/O subsystem.

MB_PerSecond	IO_Total_Time_1_1_us	IO_Total_Suspend_Time_1_1_us	IO_Max_Duration_1_1_us
0.18	10597717	11065671	1434308
0.15	12716669	13221591	1390594
0.1	8684189	8952939	1340836
0.2	8898824	9208455	1003748
0.12	9603396	10015326	975297
0.14	13584386	14137813	958608
0.2	12086895	12575309	943756
0.13	8770048	9094084	933591
0.18	16134054	16813463	919142
0.17	11199830	11660753	842476
0.2	12952539	13415911	834920
0.2	14622726	15273655	781723
0.15	10658564	11090891	679185
0.11	9726687	10149635	677612
0.21	19876884	20659627	513114
0.21	13723385	14223804	447616
0.22	14733487	15284274	445473
0.19	14649385	15139950	433519

Summary

- MP1B is the first tool in looking at the SMF data
- For many queue managers regular examination of the ‘big three’ reports can be a leading indicator of tuning work that may be necessary, or tell you where the problems are
- But these are not the only reports that may be needed!