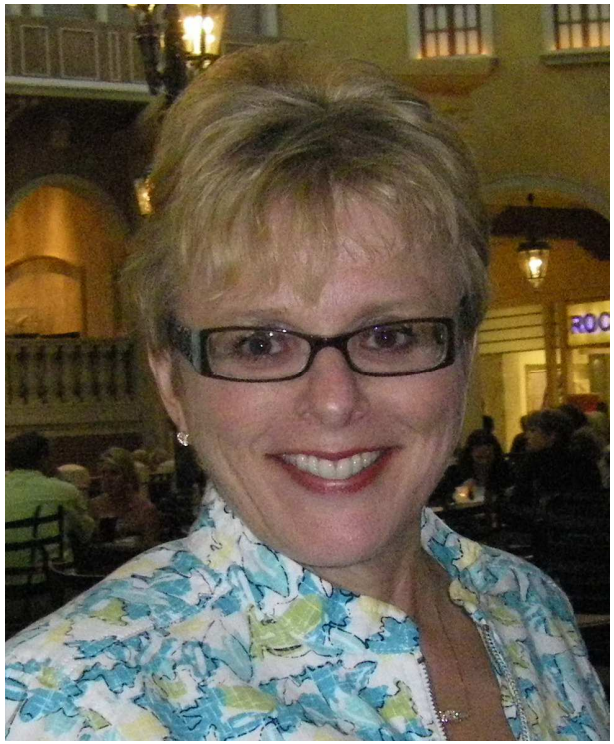
Power of db2pd



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Happy New Year – Best wishes for a super 2015 !!!

db2pd command

- *Monitor and Troubleshoot DB2* command:
  - Retrieves various statistics, internal metadata, and snapshot information from a running DB2 instance
  - Similar to the "**onstat**" utility for Informix
  - Run "**db2pd -help**" for options
- Completely non-intrusive, does not acquire latches:
  - Very fast retrieval
  - Does not impact the engine in any way (can be run even if system is hung)
  - Data might not always be completely accurate
- Developer Works article:
  - http://www-128.ibm.com/developerworks/db2/library/techarticle/dm-0504poon2

db2pd – Monitor and troubleshoot DB2

-applications	-agents	-transactions	-bufferpools	-logs	-locks
-tablespaces	-dynamic	-static	-fcm	-mempools	-memsets
-dbmcfg	-dbcfg	-catalogcache	-sysplex	-tcbstats	-reorg
-recovery	-reopt	-osinfo	-hadr	-utiltiies	-workloads
-workclasses	-thresholds	-serviceclasses	-ha	-statisticscache	-wlocks

db2pd -db tp1 -mempools

```
Database Partition 0 -- Database TP1 -- Active -- Up 0 days 00:04:43

Memory Pools:
Address    MemSet   PoolName   Id    Overhead   LogSz      LogUpBnd    LogHWM     CfgParm
0xA7806EE0 TP1      utilh      5     0          2120       20512768    2120       UTIL_HEAP_SZ
0xA7806D88 TP1      pckcacheh  7     113568     243113     Unlimited   243113     PCKCACHESZ
0xA7806CDC TP1      xmlcacheh  93    50944      80008      20971520    80008      n/a
0xA7806C30 TP1      catcacheh  8     0          67536      Unlimited   67536      CATALOGCACHE_SZ
0xA7806AD8 TP1      bph        16    32         16760384   Unlimited   16760384   n/a
0xA7806980 TP1      bph        16    64         42418432   Unlimited   42418432   n/a
0xA7806828 TP1      bph        16    32         782592     Unlimited   782592     n/a
0xA78066D0 TP1      bph        16    32         520448     Unlimited   520448     n/a
0xA7806578 TP1      bph        16    32         389376     Unlimited   389376     n/a
0xA7806420 TP1      bph        16    32         323840     Unlimited   323840     n/a
0xA7806374 TP1      shsorth    18    0          0          40960000    0          SHEAPTHRES_SHR
0xA78062C8 TP1      lockh      4     32         328192     458752      328192     LOCKLIST
0xA780621C TP1      dbh        2     381824     12346744   24379392    12346768   DBHEAP
0xB2CD62C8 AppCtl   apph       1     0          11104      1048576     27862      APPLHEAPSZ
0xB2CD6624 AppCtl   apph       1     0          7303       1048576     8411       APPLHEAPSZ
0xB2CD6578 AppCtl   apph       1     0          7347       1048576     7347       APPLHEAPSZ
0xB2CD64CC AppCtl   apph       1     0          7347       1048576     8759       APPLHEAPSZ
0xB2CD6420 AppCtl   apph       1     0          7367       1048576     7503       APPLHEAPSZ
0xB2CD621C AppCtl   appshrh    20    2304       62980      20480000    62980      application shared
```

db2pd – Monitor and troubleshoot DB2

-applications -agents -transactions -bufferpools -logs -locks
-tablespaces -dynamic -static -fcm -mempools -memsets
-dbmcfg -dbcfg -catalogcache -sysplex -tcbstats -reorg
-recovery -reopt -osinfo -hadr -utiltiies -workloads
-workclasses -thresholds -serviceclasses -ha -statisticscache -wlocks

db2pd -db tp1 -mempools

```
Database Partition 0 -- Database TP1 -- Active -- Up 0 days 00:04:43

Memory Pools:
Address    MemSet   PoolName   Id    Overhead   LogSz      LogUpBnd    LogHWM     CfgParm
0xA7806EE0 TP1      utilh      5     0          2120       20512768    2120       UTIL_HEAP_SZ
0xA7806D88 TP1      pckcacheh  7     113568     243113     Unlimited   243113     PCKCACHESZ
0xA7806CDC TP1      xmlcacheh  93    50944      80008      20971520    80008      n/a
0xA7806C30 TP1      catcacheh  8     0          67536      Unlimited   67536      CATALOGCACHE_SZ
0xA7806AD8 TP1      bph        16    32         16760384   Unlimited   16760384   n/a
0xA7806980 TP1      bph        16    64         42418432   Unlimited   42418432   n/a
0xA7806828 TP1      bph        16    32         782592     Unlimited   782592     n/a
0xA78066D0 TP1      bph        16    32         520448     Unlimited   520448     n/a
0xA7806578 TP1      bph        16    32         389376     Unlimited   389376     n/a
0xA7806420 TP1      bph        16    32         323840     Unlimited   323840     n/a
0xA7806374 TP1      shsorth    18    0          0          40960000    0          SHEAPTHRES_SHR
0xA78062C8 TP1      lockh      4     32         328192     458752      328192     LOCKLIST
0xA780621C TP1      dbh        2     381824     12346744   24379392    12346768   DBHEAP
0xB2CD62C8 AppCtl   apph       1     0          11104      1048576     27862      APPLHEAPSZ
0xB2CD6624 AppCtl   apph       1     0          7303       1048576     8411       APPLHEAPSZ
0xB2CD6578 AppCtl   apph       1     0          7347       1048576     7347       APPLHEAPSZ
0xB2CD64CC AppCtl   apph       1     0          7347       1048576     8759       APPLHEAPSZ
0xB2CD6420 AppCtl   apph       1     0          7367       1048576     7503       APPLHEAPSZ
0xB2CD621C AppCtl   appshrh    20    2304       62980      20480000    62980      application shared
```

db2pd command examples

Examples:

- List all applications for all databases under the current instance, repeating every 10 seconds:

```
db2pd -alldbs –applications –repeat 10
```

- Shows table space information for database SAMPLE:

```
db2pd -database sample –tablespaces
```

Using db2pd to monitor a partitioned database

- db2pd command options can be used to request a report for one or all database partitions:
  - **-dbpartitionnum *num* –** Specifies that the command is to run on the specified database partition server.

    ```
    db2pd –dbpartitionnum 2 –db dss -tablespaces
    ```

  - **-alldbpartitionnums –** Specifies that this command is to run on all active database partition servers in the instance.

    ```
    db2pd –alldbpartitionnums –db dss -logs
    ```

  - **db2pd** will only report information from database partition servers on the same physical machine that **db2pd** is being run on.

    •Can use db2_all without -alldbpartitionnums to route command to all database partitions in db2nodes.cfg.

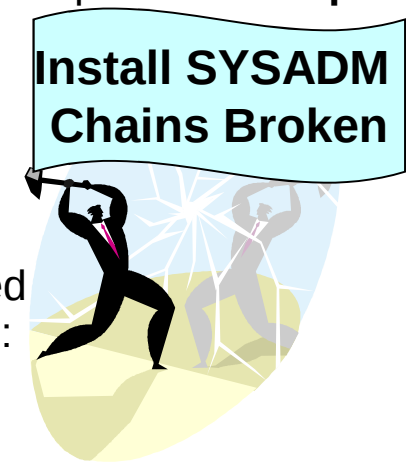
    ```
    db2_all 'db2pd -db dss -logs'
    ```

    •Can use rah with -alldbpartitionnums to route command to all partitions on all servers in db2nodes.cfg.

    ```
    rah 'db2pd -alldbpartitionnums -db dss -logs'
    ```

db2pd Authorization Level Changes

- One of the following authority levels is required for **db2pd**:
  - The SYSADM authority level.
  - The SYSCTRL authority level.
  - The SYSMAINT authority level.
  - The SYSMON authority level.



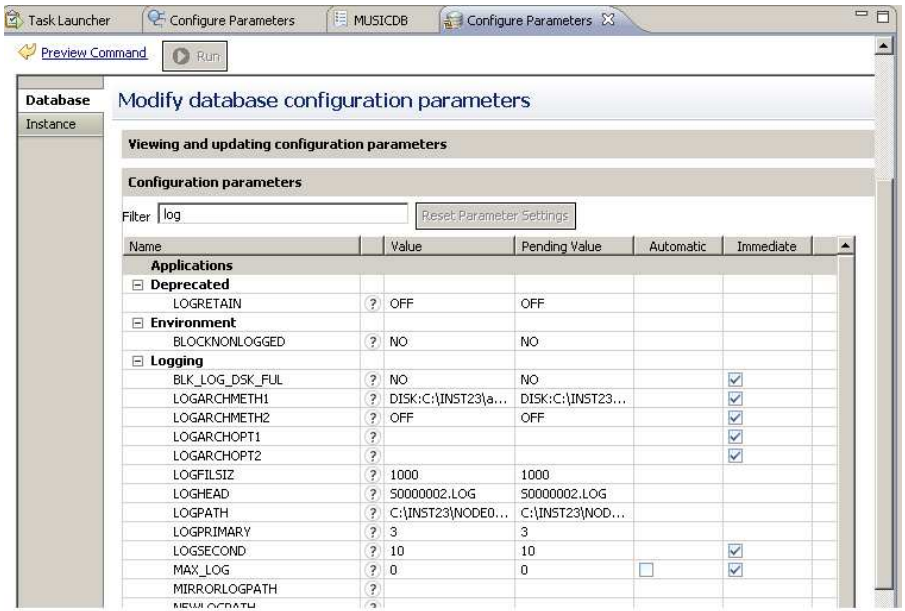
- If SYSMON authorization level granted following **db2pd** options not available:
  - dump
  - memblocks
  - Stack

- The db2pd change available with DB2 9.5 Fixpak 3
  - Prior authority on UNIX and LINUX was instance owner or Local Administrator on Windows

Listing DB2 threads using db2pd -edus

```
List of all EDUs for database partition 0

db2sysc PID: 17783
db2wdog PID: 17773
db2acd  PID: 17815

EDU ID    TID         Kernel TID     EDU Name                       USR          SYS
================================================================================
48        3066031008  23984          db2agent (idle) 0              0.000000     0.040000
47        3067079584  23983          db2agntdp (TP1     ) 0         0.790000     6.030000
46        3068128160  23839          db2evmgi (DB2DETAILDEADLOCK) 0 0.000000     0.010000
45        3069176736  23834          db2wlmd (TP1) 0                0.000000     0.000000
44        3070225312  23833          db2pfchr (TP1) 0               0.000000     0.100000
43        3071273888  23831          db2pfchr (TP1) 0               0.000000     0.090000
42        3072322464  23830          db2pfchr (TP1) 0               0.000000     0.120000
41        3073371040  23828          db2pfchr (TP1) 0               0.000000     0.150000
40        3074419616  23825          db2pclnr (TP1) 0               0.000000     0.030000
39        3075468192  23824          db2dlock (TP1) 0               0.000000     0.000000
38        3078613920  23823          db2lfr (TP1) 0                 0.000000     0.000000
37        3077565344  23822          db2loggw (TP1) 0               0.000000     0.000000
36        3076516768  23821          db2loggr (TP1) 0               0.000000     0.010000
35        3061836704  18879          db2taskd (TP1) 0               0.000000     0.020000
34        3064982432  18238          db2stmm (TP1) 0                3.120000     1.110000
17        3079662496  17908          db2agent (TP1) 0               1.410000     4.010000
16        3080711072  17813          db2resync 0                    0.000000     0.000000
15        3081759648  17812          db2tcpcm 0                     0.000000     0.000000
14        3082808224  17811          db2ipccm 0                     0.000000     0.020000
13        3083856800  17810          db2licc 0                      0.000000     0.000000
12        3084905376  17809          db2thcln 0                     0.000000     0.000000
11        3085953952  17808          db2alarm 0                     0.000000     0.000000
1         3054496672  17807          db2sysc 0                      0.070000     0.380000
```

Database configuration




```
db2 get db cfg for musicdb show detail
db2 update db cfg for musicdb using <parm> <value>
```

Check current configuration: db2pd -dbcfg

db2pd -db musicdb -dbcfg

```
Database Partition 0 -- Database MUSICDB -- Active -- Up 0 days 00:00:36

Database Configuration Settings:
Description                   Memory Value         Disk Value
DB configuration release level 0xa00                0xa00
Database release level         0xa00                0xa00
Database territory             US                   US
Database code page             1252                 1252
Database code set              IBM-1252             IBM-1252
Database country/region code   1                    1
.....................................................
LOCKLIST (4KB)                 100                  20
APPGROUP_MEM_SZ (4KB)          30000                30000
GROUPHEAP_RATIO                70                   70
APP_CTL_HEAP_SZ (4KB)          128                  128
SHEAPTHRES_SHR (4KB)           0                    0
SORTHEAP (4KB)                 256                  256
STMTHEAP (4KB)                 2048                 2048
APPLHEAPSZ (4KB)               256                  256
PCKCACHESZ (4KB)               320                  320
STAT_HEAP_SZ (4KB)             4384                 4384
DLCHKTIME                      10000                10000
MAXLOCKS                       10                   10
LOCKTIMEOUT                    -1                   -1
```

Deferred Change

DB2 10.5 Fixpack 4 (Cancun) db2pd options

db2pd -db sample **-printdbcfg**

- Output includes update database configuration commands

db2pd -db sample **-createdb**

- Output includes create database command with all explicit and implicit command options

Query storage groups with SQL using the table function ADMIN_GET_STORAGE_PATHS

```
select varchar(storage_group_name,20) as storage_group,
    storage_group_id,
    varchar(db_storage_path,20) as storage_path,
     db_storage_path_state,
    (fs_total_size / 1000000) as total_path_MB,
    (sto_path_free_size / 1000000) as path_free_MB
    from table(admin_get_storage_paths('',-1)) as T1
```

```
STORAGE_GROUP        STORAGE_GROUP_ID STORAGE_PATH         DB_STORAGE_PATH_STATE
-------------------- ---------------- -------------------- ---------------------
IBMSTOGROUP                         0 /dbauto/path1        IN_USE
APP_DATA                            1 /dbauto/path2        IN_USE

TOTAL_PATH_MB        PATH_FREE_MB
-------------------- --------------------
               20940                 5649
               20940                 5649

  2 record(s) selected.
```

Listing storage groups with the db2pd command

- **db2pd –db testdb –storagegroups**

```
Database Member 0 -- Database MUSICDB -- Active -- Up 0 days 00:09:09 -- Date
  03/23/2012 09:13:49

Storage Group Configuration:
Address    SGID  Default  DataTag    Name
0x8F241740 0     Yes      0          IBMSTOGROUP
0x8F240490 1     No       0          SG_HIGH
0x90C39640 2     No       0          SG_LOW

Storage Group Statistics:
Address    SGID  State      Numpaths  NumDropPen
0x8F241740 0     0x00000000 2         0
0x8F240490 1     0x00000000 2         0
0x90C39640 2     0x00000000 2         0

Storage Group Paths:
Address    SGID  PathID    PathState    PathName
0x8F241850 0     0         InUse        /dbauto/path1
0x8F241BF0 0     1         InUse        /dbauto/path2
0x94F6F210 1     1024      InUse        /dbauto/path1/sg_high
0x94F6F510 1     1025      InUse        /dbauto/path2/sg_high
0x90C39750 2     2048      InUse        /dbauto/path1/sg_low
0x90C39AF0 2     2049      InUse        /dbauto/path2/sg_low
```

Using the SYSCAT.TABLESPACES view

```
SELECT substr(tbspace,1,18) as tbspace, substr(definer,1,10) as definer,
 tbspaceid, tbspacetype, datatype, sgname
 from syscat.tablespaces
```

```
TBSPACE            DEFINER    TBSPACEID   TBSPACETYPE DATATYPE SGNAME
------------------ ---------- ----------- ----------- -------- ------------
SYSCATSPACE        SYSIBM               0 D           A        IBMSTOGROUP
TSP06              INST28               9 D           A        IBMSTOGROUP
SYSTOOLSPACE       INST28               3 D           L        IBMSTOGROUP
USERSPACE1         SYSIBM               2 D           L        IBMSTOGROUP
TEMPSPACE1         SYSIBM               1 S           T        IBMSTOGROUP
TSP04              INST28               7 D           L        APP_DATA
TSP05              INST28               8 D           L        APP_DATA
TSP01              INST28               4 D           A        -
TSP02              INST28               5 D           L        -
TSP03              INST28               6 D           L        -
SMS01              INST28              10 S           A        -

  11 record(s) selected.
```

Error: Table space full condition

```
2008-04-13-12.07.58.027254-240 E15810G1098        LEVEL: Error
PID     : 4258                 TID  : 3063933856  PROC : db2sysc 0
INSTANCE: inst461              NODE : 000         DB   : MUSICDB
APPHDL  : 0-7                  APPID: *LOCAL.inst461.080413160508
AUTHID  : INST461
EDUID   : 36                   EDUNAME: db2lfrm0 0
FUNCTION: DB2 UDB, buffer pool services, sqlbAllocateExtent, probe:830
MESSAGE : ADM6044E  The DMS table space "DMSMTSPD" (ID "11") is full.  If this
          is an autoresize or automatic storage DMS tablespace, the maximum
          table space size may have been reached or the existing containers or
          storage paths cannot grow any more. Additional space can be added to
          the table space by either adding new containers or extending
         existing ones using the ALTER TABLESPACE SQL statement. If this is
   an autoresize or automatic storage DMS table space, additional space
can be added by adding containers to an autoresize table space or by
          adding new storage paths to an automatic storage database.
```

db2 “select … from table (mon_get_tablespaces (‘’,-2)) as t”

db2pd -db musicdb -tablespaces

Monitor Table space utilization using the MON_TBSP_UTILIZATION view

```
SELECT substr(tbsp_name,1,20) as tbsp_name ,
 tbsp_total_size_kb as total_KB,
 dec(((dec(tbsp_total_size_kb,10,0) *
 tbsp_utilization_percent) / 100),7,1) as  used_KB,
 tbsp_utilization_percent as percent_utilized
 from SYSIBMADM.MON_TBSP_UTILIZATION
```

TBSP_NAME	TOTAL_KB	USED_KB	PERCENT_UTILIZED
SYSCATSPACE	98304	83332.3	84.77
TEMPSPACE1	4	4.0	100.00
USERSPACE1	32768	383.3	1.17
TP1DMS	145536	436.6	0.30
SYSTOOLSPACE	32768	734.0	2.24
TP1DMSH	40960	1794.0	4.38
TEMP16K	16	16.0	100.00
TP1DMSAD	160000	116384.0	72.74
TP1DMSAI	80000	17560.0	21.95

9 record(s) selected.

Monitoring table space status with db2pd

db2pd -db musicdb -tablespaces

```
Tablespace Configuration:
Address    Id    Type Content PageSz ExtentSz Auto Prefetch BufID ..Name
0x138C8120 0     DMS  Regular 4096   4        Yes  4        1     ..SYSCATSPACE
0x138C8750 1     SMS  SysTmp  4096   32       Yes  32       1     ..TEMPSPACE1
0x138CCF30 2     DMS  Large   4096   32       Yes  32       1     ..USERSPACE1
0x138CD6D0 3     SMS  Regular 4096   4        Yes  8        1     ..SMS01D
0x14330060 4     DMS  Regular 4096   4        Yes  4        1     ..DMS01D
0x14330800 5     DMS  Regular 4096   2        Yes  2        1     ..DMS01I
0x14330FF0 6     DMS  Large   4096   8        Yes  8        1     ..DMS01L
0x143317E0 7     DMS  Regular 4096   2        Yes  2        1     ..DMS02D
0x14331FD0 8     DMS  Regular 4096   2        Yes  2        1     ..DMS02I
0x143327C0 9     DMS  Regular 4096   4        Yes  4        1     ..DMS03D

Tablespace Statistics:
Address    Id    TotalPgs   UsablePgs  UsedPgs    PndFreePgs FreePgs    HWM
0x138C8120 0     8192       8188       8036       0          152        8036
0x138C8750 1     1          1          1          0          0          0
0x138CCF30 2     8192       8160       96         0          8064       96
0x138CD6D0 3     3          3          3          0          0          0
0x14330060 4     44         40         20         0          20         20
0x14330800 5     22         20         12         0          8          12
0x14330FF0 6     368        360        56         0          304        56
0x143317E0 7     22         20         16         0          4          16
0x14331FD0 8     16         14         12         0          2          12
0x143327C0 9     48         44         28         0          16         28
```

Using db2pd to list one table space

db2pd -db tp1 -dbpartitionnum 1 -tablespace id 6

```
Database Partition 1 -- Database TP1 -- Active -- Up 0 days 00:30:16

Tablespace 6 Configuration:

  Address    Type Content PageSz ExtentSz Auto Prefetch BufID BufIDDisk FSC
0x17CAEA20    DMS  Regular 4096   8        No   8        1     1         On


NumCntrs MaxStripe  LastConsecPg Name
1        0          7            TP1ACCTI

Tablespace 6 Statistics:
Address    TotalPgs   UsablePgs  UsedPgs    PndFreePgs FreePgs    HWM
0x17CAEA20 5120       5112       1856       0          3256       1856

  State      MinRecTime NQuiescers
  0x00000000 0          0

Tablespace 6 Autoresize Statistics:
Address    AS  AR  InitSize    IncSize     IIP MaxSize     LastResize
0x17CAEA20 Yes Yes 20971520    -1          No  None        None

LRF
 No

Containers:
Address    ContainNum Type    TotalPgs   UseablePgs StripeSet
0x17CAF0A0 0          File    5120       5112       0

Container
/dbauto/path1/inst49e/NODE0001/TP1/T0000006/C0000000.USR
```

Temporary table compression

- Starting with DB2 9.7, if the **Storage Optimization Feature** is licensed, then temporary tables will be compressed by default:
  - There is no additional action required by the user in order to use it
  - DB2 will evaluate the query and apply compression where appropriate
  - DB2 Optimizer will select compression for temporary tables used for sorts or joins based on expected result set
  - Might be used to reduce size of temporary tables used for utilities like REORG and LOAD
    - For example, when reorganizing a large table that uses data compression, the temporary space needed by REORG could be much larger than the table
  - When the temp table reaches the size threshold, a dictionary is created and then used to compress the remaining rows
- Applicable to User temporary tables and System temps:
  - User temporary table can be either Declared or Created temporary table
  - Temporary tables will have a dictionary created automatically
- Compression of temporary tables aims to:
  - Reduce the amount of temporary disk space required
  - Small temporary tables will not be compressed to avoid a performance impact
- Use **db2pd –temptable** report to list usage and benefit gained

Using db2pd temporary table compression report

db2pd –db test –temptable

```
System Temp Table Stats:
  Number of System Temp Tables    : 21
  Comp Eligible Sys Temps         : 3
  Compressed Sys Temps            : 3
  Total Sys Temp Bytes Stored     : 71998659
  Total Sys Temp Bytes Saved      : 19270361
  Total Sys Temp Compressed Rows  : 462857
  Total Sys Temp Table Rows:      : 3002380
User Temp Table Stats:
  Number of User Temp Tables      : 3
  Comp Eligible User Temps  : 3
  Compressed User Temps           : 1
  Total User Temp Bytes Stored    : 6229645
  Total User Temp Bytes Saved     : 6080979
  Total User Temp Compressed Rows : 158890
  Total User Temp Table Rows:     : 187622
```

Temporary table size > 100 MB

Temporary row size >= 20 bytes

Index metrics using MON_GET_INDEX

- The MON_GET_INDEX table function returns metrics for one or more indexes.

```
select substr(tabname,1,12) as table_name, IID as index_id,
  index_scans, index_only_scans, nleaf, nlevels
from table ( MON_GET_INDEX('INST481',NULL,-1) )
  AS MONIX ORDER BY 1,2
```

```
TABLE_NAME   INDEX_ID INDEX_SCANS    INDEX_ONLY_SCANS  NLEAF          NLEVELS
------------ -------- -------------- ----------------- -------------- -------
ACCT                1              1                 0           3611       3
HISTORY             1              5                 5             84       2
HISTORY             2              3                 3             84       2
TELLER              1              2                 0              4       2

  4 record(s) selected.
```

db2pd command: Index usage statistics

- **db2pd –db tp1 –tcbstats index**

  db2pd report includes access for each index on a table

Database Partition 0 -- Database TP1 -- Active -- Up 0 days 00:07:32

```
Database Partition 0 -- Database TP1 -- Active -- Up 0 days 00:07:32

TCB Table Information:
....................


TCB Index Information:
Address    InxTbspace ObjectID TbspaceID TableID MasterTbs MasterTab TableName     SchemaNm IID
0x1ACCF624 6          4        6         4       6         4         HISTORY       INST441  3
0x1ACCF624 6          4        6         4       6         4         HISTORY       INST441  2
0x1ACCF624 6          4        6         4       6         4         HISTORY       INST441  1
0x1ACCD1A4 5          4        4         4       4         4         ACCT          INST49E  2
0x1ACCD1A4 5          4        4         4       4         4         ACCT          INST49E  1
0x1AD9ACA4 11         4        11        4       11        4         HIST2         INST441  1

TCB Index Stats:
Address    TableName          IID   EmpPgDel  RootSplits BndrySplts PseuEmptPg Scans KeyUpdates
0x1ACCF624 HISTORY            3     0         0          0          0           0          0
0x1ACCF624 HISTORY            2     0         0          0          0           1          0
0x1ACCF624 HISTORY            1     0         0          0          0           1          0
0x1ACCD1A4 ACCT               2     0         0          0          0           3          0
0x1ACCD1A4 ACCT               1     0         0          0          0           0          0
0x1AD9ACA4 HIST2              1     0         0          0          0           0          0
```

ADMIN_GET_MEM_USAGE table function
Get total memory consumption for instance

```
SELECT MEMBER, MAX_MEMBER_MEM,
CURRENT_MEMBER_MEM, PEAK_MEMBER_MEM
FROM TABLE(SYSPROC.ADMIN_GET_MEM_USAGE()) AS T
```

```
MEMBER MAX_MEMBER_MEM       CURRENT_MEMBER_MEM   PEAK_MEMBER_MEM
------ -------------------- -------------------- --------------------
     0           7430103040            958169088            958300160
     3           7430103040            951615488            951615488
     1           7430103040            952664064            952664064
     2           7430103040            951615488            951615488

  4 record(s) selected.
```

Database and Instance memory display: db2mtrk

db2mtrk –d –v

```
Tracking Memory on: 2012/11/28 at 11:05:37

Memory for database: TP1

   Backup/Restore/Util Heap is of size 65536 bytes
   Package Cache is of size 196608 bytes
   Other Memory is of size 131072 bytes
   Catalog Cache Heap is of size 196608 bytes
   Buffer Pool Heap (4) is of size 17563648 bytes
   Buffer Pool Heap (3) is of size 26214400 bytes
   Buffer Pool Heap (2) is of size 16908288 bytes
   Buffer Pool Heap (1) is of size 8912896 bytes
   Buffer Pool Heap (System 32k buffer pool) is of size 851968 bytes
   Buffer Pool Heap (System 16k buffer pool) is of size 589824 bytes
   Buffer Pool Heap (System 8k buffer pool) is of size 458752 bytes
   Buffer Pool Heap (System 4k buffer pool) is of size 393216 bytes
   Shared Sort Heap is of size 0 bytes
   Lock Manager Heap is of size 393216 bytes
   Database Heap is of size 50397184 bytes

   Application Heap (54) is of size 131072 bytes
   Application Heap (53) is of size 65536 bytes
   Application Heap (52) is of size 65536 bytes
   Application Heap (51) is of size 65536 bytes
   Application Heap (50) is of size 131072 bytes
   Application Heap (49) is of size 65536 bytes
   Application Heap (48) is of size 65536 bytes
   Application Heap (47) is of size 65536 bytes
   Applications Shared Heap is of size 262144 bytes
   Total: 124190720 bytes
```

Monitoring the overall memory usage using the MON_GET_MEMORY_SET table function

```
SELECT varchar(memory_set_type,25) as memory_set,
varchar(db_name,20) as database,
memory_set_used , memory_set_used_hwm
FROM TABLE (MON_GET_MEMORY_SET(NULL,CURRENT_SERVER,-1)) as m1
```

```
MEMORY_SET                DATABASE             MEMORY_SET_USED      MEMORY_SET_USED_HWM
------------------------- -------------------- -------------------- --------------------
DBMS                      -                                 57920                58112
FMP                       -                                   448                  448
PRIVATE                   -                                  8704                 9472
DATABASE                  TP1                              134272               144704
APPLICATION               TP1                                1216                 1600

  5 record(s) selected.
```

db2pd -memsets

Monitoring Database memory usage using the table function MON_GET_MEMORY_POOL

```
SELECT VARCHAR(MEMORY_POOL_TYPE,20) AS POOL_TYPE,
MEMORY_POOL_USED, MEMORY_POOL_USED_HWM
FROM TABLE (MON_GET_MEMORY_POOL ('DATABASE',NULL,NULL) ) AS TMEM
```

POOL_TYPE	MEMORY_POOL_USED	MEMORY_POOL_USED_HWM
UTILITY	65536	65536
PACKAGE_CACHE	524288	917504
XMLCACHE	131072	131072
CAT_CACHE	393216	393216
BP	16908288	16908288
BP	52166656	52166656
BP	851968	851968
BP	589824	589824
BP	458752	458752
BP	393216	393216
SHARED_SORT	196608	262144
LOCK_MGR	2228224	2228224
DATABASE	60489728	60489728

db2pd -mempool report for one DB partition

db2pd -dbpartitionnum 1 -db tp1 -mempools

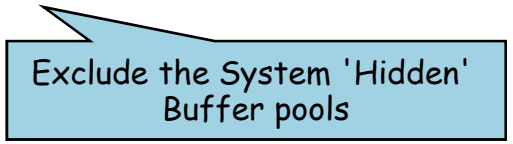
Database Partition 1 -- Database TP1 -- Active -- Up 0 days 00:41:27

Memory Pools:

Address	MemSet	PoolName	Id	Overhead	LogSz	LogUpBnd	LogHWM	CfgParm
0xAC4E3EE0	TP1	utilh	5	0	2544	20512768	2968	UTIL_HEAP_SZ
0xAC4E3D88	TP1	pckcacheh	7	113568	329184	Unlimited	330566	PCKCACHESZ
0xAC4E3CDC	TP1	xmlcacheh	93	50944	80008	20971520	80008	n/a
0xAC4E3C30	TP1	catcacheh	8	0	60552	Unlimited	60552	CATALOGCACHE_SZ
0xAC4E3AD8	TP1	bph	16	32	8508384	Unlimited	8508384	n/a
0xAC4E3980	TP1	bph	16	32	4472384	Unlimited	4472384	n/a
0xAC4E3828	TP1	bph	16	32	782592	Unlimited	782592	n/a
0xAC4E36D0	TP1	bph	16	32	520448	Unlimited	520448	n/a
0xAC4E3578	TP1	bph	16	32	389376	Unlimited	389376	n/a
0xAC4E3420	TP1	bph	16	32	323840	Unlimited	323840	n/a
0xAC4E3374	TP1	shsorth	18	0	0	30736384	9457664	SHEAPTHRES_SHR
0xAC4E32C8	TP1	lockh	4	32	590336	720896	590336	LOCKLIST
0xAC4E321C	TP1	dbh	2	359088	11989184	18677760	12878863	DBHEAP
0xB2BA36D0	AppCtl	apph	1	0	5537	262144	8927	APPLHEAPSZ
0xB2BA3624	AppCtl	apph	1	0	5537	262144	15172	APPLHEAPSZ
0xB2BA3578	AppCtl	apph	1	0	6621	262144	12425	APPLHEAPSZ
0xB2BA34CC	AppCtl	apph	1	0	4798	262144	4798	APPLHEAPSZ
0xB2BA3420	AppCtl	apph	1	0	8515	262144	9107	APPLHEAPSZ
0xB2BA32C8	AppCtl	apph	1	0	8324	262144	39940	APPLHEAPSZ
0xB2BA321C	AppCtl	appshrh	20	1824	106551	20480000	110651	application shared

Using MON_BP_UTILIZATION to show buffer pool hit ratios and prefetch activity

```
select substr(bp_name,1,30) as bp_name ,
data_hit_ratio_percent,
index_hit_ratio_percent ,
prefetch_ratio_percent
from sysibmadm.mon_bp_utilization
 where bp_name not like 'IBMSYSTEM%' ;
```



BP_NAME	DATA_HIT_RATIO_PERCENT	INDEX_HIT_RATIO_PERCENT	PREFETCH_RATIO_PERCENT
IBMDEFAULTBP	99.44	56.71	6.69
CLPBUFFL	92.30	77.04	98.99
CLPBUFFS	27.04	44.68	56.29

Using MON_GET_BUFFERPOOL table function view to query buffer pool write activity

```
SELECT sum(pool_data_writes) as pool_data_writes,
 sum(pool_data_writes - pool_async_data_writes) as data_sync_writes,
 sum(pool_write_time) as pool_write_time,
 sum(pool_lsn_gap_clns) as pool_lsn_gap_clns,
 sum(pool_drty_pg_steal_clns) as pool_drty_pg_steal_clns,
 sum(pool_drty_pg_thrsh_clns) as pool_drty_pg_thrsh_clns
 FROM TABLE(MON_GET_BUFFERPOOL(NULL,-1)) as bp1
 where bp_name not like 'IBMSYSTEM%'
```

```
POOL_DATA_WRITES     DATA_SYNC_WRITES     POOL_WRITE_TIME
-------------------- -------------------- --------------------
                5264                    0                31444

POOL_LSN_GAP_CLNS    POOL_DRTY_PG_STEAL_CLNS POOL_DRTY_PG_THRSH_CLNS
-------------------- ----------------------- -----------------------
                  23                       0                       0
```

db2pd: Buffer Pools report

```
db2pd -db tp1 -bufferpools
```

```
Database Member 0 -- Database TP1 -- Active -- Up 0 days 00:28:44 -- Date 02/06/2013 15:45:43

Bufferpools:
First Active Pool ID      1
Max Bufferpool ID         4
Max Bufferpool ID on Disk 4
Num Bufferpools           8

Address    Id   Name               PageSz     PA-NumPgs  BA-NumPgs  BlkSize    NumTbsp    … Automatic
0x909EC9D0 1    IBMDEFAULTBP       4096       2000       0          0          5          … False
0x909F4D40 2    TP1H16K            16384      1000       0          0          2          … False
0x909FD0B0 3    TP1ADATA           4096       7000       0          0          1          … False
0x90A05420 4    TP1AINDX           4096       6000       0          0          1          … False
0x909CBC10 4096 IBMSYSTEMBP4K      4096       16         0          0          0          … False
0x909D3F80 4097 IBMSYSTEMBP8K      8192       16         0          0          0          … False
0x909DC2F0 4098 IBMSYSTEMBP16K     16384      16         0          0          0          … False
0x909E4660 4099 IBMSYSTEMBP32K     32768      16         0          0          0          … False
```

Using the MON_PKG_CACHE_SUMMARY view

```
select section_type, avg_stmt_exec_time, avg_cpu_time,
 avg_lock_wait_time, prep_time
 from SYSIBMADM.MON_PKG_CACHE_SUMMARY
 order by section_type,avg_stmt_exec_time desc
```

SECTION_TYPE	AVG_STMT_EXEC_TIME	AVG_CPU_TIME	AVG_LOCK_WAIT_TIME	PREP_TIME
D	-	-	-	1
D	-	-	-	217
D	183	91517	0	151
D	34	1486	0	414
D	1	407	0	51
D	0	284	0	96
D	0	218	0	46
D	0	715	0	5
D	0	432	0	128
S	32	1671	0	0
S	0	772	0	0
S	0	540	0	0
S	0	296	0	0
S	0	397	0	0
S	0	338	0	0

Example report using MON_GET_PKG_CACHE_STMT (1 of 2)

```
select substr(package_name,1,10) as package, section_type,
num_executions, prep_time, total_act_time, total_act_wait_time,
pool_read_time, lock_wait_time, rows_read, rows_modified,
total_section_sort_time, substr (stmt_text,1,40) as sql_text
from table(mon_get_pkg_cache_stmt(NULL,NULL,NULL,-1) ) as cache_stat
where num_executions > 0  order by total_act_time desc
```

PACKAGE	SECTION TYPE	NUM EXECUTIONS	PREP_TIME	TOTAL_ACT_TIME	TOTAL_ACT WAIT_TIME	POOL_READ_TIME	LOCK_WAIT_TIME	ROWS_READ
SQLTP1DS	S	54	0	24656	23802	23802	0	1840
SQLTP1ST	S	61	0	4401	4186	4186	0	61
-	D	59	498	4087	4074	4074	0	59
-	D	1	1	2578	115	115	0	27987
-	D	1	1	2404	240	240	0	110925
SQLTP1ST	S	61	0	2363	1768	1768	0	0
-	D	59	564	1777	1673	1673	0	0
-	D	1	1	1054	25	25	0	1605
SQLTP1ST	S	61	0	486	473	473	0	61
-	D	59	143	478	474	474	0	59
-	D	1	1	279	56	56	0	19
-	D	2	60	229	1	0	0	0
-	D	59	6	162	141	141	0	59
SQLTP1ST	S	61	0	127	31	31	0	61
-	D	59	33	81	76	7	68	59
SQLTP1ST	S	61	0	56	26	17	9	61
-	D	1	1	4	0	0	0	1605
SQLTP1ST	S	61	0	2	0	0	0	61

Section type D – Dynamic
S - Static

total_act_wait_time - Total time spent waiting within the database server, while processing an activity

Example report using MON_GET_PKG_CACHE_STMT (2 of 2)

PACKAGE	SECTION TYPE	ROWS_MODIFIED	TOTAL_SECTION_SORT_TIME	SQL_TEXT
SQLTP1DS	S	0	0	DECLARE C1 CURSOR FOR SELECT A.ACCT_G
SQLTP1ST	S	0	0	DECLARE CURSOR1 CURSOR FOR SE
-	D	0	0	SELECT BALANCE, ACCT_GRP FROM ACCT WHERE
-	D	0	182	SELECT BRANCH_ID, TELLER_ID, ACCT_ID,
-	D	0	525	SELECT BRANCH_ID, TELLER_ID, ACCT_ID,
SQLTP1ST	S	61	0	INSERT INTO HISTORY(ACCT_ID, TEL
-	D	59	0	INSERT INTO HIST
-	D	0	9	SELECT BRANCH_ID, TELLER_ID, ACCT_ID,
SQLTP1ST	S	0	0	DECLARE CURSOR2 CURSOR FOR SE
-	D	59	0	UPDATE TELLER S
-	D	0	0	SELECT * FROM HISTORY WHERE BRANCH_ID
-	D	0	2	select package_name, section_type, num_e
-	D	59	0	UPDATE ACCT SET
SQLTP1ST	S	61	0	UPDATE ACCT SET BALANCE = BAL
-	D	59	0	UPDATE BRANCH SET BALANCE = BALANCE + ?
SQLTP1ST	S	61	0	UPDATE BRANCH SET BALANCE = B
-	D	0	5	SELECT * FROM HISTORY WHERE BRANCH_ID
SQLTP1ST	S	61	0	UPDATE TELLER SET BALANCE = B

Statement Text for Dynamic and Static statements

Check dynamic SQL cache stats with db2pd

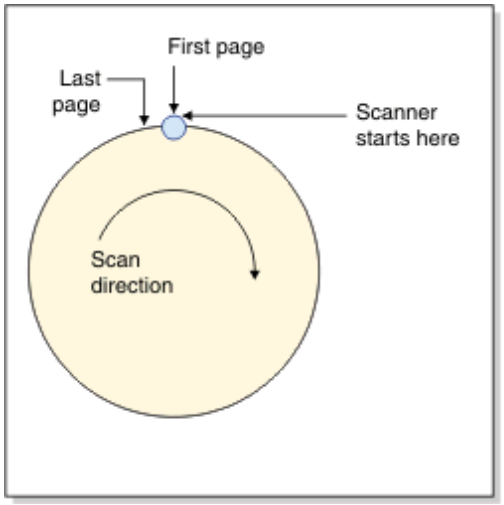
db2pd -db tp1 -dynamic

```
Database Member 0 -- Database TP1 -- Active -- Up 0 days 00:10:09 -- Date 12/06/2012
   08:13:52

Dynamic Cache:
Current Memory Used           377694
Total Heap Size               2582528
Cache Overflow Flag           0
Number of References          18270
Number of Statement Inserts   14
Number of Statement Deletes   2
Number of Variation Inserts   6
Number of Statements          12

Dynamic SQL Statements:
Address    AnchID StmtUID    NumEnv     NumVar     NumRef     NumExe     Text
0xA0C2CC60 199    1          1          1          3045       3045       UPDATE BRANCH SET
   BALANCE =
    BALANCE + ?                          WHERE BRANCH_ID = ?
0xA0D3B600 343    1          1          1          3045       3045       COMMIT
0xA0D37130 429    1          1          1          3045       3045       INSERT
     INTO HISTORY(ACCT_ID, TELLER_ID, BRANCH_ID, BALANCE,
   DELTA, PID, ACCTNAME, TEMP)
                  VALUES(?, ?, ?, ?, ?, ?, ?, ?)
```

Scan sharing
can reduce costs for access to large tables

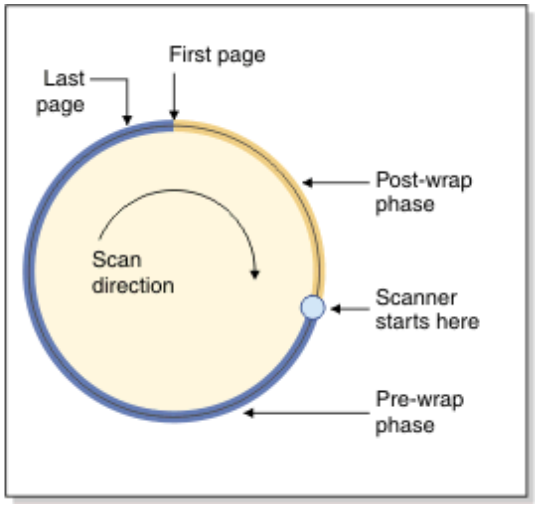
- *Scan sharing* refers to the ability of one scan to exploit the work done by another concurrently running scan.
- Shared work includes:
  - Disk page reads and disk seek time
  - Buffer pool content reuse
- Heavy scans, like table scans or MDC block index scans of large tables, might be eligible for sharing page reads:
  - Such shared scans can start at an arbitrary point in the table, to take advantage of pages that are already in the buffer pool.
  - When a sharing scan reaches the end of the table, it continues at the beginning and finishes when it reaches the point at which it started. This is called a *wrapping scan*.
- The scan sharing feature is enabled by default.
- Eligibility for scan sharing and for wrapping are determined automatically by the SQL compiler.
- At run time, an eligible scan might or might not participate in sharing or wrapping, based on factors that were not known at compile time.

Scan sharing concepts: Wrapping table scan



Regular Table Scan

- Begins on the first page of table
- Ends with the last page in table



Wrapping Table Scan

- Shared scans can start at an arbitrary point in the table, in order to take advantage of pages already in the buffer pool.
- When the scan reaches the end of the table, it continues at the beginning
- Scan finishes when it reaches the starting point.

db2pd -scansharing report current shared scans

db2pd –db testdb -scansharing

```
  Database Partition 0 -- Database TPCD -- Active -- Up 0 days 00:00:45

Scan Sets:
TbspaceID TableID ScanObject NumGroups Footprint             TableSize      FastScanRate SlowScanRate
2         3       0          2          11520               22752                2486        1000
    Group Information:
    FootPrint NumScannersInGroup
    8288                    3
   Scans In Group :
   AgentID ApplID              Mode Wrappable Fast/Slow Speed  ThrottleTime Absolute Location  Remaining Pages
   9768    1173                0    0         1         2486             0         32              22751
   11332   1165                0    0         1         2486             0       5056              17727
   15466   1155                0    0         1         2486             0       8288              14495
 Group Information:
 FootPrint NumScannersInGroup
 3232                    2
   Scans In Group :
   AgentID ApplID              Mode Wrappable Fast/Slow Speed  ThrottleTime Absolute Location  Remaining Pages
   15209   1150                0    0         1         2486             0      14080               8703
   12103   1148                0    0         1         2486             0      17280               5503
```

Warning: Lock escalation

db2pd -db musicdb -locks

```
2008-04-05-08.33.34.231230-240 E105434G580        LEVEL: Warning
PID     : 5145                 TID  : 3079662496  PROC : db2sysc 0
INSTANCE: inst481              NODE : 000         DB   : TP1
APPHDL  : 0-105                APPID: *LOCAL.inst481.080405123242
AUTHID  : INST481
EDUID   : 63                   EDUNAME: db2agent (TP1) 0
FUNCTION: DB2 UDB, data management, sqldEscalateLocks, probe:2
MESSAGE : ADM5500W  DB2 is performing lock escalation.  The total number of
          locks currently held is "21131", and the target number of locks to
          hold is "10565".

2008-04-05-08.33.34.232335-240 E106015G521        LEVEL: Warning
PID     : 5145                 TID  : 3079662496  PROC : db2sysc 0
INSTANCE: inst481              NODE : 000         DB   : TP1
APPHDL  : 0-105                APPID: *LOCAL.inst481.080405123242
AUTHID  : INST481
EDUID   : 63                   EDUNAME: db2agent (TP1) 0
FUNCTION: DB2 UDB, data management, sqldEscalateLocks, probe:3
MESSAGE : ADM5502W  The escalation of "21127" locks on table "INST481 .ACCT" to
          lock intent "X" was successful.
```

db2pd example of partitioned output for locking

db2pd –alldbpartitionnums –db tp1 –locks

```
Database Partition 0 -- Database TP1 -- Active -- Up 0 days 00:03:24

Locks:
Address    TranHdl    Lockname                   Type       Mode Sts Owner
0x17532360 7          01000000010000000100980056 Internal V ..S  G   7
0x17530540 9          53514C5450314459C28B923441 Internal P ..S  G   9
0x17531E40 7          53514C5450314459C28B923441 Internal P ..S  G   7
0x175322D0 2          53514C5450314459C28B923441 Internal P ..S  G   2
0x175310C0 8          53514C5450314459C28B923441 Internal P ..S  G   8
0x17532750 7          01000000010000000100BE0056 Internal V ..S  G   7
0x17531F60 7          03000200210001000000000052 Row        ..X  G   7
0x17532FC0 9          01000000010000000100110056 Internal V ..S  G   9
0x17530810 2          01000000010000000100110056 Internal V ..S  G   2
0x17532720 7          01000000010000000100DD0056 Internal V ..S  G   7
0x17532390 8          01000000010000000100230056 Internal V ..S  G   8
0x17532810 7          01000000010000000100230056 Internal V ..S  G   7
0x17530D20 7          030003000F0007000000000052 Row        ..X  G   7
0x17530E10 7          03000200000000000000000054 Table      .IX  G   7
0x17530F90 7          03000300000000000000000054 Table      .IX  G   7

Database Partition 1 -- Database TP1 -- Active -- Up 0 days 00:03:23

Locks:
Address    TranHdl    Lockname                   Type       Mode Sts Owner
0x17530420 2          01000000010000000100980056 Internal V ..S  G   2
0x175319C0 2          53514C5450314459C28B923441 Internal P ..S  G   2
0x17531150 6          53514C5450314459C28B923441 Internal P ..S  G   6
0x17530D80 2          01000000010000000100110056 Internal V ..S  G   2
0x175323F0 6          01000000010000000100110056 Internal V ..S  G   6
0x17530570 2          04000400000000000000000054 Table      ..X  G   2
0x17531C00 6          04000400000000000000000054 Table      ..X  W   0
```

Lock Wait
On Part. 1

Monitoring Lock escalations, waits and deadlocks using SQL

```
SELECT deadlocks,
lock_escals, lock_wait_time, lock_waits,
 lock_escals_maxlocks, lock_escals_locklist
 FROM TABLE(MON_GET_WORKLOAD('SYSDEFAULTUSERWORKLOAD',-1))
 as WKLOADS
;
```

```
DEADLOCKS            LOCK_ESCALS          LOCK_WAIT_TIME
-------------------- -------------------- --------------------
                   0                    1                 2773

LOCK_WAITS           LOCK_ESCALS_MAXLOCKS LOCK_ESCALS_LOCKLIST
-------------------- -------------------- --------------------
                  47                    1                    0
```

Using the MON_LOCKWAIT view to show active application lock waits

```
select substr(lw.hld_application_name,1,10) as "Hold App",
       substr(lw.hld_userid,1,10) as "Holder",
       substr(lw.req_application_name,1,10) as "Wait App",
       substr(lw.req_userid,1,10) as "Waiter",
       lw.lock_mode ,
       lw.lock_object_type ,
       substr(lw.tabname,1,10) as "TabName",
       substr(lw.tabschema,1,10) as "Schema",
       lw.lock_wait_elapsed_time
              as "waiting (s)"
from
  SYSIBMADM.MON_LOCKWAITS lw ;
```

Who is holding the lock?

Who is waiting on the lock?

How long is the wait?

```
Hold App   Holder     Wait App   Waiter     LOCK_MODE LOCK_OBJECT_TYPE   TabName  Schema  waiting (s)
---------- ---------- ---------- ---------- --------- ------------------ -------- ------- -----------
db2bp      INST461    db2bp      INST461    X         TABLE                HIST1    CLPM           61
```

Using db2pd commands to check for lock waits

db2pd –db tp1 -wlock

```
Locks being waited on :
AppHandl [nod-index] TranHdl    Lockname                   Type       Mode
95       [000-00095] 3          090004001B0001000000000052 RowLock    ..X
111      [000-00111] 11         090004001B0001000000000052 RowLock    .NS


Conv Sts CoorEDU    AppName  AuthID   AppID
      G   97         db2bp    INST28   *LOCAL.inst28.120507120320
      W   186        db2bp    USER28   *LOCAL.inst28.120507120949
```

Formatting the Lock Name

select name, value from table
(mon_format_lock_name ('090004001B0001000000000052')) as f

NAME	VALUE
LOCK_OBJECT_TYPE	TABLE
TBSP_NAME	USERSPACE1
TABSCHEMA	DAVEK
TABNAME	SALES

Monitoring lock waits using db2pd: Step 1

db2pd -db musicdb -applications

```
Database Partition 0 -- Database MUSICDB -- Active -- Up 0 days 00:09:20

Applications:
Address    AppHandl [nod-index] NumAgents  CoorEDUID  Status                ..Appid
0x10B02E00 13       [000-00013] 1          31         UOW-Waiting           ..*LOCAL.inst481.080412125556
0x10B00060 12       [000-00012] 1          30         Lock-wait             ..*LOCAL.inst481.080412125432
0x10A8B6A0 11       [000-00011] 1          29         ConnectCompleted      ..*LOCAL.DB2.080412125431
0x10A88900 10       [000-00010] 1          28         ConnectCompleted      ..*LOCAL.DB2.080412125430
0x10A85B60 9        [000-00009] 1          27         ConnectCompleted      ..*LOCAL.DB2.080412125429
0x1046B720 8        [000-00008] 1          26         ConnectCompleted      ..*LOCAL.DB2.080412125428
0x10467270 7        [000-00007] 1          17         UOW-Waiting           ..*LOCAL.inst481.080412125426
```

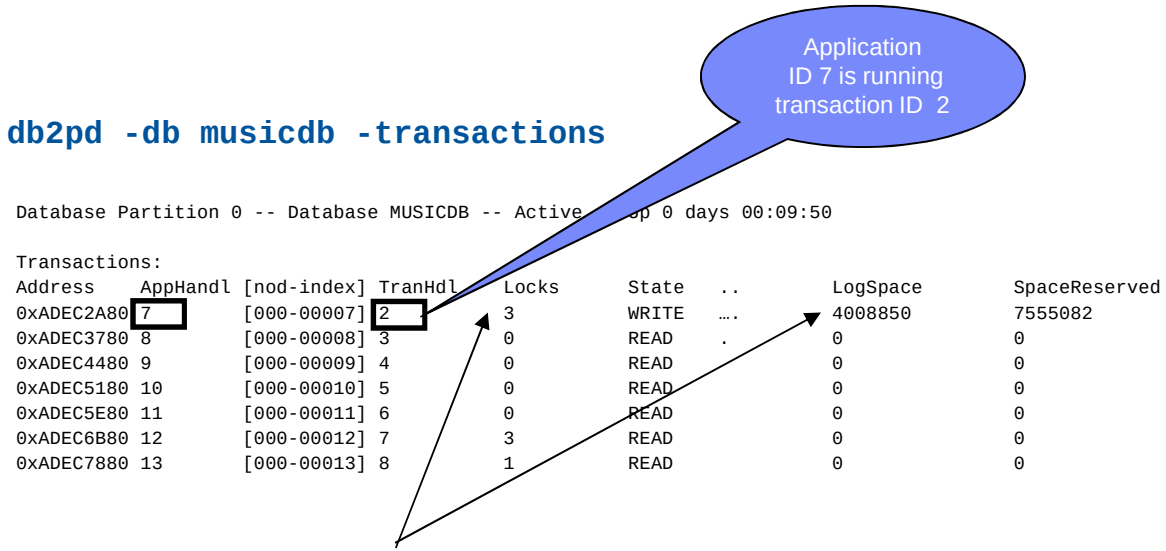
Application ID 12 in Lock Wait

db2pd -db musicdb –lock wait

```
Database Partition 0 -- Database MUSICDB -- Active -- Up 0 days 00:09:33

Locks:
Address    TranHdl    Lockname                   Type     Mode Sts Owner  Dur HoldCount  Att  ReleaseFlg
0xADF64D80 7          0A0004000000000000000000054 Table    .IX  W   2      1   0          0x00 0x40000000
0xADF61900 2          0A0004000000000000000000054 Table    ..X  G   2      1   0          0x02 0x40000000
```

Transaction ID 2 owns lock needed

Monitoring lock waits using db2pd: Step 2



db2pd -db musicdb -transactions

```
Database Partition 0 -- Database MUSICDB -- Active -- Up 0 days 00:09:50

Transactions:
Address    AppHandl [nod-index] TranHdl  Locks      State   ..        LogSpace        SpaceReserved
0xADEC2A80 7        [000-00007] 2        3          WRITE   ….        4008850         7555082
0xADEC3780 8        [000-00008] 3        0          READ    .         0               0
0xADEC4480 9        [000-00009] 4        0          READ              0               0
0xADEC5180 10       [000-00010] 5        0          READ              0               0
0xADEC5E80 11       [000-00011] 6        0          READ              0               0
0xADEC6B80 12       [000-00012] 7        3          READ              0               0
0xADEC7880 13       [000-00013] 8        1          READ              0               0
```

Large amount of logged change with small number of locks held
Indicates possible lock escalation.

Checking Load status: Load query

```
db2 load query table inst481.loadhist1
```

```
SQL3501W  The table space(s) in which the table resides will not be placed in
backup pending state since forward recovery is disabled for the database.
SQL3109N  The utility is beginning to load data from file
"/home/inst481/datamove/savehist.del".
SQL3500W  The utility is beginning the "LOAD" phase at time "05/12/2012
02:44:13.967160".
SQL3519W  Begin Load Consistency Point. Input record count = "0".
SQL3520W  Load Consistency Point was successful.
SQL3519W  Begin Load Consistency Point. Input record count = "10248".
...
SQL3519W  Begin Load Consistency Point. Input record count = "51450".
SQL3520W  Load Consistency Point was successful.
SQL0289N  Unable to allocate new pages in table space "LOADTSPD".
SQLSTATE=57011
SQL3532I  The Load utility is currently in the "LOAD" phase.

Number of rows read         = 51450
Number of rows skipped      = 0
Number of rows loaded       = 51450
Number of rows rejected     = 0
Number of rows deleted      = 0
Number of rows committed    = 51450
Number of warnings          = 0

Tablestate:
  Load Pending
```

Load monitoring: LIST UTILITIES

```
db2 LIST UTILITIES SHOW DETAIL
```

```
ID                                   = 4
Type                                 = LOAD
Database Name                        = MUSICDB
Member Number                        = 0
Description                          = [LOADID: 18.2012-05-12-02.48.55.850877.0 (11;4)]
[*LOCAL.inst481.120512063958] ONLINE LOAD DEL AUTOMATIC INDEXING INSERT NON-RECOVERABLE
INST481 .LOADHIST1
Start Time                           = 05/12/2012 02:48:55.869016
State                                = Executing
Invocation Type                      = User
Progress Monitoring:
   Phase Number                      = 1
      Description                    = SETUP
      Total Work                     = 0 bytes
      Completed Work                 = 0 bytes
      Start Time                     = 05/12/2012 02:48:55.869085

   Phase Number                      = 2
      Description                    = LOAD
      Total Work                     = 10000 rows
      Completed Work                 = 10000 rows
      Start Time                     = 05/12/2012 02:49:07.057958

   Phase Number [Current]            = 3
      Description                    = BUILD
      Total Work                     = 2 indexes
      Completed Work                 = 2 indexes
      Start Time                     = 05/12/2012 02:49:07.36690
```

Monitor column-organized table LOAD using db2pd command –utilities option

```
Database Member 0 -- Active -- Up 0 days 00:25:21 -- Date 2013-05-20-
  08.40.33.104992

Utilities:
Address            ID         Type                    State      Invoker    Priority   StartTime
  DBName   NumPhases  CurPhase   Description
0x000000020557F540 3          LOAD                    0          0          0          Mon May 20
  08:40:20 TESTBLU  4           3          [LOADID: 50.2013-05-20-08.40.20.042757.0 (4;6)]
  [*LOCAL.inst20.130520122733] OFFLINE LOAD DEL AUTOMATIC INDEXING REPLACE COPY NO INST20  .ACCT

Progress:
Address            ID         PhaseNum   CompletedWork               TotalWork
  StartTime           Description
0x000000020557F868 3          1          0 bytes                     0 bytes
  Mon May 20 08:40:20 SETUPo
0x000000020557FA20 3          2          1000000 rows                1000000 rows
  Mon May 20 08:40:20 ANALYZEl
0x000000020557FBA8 3          3          831694 rows                 1000000 rows
  Mon May 20 08:40:26 LOADm
0x000000020557FD30 3          4          0 indexes                   2 indexes
  NotStarted          BUILD
```

Analyze Phase shown for column-organized Table

Using db2pd to monitor table reorg status

db2pd –db MUSICDB -reorg

```
Database Member 0 -- Database MUSICDB -- Active -- Up 0 days 00:02:12 -- Date 2013-10-24-
09.24.50.705218

Table Reorg Information:
Address            TbspaceID TableID PartID MasterTbs MasterTab TableName Type    IndexID
TempSpaceID
0x00007F6C60937C78 11        4       n/a    n/a       n/a       HIST1     Offline 1          1
0x00007F6C60939678 11        6       n/a    n/a       n/a       HIST3     Offline 1          1

Table Reorg Stats:
Address            TableName          Start               End                 PhaseStart
0x00007F6C60937C78 HIST1              10/24/2013 09:23:48 10/24/2013 09:23:50 10/24/2013
09:23:49
0x00007F6C60939678 HIST3              10/24/2013 09:24:39 10/24/2013 09:24:42 10/24/2013
09:24:42

MaxPhase   Phase      CurCount   MaxCount   Status  Completion
4          IdxRecreat 0          0          Done    0
3          IdxRecreat 0          0          Done    0
```

- Shows active or last completed REORG for each table
- Statistics are in database memory, lost when database deactivates

Using db2pd to check reorg statistics when reorg fails to complete

```
db2pd –db MUSICDB -reorg
```

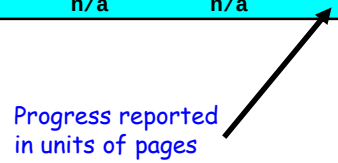
```
Database Member 0 -- Database MUSICDB -- Active -- Up 0 days 00:00:46 -- Date 2013-10-24-
09.23.24.781628

Table Reorg Information:
Address            TbspaceID TableID PartID MasterTbs MasterTab TableName Type    IndexID
TempSpaceID
0x00007F6C60937C78 11        4       n/a    n/a       n/a       HIST1     Offline 1
11

Table Reorg Stats:
Address            TableName          Start               End                 PhaseStart
0x00007F6C60937C78 HIST1              10/24/2013 09:22:40 10/24/2013 09:22:42 10/24/2013
09:22:41

MaxPhase   Phase      CurCount   MaxCount   Status  Completion
4          Build      1967       5426       Stopped
```

- Report shows REORG did not complete Build phase processing

Online table reorganization: Monitoring with db2pd

- Use **db2pd -reorg** to view progress

```
Table Reorg Information:
Address            TbspaceID TableID PartID MasterTbs MasterTab TableName Type    IndexID
TempSpaceID
0x00007F6C5FC37BF8 11        5       n/a    n/a       n/a       HIST2     Online  1
11

Table Reorg Stats:
Address            TableName          Start               End
0x00007F6C5FC37BF8 HIST2              10/24/2013 09:27:13 10/24/2013 09:27:13

PhaseStart          MaxPhase   Phase      CurCount   MaxCount   Status  Completion
n/a                 n/a        n/a        0          1601       Paused
```



Monitoring online index REORG status with db2pd commands

db2pd -reorgs index –db testdb

```
Index Reorg Stats:
Retrieval Time: 02/08/2010 23:04:21
TbspaceID: -6       TableID: -32768
Schema: TEST1    TableName: BIGRPT
Access: Allow none
Status: Completed
Start Time: 02/08/2010 23:03:55   End Time: 02/08/2010 23:04:04
Total Duration: 00:00:08
Prev Index Duration:  -
Cur Index Start: -
Cur Index: 0           Max Index: 2           Index ID: 0
Cur Phase: 0          ( -     )   Max Phase: 0
Cur Count: 0                      Max Count: 0
Total Row Count: 750000
```

Monitoring table space rebalancer progress

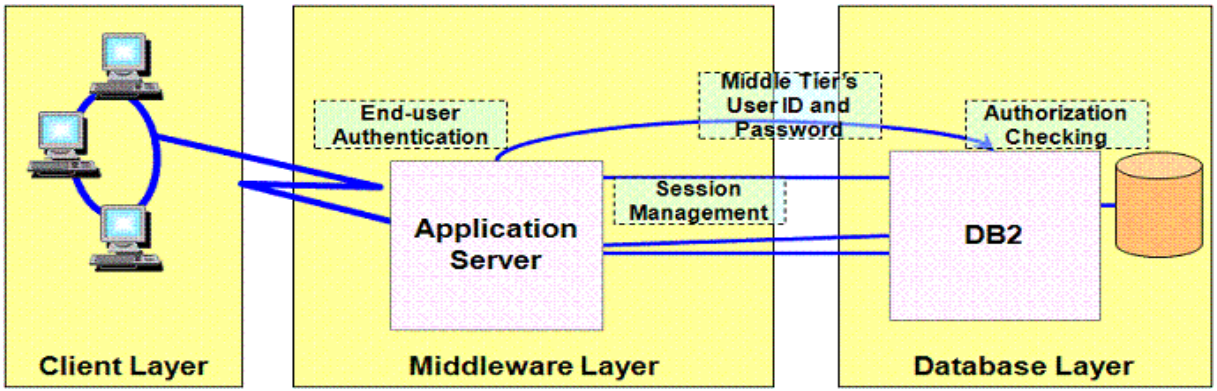
db2pd -utilities

```
Database Partition 0 -- Active -- Up 0 days 00:08:44

Utilities:
Address    ID         Type                    State      Invoker    Priority
0x10A8F720 5          REBALANCE               0          0          0

StartTime           DBName   NumPhases  CurPhase   Description
Sun Apr 13 12:12:49 MUSICDB  1           1         Tablespace ID: 11

Progress:
Address    ID         PhaseNum   CompletedWork               TotalWork
0x10A8FA1C 5          1          145 extents                 1054 extents

StartTime           Description
Sun Apr 13 12:12:49 n/a
```

Database security for three-tier application systems

For many three-tiered application systems:

- Individual Users are authenticated by the application server
- A common user name and password is used to connect to the DB2 server which is unknown to the end user
- All database/SQL processing is performed using a single user name
- A set of database access privileges are granted to the common application logon name to allow all aspects of application processing to be performed



Trusted Context – Example

```
CREATE TRUSTED CONTEXT APPSERVER
BASED UPON CONNECTION USING SYSTEM AUTHID STOPFER
DEFAULT ROLE WILDONE_ROLE ENABLE
ATTRIBUTES (ADDRESS '9.26.113.204')
```

- A database object created by a SECADM user that defines a trust relationship between a DB2 database and an external entity such as a middle-tier server.

- The statement creates a trusted context with these characteristics:
  - The connection must be made from the IP address 9.26.113.204 with a userid of STOPFER
  - The trusted context has a default role called WILDONE_ROLE. This implies that users working within the confines of this trusted context inherit the privileges associated with role appserv_role.

Trusted context problem determination – db2pd

db2pd –db salesdb –appl

```
Database Partition 0 -- Database MUSICDB -- Active -- Up 0 days 00:13:29

Applications:
Address    AppHandl [nod-index] NumAgents  CoorEDUID  Status              ...  Appid
    WorkloadID  WorkloadOccID
0x10B02E00 13       [000-00013] 1          31         ConnectCompleted    ...  *LOCAL.inst461.080128041510
    0           0
0x10B00060 12       [000-00012] 1          30         UOW-Waiting         ...  *LOCAL.inst461.080128041509
    1           1
0x10B05BA0 51       [000-00051] 1          32         ConnectCompleted    ...  192.168.111.131.1664.071015194(
    0           0

External Connection Attributes
Address    AppHandl [nod-index] ClientIPAddress       EncryptionLvl SystemAuthID
0x10B02E00 13       [000-00013] n/a                   Low           DB2SEC
0x10B00060 12       [000-00012] n/a                   Low           DB2SEC
0x10B05BA0 51       [000-00051] 192.168.1.104         Low           DB2USER2

Trusted Connection Attributes
Address    AppHandl [nod-index] TrustedContext  ConnTrustType            RoleInherited
0x10B02E00 13       [000-00013] n/a             non trusted                 n/a
0x10B00060 12       [000-00012] n/a             non trusted                 n/a
0x10B05BA0 51       [000-00051] DBCTX1          implicit trusted connection  ROLE2
```

Error: Database log full condition

```
2008-04-12-05.47.23.550969-240 E647218G587        LEVEL: Error
PID     : 9077                 TID  : 3068128160  PROC : db2sysc 0
INSTANCE: inst481              NODE : 000         DB   : MUSICDB
APPHDL  : 0-49                 APPID: *LOCAL.inst481.080412094512
AUTHID  : INST481
EDUID   : 51                   EDUNAME: db2agent (MUSICDB) 0
FUNCTION: DB2 UDB, data protection services, sqlpgResSpace, probe:2860
MESSAGE : ADM1823E  The active log is full and is held by application handle
          "49".  Terminate this application by COMMIT, ROLLBACK or FORCE
          APPLICATION.

2008-04-12-05.47.23.551851-240 I647806G552        LEVEL: Error
PID     : 9077                 TID  : 3068128160  PROC : db2sysc 0
INSTANCE: inst481              NODE : 000         DB   : MUSICDB
APPHDL  : 0-49                 APPID: *LOCAL.inst481.080412094512
AUTHID  : INST481
EDUID   : 51                   EDUNAME: db2agent (MUSICDB) 0
FUNCTION: DB2 UDB, data protection services, sqlpWriteLR, probe:6680
MESSAGE : ZRC=0x85100009=-2062548983=SQLP_NOSPACE
          "Log File has reached its saturation point"
          DIA8309C Log file was full.
```

db2 “select … table (mon_get_transaction_log ….” **db2pd -db musicdb -logs**

Monitor Log space usage with the table function MON_GET_TRANSACTION_LOG

Amount of log used and free space currently

```
select
        int(total_log_used/1024/1024) as "Log Used (Meg)",
        int(total_log_available/1024/1024)
                as "Log Space Free (Meg)",
        int((float(total_log_used) /
                float(total_log_used+total_log_available))*100)
                as "Pct Used",
        int(tot_log_used_top/1024/1024) as "Max Log Used (Meg)",
        int(sec_log_used_top/1024/1024) as "Max Sec. Used (Meg)",
        int(sec_logs_allocated) as "Secondaries"
from table (MON_GET_TRANSACTION_LOG(-2)) as tlogs ;
```

High Water Marks

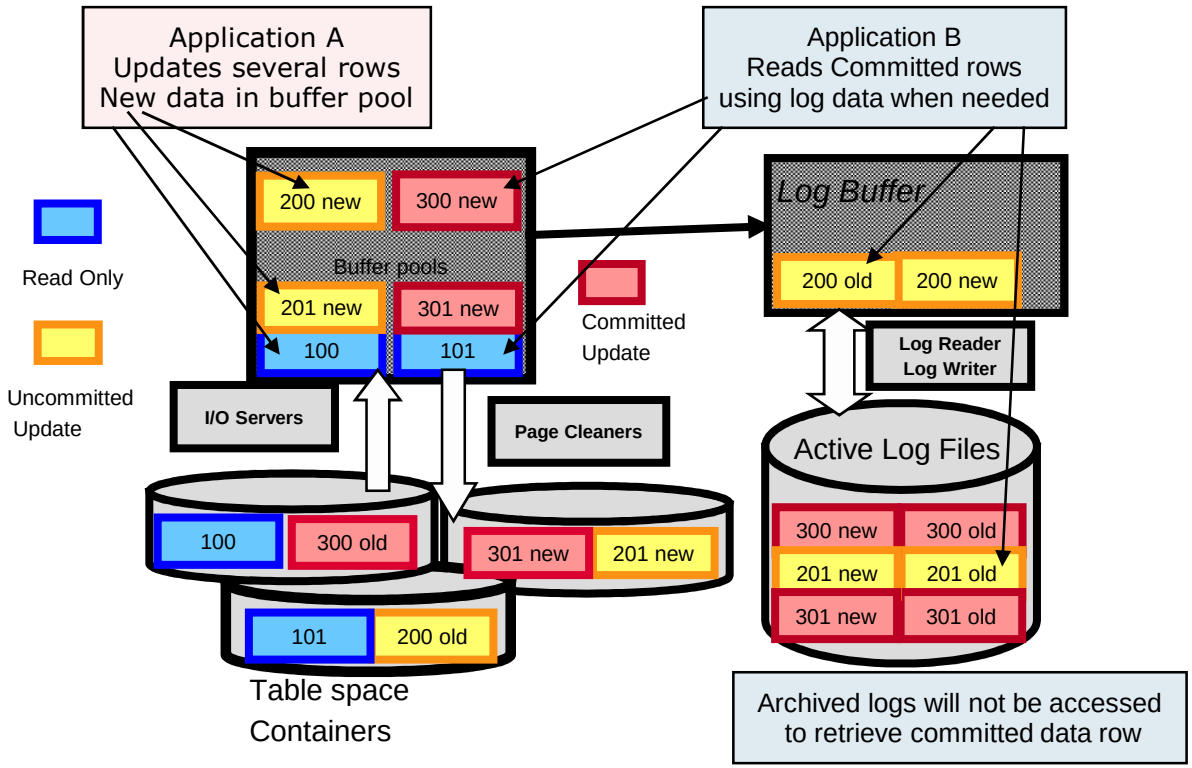
```
Log Used (Meg) Log Space Free (Meg) Pct Used Max Log Used (Meg) Max Sec. Used (Meg) Secondaries
-------------- -------------------- -------- ------------------ ------------------ -----------
            12                    3       76                 12                 10          14
```

Using db2pd: Logs to display logging status

db2pd –db tp1 -logs –alldbpart

```
Database Partition 0 -- Database TP1 -- Active -- Up 0 days 03:46:42
Logs:
Current Log Number            65
Pages Written                 49
Method 1 Archive Status       Success
Method 1 Next Log to Archive  65
Method 1 First Failure        n/a
Method 2 Archive Status       n/a
Method 2 Next Log to Archive  n/a
Method 2 First Failure        n/a
Address    StartLSN       State      Size       Pages      Filename
0x1774DE5C 0x00000B26B000 0x00000000 500        500        S0000065.LOG
0x1774DEFC 0x00000B45F000 0x00000000 500        500        S0000066.LOG
0x17AC824C 0x00000B653000 0x00000000 500        500        S0000067.LOG
0x17AC82EC 0x00000B847000 0x00000000 500        500        S0000068.LOG
0x17ABFE9C 0x00000BA3B000 0x00000000 500        500        S0000069.LOG
0x17ABFF3C 0x00000BC2F000 0x00000000 500        500        S0000070.LOG

Database Partition 1 -- Database TP1 -- Active -- Up 0 days 03:46:39
Logs:
Current Log Number            160
Pages Written                 81
Method 1 Archive Status       Success
Method 1 Next Log to Archive  160
Method 1 First Failure        n/a
Method 2 Archive Status       n/a
Method 2 Next Log to Archive  n/a
Method 2 First Failure        n/a
Address    StartLSN       State      Size       Pages      Filename
0x17ABFF3C 0x000012E0D000 0x00000000 500        500        S0000160.LOG
0x1774DE5C 0x000013001000 0x00000000 500        500        S0000161.LOG
0x1774DEFC 0x0000131F5000 0x00000000 500        500        S0000162.LOG
0x17AC824C 0x0000133E9000 0x00000000 500        500        S0000163.LOG
0x17AC82EC 0x0000135DD000 0x00000000 500        500        S0000164.LOG
0x17C6CFCC 0x0000137D1000 0x00000000 500        500        S0000165.LOG
……
```

How Currently Committed works for CS Isolation



Use db2pd to check logging activity associated with Currently Committed option for locking

```
Database Partition 0 -- Database TP1 -- Active -- Up 0 days 00:02:11

Logs:
Current Log Number            228
Pages Written                 33
Cur Commit Disk Log Reads     1811
Cur Commit Total Log Reads    51482
Method 1 Archive Status       Success
Method 1 Next Log to Archive  228
Method 1 First Failure        n/a
Method 2 Archive Status       n/a
Method 2 Next Log to Archive  n/a
Method 2 First Failure        n/a
Log Chain ID                  3
Current LSN                   0x0000000024BD783E

Address    StartLSN         State      Size       Pages      Filename
0x92202448 00000000243E6010 0x00000000 250        250        S0000220.LOG
0x92202C88 00000000244E0010 0x00000000 250        250        S0000221.LOG
0x922034C8 00000000245DA010 0x00000000 250        250        S0000222.LOG
```

Disk Reads might be reduced with larger log buffer size

BLU Resource Usage and Concurrency

- BLU philosophy is to leverage full machine resources (memory, CPU parallelism, etc.) in order to achieve order of magnitude performance benefits
- A consequence of this is that running too many columnar queries at a time can lead to significant resource competition and degrade performance
- Too many queries executing at a time can also have the potential to overload system resources and cause failures
- Some form of query concurrency management is needed to ensure orderly and efficient execution of columnar queries

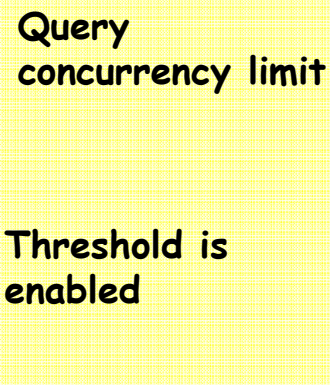
Querying the Default WLM Settings

```
db2pd -workclasssets –alldbs

Database Member 0 -- Database XDB -- Active -- Up 0 days 10:36:52
   -- Date 2013-09-05-22.33.08.942063

(…)

Work Classes:
Address                = 0x00002AAC34C11840
ClassSetId             = 2147483647
ClassId                = 2147483647
ClassName              = SYSMANAGEDQUERIES
Work Class Attributes:
  Work Type            = 2
  Timeron Cost:
    From Value         = 150000
    To Value           = 0
(…)
```

Query cost level

Querying the Default WLM Settings (cont.)

```
db2pd -thresholds -alldbs

(…)
Service Class Thresholds:

Threshold Name                = SYSDEFAULTCONCURRENT
Threshold ID                  = 2147483647
Domain                        = 40
Domain ID                     = 4
Predicate ID                  = 90
Maximum Value                 = 12
Enforcement                   = D
Queueing                      = Y
Queue Size                    = -1
Collect Flags                 = N
Partition Flags               = C
Execute Flags                 = S
Enabled                       = Y
Check Interval (seconds)      = 0
Remap Target Serv. Subclass = 0
Log Violation Evmon Record    = Y
(…)
```



Monitoring HADR status

db2pd –db TP1 -hadr

```
Database Partition 0 -- Database TP1 -- Active -- Up 0 days 00:31:18

HADR Information:
Role    State               SyncMode HeartBeatsMissed   LogGapRunAvg (bytes)
Primary Peer                Nearsync 0                  576827

ConnectStatus ConnectTime                            Timeout
Connected     Tue Jan  6 15:26:38 2009 (1231273598) 120

PeerWindowEnd                          PeerWindow
Tue Jan  6 15:47:02 2009 (1231274822) 60

LocalHost                                 LocalService
CL4100                                    6493

RemoteHost                                RemoteService      RemoteInstance
CL4100                                    6491               inst491

PrimaryFile  PrimaryPg  PrimaryLSN
S0000157.LOG 255        0x000000001E707F79

StandByFile  StandByPg  StandByLSN
S0000157.LOG 2          0x000000001E60A7A7
```

Primary Database sees that the Standby has reached a peer state

HADR status on Standby includes time for end of Peer Window

db2pd –db TP1 -hadr

```
Database Partition 0 -- Database TP1 -- Active -- Up 0 days 00:02:18

HADR Information:
Role    State                SyncMode HeartBeatsMissed   LogGapRunAvg (bytes)
Standby DisconnectedPeer     Nearsync 0                  255138

ConnectStatus ConnectTime                               Timeout
Disconnected  Tue Jan  6 16:04:27 2009 (1231275867) 120

PeerWindowEnd                          PeerWindow
Tue Jan  6 16:05:14 2009 (1231275914) 60

LocalHost                              LocalService
CL4100                                 6493

RemoteHost                             RemoteService      RemoteInstance
CL4100                                 6491               inst491

PrimaryFile  PrimaryPg  PrimaryLSN
S0000159.LOG 112        0x000000001EA60475

StandByFile  StandByPg  StandByLSN
S0000159.LOG 112        0x000000001EA60475
```

The Standby database has received a timestamp from the Primary indicating when the Peer Window will end

HADR tuning options: DB2_HADR_BUF_SIZE

DB2_HADR_BUF_SIZE - HADR Standby log receive buffer size

```
Database Partition 0 -- Database TP1 -- Standby -- Up 0 days 00:32:44

HADR Information:
Role    State                SyncMode HeartBeatsMissed   LogGapRunAvg (bytes)
Standby Peer                 Nearsync 0                  1019811
ConnectStatus ConnectTime                           Timeout
Connected     Sun Oct 24 17:21:46 2010 (1287955306) 30

PeerWindowEnd                           PeerWindow
Sun Oct 24 17:38:56 2010 (1287956336) 60
LocalHost                                  LocalService
ibmclass                                   6493
RemoteHost                                 RemoteService      RemoteInstance
ibmclass                                   6491               inst491

PrimaryFile  PrimaryPg  PrimaryLSN
S0000323.LOG 499        0x00000000296F9378

StandByFile  StandByPg  StandByLSN         StandByRcvBufUsed
S0000323.LOG 128        0x000000002958758B 76%
```

Replay-only window on the active Standby database

- When the Standby database is replaying DDL log records or maintenance operations, the Standby enters the *replay-only window*.
- When the Standby is in the replay-only window, existing connections to the Standby are terminated and new connections to the Standby are blocked (SQL1776N Reason Code 4).
- New connections are allowed on the Standby after the replay of all active DDL or maintenance operations has completed.

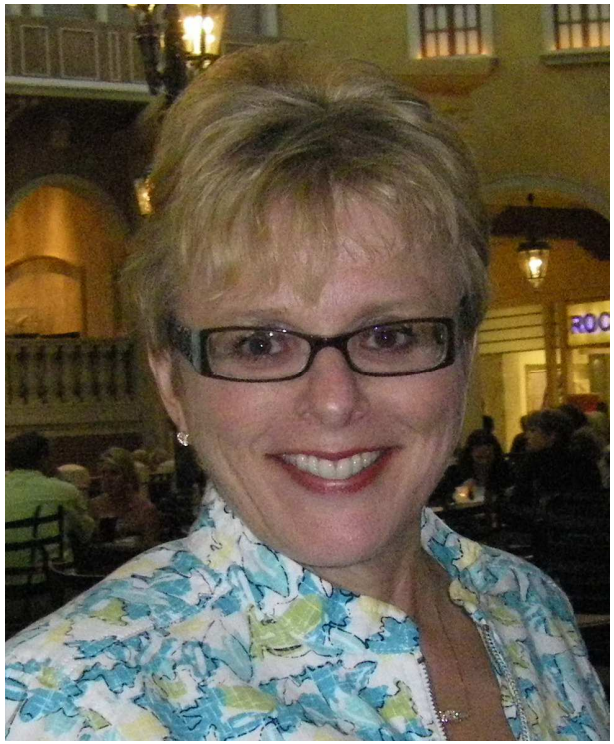
```
select count(*) as count , dec(avg(balance),9,2) as avg_balance
  from inst491.history where branch_id between 10 and 20


SQL1224N  The database manager is not able to accept new
  requests, has terminated all requests in progress, or has
  terminated the specified request because of an error or a
  forced interrupt.  SQLSTATE=55032
```

Monitoring the replay-only window using db2pd

db2pd -db hadrdb -hadr

```
Database Partition 0 -- Database HADRDB -- Active -- Up 0 days 00:00:06

HADR Information:
Role    State          SyncMode HeartBeatsMissed   LogGapRunAvg (bytes)
Standby Peer           Nearsync 0                  0

ConnectStatus ConnectTime                            Timeout
Connected     Sat Jun 15 03:09:35 2008          120

ReplayOnlyWindowStatus      ReplayOnlyWindowStartTime          MaintenanceTxCount
Active                      Sun Jun 16 08:09:35 2008           5

LocalHost        LocalService
skua             52601

RemoteHost       RemoteService       RemoteInstance
gull             52600               vinci

PrimaryFile  PrimaryPg  PrimaryLSN
S0000000.LOG 1          0x000000000137126F

StandByFile  StandByPg  StandByLSN
S0000000.LOG 0          0x000000000137092E
```

Power of db2pd



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Happy New Year – Best wishes for a super 2015 !!!