Avoiding Performance SRs

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Agenda

- Premise
- Overview of RMF and the Spreadsheet Reporter
  - As a means of visualizing z/OS performance problems
- CPU and WLM Concerns
- I/O and DASD Subsystem
- zIIP
- Real and Virtual Storage Analysis
- Class 3 Suspense Time
- Resources
Premise

- Holistic approach → top down = RMF → SMF → Traces/Dumps
  - If SWAT team or L2 performance team is involved this is where we start
  - Get the big picture then drive to root cause
  - Often problems are intermittent and require an understanding of the entire environment

- If there is a perceived DB2 subsystem, or data sharing group performance issue
  - Rule out Sysplex/ CF/ CEC/ LPAR constraints first

- If there is a workload or period of the day suffering
  - WLM/ CPU constraint/ DB2 internals

- If there is a single job, or group of transactions suffering
  - Object contention
  - Access path or DB2 component
  - Storage subsystem
RMF Spreadsheet Reporter

- ... A tool to create, post-process and analyze RMF (Resource Measurement Facility) reports in the form of Excel Spreadsheets: a graph is worth a 1,000 words, especially if it has Red in it.

- SMF (System Management Facility) records you need: reports can be run from tool, or MVS then pulled down and post-processed
  - 70-1: % CPU, zIIP busy, weightings, number of MSU’s consumed, WLM capping, physical and logical busy
  - 70-2: crypto HW busy
  - 71: paging activity
  - 72-3: workload activity
  - 73: channel path activity
  - 74-1: device activity
  - 74-4: coupling facility
  - 74-10: SCM - new
  - 74-5: cache activity
  - 74-8: disc systems
  - 75: page data sets
  - 78-2: virtual storage
  - 78-3: I/O Queueing

![No Charge!](image)
RMF Reports - CPU

- LPAR Trend report
  - REPORTS(CPU)
- Can see stacked picture of single LPAR (GP/zIIP/IFL)
  - This is useful to get an idea of the CEC utilization across processors
- Look at CEC’s CPU trend over the time period with GP and specialty engines
  - You can superimpose the max CPU % the LPAR will achieve based on weightings
  - Also see entire CEC saturation
RMF Reports - CPU

- LPAR Trend report
  - REPORTS(CPU)

- Can see relative weights between LPARs to determine if one is exceeding its share
  - i.e. who will be punished when a CPU constraint occurs

- LPAR Design tool very helpful in getting the right mix of vertical High/Med/Low processors
RMF Reports - WLM

- WLM activity report
  
  SYSRPT$TS(WLMGL(POLICY, WGROUP, SCLASS, SCPER, RCLASS, RCPER, SYSNAM(S WCN)))$

- Look at all service classes during a certain interval or 1 class over the course of several intervals
  - Yellow missed its goal, Red is a PI of >2

- See reason for delays across all service classes in an interval
  - I/O, CPU, zIIP

- Looking at raw report is tedious, could be hundreds of MBs of data
• Look for potential zIIP offload that landed on a GP
  - AAPL% IIPCP
  - Red line
  - See what % (not normalized) of a processor the workload consumed

• Response times can be seen and charted as well
  - Actual average execution time

RMF Reports - WLM
Overview Records

- This will show the CPU/zIIP Utilization broken down by service/report class as well as CPU utilized by zIIP eligible work during the intervals.
- It can show you when certain workloads collide and WLM goals are missed: who is driving the CPU % through the roof.
  - By using RMF Spreadsheet reporter you can generate the Overview Records.
    - Then create and run the Overview Report from your desktop.
- ApplOvwTrd tab now included in spreadsheet, no need to create WLM OVWs.
Reports – WLM service definition formatter

- FTP down your WLM policy in .txt format
- Import the WLM policy into a spreadsheet to analyze and filter
- Overview of total classes, periods, resource groups
  - Resource group capping results in unpredictable response times
  - ROT is 30-40 service class periods running at once
- Policy itself can be filtered
  - So why do we have 9 Imp 1 Velocity 60 service classes?
  - This is redundant work for WLM to monitor and manage these identical classes
- Easy to search through rules to determine what work is in what service class
RMF Reports - DASD

- **DASD Activity Report**
  - REPORTS(DEVICE (DASD))
- **Gives you overview of top 5 Logical Control Units**
  - See what volumes are on there, and what DB2 data is on those volumes
- **Device Summary Top10** Shows top 10 volumes based on criteria you specify and you can manipulate graphs
RMF Reports - CF

- CF activity report
  - SYSRPTS(CF)
- Look at CPU/storage utilization over entire day
- See comparison of sync vs. async across intervals
- Look for delays due to sub-channels being unavailable
- Look for directory reclaims
- Look at all metrics for all structures during a single interval
RMF Summary Report

- **RMF Summary**
  - Look at CPU Busy (remember this is usually a 15 minute interval though)
  - DASD response taking into account the rate, a very low rate could show increased response time due to missing cache, etc.
  - Demand paging

- Now-a-days we don’t want to see paging at all as storage gets cheaper and the price paid by the online applications in response time not proportional to the ‘paging rate’

- **z/OS measured the CPU cost of a sync I/O at 20-70us**

<table>
<thead>
<tr>
<th>RMF SUMMARY REPORT</th>
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<tbody>
<tr>
<td>SYSTEM ID 2D11</td>
</tr>
<tr>
<td>START 09/25/2012-11.59.00</td>
</tr>
<tr>
<td>INTERVAL 00.09.59</td>
</tr>
<tr>
<td>CONVERTED TO z/OS V1R13 RMF</td>
</tr>
<tr>
<td>END 09/25/2012-16.59.00</td>
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<td>CYCLE 1.000 SECONDS</td>
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<table>
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<th>DASD RESP RATE</th>
<th>TOTAL LENGTH</th>
<th>INTERVALS</th>
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<td>DASD</td>
<td>TAPE JOB JOB TSO TSO STC STC ASCH ASCH OMVS OMVS SWAP DEMAND</td>
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<td>1.7 1848 124.0 75 72 6 6 181 178 0 0 5 5 0.00 0.05</td>
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<td>1.8 1589 27.1 73 71 6 6 180 178 0 0 5 5 0.00 0.02</td>
<td></td>
<td></td>
<td></td>
</tr>
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</table>
CPU constraints (1)

- These 2 LPARs LP11 and LP15 are consuming every MIP on the box, borrowing back and forth
  - This was meant to be a load test, and you can see where the test LPAR (Green) ran out of steam as the production LPAR took the CPU cycles
- In internal benchmarks maximum throughput is achieved between 92-94% - determining root cause almost impossible at 100%, no consistency
CPU Constraints (2)

- LP11 and LP15 saturate the 2 out of 2 CPs during the day, trading off resources while at the same time Portal is driving 2.5 out of 5 IFLs
  - The GCPs on the previous slide is already fully utilized, and the Portal workload here has 50% of its capacity left, so it appears DB2 is the bottleneck
  - So it is the CPU capacity...as well as
WLM

- **ROT**: DB2 threads should not end up in a service class which uses WLM resource group capping
  - Resource group capping will ensure that this workload does not get over ‘x’ Service Units a second, and this includes all the DB2 subsystems in the plex,
  - Blocked workload support cannot help these capped transactions, so if there is a serious CPU constraint all DDF work could be starved, and could be suspended while holding important DB2 locks/latches
  - In general we suggest avoiding resource group capping in favor of lowering the priority of the work
  - The CAP delay is the % of delays due to resource group capping
Response time goals... too loose

- We do not want the goals to be too loose: if >90% of transactions complete in less than ½ of their goal, the goal should be adjusted tighter, to avoid violent swings in response time under CPU constraint
  - The goal here is 10 seconds for a Portal application that must render its page in 3 seconds, and the transactions are finishing in 4 milliseconds
- The WLM goals should align with the business goals/ SLAs
  - Make the goal around 20 milliseconds so the service level can be maintained

<table>
<thead>
<tr>
<th>GOAL: RESPONSE TIME 000.00.10.000 AVG</th>
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<tr>
<td>RESPONSE TIME EX PERF AVG --EXEC USING%-- ---------- EXEC DELAYS % ---------- --USING%-- --- DELAY % --- ---</td>
</tr>
<tr>
<td>SYSTEM   HHH.MM.SS.TTT VEL% INDY ADRSP CPU AAP I/O TOT CPU I/O</td>
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<tr>
<td>CALL      000.00.00.04 67.3 0.0 0.4 27 N/A 7.4 0.0 17 15 1.3 0.0 0.0 51 0.0 0.0 0.0 0.0 0.0</td>
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<tr>
<td>1E10      000.00.00.03 72.1 0.0 0.3 31 N/A 10 0.0 16 14 1.7 0.0 0.0 45 0.0 0.0 0.0 0.0 0.0</td>
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<tr>
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----------- RESPONSE TIME DISTRIBUTION -----------

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<tr>
<th>HH.MM.SS.TTT</th>
<th>CUM TOTAL</th>
<th>IN BUCKET</th>
<th>CUM TOTAL</th>
<th>IN BUCKET</th>
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<td>90322</td>
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<td>100</td>
<td>0.0</td>
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</table>
Response time goals... too stringent

- The goals need to be reasonable, i.e. attainable by the workload
  - WLM cannot shorten the response time to something lower than the CPU time needed for the transaction to complete
  - With a performance index of 5 all day long this workload could be skip clocked (ignored) if there were CPU constraints
WLM Buckets

- Look at the response time buckets in WLM activity report to gauge reality
- No amount of CPU could bring these transactions back in line with the others
  - The goal is 95%, but only 90% complete in time, so take these outlying trans and break them out into another service class, or adjust the goal to 90%
Response time goals vs. velocity goals

- For transactions and most business processes a Response time goal is much more effective/predictable during times of CPU constraint than velocity goals – percentile or average goal?
  - Transaction classes with outliers of 2x the average or more should be percentile goals

- When determining a good response time goal you need to trend it out
  - Determine where the business goal is in relevance to what it is achieving
  - z/OS 1.13 includes average response time info even for velocity goals
zIIP and LPAR Weights

- For capacity planning monitor zIIP redirect to CP, not absolute Utilization
- Correct technical solution is to add more zIIP capacity to avoid zIIP eligible work running on a CP (APPL% IIPC P CPU in WLM activity report SMF 72-3)
  - zIIPs are assist processors and not intended to be run as hard as GCPs
  - Using the RMF Spreadsheet reporter you can see the service/report class spilling over
  - On z13 proper LPAR weightings are key
- Hiperdispatch is VERY sensitive to the relative LPAR weights (HIGH/MED/LOW)
- Key is to apportion weights based on actual utilization – not share zIIPs with everyone
  - Otherwise engines will remain parked causing work to spill over to the GCPs
- Many zIIP eligible workloads are ‘spikey’ in nature: look at Work Units in CPU activity
  - Parallelism from SQL, Utility, or Sort work

<table>
<thead>
<tr>
<th>CPU TYPES</th>
<th>MIN</th>
<th>MAX</th>
<th>AVG</th>
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<tr>
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<td>0</td>
<td>24</td>
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<tr>
<td>IIP</td>
<td>0</td>
<td>185</td>
<td>1.0</td>
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4 zIIPs parked
2 zIIPs parked

zIIP overflow to GCPs

zIIP Utilization
4 zIIPs parked
2 zIIPs parked

Parallelism from SQL, Utility, or Sort work → → →
zIIP Shortages

- **What if I have lots of not accounted for time?**
  - OMPE accounting report (parallel tasks on zIIP)
  - RMF Spreadsheet Reporter response delay report
    - Part of WLM activity trend report
  - SYS1.PARMLIB (IEAOPTxx) setting
    - IIPHONORPRIORITY = NO (not recommended)
      - Meaning all zIIP eligible work will queue waiting for a zIIP
        - Normally ‘Needs Help’ algorithm re-dispatches work to a GCP
        - Parallel tasks are 80% zIIP eligible, so PARAMDEG should be influenced by the number of zIIPs you have
    - **Important in v10 and v11, and if you have zAAP on zIIP – no zAAP on z13**
      - V10 includes prefetch, deferred writes,
      - V11 includes GBP writes, castout/notify, log prefetch/write
  - Discretionary work always waits on the zIIP

<table>
<thead>
<tr>
<th>CLASS 2 TIME DISTRIBUTION</th>
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<tbody>
<tr>
<td>CPU</td>
</tr>
<tr>
<td>NOTACC</td>
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<tr>
<td>SUSP</td>
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CPU delay at about 33%, and the zIIP delay is at 34%.
zIIPs and Prefetch

- What happens if Prefetch Engines are starved of zIIP?
  - Other Read I/O events and time per event will increase
  - PREF. DISABLED – NO READ ENG could increase

- Customers have seen batch programs miss their window
  - solution is to add zIIP capacity

- Prefetch may be scheduled even if all the pages are resident, so app still sees delays with 100% BP hit ratio and no I/Os
  - Increased elapsed time
DASD response time

- Sometimes you need the entire picture when going after response time issues
  - After migration to DB2 10 customer’s applications were experiencing ‘good’ and ‘bad’ days
  - Some access path regressions… but was this related?

- Here are two top 5 logical control unit report from the same time each day
  - Activity rate is quite close (same work going on)
  - Where does the increase in response time come from? – DISC (disconnect time)
  - Synchronous remote copy (Metro Mirror) where the target cannot keep up, and asynchronous copy with write pacing (XRC) can cause high DISC time

<table>
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<th>LCU Summary</th>
<th>LCU</th>
<th>I/O Intens.</th>
<th>ST Intens.</th>
<th>Path Int.</th>
<th>Act. Rt.</th>
<th>Resp. Tm</th>
<th>Serv. Tm</th>
<th>IOSQ Tm</th>
<th>Pend. Tm</th>
<th>Disc. Tm</th>
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<td>1005.99</td>
<td>206.60</td>
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<td>3.28</td>
<td>2.91</td>
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<td>276.85</td>
<td>242.85</td>
<td>16.69</td>
<td>6.74</td>
<td>9.52</td>
<td>0.43</td>
<td>5.60</td>
</tr>
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</table>
DB2 and Storage

- What is an acceptable paging rate? → 0 for DB2 storage
- REAL storage is a one time charge which will save CPU cycles, which you pay for on a monthly basis
  - z/OS measured the CPU cost of a sync I/O to be 20us → 70us
- Even if you want to wait until V11 to tune your buffer pools with the simulation capabilities you can save CPU today by avoiding paging
- Impact customers have seen from being short on REAL storage
  - Transaction times begin to climb, customers see sub-second trans take 10’s of seconds (buffer pool hit might require a page-in from AUX)
  - # of concurrent threads in DB2 begin to climb, CTHREAD/MAXDBAT might be hit
  - SYSPROG and DBA perception is of a system slowdown
    - If SVCDUMP occurs (SDUMP,Q) workload may be non-dispatchable until dump finishes
- If however you are real storage rich (i.e. > MAXSPACE in reserve), look at turning REALSTORAGE_MANAGEMENT = AUTO → OFF
  - Have seen cases with large memory and high thread deallocations where DB2 ASID CPU could be saved
DB2 and Storage

- In the graphic we can see DB2 storage goes out from REAL to AUX when the real available drops to ‘0’ on the LPAR
  - Using IFCID 225 and MEMU2 to look at AUX vs. what’s in REAL
- Worst case in this example to get those pages back in:
  - 700 MB – sync I/O time ~3ms = 0.003*179,200 = 537 seconds
  - MAXSPACE suggestion 16GB… could not be supported here
DB2 and Storage

- So who caused me to get paged out??
  - If you run a WLM activity report and look at the Storage Trend graph in the reporter you can see the actual frames used by a service or report class
  - The Page In Rates were also high during this time for DB2 as it recovered from AUX
Real storage and Sort products

- By default DFSORT and other sort products usually take as much storage as they can get, to help performance… but what about everyone else?

- DFSORT parameters affecting storage use (II13495) → means to protect DB2
  - These can be dynamically changed for workloads using ICEPRMxx member
    - **EXPMAX** = % of storage for memory object and hyperspace sorting, somewhat depends on **EXPOLD** and **EXPRES** → how much can you spare
    - **EXPOLD** = % of storage allowed to be pushed to AUX → 0
    - **EXPRES** = % of storage to preserve, maybe in case of DUMPSPACE/ MAXSPACE → 16GB min in V10
  - For DB2SORT the PAGEMON parameter limits use of central storage

![REAL storage available](chart)

This shows EXPMAX = 25GB, effectively capping what DFSORT can consume.
Sort: 256GB LPAR ~114GB page fixed

- DB2 has over 1GB in AUX - paging of 15 / second
- EXPMAX = 20% so SORT can use ~50GB max
  - Using 45GB which is actually 31% of the available (256-114)
  - EXPMAX looks at total storage configured on the LPAR, regardless of PGFIX
- Look at EXPOLD → 0 and lowering EXPMAX to stop DFSORT from stealing old storage and pushing us out to AUX
- Ensure you do not end up with >70% of the LPAR page fixed
  - If 80% is fixed (IRA400E) and address spaces become non-dispatchable
More on AUX storage

- When 50% of your AUX storage is in use ENF 55 message sent out and all DB2s on that LPAR will enter hard discard mode (to free off 64-bit storage) causing CPU burn (DSNV516I)

- At 70% of AUX used z/OS will mark address spaces which cannot be swapped in real as non-dispatchable
  - Customers see applications starved of CPU
  - -904 for Dynamic Statement Cache
  - IRA200E if shortage of AUX, and IRA260E if you have SCM
    - DASD AUX and SCM (Flash Express memory) used to be combined

- Do not over size LFAREA
  - Large frame (LFAREA) storage is a last resort to be stolen
  - Decomposition and coalescing of 1MB frames in LFAREA to 4k, and back again wastes CPU cycles
    - Specify INCLUDE1MAFC on LFAREA specification (A42510)
How do I size LFAREA for DB2?

- LFAREA = 1.04* (sum of VPSIZE from candidate buffer pools)) + 20MB + (OUTBUFF + 31-bit low private for DB2 11)

- **Do not oversize LFAREA**
  - LFAREA used ~ DB2 usage + JAVA heap (verbosegc traces)
  - Can’t do anything about it until an IPL, if too small just means there is potential savings you could be missing out on
    - IRA127I 100% OF THE LARGE FRAME AREA IS ALLOCATED = using it all
    - If for any reason RSM denies DB2 request for 1 MB frame, uses 4k instead

- **Decomposing 1MB frames into 4k frames (due to paging w/out FlashExpress) is CPU intensive trying to maintain the LFAREA setting**
  - MAX LFAREA ALLOCATED (4K) = Not a good sign
  - This indicates you do not have enough REAL storage needed by 4k frames, so add more real or make LFAREA smaller
What about LFAREA?

- Useful commands
  - -DISPLAY BUFFERPOOL(BP1) SERVICE(4)
  
  - Useful command to find out how many 1MB size page frames are being used → DSNB999I =D2V1 4K PAGES
    DSNB999I =D2V1 1M PAGES
  
  - -DISPLAY VIRTSTOR, LFAREA

  NOT good, this means we broke down 1MB frames due to a shortage of 4K frames

  We reserve 1/8th of real on LPAR for pageable frames, then overflows to LFAREA

  IAR019I 14.37.22 DISPLAY VIRTSTOR 735
  SOURCE =
  TOTAL LFAREA = 4800M , 0G
  LFAREA AVAILABLE = 42M , 0G
  LFAREA ALLOCATED (1M) = 0M
  LFAREA ALLOCATED (4K) = 4628M
  MAX LFAREA ALLOCATED (1M) = 6M
  MAX LFAREA ALLOCATED (4K) = 4703M
  LFAREA ALLOCATED (PAGEABLE1M) = 130M
  MAX LFAREA ALLOCATED (PAGEABLE1M) = 130M
  LFAREA ALLOCATED NUMBER OF 2G PAGES = 0
  MAX LFAREA ALLOCATED NUMBER OF 2G PAGES = 0

- Shows total LFAREA, allocation split across 4KB and 1MB size frames, what is available
XCFCriticalPaging–avoidpagefaultsduringHyperSwap

- **CRITICALPAGING** is a z/OS function designed to help avoid situations where a page needed for HyperSwap is paged out to AUX to a device that has been suspended.

- The downside of this is a massive amount of fixed storage to include the following:
  - 31-bit common storage (both above and below 16M)
  - Address spaces that are defined as critical for paging
  - All data spaces associated with those address spaces that are critical for paging (unless CRITICALPAGING=NO was specified on the DSPSERV CREATE)
  - Pageable link pack area (PLPA)
  - Shared pages
  - All HVCOMMON objects
  - All HVSHARE objects
    - In DB2 the 64-bit SHARED houses thread working storage, statement cache, SKCT/SKPT

- **Apply z/OS APAR OA44913**
  - Allows z/OS to reclaim DB2 64-bit SHARED KEEPREAL=YES frames
What is in AUX now?

With CRITICALPAGING = YES HVSHARE becomes non-pageable so that leaves buffer pools and PRIVATE storage to be sacrificed.

Buffer pools are not paged out in customer #1’s environment, but they are in #2 causing 1 I/O for the price of 2, no prefetch, and could have 100% buffer hit but 100% I/Os → can’t trust the stats here.
Buffer Pool sizing considerations

- Starting in DB2 10 the root pages of the indexes are ‘fixed’ in the buffer pool
  - How many indexes/parts do you have in your index buffer pool?

- This would affect DWQT threshold
  - (ex.) 10,000 buffers, DWQT of 30%
    - With 1,000 indexes you have basically made the DWQT threshold 20%

- Watch for DWQT being hit multiple times per second and LC23 being elevated
  - Customer saw DWQT threshold being hit 80 times a second and LC23 at 40,000 a second
  - Application response times were significantly impacted due to being I/O bound, elapsed times increased 2-3x

- Ideally VDWQT should be used over DWQT for efficiency of writes and avoiding latch contention
Sync I/O

- DB2 10 added a mechanism to avoid local buffer pool scans when objects go from GBP dependent to non-GBP dependent
  - This saves DBM1 SRB time, and application elapsed time
  - But depending on the amount of pseudo closes you have it can increase synch I/O for some applications that bounce in and out of GBP dependency
  - V11 APAR PI59168 addresses some XI conditions

<table>
<thead>
<tr>
<th>GROUP BP7</th>
<th>AVERAGE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>GBP-DEPEND GETPAGES</td>
<td>343.4K</td>
<td>16481954</td>
</tr>
<tr>
<td>READ(XI)-DATA RETUR</td>
<td>30.57</td>
<td>1472</td>
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<tr>
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<td>2.50</td>
<td>120</td>
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<tr>
<td>READ(NF)-DATA RETUR</td>
<td>190.04</td>
<td>9122</td>
</tr>
<tr>
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<td>12379.02</td>
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<tr>
<th>GROUP BP12</th>
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<tr>
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<tr>
<td>READ(XI)-DATA RETUR</td>
<td>36.23</td>
<td></td>
</tr>
<tr>
<td>READ(XI)-NO DATA RT</td>
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<td></td>
</tr>
<tr>
<td>READ(NF)-DATA RETUR</td>
<td>10.52</td>
<td></td>
</tr>
<tr>
<td>READ(NF)-NO DATA RT</td>
<td>1227.54</td>
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<table>
<thead>
<tr>
<th>GROUP BP7</th>
<th>AVERAGE</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>GBP-DEPEND GETPAGES</td>
<td>320.4K</td>
<td>15380145</td>
</tr>
<tr>
<td>READ(XI)-DATA RETUR</td>
<td>54.67</td>
<td>2624</td>
</tr>
<tr>
<td>READ(XI)-NO DATA RT</td>
<td>16597.00</td>
<td>796656</td>
</tr>
<tr>
<td>READ(NF)-DATA RETUR</td>
<td>140.60</td>
<td>6749</td>
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<td>READ(NF)-NO DATA RT</td>
<td>16620.69</td>
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<table>
<thead>
<tr>
<th>GROUP BP12</th>
<th>AVERAGE</th>
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<tbody>
<tr>
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<td>--------</td>
</tr>
<tr>
<td>GBP-DEPEND GETPAGES</td>
<td>91613.63</td>
<td></td>
</tr>
<tr>
<td>READ(XI)-DATA RETUR</td>
<td>24.73</td>
<td></td>
</tr>
<tr>
<td>READ(XI)-NO DATA RT</td>
<td>24369.08</td>
<td></td>
</tr>
<tr>
<td>READ(NF)-DATA RETUR</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>READ(NF)-NO DATA RT</td>
<td>3086.73</td>
<td></td>
</tr>
</tbody>
</table>

XI No Data RT means the page was cross invalidated in the local pool, but was not found in the GBP
PCLOSEN/PCLOSESET and Synch I/O

- The default in DB2 10 is PCLOSEN=5, PCLOSESET=10
  - The customer saw a 20% increase in Synch I/O after migration
  - They had moved from PCLOSESET=30 → PCLOSESET=10 so every 10 minutes objects without inter R/W interest would pseudo close
  - When the objects moved out of GBP dependency the local buffers would be cross invalidated
    - Next execution of the application would require entire index be read back in

<table>
<thead>
<tr>
<th>OPEN/CLOSE ACTIVITY</th>
<th>QUANTITY /SECOND</th>
<th>/THREAD</th>
<th>/COMMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSETS CONVERTED R/W → R/O</td>
<td>9010.00</td>
<td>0.67</td>
<td>0.03</td>
</tr>
<tr>
<td>DSETS CONVERTED R/W → R/O</td>
<td>24721.00</td>
<td>1.72</td>
<td>0.07</td>
</tr>
</tbody>
</table>

- **ROT:** R/W → R/O = 10-15 a minute
  - The solution in this situation was to set PCLOSEN=32767 to disable it, and PCLOSESET=45 minutes so that the object did not through pseudo close until the application ran again (every 30 minutes)
Log Write I/O

- Log Write I/O time is Class 3 time resulting from the application waiting for DB2 to synchronously write log records to disc
  - Prior to V11 the culprit was often index page splits from heavy inserts
- For GBP dependent objects if update creates an overflow records result is a forced write (synchronous) of Log records and overflow page to GBP
  - Occurs after applying PM82279 in V10
- This can significantly impact Log Write I/O class 3 suspense time if most of the rows increase in size and do not fit on the same page anymore

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SYNCHRON. I/O</td>
<td>8:03:40</td>
<td>173.7K</td>
</tr>
<tr>
<td>DATABASE I/O</td>
<td>5.35:05</td>
<td>4705.31</td>
</tr>
<tr>
<td>LOG WRITE I/O</td>
<td>7:58:05</td>
<td>169.0K</td>
</tr>
<tr>
<td>WRITE AND REGISTER</td>
<td>169.0K</td>
<td>2197415</td>
</tr>
<tr>
<td>WRITE &amp; REGISTER MULT</td>
<td>55.77</td>
<td>725</td>
</tr>
<tr>
<td>CHANGED PAGES WRITTEN</td>
<td>169.5K</td>
<td>2203021</td>
</tr>
</tbody>
</table>

- Here we see log write delay for every occurrence of a page being written to the GBP (application elapsed time went from <1 minute to > 8 minutes)
Log Write I/O...

- The solution is to ensure there is enough room on the page for updated rows
  - Overflow records cause more getpages, increase elapsed time, degraded prefetch, up to 2x I/Os even without the forced write
  - PCTFREE (V10) and PCTFREE x% FOR UPDATE n% (v11)
  - Maybe even a larger page size (4k → 8k?)

- How do I know I am creating overflow records?
  - The near and far indirect references are tracked in the real time stats tables (REORGNEARINDREF)
  - Monitor the counts here before and after the application runs
  - Determine the percentage of rows overflowing and increase the free space on the pages by that amount

```sql
SELECT name, partition, (DEC(REORGNEARINDREF) + DEC(REORGFARINDREF)) / DEC(TOTALROWS) AS OVERFLOW
FROM SYSIBM.SYSTABLESPACESTATS
WHERE TOTALROWS > 0 and dbname = 'TEST15' and name = 'GLWSEMP'
WITH UR;
```
With Sync Receive and IDTHTOIN (V11 CM)

- Customer was seeing batch jobs (utilities) timing out and missing their SLAs
  - Saw timeouts and had to manually cancel threads to let batch break in..
  - So did you see IDTHTOIN pop in the log, what about in the previous release?
    - 00D3003B in the log for threads that hit IDTHTOIN
- (DB2 11) - Now when idle thread timeout is hit DDF must issue TCPIP.DROP command to kill the socket associated with the thread
- If threads are remaining in the system longer than on DB2 10, and the idle threads are not being canceled (causing timeouts or contention with other processes), then MVS.VARY.TCPIP.DROP OPERCMDS missing
  - Get DSNL512I -111 RC = 77E800DC (EACCES/JRSAFNotAuthorized)
- Process is described in setting up DDF and UNIX system services section of the installation guide
- PI06325 – message DSNL512I is enhanced to show socket=EZBNMIF4_DROPCON to alert you that service failed
References

- Techdoc for V10 and V11 MEMU2 with spreadsheet

- Subsystem and Transaction Monitoring and Tuning with DB2 11 for z/OS SG24-8182

- RMF spreadsheet reporting tool
  - Link to download
  - InfoCenter link
  - LPAR design tool
  - Redbook using RMF and the spreadsheet reporter
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