

# Workload Insights Without a Trace



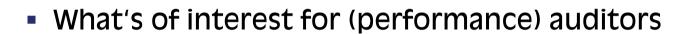
Introducing DB2 z/OS SQL tracking





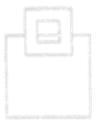
# Agenda

- What's new in DB2 10
- What's of interest for geeks in DB2 10











#### **Characteristics:**

The DSC is where dynamic SQL statements, and \*only\* dynamic SQL statements, reside once they have been PREPAREd if certain ZPARM and/or BIND options are in use.



The next time the exact same statement is to be PREPARED the cache is searched and, if all is valid and certain ZPARM and/or BIND options are in use, then the PREPARE is avoided



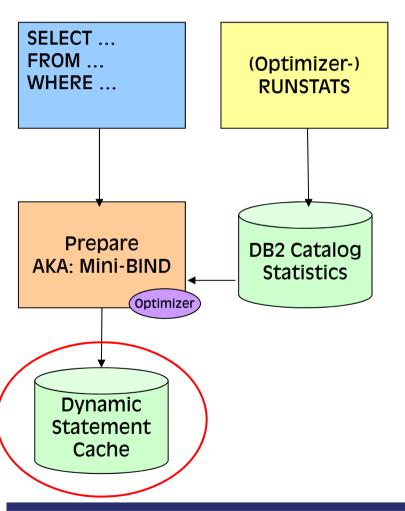
→ Thus saving lots of CPU time.

Ideally an SQL statement should stay in the cache forever, but the real world shows that two days of residency or latency is typical.





#### **Characteristics:**



Access Paths for dynamic SQL are determined on the fly and stored in the DSC.

LRU, RUNSTATS, ALTER, DROP, REVOKE, DB2 RESTART invalidates and flushes the DSC for an object.









#### Cache behavior overview:

CACHEDYN->			NO					
K	NO	•	No skeletons cached in EDMP					
E		•	Only full prepares					
E		•	No prepared statements kept across commits (note1)					
Р		•	No statement strings kep	ot across				
D			commits	NONE				
Υ								
•		•	No skeletons cached in E	DMP				
N		•	Only full prepares					
Α	YES	•	No prepared statements kept across commits (note 1)					
M				gs kept across commits –				
1			implicit prepares					
•				LOCAL				
C								

Note 1: unless a cursor WITH HOLD is open

Note 2: unless invalidated or flushed out due to LRU

Note 3: assuming MAXKEEPD > 0

#### YES

- Skeletons cached in EDMP
- 1st prepare full; others short (note 2)
- No prepared statements kept across commits (note 1)
- No statement strings kept commits
- Skeletons cached in EDMP
- 1st prepare full; others short (note 2)
- Prepared stmts across commits avoids prepares (note 3)
- Stmt strings kept across commits implicit prepares



AKA: Prepare Avoidance



#### The many flavors of PREPARE:

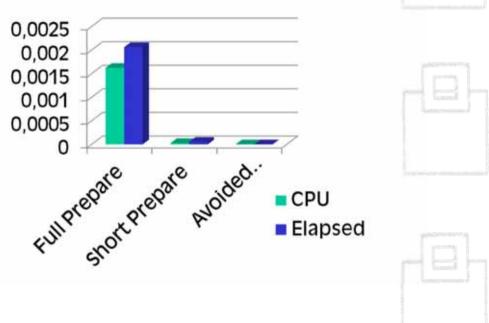
- Full
   Skeleton copy of the SQL is not in the cache or the cache is not active. Caused by a PREPARE or EXECUTE IMMEDIATE statement.
- Short
   A skeleton copy of the PREPAREd SQL statement is copied to local storage.
- Avoided
   PREPARE avoided by using full caching. PREPAREd statement information is still in thread's local storage.
- Implicit
   Due to limits, such as MAXKEEPD, a PREPARE cannot be avoided and DB2 will issue the PREPARE on behalf of the application.





#### DB2 Setup and Support:

- The right setup saves a lot of money
  - Exploit the full flavor of caching
  - MAXKEEPD>0
  - CACHEDYN=YES
  - KEEPDYNAMIC(YES)



So far, so good ...

The DSC opened up great opportunities for dynamic SQL

- Packaged applications like SAP
- Less-mainframe-skilled developers
- Interactive multi-platform solutions
- The mainframe competing with the distributed environment
- Cost efficient and well performing applications
- → The key is the Dynamic Statement Cache ..
  - ... USE IT, or IBM will make you use it...







# DSC relevant parameters and what they have been set to or defaulted to over the releases of DB2

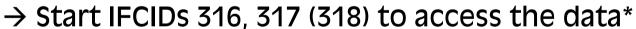
Version	MAXKEEPD 0 - 65535	CACHEDYN (Yes/No)	Notes
5	5000	NO	EDMPOOL was the CACHE
6	5000	NO	If CACHEDYN "YES" then new EDMDSPAC With valid range 1K – 2,097,152K
7	5000	NO	New EDMDSMAX with valid range 0 – 2,097,152K and default 1,048,576K
8	5000	YES	EDMDSPAC and EDMDSMAX removed. New EDMSTMTC with valid range 5,000K – 1,048,576K and new "opaque" ZPARM CACHEDYN_FREELOCAL valid values 0 or 1 with default 0 (off)
9	5000	YES	CACHEDYN_FREELOCAL default changed to 1 (on) and EDMSTMTC default changed to 56,693K
10	5000	YES	EDMSTMTC default changed to 113,386K



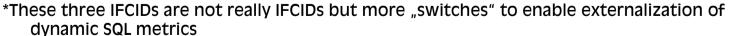
Besides the caching, the DSC gives you insight:

Memory resident storage of PREPAREd dynamic SQL statements

- SQL text
- Statement ID
- Date/time, current status
- Resource consumption



...once the data is gathered, decide on what you want to analyze...





Where



```
WLI for DB2 z/OS ---- Dynamic Statement Cache (1/8) ----- Stmt 1 from 258
                                                               Scroll ===> CSR
Command ===>
                                                                       DB2: SA10
Primary cmd: END, SE(tup), Z(oom), L(ocate) stmtid
         cmd: Z(oom), A(nalyze), E(dit Statement), S(tatement Text), T(able),
              X (EXecute)
    StmtID
                          Program
                                      PrAuthID Qualifier Executes
                                                                     Getpages
                Count
            235
                          IOADBACP
                                     HEINRIC
                                                HEINRIC
                                                                  11
                                                                           16876 V
             89
                                                                1639
                                                                           13300 V
                          IQADBACP
                                     SUBMIT
                                                SUBMIT
             87
                          IQADBACP
                                     SUBMIT
                                                SUBMIT
                                                                1644
                                                                           11667 V
            159
                          IQADBACP
                                     HEINRIC
                                                HEINRIC
                                                                   5
                                                                           9645 V
             92
                          IQADBACP
                                     SUBMIT
                                                                2855
                                                                           5712 V
                                                SUBMIT
             91
                          IOADBACP
                                     SUBMIT
                                                                2783
                                                                           5566 V
                                                SUBMIT
             90
                          IOADBACP
                                                                1639
                                                                           5266 V
                                      SUBMIT
                                                SUBMIT
             88
                          IQADBACP
                                                                1639
                                                                           4936 V
                                     SUBMIT
                                                SUBMIT
             86
                          IQADBACP
                                     SUBMIT
                                                SUBMIT
                                                                 221
                                                                           4186 V
             98
                          IQADBACP
                                     HEINRIC
                                                HEINRIC
                                                                           3836 V
            258
                          IQADBACP
                                     HEINRIC
                                                HEINRIC
                                                                   2
                                                                           3816 V
            248
                          IQADBACP
                                     HEINRIC
                                                HEINRIC
                                                                           1917 V
            250
                                     HEINRIC
                                                                           1914 V
                          IOADBACP
                                                HEINRIC
                                                                   1
            182
                          IQADBACP
                                     HEINRIC
                                                HEINRIC
                                                                 114
                                                                           1833 V
                          IQADBACP
                                                                 221
                                                                            1107 V
             93
                                      SUBMIT
                                                SUBMIT
```





```
WLI for DB2 z/OS ---- Dynamic Statement Cache (1/8) ----- Stmt 1 from 258
 WLI ----- Zoom DSC Statement -----
                                                                   More:
 DB2/Memb.:
                                  Transition:
 Inserted: 2011-03-09-03:58:58.083053 StmtID: 235 Lineno:
                                                                           1560
                                                    O Copies:
 Start 318: 2011-02-04-09:25:31.41 Users:
                                                                             0
 Status : VALID
                                                             Isolation:
                                                                             CS
Aggreg.count:
                 11 Rows examined: 8151 Sorts:
 Executions :
                                                                             66
| Getpages : 16876 Rows processed: 35 ParallelGrps: | SyncBufRead : 7 Index scans : 11 NoRID limits: | SyncBufWrite: 0 Tablesp. scans: 66 NoRID stor. :
                                                                              0
                       HHHH:MM:SS.ttt Wait times HHHH:MM:SS.ttt
Total elapse time : 2.244 Synchronous I/O :
Average elapse time: 0.204 Lock and latch :
Total CPU time : 1.665 Synch exec unit switch:
                                                                          0.037
                                                                          0.002
| Average CPU time : 0.151 Global locks
                                       Read activity others :
                                                                          0.119
                                        Write activity others :
                                                                          0.059
                       1 IQADBACP SUBMIT
                                                                            1107 V
             93
                                                SUBMIT
                                                                 221
```





```
WLI for DB2 z/OS ---- Dynamic Statement Cache (1/8) ----- Stmt 1 from 258
 WLI ----- Zoom DSC Statement -----
                                                        More:
                                 Write activity others :
                                                              0.059
 Currentdata: NO Current degree: 1 Current precision: 15
 Dynamic rules: RUN Current rules: DB2 Cursor hold : YES
Primary
 AuthID : HEINRIC
 Program : IQADBACP
 SQLID : HEINRIC
 Qualifier: HEINRIC
 Schema :
 Object
 Creator : IDUG610
 Name : IQA PLAN TABLE
 User
 string :
          93
                   1 IQADBACP SUBMIT
                                        SUBMIT
                                                       221
                                                               1107 V
```



```
WLI for DB2 z/OS ---- Dynamic Statement Cache (2/8) ----- Stmt 1 from 258
                                                              Scroll ===> CSR
Command ===>
                                                                      DB2: SA10
Primary cmd: END, SE(tup), Z(oom), L(ocate) stmtid
        cmd: Z(oom), A(nalyze), E(dit Statement), S(tatement Text), T(able),
             X (EXecute)
                 StmtLen Statementtext
     StmtID
            235
                     937
                         SELECT STRIP(TB.DBNAME), STRIP(TB.TSNAME), STRIP(TB.CR
                         SELECT "QUERYNO" , QBLOCKNO , APPLNAME , RTRIM (PROGNAME)
            89
                     977 SELECT "QUERYNO" , OBLOCKNO , APPLNAME , RTRIM (PROGNAME)
            87
                    1055 SELECT S.BAIM KEY , S.EXPLAIN FLAG , S.EXPLAIN TIME ,
            159
                         INSERT INTO IDUG610.BAIM OBJECTS (BAIM KEY, RUNID,
             92
                     132
                     509
                         INSERT INTO IDUG610.BAIM STATEMENTS (BAIM KEY, RUNI
             91
             90
                     260
                         SELECT "QUERYNO" , APPLNAME , RTRIM (PROGNAME) , RTRIM (COL
                     291 SELECT "QUERYNO" , APPLNAME , RTRIM (PROGNAME) , RTRIM (COL
            88
                    722 SELECT 0 , 0 , 0 , STMT , ISOLATION , STATUS , ACCESSP
            86
                    2209 SELECT S.BAIM KEY , S.EXPLAIN FLAG , S.EXPLAIN TIME ,
             98
                    134 SELECT CHANGEFLAG , COUNT(*) FROM IDUG610.BAIM STATEME
            258
            248
                    1055 SELECT S.BAIM KEY , S.EXPLAIN FLAG , S.EXPLAIN TIME ,
            250
                    1055 SELECT S.BAIM KEY , S.EXPLAIN FLAG , S.EXPLAIN TIME ,
                    313 SELECT B.X CONDNR, B.X CONDTYP, B.X TABORDER, B.X EXPL
            182
                     677 UPDATE IDUG610.BAIM PROGRAMS SET CHANGEFLAG = ? , REB
             93
```





```
WLI for DB2 z/OS ---- Dynamic Statement Cache (3/8) ----- Stmt 1 from 258
                                                              Scroll ===> CSR
Command ===>
                                                                      DB2: SA10
Primary cmd: END, SE(tup), Z(oom), L(ocate) stmtid
        cmd: Z(oom), A(nalyze), E(dit Statement), S(tatement Text), T(able),
             X (EXecute)
                 Table
                           Table (only first)
    StmtID
                 Creator
                           Name
                                               Inserted
                                                                           Isol.
                IDUG610
                           IQA PLAN TABLE
                                               2011-03-09-03:58:58.083053
            235
                           PLAN TABLE
            89
                HOPPE
                                               2011-02-04-09:26:03.453877
                                                                           CS
                           PLAN TABLE
            87 R510
                                               2011-02-04-09:26:00.901839
                                                                           CS
            159
                IDUG610
                           IDUGB005
                                               2011-03-09-03:36:04.727479
                                                                           CS
             92
                IDUG610
                           IDUGB016
                                               2011-02-04-09:26:03.702272
                                                                           CS
                IDUG610
                           IDUGB006
             91
                                               2011-02-04-09:26:03.536507
             90 HOPPE
                           DSN STATEMNT TABLE
                                              2011-02-04-09:26:03.484569
                                                                           CS
            88 R510
                           DSN STATEMNT TABLE 2011-02-04-09:26:01.287488
                                                                           CS
                           SYSPACKSTMT
            86 SYSIBM
                                               2011-02-04-09:26:00.686328
                                                                           CS
                           IDUGB006
                IDUG610
                                               2011-02-04-09:27:41.088935
             98
                                                                           CS
            258
                IDUG610
                           IDUGB006
                                               2011-03-09-04:06:00.831677
                                                                           CS
                IDUG610
            248
                           IDUGB005
                                               2011-03-09-04:04:54.020898
                                                                           CS
            250 IDUG610
                           IDUGB005
                                               2011-03-09-04:05:24.656481
                                                                           CS
            182 IDUG610
                           IDUGA005
                                               2011-03-09-03:58:56.056553
                                                                           CS
                IDUG610
                                               2011-02-04-09:26:04.673020
             93
                           IDUGB005
                                                                           CS
```



	T(able),	ent Text),				ND, SE(tup), (oom), A(na. (EXecute)	cmd: Z	
	Tablespc.	Index	Rows	Rows	Synchr.	Synchr.		
	Scans	Scans	processed	examined	Buffer Wr	Buffer Rd	StmtID	
	66	11	35	8151	0	7	235	
	1639	1639	3003	3003	0	0	89	
	1639	1639	3003	0	0	25	87	
	10	0	1020	270520	0	2	159	
Tanus	0	0	2855	0	0	9	92	
	0	0	2783	0	0	9	91	
	0	1639	1639	1639	0	0	90	
	0	1639	1639	0	0	19	88	
	221	442	4165	5143	0	337	86	
	5	0	294	105565	0	37	98	
	2	0	12	108208	0	0	258	
	2	0	95	54104	0	1	248	
	2	0	3	54104	0	1	250	
	114	384	270	540	0	9	182	
1	0	221	221	0	0	0	93	



				atement),	S(tatement Te	ext), T(able	
StmtID	Users	Copies	Sor		arallel Nori roups Limi		id cage
	235	0	0	66	0	0	0
	89	O	0	1639	0	0	O
	87	0	0	1644	0	0	0
	159	0	0	5	0	0	0
	92	0	0	0	0	0	0
	91	0	0	0	0	O	O
	90	0	0	0	0	0	O
	88	0	0	O	0	0	O
	86	0	0	221	0	0	0
	98	0	0	4	0	0	O
	258	0	0	2	0	0	O
	248	0	0	1	0	0	0
	250	O	0	1	0	0	0
	182	0	0	114	0	0	0
	93	0	0	0	0	0	0



```
WLI for DB2 z/OS ---- Dynamic Statement Cache (6/8) ----- Stmt 1 from 258
Command ===>
                                                               Scroll ===> CSR
                                                                        DB2: SA10
Primary cmd: END, SE(tup), Z(oom), L(ocate) stmtid
         cmd: Z(oom), A(nalyze), E(dit Statement), S(tatement Text), T(able),
              X (EXecute)
                                                                 Average Elapse
                Total CPU
                                Average CPU
                                                 Total Elapse
     StmtID
                HHHH:MM:SS.ttt
                                HHHH:MM:SS.ttt
                                                 HHHH:MM:SS.ttt
                                                                 HHHH:MM:SS.ttt
            235
                         1.665
                                          0.151
                                                          2.244
                                                                           0.204
             89
                         5.416
                                          0.003
                                                          5.812
                                                                           0.004
             87
                         5.598
                                          0.003
                                                          7.192
                                                                           0.004
                         1.639
                                          0.328
                                                          1.774
            159
                                                                           0.355
             92
                         1.251
                                                          1.685
                                                                           0.001
             91
                         1.835
                                          0.001
                                                          2.167
                                                                           0.001
             90
                         0.945
                                          0.001
                                                          1.022
                                                                           0.001
             88
                         1.290
                                          0.001
                                                          1.758
                                                                           0.001
             86
                         1.617
                                          0.007
                                                          2.769
                                                                           0.013
             98
                         0.801
                                          0.801
                                                          1.774
                                                                           1.774
                         0.585
                                          0.293
                                                          0.643
            258
                                                                           0.322
            248
                         0.300
                                          0.300
                                                          0.330
                                                                           0.330
            250
                         0.264
                                          0.264
                                                          0.329
                                                                           0.329
            182
                         0.469
                                          0.004
                                                          0.732
                                                                           0.006
             93
                         0.278
                                          0.001
                                                          0.318
                                                                           0.001
```



```
WLI for DB2 z/OS ---- Dynamic Statement Cache (7/8) ----- Stmt 1 from 258
Command ===>
                                                        Scroll ===> CSR
                                                               DB2: SA10
Primary cmd: END, SE(tup), Z(oom), L(ocate) stmtid
        cmd: Z(oom), A(nalyze), E(dit Statement), S(tatement Text), T(able),
            X (EXecute)
              Wait times for
              Synchr. I/O Lock and Latch SyncExecUnitSw Global Locks
    StmtID
              HHHH:MM:SS.ttt HHHH:MM:SS.ttt
                                           HHHH:MM:SS.ttt HHHH:MM:SS.ttt
          235
                      0.037
                                     0.002
                                     0.006
           89
           87
                                     0.003
                      0.081
                      0.021
          159
           92
                      0.069
           91
                      0.034
                                     0.004
           90
                                     0.005
           88
                      0.059
                                     0.006
           86
                      0.775
                      0.163
           98
          258
          248
                      0.014
          250
                      0.016
          182
                      0.065
           93
```



				1000 P			DB2:	SA10	
rimary cmd: END, SE(tup), Z(oom), L(ocate) stmtid ine cmd: Z(oom), A(nalyze), E(dit Statement), S(tatement Text), T(able), X(EXecute)									
	Wait t	imes for	other threads	Curr.	Dyn-	Current	Curr.		
StmtID			Write Activity HHHH:MM:SS.ttt	Degree	Rules	Data	Rule	Hold	
Z 23	5	0.119	0.059	1	RUN	NO	DB2	YES	
8	9			1	RUN	NO	DB2	YES	
8	7	0.602		1	RUN	NO	DB2	YES	
15	9	0.017	0.002	1	RUN	NO	DB2	YES	Į
9	2			1	RUN	NO	DB2	NO	160
g	1			1	RUN	NO	DB2	NO	
9	0			1	RUN	NO	DB2	YES	
8	8	0.089		1	RUN	NO	DB2	YES	
8	6	0.206		1	RUN	NO	DB2	YES	
Ç	8	0.318		1	RUN	NO	DB2	YES	
25	8			1	RUN	NO	DB2	YES	
24	8			1	RUN	NO	DB2	YES	
25		0.024		1	RUN	NO	DB2	YES	
18	2	0.024		1	RUN	NO	DB2	YES	
	3				RUN	NO	DB2	NO	



#### WOW!

This is great insight, without having to run a monitor, nor a trace!



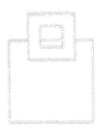
#### BUT!

Does it really show ALL statements being executed? Do you really get the full picture?



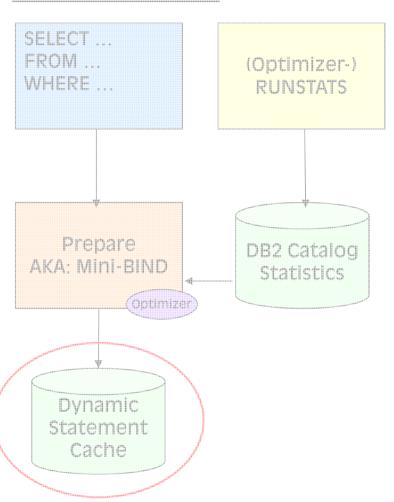
What about static SQL?

What was this flush thing from slide four?





#### Characteristics:



Access Paths for dynamic SQL are determined on the fly and stored in the DSC.

LRU, RUNSTATS, ALTER, DROP, REVOKE, DB2 RESTART invalidates and flushes the DSC for an object.







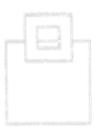


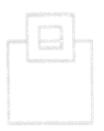
...How does the smarter database, how does DB2 10 for z/OS deal with it?...

#### New:

 IFCIDs 316 was enhanced to externalize the data from the DSC when a flushing situation occurs (LRU, RUNSTATS, ALTER, DROP, REVOKE, ...)





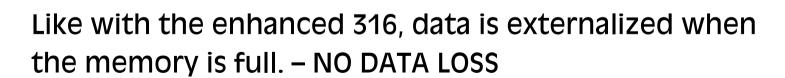


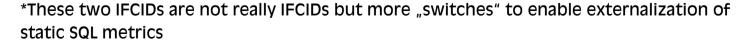
→ Start the new IFCIDs 400, 401 to access additional data\* – let's call it the Static Statement Cache

The SSC gives you the full picture:

- Memory resident storage of
- static SQL statements
- Statement ID
- Date/time, current status
- Resource consumption













```
WLI for DB2 z/OS ----- Static Statement Cache (1/8) ---- Statement 1 from 117
Command ===>
                                                               Scroll ===> CSR
                                                                      DB2: SA1B
Primary cmd: END, F(ilter), Z(oom), L(ocate) getpages
        cmd: Z(oom), A(nalyze), E(dit statement), S(tatement text), T(able),
             X (EXecute)
                                               Qualifier Executes
    StmtID
                Program
                         Lineno
                                     UserID
                                                                    Getpages
          2162 IOADBACP
                              1086
                                    BOXWELL
                                               BOXWELL
                                                                           245 V
                                                                 14
          2164 IQADBACP
                              1094 BOXWELL
                                               BOXWELL
                                                                 36
                                                                           222 V
          2152 IQADBACP
                              1086 BOXWELL
                                               BOXWELL
                                                                  3
                                                                            61 V
          2154 IQADBACP
                              1086 BOXWELL
                                               BOXWELL
                                                                  7
                                                                            48 V
                              1042 BOXWELL
          2247 IQADBACP
                                               BOXWELL
                                                                  1
                                                                            48 V
          2250 IQADBACP
                              1042 BOXWELL
                                               BOXWELL
                                                                  1
                                                                            48 V
          2192 IOADBACP
                              1082 BOXWELL
                                               BOXWELL
                                                                 10
                                                                            47 V
          2208 IOADBACP
                              1042 BOXWELL
                                               BOXWELL
                                                                  1
                                                                            47 V
          2138 IQADBACP
                              1082 BOXWELL
                                               BOXWELL
                                                                 12
                                                                            39 V
          2150 IQADBACP
                              1086 BOXWELL
                                                                  3
                                               BOXWELL
                                                                            24 V
          2155 IQADBACP
                              1086 BOXWELL
                                               BOXWELL
                                                                  7
                                                                            24 V
          2253 IQADBACP
                              1022 BOXWELL
                                               BOXWELL
                                                                  1
                                                                            23 V
                              1090 BOXWELL
          2255 IOADBACP
                                               BOXWELL
                                                                  3
                                                                            21 V
          2256 IOADBACP
                              1094 BOXWELL
                                               BOXWELL
                                                                  4
                                                                            20 V
          2142 IQADBACP
                              1086 BOXWELL
                                               BOXWELL
                                                                  8
                                                                            18 V
          2112 IOADBACP
                              1082 BOXWELL
                                               BOXWELL
                                                                            16 V
```





```
WLI for DB2 z/OS ----- Static Statement Cache (4/8) ---- Statement 1 from 117
                                                                  Scroll ===> CSR
Command ===>
                                                                          DB2: SA10
Primary cmd: END, F(ilter), Z(oom), L(ocate) getpages
         cmd: Z(oom), A(nalyze), E(dit statement), S(tatement text), T(able),
              X (EXecute)
                Synchr.
                            Synchr.
                                                              Index
                                                                         Tablespc.
                                       Rows
                                                  Rows
                Buffer Rd Buffer Wr examined
                                                  processed Scans
     StmtID
                                                                         Scans
           2162
                          0
                                               74
                                                           37
                                                                       52
                                                                                  15
           2164
                                                          185
                                                                                  74
                                                                        0
                                                0
           2152
                                     0
                                               38
                                                           19
                                                                       30
                                                                                   4
           2154
                          0
                                     0
                                               16
                                                            8
                                                                      16
                                                                                   0
           2247
                                     0
                                              101
                                                                                   1
           2250
                                              101
                                                                        2
                          0
                                     0
                                                                                   1
           2192
                                              844
                          0
                                     0
                                                                                  11
           2208
                                              100
                                                           39
           2138
                                                           13
                          0
                                     0
                                               13
                                                                       13
                                                                                   0
                          0
                                     0
                                                            4
                                                                        8
           2150
                                                8
                                                                                   0
           2155
                          0
                                     0
                                                            0
                                                                                   0
           2253
                          0
                                     0
                                                                        0
                                                                                   0
           2255
                                                                                   3
           2256
                          0
                                     0
                                                                        0
                                                                                   8
           2142
                          0
                                     0
                                                                        0
           2112
```





```
WLI for DB2 z/OS ----- Static Statement Cache (6/8) ---- Statement 1 from 117
Command ===>
                                                                 Scroll ===> CSR
                                                                        DB2: SA10
Primary cmd: END, F(ilter), Z(oom), L(ocate) getpages
        cmd: Z(oom), A(nalyze), E(dit statement), S(tatement text), T(able),
Line
             X (EXecute)
    StmtID
               Total CPU
                                Average CPU
                                                 Total Elapse
                                                                 Average Elapse
               HHHH: MM: SS. ttt HHHH: MM: SS. ttt
                                                 HHHH: MM: SS. ttt
                                                                 HHHH: MM: SS. ttt
                                                                           0.027
          2162
                         0.040
                                         0.003
                                                          0.373
          2164
                        0.047
                                         0.001
                                                          0.128
                                                                           0.004
          2152
                        0.014
                                         0.005
                                                          0.104
                                                                           0.035
          2154
                         0.007
                                         0.001
                                                          0.007
                                                                           0.001
          2247
                                                                           0.006
                         0.006
                                         0.006
                                                          0.006
          2250
                        0.006
                                         0.006
                                                          0.006
                                                                           0.006
          2192
                         0.005
                                         0.001
                                                          0.005
                                                                           0.001
          2208
                        0.013
                                                                           0.089
                                         0.013
                                                          0.089
                         0.004
          2138
                                                          0.004
          2150
                         0.002
                                         0.001
                                                          0.002
                                                                           0.001
          2155
                         0.002
                                                          0.002
          2253
          2255
                                         0.001
                                                                           0.001
                         0.004
                                                          0.004
          2256
                        0.004
                                         0.001
                                                          0.004
                                                                           0.001
          2142
                         0.002
                                                          0.002
          2112
```

DB2 10 also provides some additional information from The DSC trace we all know today:

- Wait time accumulation for
  - Latch requests
  - Page latches
  - Drain locks
  - Drains during waits for claims to be released
  - Log writers





- Date and time in store clock format for Stmt insertion and update (along with internal format)
- Number of times that
  - a RID list overflowed because of
    - storage shortage
    - # of RIDs exceeded internal limit(s)
  - a RID list append for a hybrid join interrupted
    - because of RID pool storage shortage
    - # of RIDs exceeded internal limit(s)
  - a RID list retrieval failed for multiple IX access. The result of IX AND/Oring could not be determined



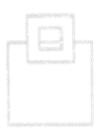
# How to exploit DSC & SSC

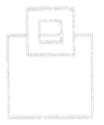
Have a started task running 24x7 catching all the IFCIDs that DB2 will be throwing and stores the data.

Allow to exclude yourself from the system.

Externalize the data like every 60 min, or allow

- -customization (e.g. 30 180 minutes
- -ad hoc data refresh





# How to exploit DSC & SSC

Triggered at the interval, the data captured needs to be processed locally, or at a different site:



Allow two levels of details for static SQL

- Full Capture the SQL Text at trace time
- Ref Use the SYSPACKSTMT table for the SQL Text

Referring to the Catalog should be the efficient default. However, in case of a very dynamic environment the SQL text needs to be captured real-time to avoid missing SQL text situations when using history and the original SQL isn't there anymore (e.g. a new pre-compile leads to a new STMTNO).



## How to exploit DSC & SSC



#### Resulting benefits:

- Executed SQL in a plex report
- Workload and Performance warehouse repository that contains \*all\* executed SQL
- Threshold based warning system for
  - Exceeded resource limits
  - Unusual workload
- Powerful history and trending analysis

All of this is now available with the smallest ever possible overhead!





#### How to exploit it

#### Real world scenarios:

Scenario 1: Heavy hitters

Scenario 2: Executed SQL by program

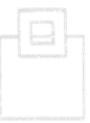
Scenario 3: Objects used in SQL

Scenario 4: Never executed SQL

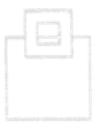
Scenario 5: RID Pool control

Auditor Scenario 1: Who did what?

Auditor Scenario 2: When did it happen?







# Scenario 1: Heavy hitters

All SQL that uses over a threshold of CPU
All SQL that scans over a threshold of Getpages
All SQL that waits too long
Etc etc

History, Drill-down Static and Dynamic





# Scenario 1: Heavy hitters



# Scenario 1: Heavy hitters – data for SSC

```
WLI for DB2 z/OS ----- Limits -----
Command ===>
                                                                  DB2: SA10
NO LIMITATION
HIGHEST VALUES
EXCEED THRESHOLD:
                       THRESHOLD:
For limitation to highest values or exceeding of specified threshold
EXECUTIONS
                       ROWS PROCESSED
                                                 SORTS
BUFFER READS
                       ROWS EXAMINED
                                                 PARALLEL GROUPS
BUFFER WRITES
                      INDEX SCANS
GETPAGES
                       TABLE SPACE SCANS :
RID Pool not used because ...
                    EXCEEDED STORAGE
EXCEEDED LIMITS :
                                                 MIX UNKNOWN
                     TO WF STORAGE
TO WF LIMITS
HYBRID LIMITS
                       HYBRID STORAGE
For limitation to highest values only
ELAPSE TIME
                       CPU TIME
Wait time for ...
SYNCRONOUS I/O :
                     SYNCR. EXECUTION
                                                 READS OTHER THREADS
LOCKS
                       GLOBAL LOCKS
                                                 WRITES OTHER THREADS
LATCHES
                       PAGE LATCHES
                                                 DRAIN LOCKS
DRAINS DURING
                       LOG WRITERS
```

# Scenario 1: Heavy hitters



Command ===>	Filt	ter		DB2: SA10
DYNAMIC STATIC	: <u>x</u> collid:		PACKAGE:	
FROM FO	:			
(FIRST) TABLE	:			
(FIRST) TABLE	!			guarde CPF
QUALIFIER	:			
PRIMARY	:			
SELECT X	STMT COUNT b	between between	and and	(Integer) (Integer)
JPDATE X DELETE X	AVG ELAPSE TIME b	between between between	and and and	(MM:SS.TTT) (MM:SS.TTT) (Integer)
OUTPUT LIMIT	: <u>10000</u> 0 - 250	000 Max number of	statements to	

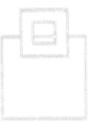
# Scenario 1: Heavy hitters

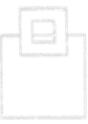


X (EXec Sync StmtID Buff	cute)		tatement),	S (tateme	nt text), 1	(able),
StmtID Buff		chr. Row				
	er Rd Buf		rs Row			Tablespc.
	or rec Dar	fer Wr exa	mined pro	cessed	Scans	Scans
2162	0	0	74	37	52	15
2164	0	0	0	185	0	74
2152	4	0	38	19	30	4
2154	0	0	16	8	16	0
2247	0	0	101	2	2	1
2250	0	0	101	2	2	1
2192	0	0	844	2	4	11
2208	4	0	100	39	2	1
2138	0	0	13	13	13	0
2150	0	0	8	4	8	
2155	0	0	8	0	8	0
2253	0	0	3	1	0	0
2255	0	0	0	7	3	3
2256	0	0	0	2	0	8
2142	0	0	0	9	0	9

All SQL in programs with usage stats

History, Drill-down Static









Command ===>	Limits		DB2: SA10
NO LIMITATION :	: X : _ THRESHOLD:		Promising
For limitation to EXECUTIONS BUFFER READS	nows PROCESSED ROWS EXAMINED INDEX SCANS	ng of specified threshold : SORTS : PARALLEL GROUPS	
RID Pool not used EXCEEDED LIMITS : TO WF LIMITS :	TABLE SPACE SCANS  i because  EXCEEDED STORAGE  TO WF STORAGE  HYBRID STORAGE	: _ MIX UNKNOWN	:_
	c highest values only	: _	Sea Marie Park
Wait time for SYNCRONOUS I/O LOCKS LATCHES DRAINS DURING	SYNCR. EXECUTION GLOBAL LOCKS PAGE LATCHES LOG WRITERS	READS OTHER THREE WRITES OTHER THREE DRAIN LOCKS	EADS :



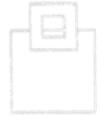
WLICommand ===>	Fil	lter		DB2: SA10
DYNAMIC STATIC	: <u>X</u> COLLID: <u>1</u>	TESTCOLL2%	PACKAGE: TEST%	
FROM TO	:			
(FIRST) TABLE CREATOR				
(FIRST) TABLE	:			
QUALIFIER	:			
PRIMARY AUTHID	:			
SELECT X INSERT X UPDATE X	STMT COUNT AVG CPU TIME	between between between	and and	(Integer) (Integer) (MM:SS.TTT)
DELETE X	AVG ELAPSE TIME AVG GETPAGES	between between	andand	(MM:SS.TTT) (Integer)
OUTPUT LIMIT	: 10000 0 - 25	5000 Max number of	f statements to	be displayed



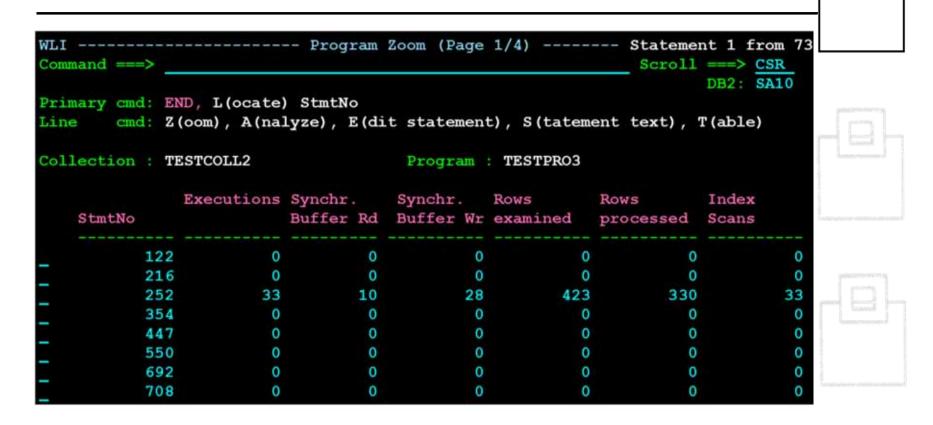
```
WLI ----- Program Overview ----- Program 1 from 6
                                                           Scroll ===> CSR
Primary cmd: END, F(ilter), L(ocate) Collection
       cmd: Z (oom)
                          Package
                                             Statements
    Collection
                                    Count
    TESTCOLL2
                                         162
                                                   3164
                          TESTPROG
    TESTCOLL2
                                          12
                                                    324
                                          21
                                                  32521
   TESTCOLL2
   TESTCOLL2
                                                     33
   TESTCOLL2
    TESTCOLL21
                                          16
                                                   1098
                          TESTPROG
```

Here you can see the "Count" column

This gives the correct sequence in the BIND statement depending on the execution rate – Another bonus!







Again lots of data "off to the right"



## Scenario 3: Objects used in SQL

All SQL in programs with usage stats

If the SQL text has been processed you can then see what objects are being used in your system. Of course what is even better is to see those objects \*not\* being used!



History, Drill-down Static and Dynamic



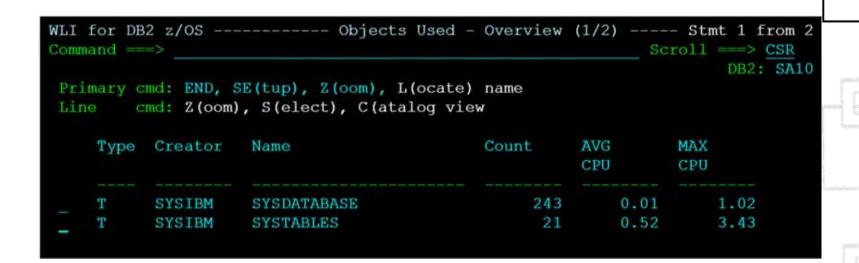


# Scenario 3: Objects used in SQL



WLI Command ===>				F	ilter							 DB2	: SA10	ĪL	
DYNAMIC STATIC		$\frac{\overline{x}}{x}$	СО	LLID:	DDLG	EN	PA	CKAGE:	DDL%						
FROM TO		=													
TABLE CREATOR													=		
TABLE NAME															
Optionally Fi	lte	er b	y IN	DEX											
INDEX CREATOR		_													
INDEX NAME		=													
Note that IND				ieved	throu	igh EXI	PLAIN	and s	o may	not r	eflect	the a	actual		
OUTPUT LIMIT	:	100	00	0 -	25000	Max nu	umber	of st	ateme	nts to	be di	splaye	ed		

## Scenario 3: Objects used in SQL



Here you can Zoom to the catalog object details or Select down to detail level to review SQL text and then link across to our Analyse+ tool.

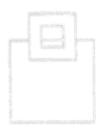
All SQL in programs that has \*never\* been executed! Think of the possibilities here...

How often have you tuned and tuned a SQL to then find out that it is never actually executed?



History, Drill-down Static



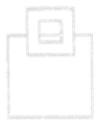


WLI for DB2 z/C	)S	Limits		DE	32: SA10
NO LIMITATION HIGHEST VALUES					
EXCEED THRESHOI	D: _	THRESHOLD:			
		hest values or excee			**
EXECUTIONS	: _	ROWS PROCESSED	: _	SORTS	
BUFFER READS	: _	ROWS EXAMINED	: _	PARALLEL GROUPS	And the second second
BUFFER WRITES		INDEX SCANS	: _		
GETPAGES	: _	TABLE SPACE SCAN	s : _		
RID Pool not us	sed beca	ause			
EXCEEDED LIMITS		EXCEEDED STORAGE	: _	MIX UNKNOWN	
TO WF LIMITS	:	TO WF STORAGE	:		-
HYBRID LIMITS	: _	HYBRID STORAGE	: _		
For limitation	to high	hest values only			
ELAPSE TIME	: _	CPU TIME	: _		
Wait time for .					years
SYNCRONOUS I/O		SYNCR. EXECUTION		READS OTHER THREAD	S:
LOCKS	: -	GLOBAL LOCKS	: -	WRITES OTHER THREAD	os :
LATCHES	: -	GLOBAL LOCKS PAGE LATCHES	: -	DRAIN LOCKS	
DRAINS DURING	: -	LOG WRITERS	: -		

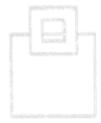
	Fi			DB2: SA10
DYNAMIC	1_		PACKAGE: TEST%	_
FROM TO	:			
(FIRST) TABLE CREATOR	:			
(FIRST) TABLE NAME	:			
QUALIFIER	:			
PRIMARY AUTHID	:			
SELECT X	CURRENT USERS	between	and	(Integer)
INSERT X	STMT COUNT	between	and	(Integer)
UPDATE X	AVG CPU TIME	between	and	(MM: SS.TTT)
DELETE X	AVG ELAPSE TIME AVG GETPAGES	between	and and	(MM:SS.TTT) (Integer)



Here you can see the never executed statements in a given package

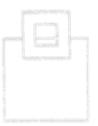






Where am I getting RID overflow or failure?
Can I solve it with better statistics and a REBIND?

History, Drill-down Static and Dynamic









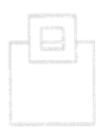
Command ===>					DB2:	SA10	
NO LIMITATION HIGHEST VALUES EXCEED THRESHOLD		THRESHOLD:					
EXECUTIONS BUFFER READS BUFFER WRITES	=	ROWS PROCESSED ROWS EXAMINED		specified threshold SORTS PARALLEL GROUPS		: _	
TO WF LIMITS	<u>x</u>		X	MIX UNKNOWN		: <u>x</u>	
For limitation to			-			A producerous	
Wait time for SYNCRONOUS I/O LOCKS LATCHES DRAINS DURING	_	SYNCR. EXECUTION GLOBAL LOCKS PAGE LATCHES LOG WRITERS	 1111	READS OTHER THROWNITES OTHER THRO	EADS	=	

WLI	Fil	ter		DB2: SA10	
DYNAMIC STATIC	: <u>X</u> COLLID: _		PACKAGE:		
FROM TO	:				
(FIRST) TABLE CREATOR	:				
(FIRST) TABLE NAME	:				
QUALIFIER	:				
PRIMARY AUTHID					
SELECT X INSERT X UPDATE X DELETE X	STMT COUNT AVG CPU TIME AVG ELAPSE TIME	between between between	and and and and	(Integer) (Integer) (MM:SS.TTT) (MM:SS.TTT)	
OUTPUT LIMIT		between	andumber of statements to	(Integer) be displayed	



```
WLI ----- Statement 1 from 3
                                                  Scroll ===> CSR
                                                        DB2: SA10
Primary cmd: END, L(ocate) StmtNo
      cmd: Z(oom), A(nalyze), E(dit statement), S(tatement text), T(able)
   Collection
                                                             Overflow
                  Program StmtNo
                                  Executions DB2
                                                    Storage
                                           Limits
                                                             Limits
                               122
                                        221
   TESTCOLL2
                  TESTPROG
   TESTCOLL2
                               232
                  TESTPROG
   TESTCOLL2
                               442
                  TESTPROG
```

Again lots of data "off to the right"



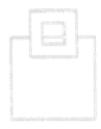
### **Auditor Scenario 1: Who did what?**

All executed SQL for a given Authorization

History, Drill-down Dynamic







## Auditor Scenario 1: Who did what?

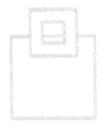
		ı
		Г

Command ===>	Fil	ter			DB2: SA10	
OYNAMIC STATIC	: <u>X</u> : _ COLLID: _		P/	ACKAGE:		part to the
TROM O	:					
FIRST) TABLE REATOR	:					
FIRST) TABLE	:					
UALIFIER	:					La second
RIMARY UTHID	: USER%					
ELECT X NSERT X PDATE X ELETE X	STMT COUNT DAVIS CPU TIME DAVIS ELAPSE TIME	between between between between		and and and and and	(Integer) (Integer) (MM:SS.TTT) (MM:SS.TTT) (Integer)	
OUTPUT LIMIT		-	number of	statements to	The state of the s	

## Auditor Scenario 1: Who did what?



rimary cmd: I	END, F(i	lter), Z(oom	), L(ocate)	AuthId		DB2: SA10	
	Z(oom), K(EXecut	A(nalyze), E e)	(dit statem	ent), S(tat	ement text)	, T(able),	
		Current	Number	Number	Synchr.	Synchr.	
StmtID	Auth I	d Users	Copies	Executions	Buffer Rd	Buffer Wr	
2162	USER01	10	10	74	37	52	
2164	USER01	20	20	0	185	0	
2152	USER01	4	5	38	19	30	
2154	USER01	11	11	16	8	16	
2247	USER01	10	10	101	2	2	The married
2250	USER01	10	10	101	2	2	
2192	USER02	1	1	844	2	4	
2208	USER02	1	1	100	39	2	
2138	USER02	1	1	13	13	13	

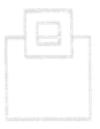


All executed SQL from a given (1st) time

History, Drill-down Static and Dynamic









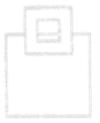
Command ===>	Limits	DB2: SA10
NO LIMITATION : HIGHEST VALUES : EXCEED THRESHOLD:	A THRESHOLD:	
EXECUTIONS :	highest values or exceeding of specified ROWS PROCESSED : SORTS ROWS EXAMINED : PARALLE INDEX SCANS : TABLE SPACE SCANS :	
TO WF LIMITS :	because  EXCEEDED STORAGE : _ MIX UNE TO WF STORAGE : _ HYBRID STORAGE : _	KNOWN : _
For limitation to ELAPSE TIME :	highest values only _ CPU TIME : _	
LOCKS :	SYNCR. EXECUTION : READS GLOBAL LOCKS : WRITES PAGE LATCHES : DRAIN I	OTHER THREADS :

WLI	Filter				DB2: SA10		
DYNAMIC STATIC	: <u>X</u> : _ COLLID:		PACKAGE:				
FROM TO	: 2011-03-17-10 : 2011-03-18-10						
(FIRST) TABLE CREATOR							
(FIRST) TABLE NAME	:						
QUALIFIER	:						
PRIMARY AUTHID	: USERO%						
SELECT X INSERT X UPDATE X DELETE X	CURRENT USERS STMT COUNT AVG CPU TIME AVG ELAPSE TIME AVG GETPAGES	between between between between between	and and and and and and and	(Integer) (Integer) (MM:SS.TTT) (MM:SS.TTT) (Integer)	FE		
OUTPUT LIMIT		Colonia i sessora		to be displayed			



```
----- SQL Overview (Page 1/8) ----- Statement 1 from 12
                                                              Scroll ===> CSR
                                                                     DB2: SA10
Primary cmd: END, F(ilter), Z(oom), L(ocate) AuthId
       cmd: Z(oom), A(nalyze), E(dit statement), S(tatement text), T(able),
            X (EXecute)
                                             Number
                                                        Synchr.
                                                                   Synchr.
                                 Number
                        Current
                                             Executions Buffer Rd Buffer Wr
   StmtID
              Auth Id Users
                                 Copies
         2162 USER01
         2154 USER01
                                           2
                                                      1
         2247 USER01
                              10
                                          10
                                                    101
         2250 USER01
                              10
                                          10
                                                    101
         2192 USER02
                               1
                                           1
                                                    844
         2208 USER02
                                                    100
          2138 USER02
                                1
                                                     13
                                                                13
                                                                           13
```

Timestamps and other data off to the right remember!



#### Conclusion

The DSC continues to increase DB2 efficiency.

- An additional enhancement "SSC" closes the gap of out-of-the-box workload data
- DSC and SSC provide detailed production workload information ready-to-go

