z/OS WLM – What Are You Thinking?

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Agenda

- IBM Recommendations not being followed
  - Service Definition Coefficients
  - Classifying new work and SYSOTHER
  - SYSSTC Observations and recommendation

- CICS/IMS Velocity vs. Response Time Goals

- Common mistakes
  - Bad Service Class Example
Service Definition Coefficients

- **Following are typical values**
  - CPU – 1.0, SRB – 1.0, IOC – 0.1, **MSO – 0.0000**
  - MSO needs to be 0, long running address spaces (CICS, IMS, DB2) will accumulate so much service the reports will be skewed
  - MSO is a calculated value
    - Storage used while CPU Cycles are being used
    - With no storage contention, old frame pages may stay for multiple days
  - Many times see IOC set to 0.5
    - Site preference, how much weight to give I/O to period aging values
    - With value of 0.1, easier to compare units to CPU/SRB

- **When changing values, need to evaluate impact on multi-period service classes**
Have a Method to Identify New Work

- **Unclassified work will default to one of two places**
  - Started Tasks default to SYSSTC
  - All other work defaults to SYSOTHER

- **Do not want new started task work to dominate the system**

- **Recommendation:**
  - Under Started Task Rules, have ‘NEWWORK’ as your default service class to prevent new tasks from running in SYSSTC
    - Give NEWWORK a medium importance and velocity
  - Monitor both NEWWORK and SYSOTHER for any activity
  - In SYSOTHER, if active, or even have resident transactions, work to classify work as soon as possible
    - Many times see TCPIP Enclaves in SYSOTHER
User Work in SYSSTC

- Many times we have seen work classified SYSSTC that should not be there
  - DB2MSTR, DB2WLM, some CICS address spaces, MQMSTR, etc.

- Recommendations for SYSSTC
  - DB2IRLM and IMS IRLM – Lock manager needs high dispatching priority in order to let work flow properly through the system
  - “Emergency” TSO ID – Only one TSO ID should be defined to SYSSTC
    - All other TSO IDs should be grouped together, no special high priority service class for system programmers or management
Importance Levels

- Many customers not effectively using importance levels
  - Best recommendation is to use all five importance levels in order to differentiate work

- Policy must be clear enough so that in times of contention you know which workloads will get delay
  - There will be some importance level where delays are not acceptable
Use of CPU critical

- **Limit use of CPU critical**
  - Intended to be used when rapid workload shifts happen regularly and WLM will not be fast enough in adjusting priorities
  - CPU Critical only protects that work from lower importance work, no protection from work at same or higher importance, better to have the right goal

- **When running CICS/IMS with response time goals, and CPU critical is necessary, designate both regions and transactions as CPU critical**
  - Handles idle periods and restarts
Other Issues Commonly Seen

- **Use of Average Response time Goals instead of Percentile**
  - Use of percentile goals negates impact of outliers

- **Unachievable/Unrealistic velocity goals – ie. goal of 90**
  - Check velocities of SYSTEM and SYSSTC to determine highest achievable velocities
  - Smaller n-way partitions will necessitate lower velocity goals

- **Do not want some regions doing region management, and some transaction management**
  - In workload activity report, see service class SERVER serving CICSPRD and SERVER service classes

- **Server service classes should be separated from other service classes**
CICS and IMS – R.T. or Velocity Goal?

- **Which is the better way to manage online work?**
- **Remember, WLM will set dispatching priority for the region**
  - Need to have the CICS and IMS Regions dispatched properly
  - CICS and IMS have their own internal routines to decide which to run within their regions
  - If transactions 0101 and PRD1 both run in AOR1, CICS will decide which to dispatch, **NOT** Workload Manager
- **So the ‘right’ goal depends on your environment**
Velocity Goals for CICS and IMS

- Velocity goals are acceptable for environments with only one partition, or sysplexes with similar sized partitions
  - A sysplex with a 4-way and a 20-way may not be a good candidate
  - Want to put enough work into each service class that WLM sampling gives a good view of usage

- Can be used when the nature of online transactions does not make classification of transactions goals reasonable
  - Vastly different types of transactions would skew response time distribution data
  - Two transactions service classes in same region will get same dispatching priority

- Velocity goals do need to be monitored and may need to be adjusted during any processor changes
  - Processor upgrades, LPAR definition changes, etc.
Response Time Goals for CICS and IMS

- **3 major advantages of response time goals**
  - Easier to understand and can be set to a business SLA
  - Normally no need to change when environment is changed
  - Can use same goal across entire parallel sysplex, regardless of individual partition size/speed

- **Too many policies have too many response time goals defined in policy**
  - Okay only if each region only runs one type of transaction
  - Keep it Simple!

- **Recommendation:**
  - Strive for 1 to 2 response time service classes (Fast, Other)
  - Set goal for dominate transaction(s)
  - Manage to stable population
    - If you know 10% or transactions will never meet goal, take that into account when setting the goal,
Velocity Goals – Understand Distribution

- When running with velocity goals, for online work create report classes or use new functionality in z/OS V1R13 support
  - Will give transaction level information and statistics

- Advantages
  - Get ended transaction rate
  - Average transaction time
  - Response time breakdown buckets (only in V1R13)

- Review service classes to determine possibility of migrating if desired
Setting Service Class Definitions

- Use service class called DDFEXAMP to highlight many common issues

- Issues common to multi-period service classes
  - DDF
  - TSO
  - Batch
  - Enclaves
The DDFEXAMP Service Class

- Four period service class with both response time and velocity goals

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<tr>
<th>Service Class Name</th>
<th>DDFEXAMP (Required)</th>
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<tr>
<td>Description</td>
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<td>Workload Name</td>
<td>DB_WKL (name or ?)</td>
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<tr>
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<td>________ (name or ?)</td>
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Specify BASE GOAL information. Action Codes: I=Insert new period, E=Edit period, D=Delete period.

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<th>Imp.</th>
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<td>__</td>
<td>4</td>
<td>________</td>
<td>_</td>
<td>Discretionary</td>
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DDFEXAMP Issue Number 1

- **Multiple Service Class Periods**
  - Recommendation is to use as few multi-period service classes as possible
  - Keep within the rule of thumb of 25-35 active service class periods
  - Each period needs to have sufficient samplings and ended transactions to give accurate view of workload

- **Typical assumption is longer running work is less important**
  - Low importance work can hold resources needed by high importance work
  - If work drops into lower periods, less access to CPU.

- **For Batch and Websphere work**
  - Batch and Websphere queue time delay only accumulates in first period
  - May have more success with single period workloads

- **Proper use of multiple periods**
  - For some work, many times unable to have all work in single period due to mixture
  - Attempt to keep number of periods to a max of 2
  - Check Standard Deviation of response time in Workload Activity Report
Notes on Multiple Periods

- Workload Manager makes better decisions when there are more samples per service class period
- Review RMF Workload Activity Report for service class utilization by period
- If one period of a multi-period service class is always much smaller than the other periods, consider consolidation
- For example, typical utilization pattern of three period service class
  - SCLAS Period 1 – APPL% = 71.1
  - SCLAS Period 2 – APPL% = 0.37
  - SCLAS Period 3 – APPL% = 138.0
- In this case, period 2 should either be combined with 1 or 3
DDFEXAMP Issue Number 2

- Comparing periods 2 and 3, velocity goals are too close
  - Period 2 Velocity of 40, Period 3 Velocity of 43
  - Indication of trying to micro-manage goals

- Many times customers will have two or more service classes with velocity goals that are too close together

- Workload Manager does not manage a velocity, it adjusts a dispatching priority and observes the resulting velocity
  - Different dispatching priorities can result in wide variety of achieved velocities

- Velocity goals should be set with a difference of at least 10 to be effective and meaningful
  - Any service classes with goals closer than 10 should be evaluated to be combined into one service class
DDFEXAMP Issue Number 3

- Discretionary goal used
- When discretionary goals are active, discretionary goal management may affect other production service classes
  - Can see capping on other service classes with velocity less of 30 or less or response time goal over 1 minute, and PI less than 0.71
- Work that holds resources should be in managed service class
  - Some customers may be okay with longer running batch in discretionary
  - Discretionary is first work to see delay, should have no SLA associated for work with a discretionary goal
- Discretionary work and specialty processors
  - The ‘Needs Help’ algorithm will not cause discretionary work to run on general purpose CPs
- Only discretionary goals get mean time to wait
DDFEXAMP Issue Number 4

- Duration Values are not set appropriately
- Can only be checked by reviewing RMF Data
  - DDFEXAMP Period 1 duration of 2,000
  - From RMF:

```
REPORT BY: POLICY=POL01 WORKLOAD=DB2 SERVICE CLASS=DDFEXAMP

-TRANSACTIONS- TRANS-TIME HHH.MM.SS.TTT --DASD I/O-- ---SERVICE---
AVG  78.97  ACTUAL  201  SSCHRT  1466  IOC  0
MPL  78.97  EXECUTION  200  RESP  7.2  CPU  29852K
ENDED  349080  QUEUED  0  CONN  0.4  MSO  0
END/S  387.87  R/S AFFIN  0  DISC  6.0  SRB  0
#SWAPS  0  INELIGIBLE  0  Q+PEND  0.8  TOT  29852K
EXCTD  0  CONVERSION  0  IOSQ  0.0 /SEC  33169
```

- Divide total service by total ended transactions
  - Or service/sec divided by end/s
- On average, transactions ended in period 1 used 85.5 service units

- Many times duration values were not adjusted when SDC were changed to current recommended values
  - CPU and SRB changed from 10.0 to 1.0
DDFEXAMP Issue Number 4

- When multiple periods are necessary, usually better for first period to have a more uniform set of transactions
  - Easier to set a proper response time goal if desired

- DDFEXAMP Period 1 has a goal of 90% of transactions completing in 0.5 seconds
  - Adjusting duration from 2,000 to 200 will allow for better management of short running transactions with a tighter goal

- This leads us too....
DDFEXAMP Issue Number 5

- Period 1 response time goal may be set too leniently
- All goals must be checked to determine if they are set appropriately for business goals and average system performance
- Note: In RMF, response time PI will range from 0.5 to 4.0
  - Response time buckets range from half of goal to four times goal

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Note: In RMF, response time PI will range from 0.5 to 4.0
Review

- Follow recommendations on SDC
- In debate of Response Time goals vs. Velocity goals, understand and use what is best for your environment
- Server service classes need appropriate even when transactions are running
- Separate Velocity goals by at least 10 each
- Use multiple periods sparingly
- Monitor PIs of all service classes
  - PI for Response time goals have range of 0.5 to 4.0
- For CICS/IMS transaction goals, have only 1 or 2
- And as always, keep number of active service class periods to a range of 25 to 35!!!
System z Social Media

- **System z official Twitter handle:**
  - @ibm_system_z

- **Top Facebook pages related to System z:**
  - Systemz Mainframe
  - IBM System z on Campus
  - IBM Mainframe Professionals
  - Millennial Mainframer

- **Top LinkedIn Groups related to System z:**
  - Mainframe Experts Network
  - Mainframe
  - IBM Mainframe
  - System z Advocates
  - Cloud Mainframe Computing

- **YouTube**
  - IBM System z

- **Leading Blogs related to System z:**
  - Evangelizing Mainframe (Destination z blog)
  - Mainframe Performance Topics
  - Common Sense
  - Enterprise Class Innovation: System z perspectives
  - Mainframe
  - MainframeZone
  - Smarter Computing Blog
  - Millennial Mainframer
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