The Dark Side of Monitoring MQ – SMF 115 and 116 record reading and interpretation

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IBM – Advanced Technical Skills

Session Agenda

• Shameless Laziness
• Introduce the native audit capabilities of WMQ
• Discuss real-time monitoring of WMQ for z/OS
• Finally, an introduction to the dark arts – a quick view into SMF115 and 116
• Final shameless plug
Shameless Laziness

- This session is light on Auditing and Monitoring because
  - There was already a session (Monday at 3) covering Auditing and Monitoring
- This session immediately follows lunch
  - The presenter is not responsible for injuries that occur:
    - When you start to snore and the person beside you hits you
    - Your head hits the table
    - Or anything else for that matter

WMQ for z/OS and Auditing

- System Management Auditing needs
  - New Objects
  - Changed Objects
  - Updated Objects
WMQ for z/OS and Auditing - Notes

- WMQ V7 introduced command and configuration events for all platforms
- Enabled at the queue manager level

Enabling configuration Events

- Use the DISPLAY QMGR command to show the current configuration event setting
- If the display indicates disabled
- Use the ALTER QMGR command to set configuration events on
Configuration Events

- Once config events are enabled
  - Changes to the objects are recorded
    - On z/OS the messages will typically be persistent

<table>
<thead>
<tr>
<th>Queue name</th>
<th>Queue type</th>
<th>QoS deposit</th>
<th>Open input count</th>
<th>Open output</th>
<th>Current queue depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSTEM/ADMIN.ACTIVITY.QUEUE</td>
<td>Local</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SYSTEM/ADMIN.CHANNEL.EVENT</td>
<td>Local</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SYSTEM/ADMIN.COMMAND.EVENT</td>
<td>Local</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SYSTEM/ADMIN.COMMAND.QUEUE</td>
<td>Alias</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SYSTEM/ADMIN.COMMIT.EVENT</td>
<td>Local</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>SYSTEM/ADMIN.ERROR.EVENT</td>
<td>Local</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SYSTEM/ADMIN.QUERY.EVENT</td>
<td>Local</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>SYSTEM/ADMIN.TRACES.QUEUE</td>
<td>Local</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Configuration Events

- Messages not ‘human readable’
Configuration Events

- They can easily be displayed using MS0P Plug-In
  - Right click on the queue name and select ‘Format Event messages
  - Events and Statistics selection panel is used to select the messages to be formatted

```
Configuration Events

- The event messages are configured and can be examined to see the changes that have been made
```

```
Queue Manager: QML1
Last Operation: Reading from SYSTEM.ADMIN.CONFIG.EVENT
Events for Queue Manager: [QMQ3.DTCC.BEP12.SMF]
- [2011/02/24 17:04:57] Config Change Object [2268]
- [2011/02/24 17:04:07] Config Change Object [2268]
- [2011/02/24 17:07:02] Config Create Object [2267]
- [2011/02/24 17:09:01] Config Change Object [2268]
- [2011/02/24 17:08:04] Config Change Object [2268]
- [2011/02/24 17:09:04] Config Change Object [2268]
- [2011/02/24 17:09:04] Config Change Object [2268]
- [2011/02/24 17:09:07] Config Change Object [2268]
- [2011/02/24 17:10:23] Config Change Object [2267]
- [2011/02/24 17:12:27] Config Delete Object [2268]
- [2011/02/24 17:12:40] Config Delete Object [2269]
- [2011/02/25 11:01:17] Config Create Object [2267]
- [2011/02/25 12:01:19] Config Delete Object [2268]
```
Configuration Events - Notes

- Note that change messages are in pairs, showing the before and after image. Creation and deletion are single messages.

![Configuration Events Before and After](image-url)
Auditing Configuration Changes

- MS0P is a good place to start
  - Gives you a quick look into changes that have been made
  - Without user action, the configuration events may be lost
- Turn monitoring on the configuration events file
  - If objects change unexpectedly, someone can be notified immediately
- To keep an audit trail
  - Write the event messages to a file
  - Create reports

Real Time Monitoring

- What are you watching today?
  - No one source gives you a complete picture of a queue manager’s use and health
  - No one source gives you all the information you may need for problem determination
- How are you watching WMQ?
- Who is watching WMQ?
Real Time Monitoring

- What are you watching today?
  - Channel status
  - Queue depth
  - Queue usage
  - Queue manager and chinit status

- But are you watching?
  - Queue manager storage usage
    
    CSQY2201 QML queue manager is using 627 MB of local storage, 1105 MB are free

- RBA of your logs

---

Real Time Monitoring

- But are you watching?
  - Long running UOWs
    - Log shunting
      - CSQR026I: Long-running UOW shunted to RBA=rba, URID=urid connection name=name

    - CSQR027I: Long-running UOW shunting failed, URID=urid connection name=name

  - Amount of time messages are on the queues?
Real Time Monitoring

• How are you watching?
  • Automated monitoring tools
    • Tivoli, BMC, RYO, etc.
  • IEBEYEBALL

• Who is watching WMQ?
  • Developers
  • Application owners
  • System administrators
  • Execs?

Real Time Monitoring - Notes

• Some monitoring ‘war stories’
  • Perpetual enter key compulsion when doing stress periods
    • We’ve seen 99% of the transactional traffic on MQ as monitoring requests – hugely impacting other work
  • RBA wrapping, or as it was described ‘the unthinkable has happened’
  • Not monitoring Admin queues
  • Not monitoring storage usage
  • Subscription queues
The dark arts – SMF Data

- Unreal time monitoring
- Introduction to SMF115
  - What it can tell you and what it cannot
  - Trend analysis
- Introduction to SMF116 – class 3
  - What it tells you in horrid detail
  - What is doesn’t tell you

Introduction to SMF115

- Statistics records for the Queue Manager
- Enabled via:
  - SYSP Macro
  - START Trace command
- Lightweight - two cut per SMF interval per queue manager
- Recommendations:
  - Always gather and examine this data
  - Useful to store for trend analysis
- Contains information on the managers:
  - Buffer manager
  - Log manager
  - Storage manager
  - Message manager
  - Data manager
  - Lock manager
  - CF Manager
  - DB2 Manager
SupportPacs

- SupportPac MP1B
  - Sample programs to print the SMF data
  - Documentation on how to use an interpret the information
- SupportPac MP16
  - The WMQ for z/OS handbook

Buffer Manager

- Often biggest bang for the buck on performance tuning
- For each bufferpool it reports:
  - The number of pages allocated
  - The ‘low’ point
  - How the pool is used
  - Short on Storage
- What it doesn’t tell you:
  - How many pagesets are used by this pool
  - Number of pages written to/read from each pageset
  - Number of pageset expansions
- It does NO good to increase the bufferpools for shared queues
Buffer Manager

Bufferpool churn example from a stress test:
- Note the ‘low’ value of ‘0’ and the SOS value of 413
  - The bufferpool went to short on storage 413 times in a 5 minute interval
  - There were 102,140 reads from the pagesets
  - There were 129,209 writes to the pagesets
  - The async write process was started 137 times
  - The synchronous write process was started 81,686 times!
  - JES log also had repetitions of the following messages

Buffer Manager - Notes

- The information in interpretation is taken from MP1B
- While this example is from a stress test, we have seen similar situations in production environments
- If the bufferpool becomes completely exhausted and nothing can be freed, the queue manager will abend with a '00D70120' reason code
- There is no indication of pageset expansions, that information can be obtained from the JES log
Log Manager

- This is important for customers using a lot of persistent messaging – and those who don’t think they are
- Some of the interesting fields include:
  - Checkpoint
    - The numbers are slightly deceiving, the checkpoint count only includes when the LOGLOAD has been hit, not when log switching has occurred
  - Any of the log read fields – indicating work is being backed out
  - Wait for buffers
  - Write force – tasks are suspended until the write completes
- Information not available:
  - Number of log switches
  - Number of log shunts
  - Number of long running UOWs detected

Log Manager Example

Note that checkpoints were 0, but there had been more than 20 during the interval caused by log switches

- WTB – is the wait count for unavailable buffers, and the outbuffer value is at the recommended value
Storage Manager

Two fields are of interest:
- SOS bits – QSSTCRIT – which indicates a critical short on storage
- A sort on storage was detected – QSSTCONT – and storage contractions had to be done.

Information not available:
- High and low watermark use, both below and above the bar
- Storage use by type (security caching, index, etc.)
- Storage use in the CHIN by clients and channels

Storage Manager - Notes

In addition to the storage manager statistics, review the JES log for the storage use messages
- If storage use keeps increasing and the free storage goes to less than 100 MB, the queue manager may need to be stopped and restarted to avoid an abend soon. Investigation should take place to determine why storage is not being freed.

Information about the structure storage use may be found in the CF activity reports
Message Manager

<table>
<thead>
<tr>
<th>Message manager : QMST</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQOPENS</td>
</tr>
<tr>
<td>MQPUTS</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

- The message manager reports the number of API requests that have been made
  - NOT the number of successful requests
  - Useful for volume tracking

Data Manager & Lock manager

- The data manager statistics can provide information about the number of read ahead and gets that required real I/O, however these fields are not included in the sample SMF reports
- The lock manager statistics are only of interest to IBM.
DB2 Manager & CF Manager

- Only used when there are shared queues
- The DB2 Manager data:
  - Is used to report on the queue manager interaction with DB2
  - DB2 response time will impact the WMQ response times and should be monitored
  - Should be used in conjunction with DB2 performance reports
- The CF Manager data
  - Is used to report on the interaction with the CF structures
  - Should be used in conjunction with the CF Activity Report

In the sample above, the ‘High’ value represents the high water mark on requests to the DB2 server.
- The SCS fields are for Shared Channel Status table
- The SSK fields are for the Shared Sync Key table
In the sample above there were no Structure full conditions

Requests to the CF can be to update a single entry or multiple entries, based on the type of request. They are reported separately in the statistics.

‘Retries’ indicates the number of times a 4K buffer was not sufficient to retrieve the data from the CF and the request had to be retried with a larger (64K) buffer.

**Trend Analysis**

- External to WMQ
- Some monitoring tools have historical capture and trend analysis tools
  - For smaller implementations (<10 production queue managers) keeping spreadsheets may be sufficient
  - For others, look into implementing this component of your monitoring tool if it’s not in place
Introduction to SMF116 – Class 3

- The Really Dark Arts

Introduction to SMF116 – class 3

- Also known as the “New” Accounting records
- Heavyweight – multiple records may be cut for each transaction, and at SMF intervals for long running UoWs
  - Turning this on has been known to swamp an SMF environment
  - But you get marvelous information about what is actually happening
  - Often used in tracking down an application problem and in performance tuning
- Enabled like the Statistics records
- Recommendation - Even though they are prolific:
  - At least once a month turn on class 3 accounting for one SMF interval
  - Become familiar with the data and with the patterns of WMQ usage
SMF116 – The header Information

- The Thread type gives you information about the task, in this case it’s a batch process. It may also be mover (for channels), CICS and IMS
- Connection name is the jobname
- The channel name will be present when this is a mover thread
- The correlator ID is not the correlation ID
  - If the SMF data is for a CICS transaction, it will contain the transaction ID. The transaction ID for this record is QPUB:
    - **== Correlator ID........>** .®.ÇQPUB.
    - **== Correlator ID.....(HEX)>** 20AF4B68D8D7E4C20043219C
**SMF116 – The Header Information – cont’d**

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task token</td>
<td>2020-08-09 17:30:31.73, 3431a3e0, 342e1a0</td>
</tr>
<tr>
<td>Interval</td>
<td>START 20-09-2010 17:30:31.73</td>
</tr>
<tr>
<td>Interval</td>
<td>END 20-09-2010 17:30:19.73</td>
</tr>
<tr>
<td>Number of queue blocks for this task</td>
<td>4</td>
</tr>
<tr>
<td>Other recs.</td>
<td>4, Avg elapsed 200, Avg CPU 13</td>
</tr>
<tr>
<td>Latch 7, Total Wait</td>
<td>101 mics, waits 2, Name OMCSIC1G</td>
</tr>
<tr>
<td>Latch 11, Total Wait</td>
<td>993 mics, waits 9, Name OMCSIC1G</td>
</tr>
<tr>
<td>Latch 12, Total Wait</td>
<td>2493010 mics, waits 102, Name OMCSIC1G</td>
</tr>
<tr>
<td>Latch 13, Total Wait</td>
<td>166691 mics, waits 55, Name OCMX1L1</td>
</tr>
<tr>
<td>Latch 16, Total Wait</td>
<td>792977 mics, waits 79, Name OCMX1L1</td>
</tr>
<tr>
<td>Latch 19, Total Wait</td>
<td>166691 mics, waits 55, Name OCMX1L1</td>
</tr>
<tr>
<td>Total wait</td>
<td>18040544 mics, waits 10680, Name RLNLW1</td>
</tr>
<tr>
<td>Total wait</td>
<td>225667 mics, waits 53, Name RLNLW1</td>
</tr>
<tr>
<td>Total wait</td>
<td>0 mics, waits 0, Name DPLATCH</td>
</tr>
<tr>
<td>Total wait</td>
<td>2836E mics, waits 45, Name SMCCB</td>
</tr>
<tr>
<td>Address of latch for longest wait</td>
<td>0000000000042c37e80</td>
</tr>
<tr>
<td>Commit</td>
<td>Count 113, Avg elapsed 53071, Avg CPU 18</td>
</tr>
<tr>
<td>Log z/d</td>
<td>Count 461, Avg elapsed 18574, Bytes 331798792</td>
</tr>
<tr>
<td>Suspends</td>
<td>Count 113, Avg elapsed 53051</td>
</tr>
<tr>
<td>Pages</td>
<td>New 90408, Old 95377</td>
</tr>
</tbody>
</table>

**SMF116 – The really interesting header Information**

- Task token is the task identifying information
- Since this is a long running task, the interval start and end information may be of interest
- The queue blocks gives you the number of queues that have been accessed
- Then there’s the latches..........
Latching is performed to serialize requests within the queue manager.

There is always latching going on:

- But there are times when it gets a bit excessive, and needs to be investigated.
- This is one of those times.

The ‘Max number’ is really the latch type that showed the longest wait, in this case latch type 19.

Latch types may be used for multiple purposes.

MP1B has a list of some of the more typical entries, latch 19 is used for serialization to bufferpools.

Latch 21, the second largest wait count, is used when updating log buffers.

Using these numbers, and looking at the JES message log for the queue manager indicates that during this interval there were numerous log switches and one of the bufferpools expanded.

Further investigation uncovered I/O subsystem issues – the logs and the pagesets were on the same devices for this environment, leading to significant contention.
SMF116 – More Header Information

- The commit count is useful, especially when working with long running tasks
- The ‘Pages’ values show how many new and old buffer pages have been used during this interval by this task

SMF116 – Queue Information

- This is the first queue used by the task
- Detailed information about the queue’s use by this task, including:
  - Pageset and bufferpool
  - Number of valid requests
  - Record size range, you an calculate the average size
  - Total elapsed time and cpu time for the requests
  - Maximum depth
SMF116 – Queue Information

- This is the fourth queue used by the task, the ‘get’ queue
- In addition to the information common to all queues, the following should be noted on the GET queues
  - Number of valid gets as compared to the total gets issued
    - The difference means that a number of gets returned no message, often due to a get wait expiring
  - Time on queue
    - In microseconds – though the average often overflows
  - PSET is the average I/O time for a read from a pageset
  - Epages is the number of empty pages there were scanned during a get
  - Skip is the number of pages with messages that were skipped
  - Expire is the number of expired messages that were skipped
SMF116 Uses

- Channel usage
- Bufferpool/pageset balancing
  - In a high volume request reply scenario if the two queues are on the same pageset, separating them can improve performance
  - When queues have become concentrated in one resource pool
- Preparation for migration to shared queues
  - Min/Max/Average message size and duration on queue
- Application Performance tuning
  - Proper Indexing
  - Elimination of ‘hot spots’ – reducing contention
- Problem determination

SMF116 – What it does not tell you

- Often a consolidated view is needed
  - How many tasks are concurrently using this set of queues?
  - What tasks are related?
    - Can be determined via the queues accessed, but not easily
- Were security calls made during this task?
- Finally, how can the z/OS information and distributed information be consolidated for a complete view?
## The rest of the week …

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00</td>
<td>More than a buzzword: Extending the reach of your MQ</td>
<td>Batch, local, remote, and traditional MVS - file processing in Message Broker</td>
<td>The Do's and Don'ts of Queue Manager Performance</td>
<td>Lyn's Story Time - Avoiding the MQ Problems - Others have Hit</td>
<td></td>
</tr>
<tr>
<td>09:30</td>
<td>WebSphere MQ 101: Introduction to the world's leading</td>
<td>The Do's and Don'ts of Queue Manager Performance</td>
<td>So, what else can I do? - MQ API beyond the basics</td>
<td>MQ Project Planning Session</td>
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<tr>
<td>11:00</td>
<td>MQ Publish/Subscribe</td>
<td>The Do's and Don'ts of Message Broker Performance</td>
<td>Diagnosing problems for Message Broker</td>
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<tr>
<td>12:15</td>
<td>MQ Freebies! Top 5 SupportPlaza</td>
<td>The doctor is in. Hands-on lab and lots of help with the MQ family</td>
<td>Using the WMQ V7 Verbs in CICS Programs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01:30</td>
<td>Diagnosing problems for MQ</td>
<td>WebSphere Message Broker 101</td>
<td>The Dark Side of Monitoring MQ - BAM 115 and 116 record reading and interpretation</td>
<td>Getting your MQ JMS applications running, with or without WAS</td>
<td></td>
</tr>
<tr>
<td>03:00</td>
<td>Keeping your eye on it all - Queue Manager</td>
<td>The MQ API for dummies - the basics</td>
<td>Under the hood of Message Broker on z/OS - WLM, SMF and more</td>
<td>Message Broker Patterns - Generate applications in an instant</td>
<td></td>
</tr>
<tr>
<td>04:30</td>
<td>Message Broker administration for dummies</td>
<td>All About WebSphere MQ File Transfer Edition</td>
<td>For your eyes only - WebSphere MQ Advanced Message Security</td>
<td>Keeping your MQ service up and running - Queue Manager clustering</td>
<td></td>
</tr>
<tr>
<td>06:00</td>
<td>Free MQ - MQ Clients and what you can do with them</td>
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