IMS Database Performance –
Could have, Should have, Would Have

Rosemary Galvan
Principal IMS Software Consultant
Agenda

- Review of various performance statistics which could be monitored to determine database health
  - Do you need to reorg? – Do you need to resize?
  - Focus on Full Function and Fast Path DEDB
  - Focus on statistics/reports obtained from BMC Software utilities or native utilities

- What to look at and why you should

- What would simplify database performance monitoring
What to monitor - CI/CA Splits

- Occurs in VSAM KSDS, not in VSAM DEDB
  - Index databases - Primary or Secondary
- Occurs with normal insert/delete activity over time
  - Cause performance degradation over time
- Use IDCAMS, LISTCAT option
  - Displays # of CI/CA Splits
  - High # of CI splits
  - High or any # of CA splits
    - CA splits rare
- **Means it’s time to reorg**

Control Interval = 1 to n+ number of records
Control Area = Block of records
What to monitor - CI/CA Splits

- Needs of the one over the many?
  - One index may become fragmented over other index databases or the main database
    - Reorg of everything is un-necessary, lengthy outage
  - IDCAMS REPRO option to “reorg” individual Index database
    - Requires an outage
  - MAXM Reorg/Online for IMS
    - Copy function
      - Performs similar function to REPRO but allows index to remain online
What to monitor - Database Dataset Extents

- Max for OSAM is 60, Max for VSAM is 255, Max for DEDB is 0
- Indicates data is being added to the end of the database because there isn’t enough free space in the middle

- Determining number of extents
  - VSAM - IDCAMS, LISTCAT option
  - OSAM – ISPF option 3.2
  - Fast Path – IDCAMs, LISTCAT option

- Also monitor volumes as well
  - Ensure space available on candidate volumes to take an extent
  - U844’s when not enough space to take extents
### ATTRIBUTES
- **KEYLEN**: 19
- **AVGLRECL**: 330
- **CISIZE**: 2048
- **RKP**: 0
- **MAXLRECL**: 330
- **CI/CA**: 315
- **SHROPTNS(2,3)**
- **RECOVERY**: NOERASE
- **SUBALLOC**: EXTRALARGEINDEXED
- **NOWRITECHK**: NOIMBED
- **NOREPLICATE**: NOREUSE
- **UNORDERED**: NONSPANNED

### STATISTICS
- **REC-TOTAL**: 3916753
- **SPLITS-CI**: 7960
- **EXCP**: 163738140
- **REC-DELETED**: 4155
- **SPLITS-CA**: 1576
- **EXTENTS**: 19
- **REC-INSERTED**: 1622557
- **FREE SPACE-%CI**: 0
- **SYSTEM-TIMESTAMP**: 2007.183 02:01:48
- **REC-UPDATED**: 32262
- **FREE SPACE-%CA**: 0
- **REC-RETRIEVED**: 378842242
- **FREE SPACE**: 150570
- **X'C0D47CA4D42B836A'**

### ALLOCATION
- **SPACE-TYPE**: CYLINDER
- **SPACE-PRI**: 800
- **USECLASS-PRI**: 0
- **HALRBA-OR-CI**: 2000370500
- **SPACE-SEC**: 500
- **USECLASS-SEC**: 0
- **HUSRBA-OR-CI**: 2000219930

---

Lots of CI/CA splits

0% means low to Total # records in DB
# OSAM Database Dataset

## Data Set Information

### General Data
- **Data Set Name**: DBU.QA.HSR.OLRHDO01.OLRHDO01
- **Management class**: **None**
- **Storage class**: **None**
- **Volume serial**: DBU065
- **Device type**: 3390
- **Data class**: **None**
- **Organization**: PS
- **Record format**: FBS
- **Record length**: 4096
- **Block size**: 4096
- **1st extent cylinders**: 25
- **Secondary cylinders**: 15
- **Data set name type**: 

### Current Allocation
- **Allocated cylinders**: 100
- **Allocated extents**: 6

### Current Utilization
- **Used cylinders**: 88
- **Used extents**: 6

### Other Information
- **SMS Compressible**: NO
- **Creation date**: 2009/12/09
- **Referenced date**: 2010/03/12
- **Expiration date**: ***None***
Lots of information is misleading

<table>
<thead>
<tr>
<th>ATTRIBUTES</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
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<tr>
<td>KEYLEN</td>
<td>0</td>
<td>AVGLRECL</td>
<td>4089</td>
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<tr>
<td>RKP</td>
<td>0</td>
<td>MAXLRECL</td>
<td>4089</td>
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<td>SHROPTNS(3,3)</td>
<td>RECOVERY</td>
<td>UNIQUE</td>
<td>NOERASE</td>
</tr>
<tr>
<td></td>
<td>UNORDERED</td>
<td>REUSE</td>
<td>NONSPANNED</td>
</tr>
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<th>STATISTICS</th>
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<tr>
<td>REC-TOTAL</td>
<td>150</td>
<td>SPLITSCLI</td>
<td>0</td>
</tr>
<tr>
<td>REC-DELETED</td>
<td>0</td>
<td>SPLITSCA</td>
<td>0</td>
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<td>REC-INSERTED</td>
<td>0</td>
<td>FREESPACE-%CI</td>
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<td>REC-UPDATED</td>
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<td>FREESPACE-%CA</td>
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<tr>
<td>SPACE-TYPE</td>
<td>CYLINDER</td>
<td>HI-A-RBA</td>
<td>737280</td>
</tr>
<tr>
<td>SPACE-PRI</td>
<td>1</td>
<td>HI-U-RBA</td>
<td>614400</td>
</tr>
<tr>
<td>SPACE-SEC</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DEDB – EXTEND Area Summary Report</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DBD Name:</strong> DPOP1</th>
<th><strong>Area DDname:</strong> DPOP1A0</th>
<th><strong>Area DSname:</strong> PFP.QA.DB.DPOP1A1</th>
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</thead>
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<tr>
<td><strong>Randomizing Module Name</strong></td>
<td>DBFHDC40</td>
<td><strong>Original</strong></td>
</tr>
<tr>
<td><strong>UOW=(9,3)</strong></td>
<td><strong>CISIZE=4096</strong></td>
<td><strong>ROOT=(14,4)</strong></td>
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<table>
<thead>
<tr>
<th><strong>Root Addressable Area (RAA) Portion:</strong></th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>UOW’s in RAA</strong></td>
<td>10</td>
</tr>
<tr>
<td><strong>Total CI’s per UOW</strong></td>
<td>9</td>
</tr>
<tr>
<td><strong>RAP CI’s per UOW</strong></td>
<td>6</td>
</tr>
<tr>
<td><strong>DOVF CI’s per UOW</strong></td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Root Anchor Point CI’s</strong></td>
<td>60</td>
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<tr>
<td><strong>Total Dependent Overflow CI’s</strong></td>
<td>30</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th><strong>Independent Overflow (IOVF) Portion:</strong></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Independent Overflow CI’s</strong></td>
<td>36</td>
</tr>
<tr>
<td><strong>IOVF Space Map CI’s</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>IOVF Data CI’s</strong></td>
<td>35</td>
</tr>
<tr>
<td><strong>Used IOVF CI’s</strong></td>
<td>9 (26%)</td>
</tr>
<tr>
<td><strong>Free IOVF CI’s</strong></td>
<td>26 (74%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Sequential Dependent (SDEP) Portion:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Sequential Dependent CI’s</strong></td>
<td>13</td>
</tr>
<tr>
<td><strong>SDEP Logical Begin</strong></td>
<td>00000001:00089000</td>
</tr>
<tr>
<td><strong>SDEP Logical End</strong></td>
<td>00000001:0009032B</td>
</tr>
<tr>
<td><strong>Used SDEP CI’s</strong></td>
<td>8 (62%)</td>
</tr>
<tr>
<td><strong>Free SDEP CI’s</strong></td>
<td>5 (38%)</td>
</tr>
</tbody>
</table>

*Increased 5 times w/o taking offline*
What to monitor – Space Usage

- How close to 4 GIG VSAM limit or 8 GIG OSAM limit or DEDB is almost unlimited
- Schedule purge jobs to delete or archive off data from database to keep within limit.
- Another option is to compress the database.
- If databases continue to grow, other alternatives may need to be considered
  - Database Partitioning is an option

Monitor
- VSAM – IDCAMS Listcat option
  - High Used RBA / High Allocate RBA * 100 is percentage of how full you are & how close to the limit
- OSAM – get out the calculator
- DEDB – not much data available
VSAM - IDCAMS LISTCAT

ATTRIBUTES
KEYLEN----------------19 AVGLRECL---------330... CISIZE---------2048
RKP------------------0 MAXLRECL---------330... CI/CA---------315
SHROPTNS(2,3) RECOVERY SUBALLOC NOERASE EXTRALARGEINDEXED
NOWRITECHK NOIMBED NOREPLICAT UNORDERED NOREUSE NONSPANNED

STATISTICS
REC-TOTAL--------3916753 SPLITS-CI---------7960 EXCPS---------163738140
REC-DELETED-------4155 SPLITS-CA---------1576 EXTENTS-----------19
REC-INSERTED-----1622557 FREESPACE-%CI------0 SYSTEM-TIMESTAMP:
REC-UPDATED--------32262 FREESPACE-%CA------0 2007.183 02:01:48
REC-RETRIEVED--378842242 FREESPACE--------150570 X'C0D47CA4D42B836A'

ALLOCATION
SPACE-TYPE------CYLINDER
SPACE-PRI--------800 USECLASS-PRI--------0 HALRBA-OR-CI--2000370500
SPACE-SEC--------500 USECLASS-SEC--------0 HUSRBA-OR-CI--2000219930

About 2 gig dataset
Within 99% of that limit
HiUse / HiAlloc * 100 = %
2000219930/2000270500*100=99%
OSAM Database Allocation

Data Set Information

Data Set Name . . . . : DBU.HLD.HI8GIG01.HI8GIG01

General Data
Management class . . : LRGL2
Storage class . . . . : DEVSMS
Volume serial . . . : DVL092 +
Device type . . . . : 3390
Data class . . . . . : **None**
Organization . . . : PS
Record format . . . : FBS
Record length . . . : 8192
Block size . . . . : 8192
1st extent cylinders: 22
Secondary cylinders : 500
Data set name type :

Creation date . . . : 2009/10/13
Expiration date . . : ***None***

Current Allocation
Allocated cylinders : 11,200
Allocated extents . : 28

Current Utilization
Used cylinders . . : 11,200
Used extents . . . : 28

SMS Compressible : NO

So, How close am I to the 8 gig limit?
Notice allocated & Used values the same
## SPACE USAGE ANALYSIS

TOTAL NUMBER OF BLOCKS.................. 1,007,978
NUMBER OF BLOCKS WITH FREE SPACE........ 1,007,962
NUMBER OF FREE SPACE ELEMENTS............ 1,007,962
NUMBER OF FSE THAT WILL HOLD LARGEST SEG... 555,929
NUMBER OF FSE TOO SMALL FOR SMALLEST SEG.... 0
SEGMENT SIZE RANGE FOR THIS DSG........... 797 TO 1,735
FREE BLOCK FREQUENCY FACTOR (FROM DBD)..... 0
FREE SPACE PERCENT FACTOR (FROM DBD)....... 13
BYTES OF SPACE REPRESENTED BY FSPF....... 1,065

TOTAL BYTES OF SPACE.................... 8,257,355,776
SEGMENT PREFIX............................ 44,704,854 0.5%
SEGMENT DATA.............................. 6,462,221,713 78.3%
SEGMENT PAD............................... 5,259,829 0.1%
FREE SPACE -- USEABLE................... 1,736,972,876 21.0%
FREE SPACE -- NOT USEABLE............... 0 0.0%
SLACK........................................ 0 0.0%

8 billion bytes means close to 8 Gig
This is all the space left
DEDB Monitoring

- IDCAMS LISTCAT not updated by Media Manager
  CLUSTER ------ PFP.TEST.FPDEDB.FPDEDB01
  STATISTICS
    REC-TOTAL---------------0            SPLITS-CI-------------------0            EXCPS------------------------0
    REC-DELETED--------0             SPLITS-CA-------------------0            EXTCPS----------------------0
    REC-INSERTED--------0             FREESPACE-%CI--------0             SYSTEM-TIMESTAMP: X'0000000000000000'
    REC-UPDATED--------0             FREESPACE-%CA------0                     X'0000000000000000'
    REC-RETRIEVED-------0             FREESPC---------11796480
  ALLOCATION
    SPACE-TYPE------CYLINDER     HI-A-RBA---------11796480
    SPACE-PRI------------16       HI-U-RBA---------11796480
    SPACE-SEC-----------1

- IMS Display Area using the IOVF keyword
  /DIS AREA FPDEDB01 IOVF
  DFS000I  AREANAME EQECT TOTAL UNUSED TOTAL UNUSED DBNAME EEQECT
  DFS000I  DDNAME REMAIN SEQ DEPENDENT DIR ADDRESSABLE
  DFS000I  FPDEDB01 N/A  868   631   991   920-CI  FPDEDB  0
  DFS000I  FPDEDB01  10   N/A   N/A   N/A   N/A    N/A
  DFS000I  *10139/100645*   TSTA
What to Monitor? Available Free Space

- Normal update activity reduces free space available for new data over time
- IMS tries to place new data in a convenient location but as free space becomes scarce, data is spread across multiple locations or placed at the end.
- As databases become unorganized, additional I/O’s are required to access data which slows down applications trying to access this data.
- Regular Reorganization maintains Database Health
  - Balancing act – REORG enough to keep databases healthy but not too often that impact availability or waste resources
Analyzing space usage with BMC Software Pointer Checker Plus

- Several standard reports created which can be used to analyze space usage
  - Bit Map Summary Report
  - Block/CI Summary
  - Distribution of FSE per Block
  - Percent of Blocks without Free Space
  - Space Usage Analysis

- Other optional reports can be requested as well
What is a Bit Map and why do I care?

- Bit maps keep track of free space in the database.
- Actual Bit Map Detail is a series of *’s and blanks or 1’s and 0’s.
  - In BMC Bit Map - * means no space and blank means space.
- Indicates if there’s enough space in a CI or OSAM block to hold the largest segment defined for the database.
Bit Map Detail – beginning of the map
Bit Map Detail – end of the database
Bitmap Summary Report

- Total # blocks is 219149
- So approximately 20% of the blocks contain enough contiguous freespace to hold the largest segment
- So the database is about 80% full
  - If your threshold is 20% you’re reached it, but if it’s 30%, you’ve exceed it
  - Padding thresholds is pro-active monitoring
What bothers me on this report is the low number of empty blocks (0%) 
This could be okay but I need more information
Segment Counts Report – Tells me how much room I need

<table>
<thead>
<tr>
<th>SEGMENT</th>
<th>SEGMENT LENGTH</th>
<th>TOTAL NUMBER</th>
<th>NBR IN OVERFLOW</th>
<th>NBR PHY DELETED</th>
<th>NBR LOG DELETED</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMCHDR01</td>
<td>412</td>
<td>1,455,260</td>
<td>159,880</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>BMCHDR02</td>
<td>36</td>
<td>776</td>
<td>208</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>BMCHDR04</td>
<td>61</td>
<td>1,112,365</td>
<td>141,632</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>BMCHDR05</td>
<td>61</td>
<td>246,802</td>
<td>33,970</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>BMCHDR06</td>
<td>15</td>
<td>356,439</td>
<td>45,876</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>BMCHDR07</td>
<td>171</td>
<td>359,987</td>
<td>49,048</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>BMCHDR09</td>
<td>32</td>
<td>1,259,405</td>
<td>164,297</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>BMCHDR10</td>
<td>173</td>
<td>775</td>
<td>77</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

TOTAL SEGMENTS = 4,791,809 594,988

Notice counts for segments of length 412, 61, and 32
The largest count is for the largest segment length, 412
## Analyzing Space Usage

### DISTRIBUTION OF FSE PER BLOCK

<table>
<thead>
<tr>
<th>DBD=BMCHDMDD</th>
<th>DDNAME=BMCHDMDD</th>
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<tbody>
<tr>
<td>NUMBER OF FSE PER BLK</td>
<td>BLOCK COUNT</td>
</tr>
<tr>
<td>0</td>
<td>26,792</td>
</tr>
<tr>
<td>1</td>
<td>158,349</td>
</tr>
<tr>
<td>2</td>
<td>21,856</td>
</tr>
<tr>
<td>3</td>
<td>7,639</td>
</tr>
<tr>
<td>4</td>
<td>2,240</td>
</tr>
<tr>
<td>5</td>
<td>722</td>
</tr>
<tr>
<td>6</td>
<td>258</td>
</tr>
<tr>
<td>7</td>
<td>140</td>
</tr>
<tr>
<td>8</td>
<td>93</td>
</tr>
<tr>
<td>9+</td>
<td>1,060</td>
</tr>
</tbody>
</table>

AVERAGE: 1.2

219,149 333 20.8% 79.2%

- *A little room for the 412 length segments but lots for everyone else*
Space Usage Analysis – Percentage of Blocks without Free Space

- This is a graph of the % of FULL blocks

Too data much for slide
Space Usage Analysis – Percentage of Blocks without Free Space

Just go to the end of this report

NOTE: TOTAL NUMBER OF BLOCKS IN DSGROUP = 219,150
NUMBER OF BLOCKS REPRESENTED BY EACH VERTICAL BAR = 2,192
HDAM OVERFLOW AREA STARTS IN BLOCK = 175,001
BYTES OF SPACE REQUIRED FOR BITMAP TO REFLECT "SPACE" = 4,006

BLOCKS WITH FREE SPACE = 43  97.7%
BLOCKS WITHOUT FREE SPACE = 1  2.3%
Space Usage Analysis Report – BMC Software Pointer Checker Plus

This report shows how the space in the database is being used.

A large # of unusable FSEs could indicate the need to Reorganize.
How about DEDB SPACE?

Why do you Reorganize?
• Simply to elimination fragmented free space elements (FSEs) and scraps in the root addressable area (RAA)
• Move as many segments as possible from independent overflow (IOVF) into their respective RAA or DOVF control intervals (CIs).
• Also:
  • Reclaims space, Resequences roots, Controls segment placement
• Reporting:
  • Area Summary Report
  • UOW Detailed Analysis Report
  • IOVF Space Analysis Report
  • Free Space Analysis Report

Trade speed for space, Fast Path is a space Hog
**Area Summary Report**

**DBD Name:** DP$10  
**Area DDname:** DP$10A0  
**Area DSname:** PFP.QA.DB.DP$10A1  
**Area number:** 1

**Randomizing Module Name:** DBFHDC40  
**UOW=(9,3)**  
**ROOT=(14,4)**  
**CISIZE=4096**

**Root Addressable Area (RAA) Portion:**
- **UOW's in RAA:** 10
- **Total CI's per UOW:** 9
- **RAP CI's per UOW:** 6
- **DOVF CI's per UOW:** 3
- **Total Root Anchor Point CI's:** 60
- **Total Dependent Overflow CI's:** 30

**Independent Overflow (IOVF) Portion:**
- **Total Independent Overflow CI's:** 36
- **IOVF Space Map CI's:** 1
- **IOVF Data CI's:** 35

**Sequential Dependent (SDEP) Portion:**
- **Total Sequential Dependent CI's:** 13
- **SDEP Logical Begin:** 00000001:00089000
- **SDEP Logical End:** 00000001:0009032B

**Significant RBA values:**
- **First Root Anchor Point:** 00002000
- **First IOVF CI:** 00005C00
- **REORG UOW:** 00080000
- **First SDEP CI:** 00089000
- **End of AREA:** 00096000

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**Area Summary Report – Shows how the Area is defined**

- How CI's allocated in the Root, DOVF, IOVF, and SDEP portions
UOW Detailed Analysis Report

DBD Name: DPOP1     Area DDname: DPOP1A0     Area DSname: PFP.QA.DB.DPOP1A1

<table>
<thead>
<tr>
<th>Area number: 1</th>
<th>UOW Range: All</th>
</tr>
</thead>
<tbody>
<tr>
<td>UOW  ---Number CIs Used---</td>
<td>No. RAPs --% RAP FS---</td>
</tr>
<tr>
<td>No.  RAP  DOVF IOVF Use Ovfl Avg Max Min Part FS Records</td>
<td>Avg</td>
</tr>
<tr>
<td>0      6      3      1        4     33  53  1     28   14   2,005  3,011  1,272</td>
<td></td>
</tr>
<tr>
<td>1      5      2      0        2     28  52  0     51   10   2,057  3,051  1,281</td>
<td></td>
</tr>
<tr>
<td>2      6      2      0        2     34  50  1     61   10   2,091  2,983  937</td>
<td></td>
</tr>
<tr>
<td>3      6      3      1        4     26  55  0     9    14   2,253  3,203  1,769</td>
<td></td>
</tr>
<tr>
<td>4      6      3      2        4     3   7   0     34   16   2,422  3,336  1,736</td>
<td></td>
</tr>
<tr>
<td>5      5      3      0        4     25  53  0     15   11   2,332  2,924  1,635</td>
<td></td>
</tr>
<tr>
<td>6      6      3      1        3     25  57  0     33   12   2,333  2,894  1,735</td>
<td></td>
</tr>
<tr>
<td>7      5      3      1        3     20  50  1     30   12   2,183  2,916  1,847</td>
<td></td>
</tr>
<tr>
<td>8      5      3      2        3     3   3   0     49   14   2,287  2,899  1,856</td>
<td></td>
</tr>
<tr>
<td>9      5      3      1        4     12  43  2     25   13   2,157  2,712  1,625</td>
<td></td>
</tr>
</tbody>
</table>

*** UOW Range Total ***

<table>
<thead>
<tr>
<th>UOW Range Total</th>
<th>Avg</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>126</td>
<td>2,220</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

UOWs using 100% of DOVF = 8 (80.0%)  
80% in Dependent overflow, not bad
IOVF Space Analysis Report

DBD Name: DPOP1  Area DDname: DPOP1A0  Area DSname: PFP.QA.DB.DPOP1A1

Area number: 1

<table>
<thead>
<tr>
<th>No.</th>
<th>Map RBA</th>
<th>Used</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0005C000</td>
<td></td>
<td>*****</td>
</tr>
</tbody>
</table>

- VISUAL REPRESENTATION OF CIs USED
- CAN BE USED TO CALCULATE IOVF FREESPACE
**Free Space Analysis Report**

Area DSname: PFP.QA.DB.DPOD7A1  
UOW Range: All

<table>
<thead>
<tr>
<th></th>
<th>RAP</th>
<th>DOVF</th>
<th>IOVF</th>
<th>SDEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total % FS</td>
<td>24%</td>
<td>2%</td>
<td>55%</td>
<td>78%</td>
</tr>
<tr>
<td>Usable % FS</td>
<td>23%</td>
<td>1%</td>
<td>55%</td>
<td>78%</td>
</tr>
<tr>
<td>Unused</td>
<td>17%</td>
<td>0%</td>
<td>52%</td>
<td>78%</td>
</tr>
<tr>
<td>In Area</td>
<td>5%</td>
<td>0%</td>
<td>31%</td>
<td></td>
</tr>
<tr>
<td>FS for Root</td>
<td></td>
<td></td>
<td></td>
<td>29%</td>
</tr>
</tbody>
</table>

- QUICK GUIDE TO AVAILABLE SPACE FOR A PARTICULAR AREA
- SHOWS LITTLE FREESPACE IN DOVF
- COULD BE HOW RANDOMIZER IS PLACING DATA
- FREESPACE IN RAP WON’T HELP UNLESS RECORDS RANDOMIZE TO THE RAPS WITH FREESPACE
- DATABASE HAS PLENTY OF SPACE JUST NEED TO MONITOR IT
Standard reports created which can be used to monitor health
- HDAM Rap Summary Report
- Segment Pointer Statistics Report
- Distribution of Roots per block

Other optional reports can be requested as well
Health Check on your IMS Database – BMC Pointer Checker Plus Reports

- HDAM Rap Summary Report
  - Displays counts of blocks in RAA and overflow
  - Displays RAP usage information

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blocks in Root Addressable Area</td>
<td>175,000</td>
</tr>
<tr>
<td>Blocks in Overflow Area</td>
<td>44,149</td>
</tr>
<tr>
<td>Number of RAPS per Block</td>
<td>5</td>
</tr>
<tr>
<td>RAPS Not Used</td>
<td>165,797</td>
</tr>
<tr>
<td>RAPS Used</td>
<td>709,203</td>
</tr>
<tr>
<td>RAPS Pointing Outside their Block</td>
<td>434,311</td>
</tr>
</tbody>
</table>

- Of the RAPS used, 61% point outside their block
- High # of RAPS pointing outside of their block indicates reorg needed
### Health Check on your IMS Database – BMC Pointer Checker Plus Reports

**SEGMENT POINTER STATISTICS**

<table>
<thead>
<tr>
<th>SOURCE SEGMENT</th>
<th>PTR TYPE</th>
<th>TARGET SEGMENT</th>
<th>NBR-OF-SOURCE-SEGS W/O PTR</th>
<th>WITH PTR</th>
<th>I/O PROB</th>
<th>FREQ-THAT-SEGS-ARE-IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDAM RAP TO FIRST ROOT</td>
<td>PTF</td>
<td>BMCHDR01</td>
<td>709,203</td>
<td>746,057</td>
<td>.612</td>
<td>274,892</td>
</tr>
<tr>
<td>BMCHDR01</td>
<td>PTF</td>
<td>BMCHDR02</td>
<td>1,454,484</td>
<td>776</td>
<td>.189</td>
<td>544,243</td>
</tr>
<tr>
<td>PCF</td>
<td>BMCHDR04</td>
<td>342,895</td>
<td>1,112,365</td>
<td>1,112,365</td>
<td>.026</td>
<td>28,890</td>
</tr>
<tr>
<td>PCF</td>
<td>BMCHDR05</td>
<td>1,208,458</td>
<td>246,802</td>
<td>246,802</td>
<td>.036</td>
<td>8,770</td>
</tr>
<tr>
<td>PCF</td>
<td>BMCHDR06</td>
<td>1,098,821</td>
<td>356,439</td>
<td>356,439</td>
<td>.044</td>
<td>15,554</td>
</tr>
<tr>
<td>PCF</td>
<td>BMCHDR07</td>
<td>1,095,273</td>
<td>359,987</td>
<td>359,987</td>
<td>.138</td>
<td>49,707</td>
</tr>
<tr>
<td>PCF</td>
<td>BMCHDR09</td>
<td>356,143</td>
<td>1,099,117</td>
<td>1,099,117</td>
<td>.068</td>
<td>74,564</td>
</tr>
<tr>
<td>PCF</td>
<td>BMCHDR10</td>
<td>1,454,533</td>
<td>727</td>
<td>727</td>
<td>.323</td>
<td>235</td>
</tr>
<tr>
<td>BMCHDR02</td>
<td>PTF</td>
<td>BMCHDR04</td>
<td>1,112,365</td>
<td>0</td>
<td>.000</td>
<td>0</td>
</tr>
<tr>
<td>BMCHDR04</td>
<td>PTF</td>
<td>BMCHDR05</td>
<td>246,802</td>
<td>0</td>
<td>.000</td>
<td>0</td>
</tr>
<tr>
<td>BMCHDR05</td>
<td>PTF</td>
<td>BMCHDR06</td>
<td>356,439</td>
<td>0</td>
<td>.000</td>
<td>0</td>
</tr>
<tr>
<td>BMCHDR06</td>
<td>PTF</td>
<td>BMCHDR07</td>
<td>359,987</td>
<td>0</td>
<td>.000</td>
<td>0</td>
</tr>
<tr>
<td>BMCHDR07</td>
<td>PTF</td>
<td>BMCHDR09</td>
<td>1,099,117</td>
<td>160,288</td>
<td>.027</td>
<td>4,285</td>
</tr>
<tr>
<td>BMCHDR09</td>
<td>PTF</td>
<td>BMCHDR10</td>
<td>727</td>
<td>48</td>
<td>.063</td>
<td>45</td>
</tr>
</tbody>
</table>

**How often a pointer references a different block than the source segment**
Don’t I need to know how many roots will fit into each block?

Don’t I need the length of the database records, the blocksize, and the bytes parameter to figure this out?
How about DEDB Performance?

Why reorg?
• Does the UOW extend into IOVF?
• Is UOW fragmentation over a specified threshold?
• Can reorganization of the UOW save a specified amount of IOVF?

Reporting:
• Segment I/O Placement
• Fragmentation on Area Summary Report
• Reorg Report
SEGMENT PLACEMENT ANALYSIS REPORT

FAST PATH ANALYZER/EP
Segment Placement Analysis Report

DBD Name: DPOP1     Area DDname: DPOP1A0   Area DSname: PFP.QA.DB.DPOP1A1
Area number: 1                  UOW Range: All

<table>
<thead>
<tr>
<th>SegName</th>
<th>CD</th>
<th>Lvl</th>
<th>Total Segs</th>
<th>---In RAA Base--- No.</th>
<th>%</th>
<th>---In DOVF---- No.</th>
<th>%</th>
<th>---In IOVF----- No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEGA</td>
<td>1</td>
<td>1</td>
<td>126</td>
<td>91</td>
<td>72.2</td>
<td>29</td>
<td>23.0</td>
<td>6</td>
<td>4.8</td>
</tr>
<tr>
<td>SDEP</td>
<td>2</td>
<td>2</td>
<td>239</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEGB</td>
<td>3</td>
<td>2</td>
<td>389</td>
<td>267</td>
<td>68.6</td>
<td>95</td>
<td>24.4</td>
<td>27</td>
<td>6.9</td>
</tr>
<tr>
<td>SEGC</td>
<td>4</td>
<td>3</td>
<td>569</td>
<td>381</td>
<td>67.0</td>
<td>145</td>
<td>25.5</td>
<td>43</td>
<td>7.6</td>
</tr>
<tr>
<td>SEGD</td>
<td>5</td>
<td>3</td>
<td>541</td>
<td>354</td>
<td>65.4</td>
<td>149</td>
<td>27.5</td>
<td>38</td>
<td>7.0</td>
</tr>
<tr>
<td>SEGE</td>
<td>6</td>
<td>2</td>
<td>325</td>
<td>140</td>
<td>43.1</td>
<td>150</td>
<td>46.2</td>
<td>35</td>
<td>10.8</td>
</tr>
</tbody>
</table>

| Direct Segments | 1,950 | 1,233 | 63.2 | 568 | 29.1 | 149 | 7.6 |
| All Segments    | 2,189 |

Most segments in RAA & DOVF for good performance
**SEGMENT I/O ANALYSIS REPORT**

**FAST PATH ANALYZER/EP**

Segment I/O Analysis Report

DBD Name: DPOP1  Area DDname: DPOP1A0  Area DSname: PFP.QA.DB.DPOP1A1
Area number: 1  UOW Range: All

-Segment I/O Analysis - Average DB Record

<table>
<thead>
<tr>
<th>SegName</th>
<th>Seg</th>
<th>Seg Freq</th>
<th>Avg</th>
<th>Avg/ SDev</th>
<th>Max/ Min</th>
<th>Avg/ SDev</th>
<th>Max/ Min</th>
<th>Avg/ SDev</th>
<th>Max/ Min</th>
<th>Avg</th>
<th>SDev</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEGA</td>
<td>1</td>
<td>1</td>
<td>1.00</td>
<td>0.72</td>
<td>1.00</td>
<td>0.23</td>
<td>1.00</td>
<td>0.05</td>
<td>1.00</td>
<td>1.52</td>
<td>0.70</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>SEGB</td>
<td>3</td>
<td>2</td>
<td>3.09</td>
<td>2.12</td>
<td>3.09</td>
<td>0.75</td>
<td>3.09</td>
<td>0.21</td>
<td>3.09</td>
<td>0.15</td>
<td>0.36</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>SEGC</td>
<td>4</td>
<td>3</td>
<td>4.52</td>
<td>3.02</td>
<td>4.52</td>
<td>1.15</td>
<td>4.52</td>
<td>0.34</td>
<td>4.52</td>
<td>0.04</td>
<td>0.20</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>SEGD</td>
<td>5</td>
<td>3</td>
<td>4.29</td>
<td>2.81</td>
<td>4.29</td>
<td>1.18</td>
<td>4.29</td>
<td>0.30</td>
<td>4.29</td>
<td>0.06</td>
<td>0.24</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>SEGE</td>
<td>6</td>
<td>2</td>
<td>2.58</td>
<td>1.11</td>
<td>2.58</td>
<td>1.19</td>
<td>2.58</td>
<td>0.28</td>
<td>2.58</td>
<td>0.38</td>
<td>0.59</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

- **Record I/O**  
  Avg: 1.93  
  SDev: 1.01  
  Max: 4  
  Min: 1

- **Root I/O**  
  Avg: 1.52  
  SDev: 0.70  
  Max: 3  
  Min: 1
FRAGMENTATION ON AREA SUMMARY

FAST PATH ONLINE ANALYZER/EP
Area Summary Report

DBD Name: DPOD7   Area DDname: DPOD7A0   Area DSname: PFP.QA.DB.DPOD7A1
Area number: 1
Randomizing Module Name . . . . . . . . . . .         DBFHDC44
UOW=(40,10)   ROOT=(100,60)   CISIZE=4096

Root Addressable Area (RAA) Portion:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>UOW's in RAA</td>
<td>40</td>
</tr>
<tr>
<td>Total CI's per UOW</td>
<td>40</td>
</tr>
<tr>
<td>RAP CI's per UOW</td>
<td>30</td>
</tr>
<tr>
<td>DOVF CI's per UOW</td>
<td>10</td>
</tr>
<tr>
<td>Total Root Anchor Point CI's</td>
<td>1,200</td>
</tr>
<tr>
<td>Total Dependent Overflow CI's</td>
<td>400</td>
</tr>
</tbody>
</table>

Independent Overflow (IOVF) Portion:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Independent Overflow CI's</td>
<td>2,400</td>
</tr>
<tr>
<td>IOVF Space Map CI's</td>
<td>20</td>
</tr>
<tr>
<td>IOVF Data CI's</td>
<td>2,380</td>
</tr>
</tbody>
</table>

Sequential Dependent (SDEP) Portion:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Sequential Dependent CI's</td>
<td>458</td>
</tr>
<tr>
<td>SDEP Logical Begin</td>
<td>00000001:00FCA000</td>
</tr>
<tr>
<td>SDEP Logical End</td>
<td>00000001:01030B9D</td>
</tr>
</tbody>
</table>

Significant RBA values:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Root Anchor Point</td>
<td>00002000</td>
</tr>
</tbody>
</table>

Performance factors:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fragmentation</td>
<td>2.84</td>
</tr>
</tbody>
</table>

Low % fragmentation is good
## Fast Path

### REORGANIZATION REPORT PARAMETERS

#### Reorganization Parameters

**Selection Criteria:**
- Only UOW's that use IOVF

**Process Criteria:**
- Selected UOW's where the number of IOVF CI's saved is >= 1

#### Reorganization Statistics

**Root Addressable Area Portion:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>UOW's Selected</td>
<td>7</td>
</tr>
<tr>
<td>UOW's Empty</td>
<td>0</td>
</tr>
<tr>
<td>UOW's Rejected due to no IOVF used</td>
<td>3</td>
</tr>
<tr>
<td>UOW's Rejected due to no IOVF saved</td>
<td>0</td>
</tr>
<tr>
<td>RAP CI's Read</td>
<td>42</td>
</tr>
<tr>
<td>RAP CI's Reused</td>
<td>39</td>
</tr>
<tr>
<td>RAP CI's Empty</td>
<td>3</td>
</tr>
</tbody>
</table>

**Independent Overflow Portion:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOVF CI's Used</td>
<td>9</td>
</tr>
<tr>
<td>IOVF CI's Reused</td>
<td>1</td>
</tr>
<tr>
<td>IOVF CI's Reclaimed</td>
<td>8 ***</td>
</tr>
</tbody>
</table>

**REORGANIZE Buffer Statistics:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Maps Read</td>
<td>1</td>
</tr>
<tr>
<td>Space Maps Written</td>
<td>7</td>
</tr>
</tbody>
</table>
Monitoring Database Health is Challenging

- Space may be the final frontier but not the only thing to monitor!
- HDAM and DEDB tuning involves several parameters like:
  - Block Size, RAA size, RAPS parameter, CI’s, UOWs
  - Etc..
- Lots of reports available to indicate something is wrong, but no report tells you what to change

*It’s time to pull out the calculator*

- By the time you look at a report & notice something is wrong, maybe you’ve already missed your reorg window
  - End up “padding” values & thresholds to be “pro-active”
Why is database performance monitoring rarely done?

- Tedious, time consuming, manual process
- Strain on staff resources
  - Lots of database statistics and performance metrics are obtained when database utilities execute but who has time to review the data?
  - Group of dedicated performance experts, reduced to one, then none
    - Maintaining database performance just another responsibility for the DBA
  - IMS only DBA’s rare
    - Typically support both IMS and DB2
    - Some cases, IMS DBA function performed by IMS SysProg
Why is database performance monitoring rarely done?

- 2 approaches to database performance monitor
  - React response
    ▪ Wait until end users complain about poor response
  - Pro-active response
    ▪ Reorg as often as possible
    ▪ In the past, databases were monitored to avoid un-necessary reorgs and the lengthy associated outage
    ▪ Database utilities have evolved over time & provide capabilities for near online and online reorgs
      - BMC Software MAXM Reorg/Online for IMS
    ▪ Is it really okay to waste cycles for un-necessary reorgs?

- A dedicated IMS database expert probably sounds pretty good by now
MAXM Database Advisor

- Encapsulates the knowledge of an experienced DBA into a graphical user interface
  - *Focused* monitoring of your IMS database environment
    - Not worried about DB2
    - No meetings to attend
    - No vacation or sick time
    - No worries about Fantasy Football or March Madness Brackets
  - Space & performance metrics gathered during utility executions and/or through a separate data collector
  - Metrics gathered are automatically analyzed
    - Eliminates need for DBA staff to manually review and interpret various reports
MAXM Database Advisor

- Pro-active monitoring of database health
  - Metrics gather stored in a repository for history, trending and forecasting
  - DBA's notified of exceptions and provided recommendations for resolution
    - Doesn’t just tell you the database needs to be re-sized but provides information on what to change

- Conditional Reorg
  - No wasted CPU cycles on un-necessary reorgs

- Fast Path Online
  - Like Cond Reorg - Intelligent Reorg monitors UOW’s and only reorgs what needs to be reorged.
BUSINESS RUNS ON I.T.
I.T. RUNS ON BMC™