



Enterprise performance management for DB2 on zOS

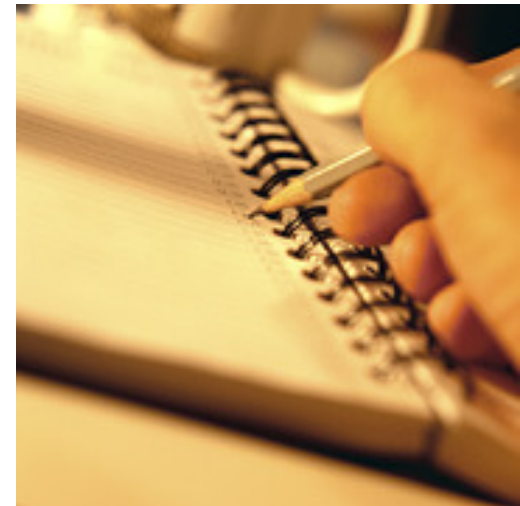
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Information Management software



Agenda

- Overview
- DB2 Connect Monitoring
- Identify potential SQL issues before they impact performance
- Produce DB2 batch performance reports without SMF data
- Buffer analysis and object placement
- Workload and Index analysis
- Q & A



Today's Focus

Over the last several years, I have presented the IBM's DB2 performance monitoring and reporting solution to you. Some of it has been very general and some of it has been very detailed. Today, I am going to focus on just a few specific items and drill down deeper into several specific functions of the tools.

After today's presentation, you will have a better understanding of the IBM DB2 for zOS Performance Solution and how the IBM DB2 tools compliment each other.

Ask yourself the following questions:

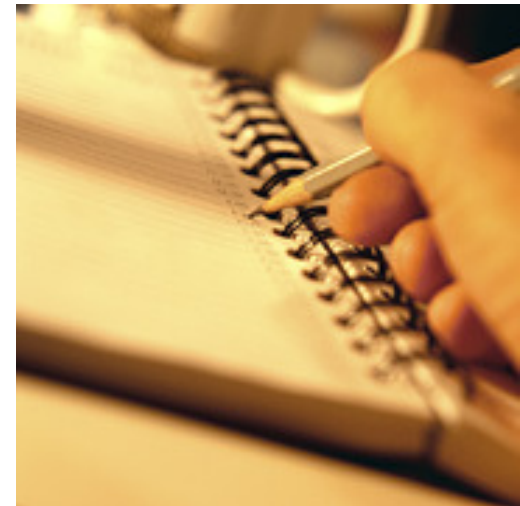
- With remote transactions how do you identify the problem area; DB2, DB2 Connect, network, or something else?
- What is your most expensive SQL statement and who is executing it? How often is it executed? How do you fix it?
- What is the best way to tune the buffers and what objects belong in what buffer pools?
- Do you have the need to generate batch performance reports before the SMF datasets are switched and dumped?
- Do you have the right indexes defined?
- What is the best way to tune specific workloads?

IBM has the solution to those questions

- Tivoli Omegamon XE for DB2 on zOS Performance Expert
 - Includes DB2 Connect Monitoring and DB2 Buffer Pool Analyzer. (Performance Monitor does not include BPA)
- DB2 Query Monitor for zOS
- DB2 SQL Performance Analyzer for zOS
- DB2 Optimization Expert for zOS

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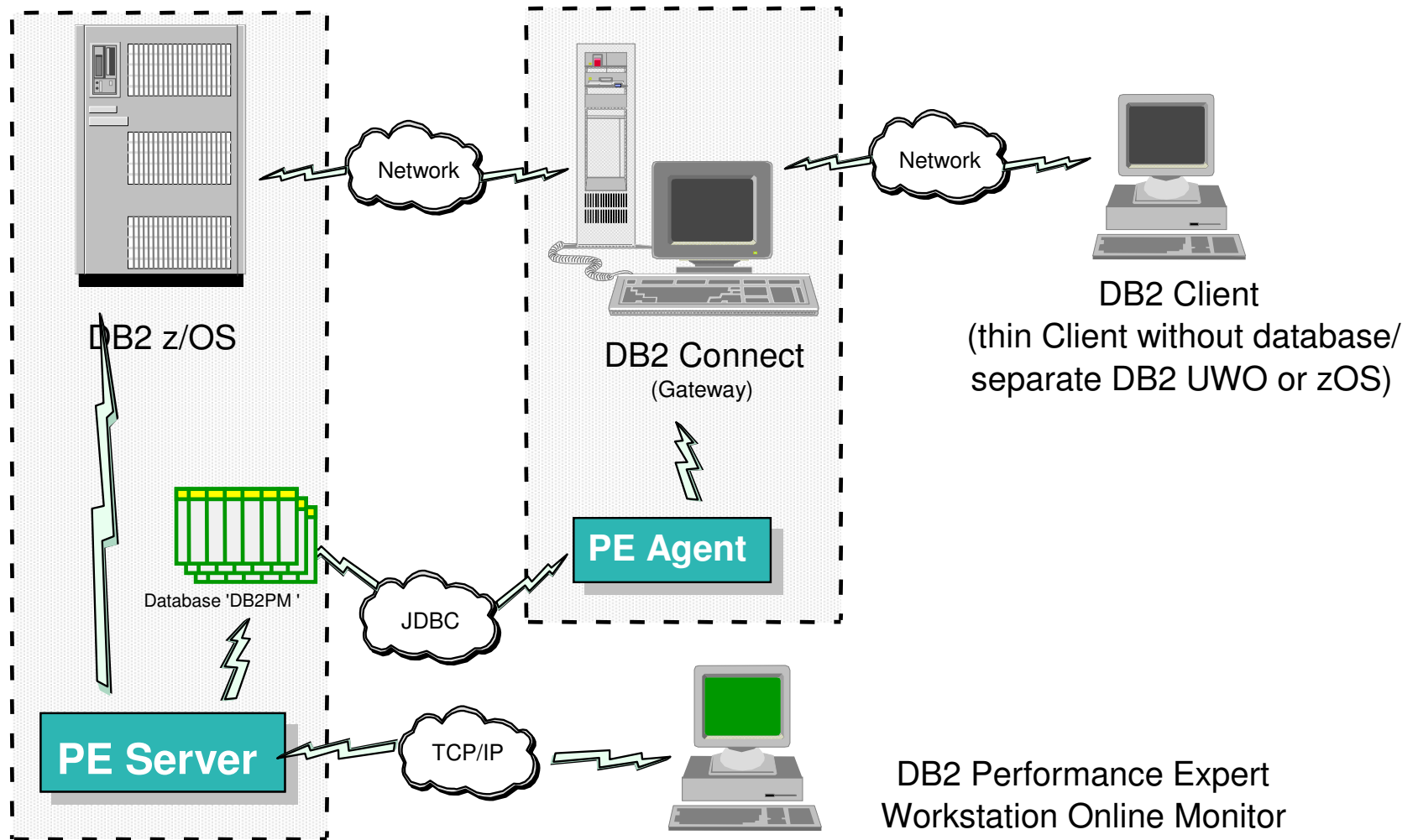
DB2 Connect Monitoring

- **Tivoli Omegamon XE for DB2 on zOS Performance Expert/Performance Monitor**
 - End to End Performance Metrics (almost, user to DB2 Connect gateway not captured)
 - Drill down from the host transaction
 - Drill up from the gateway
 - View gateway activity
 - View network times
- Answer the question – Is it DB2 Connect or the network?

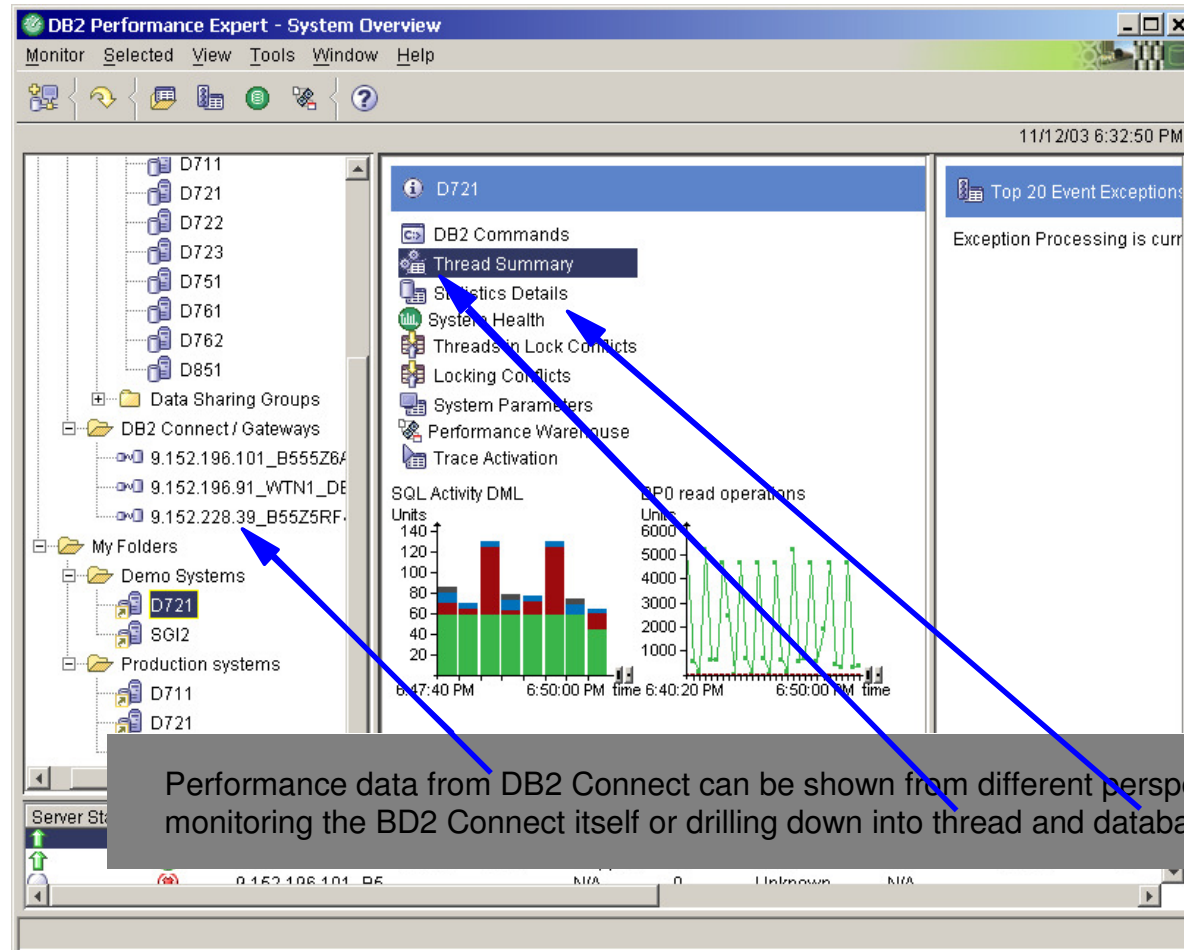
DB2 Connect Monitoring

- Different views to the DB2 Connect data
 - Select Statistics Details (of a selected DB2 subsystem)
 - Show DB2 Connect/Gateway information connected to the selected DB2 subsystem
 - Select Thread Summary + Details
 - Show DB2 Connect DCS applications information connected to the selected DB2 subsystem
 - Select DB2 Connect / Gateways
 - Show DB2 Connect/Gateway information independent on any selected DB2 subsystem

DB2 Connect Monitoring



DB2 Connect Monitoring - Display of data from different places



DB2 Connect Monitoring – Statistics Detail

Show DB2 Connect/Gateway information connected to the selected DB2 subsystem

The screenshot shows the 'D721 - Statistic Details' window. The left sidebar contains a tree view with the following items: SGI2, DB2 Commands, Thread Summary, **Statistics Details** (circled in red), System Health, Threads in Lock Conflicts, Locking Conflicts, System Parameters, Performance Warehouse, and Trace Activation. The main window displays a table titled 'DB2 Connect Server' with the following data:

Name	IP address	Node name	Node Num...	Gateway Snapshot Time
saphir	9.152.195.19	N/P	0	11/12/03 6:36:37 PM
B55Z5RF4	9.152.228.39	N/P	0	11/12/03 6:33:05 PM
B55Z6AH	9.152.196.101	JENNINGE	0	11/12/03 6:34:46 PM

DB2 Connect Monitoring - Statistics Details / DB2 Connect

DB2 Connect Server

Name	IP address	Node name	Node Num...	Gateway Snapshot Time	Server ProductVersion ID	Server Instance ...	Time Zone Displace...	Server Version
saphir	9.152.195.19	N/P	0	11/12/03 6:36:37 PM	SQL07028	db2in71	3 600	5
B55Z5RF4	9.152.228.39	N/P	0	11/12/03 6:33:05 PM	SQL07028	DB2	3 600	5
B55Z6AH	9.152.196.101	JENNINGE	0	11/12/03 6:34:46 PM	SQL07026	DB2	3 600	5

Select and drill down into more details

Main DB2 Connect Server: 9.152.196.101-...

DB2 Connect/Gateway S
Tasks List
Performance
Package statistics

DB2 Connect/Gateway Statistics

DB2 Connect Information

Name	B55Z6AH
IP address	9.152.196.101
Node name	JENNINGE
Node Number	0
Server ProductVersion ID	SQL07026
Server Instance Name	DB2
Server Version	5
Time Zone Displacement	3 600
Gateway Snapshot Time	11/12/03 6:34:46 PM

Agents

Agents registered	
Agents waiting for token	
Maximum agents registered	
Maximum agents waiting	
Committed private memory	1 5
Agents assigned from pool	
Agents created due to empty pool	
Maximum coordinating agents	
Stolen agents	
Connection switches	
Total inactive DRDA agents	
Idle agents	

Connections

Current connections	0
---------------------	---

DB2 Connect Monitoring - Statistics Details / DB2 Connect

Main DB2 Connect Server: 9.152.196.101-...

DB2 Connect/G
Tasks List
 Performance
 Package status

Process name	Process owner name	Gateway process ID	User process ti...	System process time	Overall process time	Memory us
javaw.exe	N/P	2 068	0.00002	0.00000	0.00002	N/P
nlnotes.exe	N/P	1 976	0.00001	0.00000	0.00001	N/P
WinMgmt.exe	N/P	1 120	0.00000	0.00000	0.00000	N/P
java.exe	N/P	2 132	0.00000	0.00000	0.00000	N/P
explorer.exe	N/P	1 552	0.00000	0.00000	0.00000	N/P
nupdate.exe	N/P	668	0.00000	0.00000	0.00000	N/P
svchost.exe	N/P	484	0.00000	0.00000	0.00000	N/P
nwrdaemn.exe	N/P	640	0.00000	0.00000	0.00000	N/P
pcsaws.exe	N/P	1 508	0.00000	0.00000	0.00000	N/P
System.exe	N/P	8	0.00000	0.00000	0.00000	N/P
SMSS.exe	N/P	184	0.00000	0.00000	0.00000	N/P
CSRSS.exe	N/P	208	0.00000	0.00000	0.00000	N/P
WINLOGON.exe	N/P	228	0.00000	0.00000	0.00000	N/P
SERVICES.exe	N/P	256	0.00000	0.00000	0.00000	N/P
LSASS.exe	N/P	268	0.00000	0.00000	0.00000	N/P
ibmpmsvc.exe	N/P	364	0.00000	0.00000	0.00000	N/P
svchost.exe	N/P	104	0.00000	0.00000	0.00000	N/P
spoolsv.exe	N/P	536	0.00000	0.00000	0.00000	N/P
trcbboot.exe	N/P	564	0.00000	0.00000	0.00000	N/P
pcs_agnt.exe	N/P	596	0.00000	0.00000	0.00000	N/P
db2syscs.exe	N/P	652	0.00000	0.00000	0.00000	N/P
db2jds.exe	N/P	680	0.00000	0.00000	0.00000	N/P
db2licd.exe	N/P	696	0.00000	0.00000	0.00000	N/P
db2syscs.exe	N/P	708	0.00000	0.00000	0.00000	N/P

DB2 Connect Monitoring - DB2 Connect / Gateway

The screenshot shows the DB2 Connect Monitoring application interface. The title bar reads "9.152.196.101_B555Z6AH_DB2 - Application Details". The main window is divided into several sections:

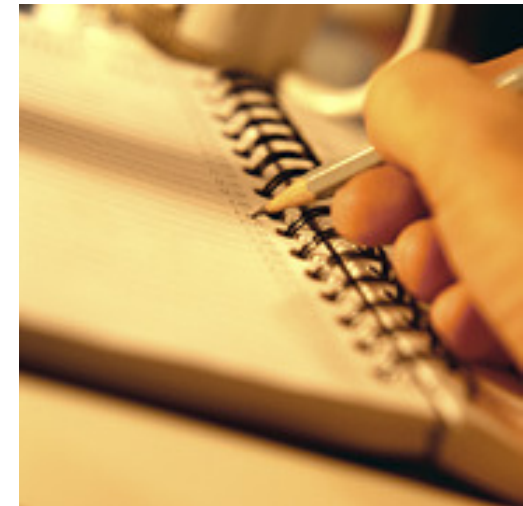
- Top Panel:** Includes a menu bar (DCS Databases, View, Tools, Window, Help), a toolbar with navigation icons, a timeline showing "11/12/03 7:35:00 PM", and a timer set to "0:00:20".
- Right Panel:** A file explorer showing a folder "DB2 Connect / Gateways" containing three sub-folders: "9.152.196.101_B555Z6AH_DB2" (circled in red), "9.152.196.91_WTIN1_DB2", and "9.152.228.39_B55Z5RF4_DB2".
- Left Panel:** A navigation pane with "Overview" selected, along with "Statement information" and "Package statistics".
- Main Content Area:** Titled "Overview", it displays a table of application details and a list of "Overall transaction data".

Application handle (agent ID)	40
Application name	db2bp.exe
Application ID	*LOCAL.DB2.031112173605
Authorization ID	JEN
Code page used by application	1 252
Client process ID	2 236
Client operating platform	NT/WIN2000
Client communication protocol	LOCAL
Host coded character set ID	500
Configuration name of client	JENNINGE
Client product/version ID	SQL07026
Inbound communication address	*LOCAL.DB2
DCS application status	UOWWAITINBOUND
Application status change time	11/12/03 7:25:53 PM
User login ID	JEN
Sequence number	0001

Transaction ID
Number of open cursors
Application idle time
Last reset timestamp
DB2 connect first connect
Elapsed time DB2CONN execution
Total host response time
Unit of work completion status
Previous UOW completion timestamp
Unit of work start timestamp
Unit of work stop timestamp
Most recent UOW elapsed time
Number of SQL stmt attempted
Failed statements operations
Commit statements attempted

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Identify Potential SQL Problems

```

2008/04/10 10:02:32 ---- IBM DB2 Query Monitor for z/OS -----
Option ==> _____

DB2 QM Subsystem ID: DQMC (? to Select)           User: DBA105
                                                    Release: CQM V2R2M0

-----

U. View Activity Summaries           N. View SQLCODEs
A. View Current Activity             C. View DB2 Command Activity
E. View Exceptions

M. Work with Monitoring Agents       S. Setup
P. Work with Profiles                X. Exit Query Monitor
    
```

1 - Catch the statement with DB2 Query Monitor



```

SQL PA                               SQL PA Primary Menu           10:02
Option ==> _____
Enter Option:                          DB2 System: DSNC
                                         DB2 SQLID : DBA105

1 Basic SQL PA Processing
  Process SQL Statements from various sources

2 Advanced SQL PA Processing
  Evaluate effect of changing DB2 definitions

3 Modify SQL PA Configuration
  Change the definition of your SQL PA environment, such as
  the names of your report datasets

4 Exit
  Exit from the SQL PA application
    
```

2 - Analyze the statement with DB2 SQL Performance Analyzer

Identify Exceptions (defined in Monitoring Profile)

```

2008/04/10 10:18:59 ----- Display Exceptions ----- Row 25 of 31
Option ==>                                     Scroll ==> CSR
DB2 QM Subsystem: DQMC           Interval Start Date: 04/10/2008   Time: 08:59:56
Filters Enabled: N               Interval End   Date: CURRENT       Time: CURRENT
C:A-Analyze,B-Buffers,C-Calls,D-Delays,L-Locks,O-Objects,S-SQL Text
H-Host Variables,P-Parallel Activity,Q-Misc Stats
-----
CMD  SSID  Plan      Program      DB2 CPU Time      DB2 Elapsed      GETPAGES  SQLCODE
-----
_   DSNC  ADB       ADBMAIN      0.132413          7.542027          4,687     +100
_   DSNC  ADB       ADBMAIN      0.095309          4.258462          4,364     +100
_   DSNC  DSNREXX  DSNREXX      0.102541          1.001212          13,556     0
_   DSNC  DSNREXX  PRJADD       0.104262          1.538746          16,833     0
S   DSNC  DSNREXX  PRJADD       0.103459          0.131435          16,825     0
_   DSNC  DSNREXX  DSNREXX      0.001306          4.837179          22,743     0
_   DSNC  DSNREXX  DSNREXX      0.000589          1.053043          24,082     0

```

Several Plans have exceeded the getpages threshold. Use option "S" to view the SQL Text.

Export for further analysis

```
2008/04/10 10:20:02 ---- Display SQL Statement Text ---- Row 1 of 5
Option ==> EXPORT _____ Scroll ==> CSR

DB2 SSID: DSNC   Plan: DSNREXX   DBRM: PRJADD   Coll: WDCL
          Cursor:                Section:        6
-----

SELECT MIN ( EMP_NO ) INTO : H
FROM GLWTEMP
WHERE BIRTHDATE = ( SELECT MIN ( BIRTHDATE )
FROM GLWTEMP
WHERE WORKDEPT = : H )
```

The statement may be saved to a dataset and/or Sent to DB2 SQL Performance Analyzer. Analyze on the previous panel invokes SQL PA as well.

The SQL statement is sent to the process panel

If you have seen SQL PA in the past, you will notice a dramatic difference in the user interface.

```
SQL PA                               Process SQL                               10:23
Command ==> _____

Commands:  _EXPLAIN  SQL  TABLES  EDIT                                DB2 System:  DSNC
                                                DB2 SQL ID:  DBA105

Enter input data set name:          (required can be sequential or partitioned)
  Data Set Name ... 'DBA105.SQL.CNTL(TELETEST) '

Enter:
Use PF10 (Left) and PF11 (Right) to scroll through the Qualifier
below if necessary:
  Qualifier ..... _____ (optional table qualifier)
  Current Degree ... _____ (optional degree of parallelism, default ANY)
```

Now you can Explain the statement, or view the SQL report or even the Tables report. If you wish, you may edit the statement.

The caret indicates a scrollable field.

The first screen is the Query Limits Report

```

SQL PA                               Query Limits Report                Row 1 to 1 of 1
Command ==> _

                                         DB2 System: DSNC
                                         DB2 SQL ID: DBA105

Commands:  PR - Print
Line commands:
C - Cost Report  E - Explain Report  S - SQL  T - Trace Report  R - EEE Report
W - What-If

                               Stmt
S CEIQ  Error  Query No  Type CPU Time  Elap Time  Phys I/O  QUNITS  Cost
-----  -
-----  0      100000001  NB   0.01722  0.120      0          5      0.0042
    
```

Select the report you wish to review

SQL PA can have exception thresholds as well.

Report Examples

SQL PA Analysis for Queryno 100000001

```
SELECT MIN ( EMP_NO )
FROM GLWTEMP
WHERE BIRTHDATE = (
SELECT MIN ( BIRTHDATE )
FROM GLWTEMP
WHERE WORKDEPT = ? )
```

Queryno: 100000001 QBlk: 1 Pln: 1 M
Process ->

```
+----- Queryno
ANL7003I *** GUIDELINE:
Close Yes was specified for the
if these are little used this is
consider Close No. Extremely rel
in memory by highly referencing,
putting into a dedicated buffer
pages, deploying data sharing wi
option, etc. each with associate
```

- 1 = Explain Report
- 2 = Cost Report
- 3 = EEE Report

```
ANL3022I No statistic for "NLEVELS " on index DBA105 .GLWXEMP2
Optimizer default used for Queryno 100000001
ANL3023I No statistic for "FIRSTKEYCARDF" on index DBA105 .GLWXEMP2
Optimizer default used for Queryno 100000001
ANL3024I No statistic for "FULLKEYCARDF" on index DBA105 .GLWXEMP2
Optimizer default used for Queryno 100000001
ANL3025I No statistic for "CLUSTERRATIOF" on index DBA105 .GLWXEMP2
Optimizer default used for Queryno 100000001
```

```
ANL3026W No Statistics found in catalog for one or more variables
Optimizer defaults were used where missing values found.
```

```
*-----*
* Query 100000001 will require 0.12008 Seconds of Elapsed Time
* During which 0.01722 Seconds of CPU Time will be consumed and
* a Total of 0 Physical I/O requests will be issued to disk
* Qunits 5 Estimated processing cost $ 0.0042 DOLLARS
```

The Access Path Chosen by DB2 at 10:27:13 on 2008-04-10:

```
+-----+
Table space scan - no index will be used
Table/Index: DBA105.GLWTEMP/*none*
Processor cost: 9 msec. 213 SU. Cat: 'B' - TABLE CARDINALITY
Standard sequential PREFETCH will be performed
Query block SQL operation: SELECT
Lock mode is Share Lock for the page
```

```
EEE130I No statistics available - execute RUNSTATS
Pages Active: -1, TabSp id: 28, Eraserule: No, SpaceOwner: DBA1
TS Page Size: 4K, Lockrule: Any, Closerule: Yes, Tablespace: GLWS
TSPartitions: 4, Buf.Pool: BP15, TS Status: A, Database : DBA1
TS Space: N/A K, Seg.Size:UnSeg, Tables/TS: 1, Stogroup : GLWG
LockMax: -1, TS Type: Norml, StatsTime: 0001-01-01-00.00.00.00
```

Table DBA105.GLWTEMP has the following available index(es):

```
GLWXEMP1 - Unique: Yes, Clustering: Yes, Clust.Rat: 0%, Clos
(LASTNAME, FIRSTNME, EMP_NO)
```

New Options Panel for SQL Performance Analyzer

```
SQL PA                               Basic Processing Options                               10:57

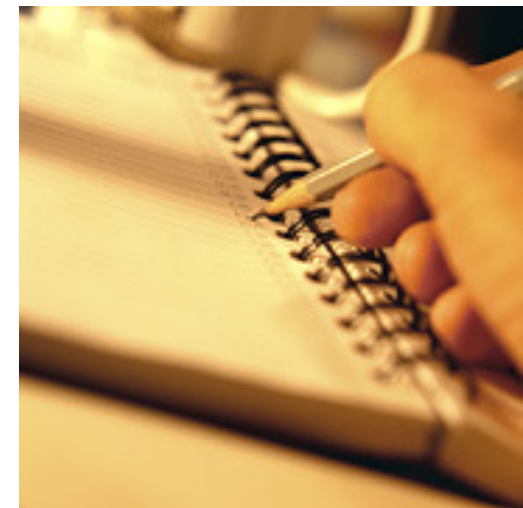
Option ==> _____

Enter Option:                          DB2 System: DSNC
                                         DB2 SQLID : DBA105

 1  Process plans from the DB2 system catalog
 2  Process packages from the DB2 system catalog
 3  Process application DBRM
 4  Process SQL from a sequential file or PDS member
 5  Process SQL from program source
 6  Process a query number from the plan table
 7  Process a QMF statement
 8  Exit from the SQL PA application
```

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Batch Collect Report Data (CRD) & subsequent processing

Customer A scenario:

Review terminated thread data via user written ISPF routine. The data is stored in DB2 tables (the performance DB).

Solution with OMPE of customer A scenario

Overview

Functional overview

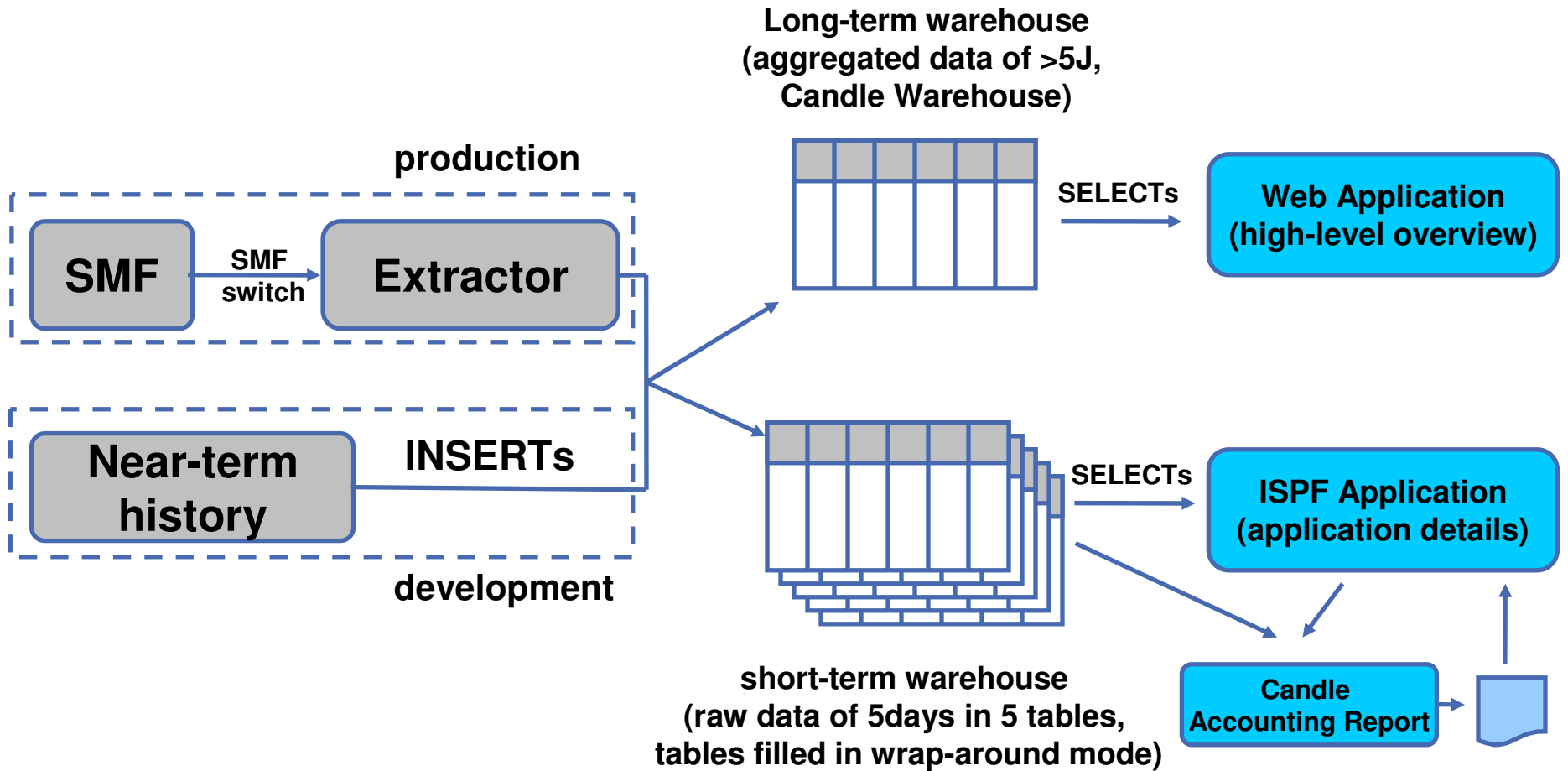
- Batch job to collect data for further processing in OMPE (report generation, load into PDB/PWH)
- Allows almost real-time loading of data while collection via job exit
- Full data sharing group support
- Cheaper collection than SMF and GTF
- Write to GDG

Built as

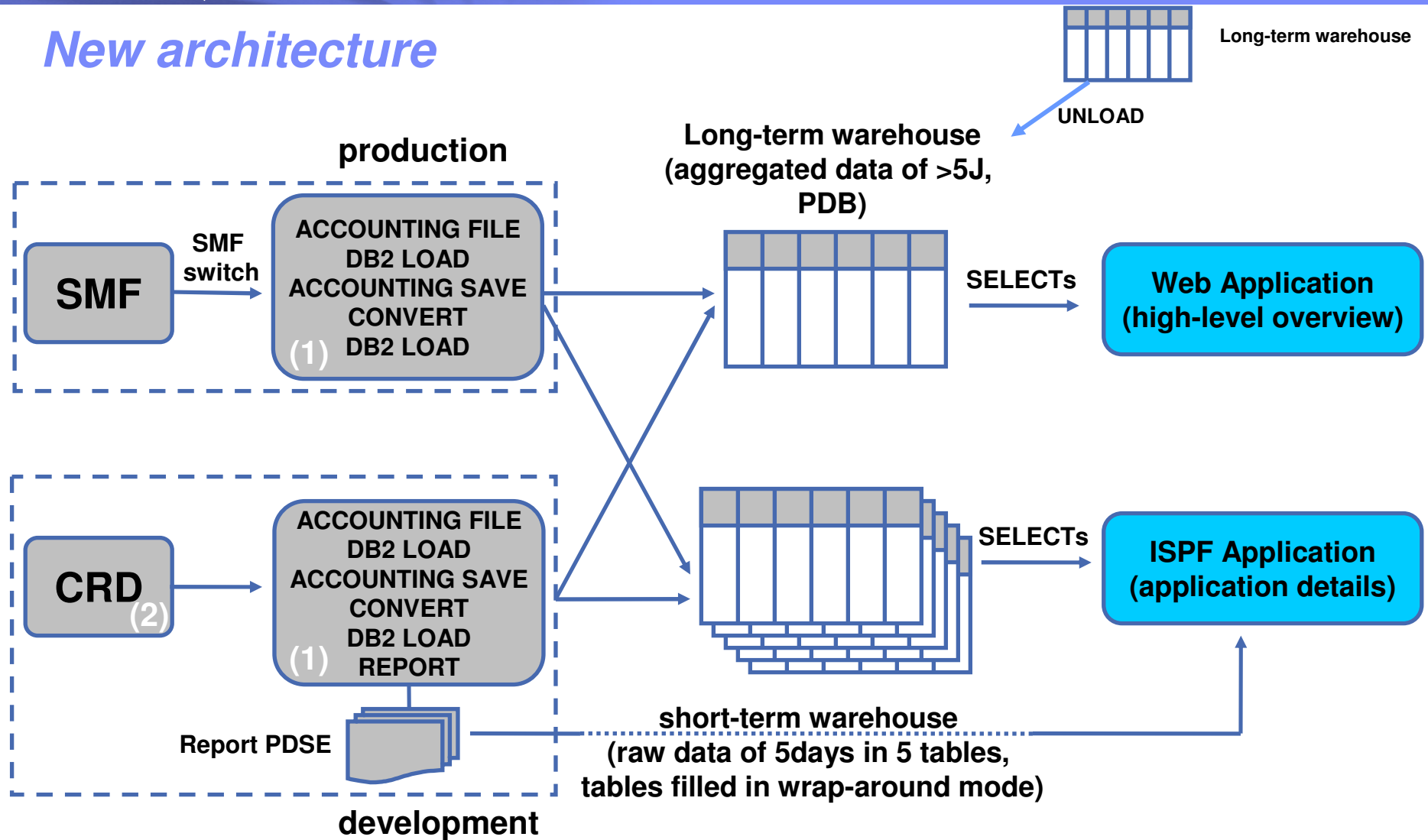
- Replacement for OMEGAMON Extractor, which was used to load data via INSERTS directly into candle warehouse while NTH was collecting data
- alternative to SMF with much more flexibility to load data into OMPE Performance Database

Next two slides shows example from a customer who migrated from OMEGAMON for DB2 to OMEGAMON XE for DB2 PE using the new CRD batch job ...

old architecture



New architecture



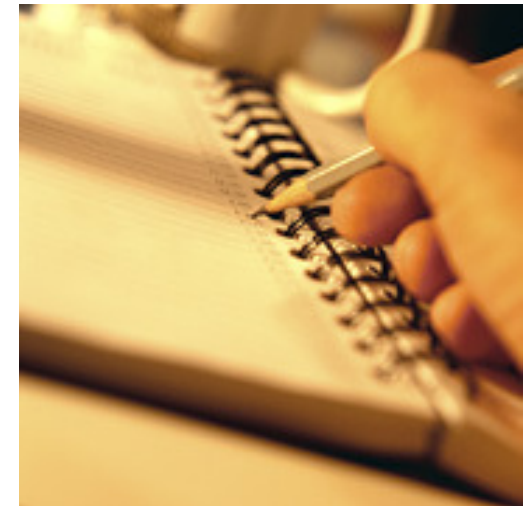
- (1) Use Batch process to (a) aggregate data and load it into long-term warehouse and (b) load raw data into short-term warehouse
- (2) Invoke Batch CRD via OPC to collect data

Performance Factors for Collect Report Data

- SMF factor 5
- GTF factor 3
- OP-buffer factor 1 (1/5 of SMF)
- SMF needs to be coordinated with all the other z components writing to SMF.
- OP buffer is just a storage area.

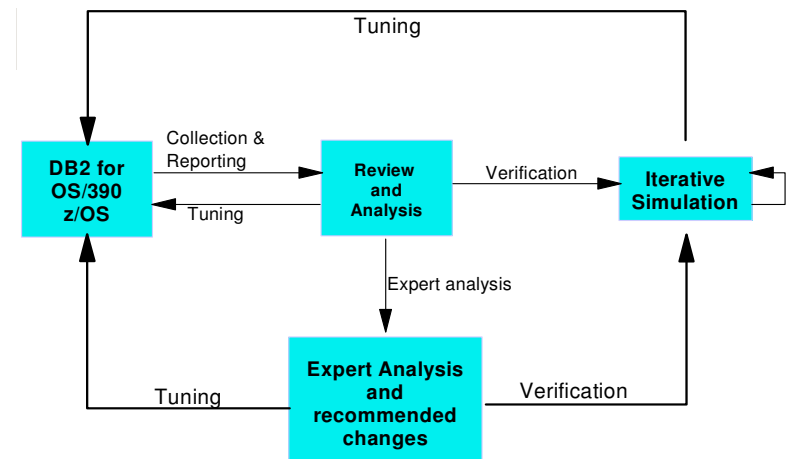
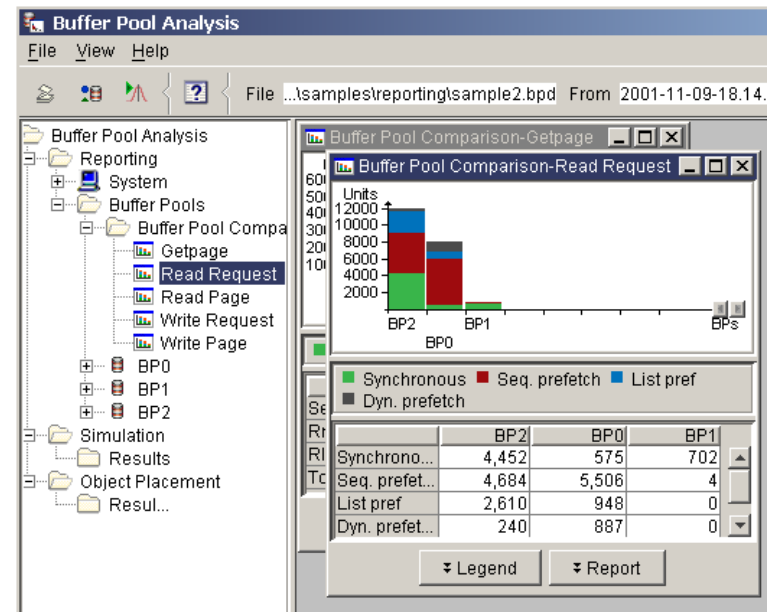
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Analysis Support – Buffer Pool Analysis

- **Collects** buffer pool data
 - as summary or detailed data
 - continuously or in sampling mode
 - in Online and Batch
- Generates various **reports and displays** results in multiple formats for BP and GBP (including graphical end-user interface)
- Provides expert knowledge and recommendations
- Recommends **object placements, BP size & thresholds**
- Generates **ALTER statements** for the recommendation
- Provides **simulation** for planned changes
- Makes it easy to tune your buffer pools



Available stand-alone or as part of Performance Expert

Analysis Support – Object Placement / Simulation

Buffer Pool Analysis - Object Placement

Use this function to get object placement recommendations and generate appropriate ALTER statements.

3. Object placement: Assign objects to buffer pools (optional). Reset selected Reset all

Object Name	Type	Page	Used	Cat...	Seq. Access [%]	Change Rate [%]	Size ...	Current	Recom...	User...
FIJ1DB01.FIJCCONT	INDEX	4K	YES	---	0	0	1	BP1	BP1	BP1
FIJ1DB01.FIJCENGC	INDEX	4K	YES	---	0	0	1	BP1	BP1	BP1
FIJ1DB01.FIJCINVD	INDEX	4K	YES	---	0	0	5	BP1	BP1	BP1
FIJ1DB01.FIJCITEM	INDEX	4K	YES	---	0	0	4	BP1	BP1	BP1
FIJ1DB01.FIJCITMD	INDEX	4K	YES	---	0	0	4	BP1	BP1	BP1
FIJ1DB01.FIJCITMR	INDEX	4K	YES	---	0	0	1	BP1	BP1	BP1
FIJ1DB01.FIJCLOCA	INDEX	4K	YES	---	0	0	13	BP1	BP1	BP1
FIJ1DB01.FIJCPLNO	INDEX	4K	YES	---	0	0	6	BP1	BP1	BP1
FIJ1DB01.FIJCPLPG	INDEX	4K	YES	---	0	0	6	BP1	BP1	BP1
FIJ1DB01.FIJCPROD	INDEX	4K	YES	---	0	0	59	BP1	BP1	BP1
FIJ1DB01.FIJCShPC	INDEX	4K	YES	---	59	59	59	BP1	BP1	BP1
FIJ1DB01.FIJCWIPG	INDEX	4K	YES	---	0	0	0	BP1	BP1	BP1
FIJ1DB01.FIJCWORD	INDEX	4K	YES	---	6	6	6	BP1	BP1	BP1
FIJ1DB01.FIJS0004	TABLESP...	4K	YES	---	17	17	17	BP1	BP1	BP1
FIJ1DB01.FIJS0005	TABLESP...	4K	YES	---	0	0	0	BP1	BP1	BP1
FIJ1DB01.FIJS0009	TABLESP...	4K	YES	---	32	32	32	BP1	BP1	BP1
FIJ1DB01.FIJS0010	TABLESP...	4K	YES	---	2	2	2	BP1	BP1	BP1

Buffer pool data file : SGI2FILE.bpd
in F:\BPODAT\July02

The first step result shows the recommended buffer pools for each object.

The user can overwrite the recommended buffer pool if desired.

Recommended sizing for separate Buffer Pools

This table indicates how the available memory should be distributed.

[Click here to see more online help](#)

Total Pages	BP0 pages	BP1 pages	BP2 pages
300	100	100	100
400	100	100	200
500	100	100	300
600	100	100	400
700	200	100	400
800	300	100	400
900	300	100	500
1000	400	100	500
1100	500	100	500
1200	500	100	600
1300	500	100	700
1400	500	100	800
1500	500	100	900
1600	500	100	1000

Simulated behavior of each separate Buffer Pools

This table indicates the behaviour of each buffer pool for each total page size.

[Click here to see more online help](#)

Buffer Pool Pages	Buffer Pool BP0			Buffer Pool BP1			Buffer Pool BP2		
	Misses	Application Hit Ratio	Global Miss Ratio	Misses	Application Hit Ratio	Global Miss Ratio	Misses	Application Hit Ratio	Global Miss Ratio
100	22931	51.8	12.5	686	86.4	0.4	128569	1.6	70.2
200	11012	76.8	6.0	639	87.3	0.3	113565	13.1	62.0
300	4190	91.2	2.3	639	87.3	0.3	36315	72.2	19.8
400	2667	94.4	1.5	639	87.3	0.3	11791	91.0	6.4
500	1721	96.4	0.9	639	87.3	0.3	10139	92.2	5.5
600	1550	96.7	0.8	639	87.3	0.3	10013	92.3	5.5

Simulated behavior of Buffer Pool BP2

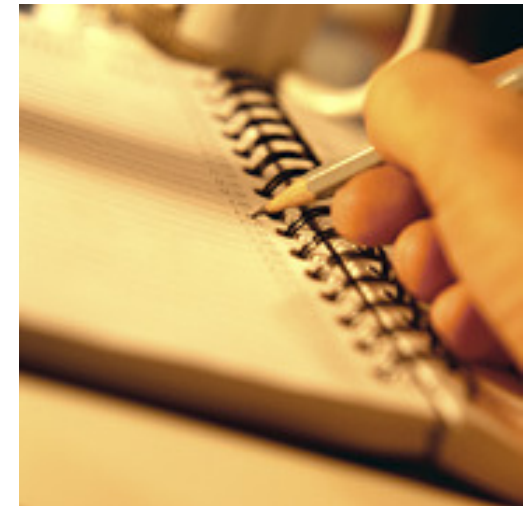
This table indicates the behaviour of an individual simulated buffer pool.

[Click here to see more online help](#)

Buffer Pool Pages	Total Misses	Application Hit Ratio	Random		Sequential Prefetch		List Prefetch	
			Misses	% of Total Misses	Misses	% of Total Misses	Misses	% of Total Misses
100	128569	1.6	1935	1.5	126216	98.2	427	0.3
200	113565	13.1	1918	1.7	111583	98.3	63	0.1
300	36315	72.2	190	5.2	34378	94.7	35	0.1
400	11791	91.0	1868	15.8	9889	83.9	33	0.3
500	10139	92.2	1854	18.3	8252	81.4	32	0.3
600	10013	92.3	1834	18.3	8146	81.4	32	0.3
700	9910	92.4	1815	18.3	8064	81.4	30	0.3
800	9529	92.7	1798	18.9	7700	80.8	30	0.3
900	8252	93.7	1785	21.6	6436	78.0	30	0.4
1000	6527	95.0	1770	27.1	4727	72.4	29	0.4
1100	5915	95.5	1751	29.6	4134	69.9	29	0.5
1200	5870	95.5	1735	29.6	4105	69.9	29	0.5
1300	5827	95.5	1718	29.4	4087	70.1	26	0.4
1400	5792	95.6	1694	29.2	4074	70.3	23	0.4
1500	5732	95.6	1684	29.0	4045	70.6	22	0.4

Agenda

- Overview
- DB2 Connect Monitoring
- Identify potential SQL issues before they impact performance
- Produce DB2 batch performance reports without SMF data
- Buffer analysis and object placement
- **Workload and Index analysis**
- Q & A



Optimization Expert – Capture the statement

The screenshot shows the IBM DB2 Optimization Expert for z/OS interface. The 'Subsystem Context' section is set to 'OETUTORIAL <enabled>'. The 'Queries List' section is set to 'Statement cache' and 'ACCUM_CPU_DESC' view. Below the settings, a table displays query statistics for 9 rows.

STMT_ID	STAT_EXEC	STAT_CPU	STAT_ELAP	STAT_GPAG	STMT_TEXT
4705	40	0.06779421871783686	0.09397925442340327	120	SELECT X.DISCOUNT,
4702	10	0.036362697374002606	0.09271599358203364	60	SELECT DISCOUNT, O_
4704	30	0.031796031635181576	0.03740149084843841	30	SELECT SUPP_NATION,
3182	31	0.0155405188015863	0.01665736455835548	31	SELECT L_ORDERKEY, L
3184	9	0.01341586653508392	0.027903352867738873	18	SELECT DISTINCT O_OF
4703	20	0.013225768696443707	0.015919675122873456	20	SELECT S_ACCTBAL,S_I
3183	11	0.010121394883768231	0.025475797247068555	11	SELECT * FROM SYSADI
3181	19	0.008342259567157895	0.008941718380825192	19	select * from ORDER,LI
3180	12	0.0068830112031861845	0.00940714124955383	12	select l_suppkey from l

Receive Index recommendations

The following information shows the index recommendations for the selected query.

Feature Details	Object Name	Columns	Estimated Disk Space
<input checked="" type="checkbox"/> SYSTABLES			
<input checked="" type="checkbox"/> Index	SYSTABLES_...	CREATOR(ASC), NAM...	0.078125 M

Show DDL...

Run...

Select All

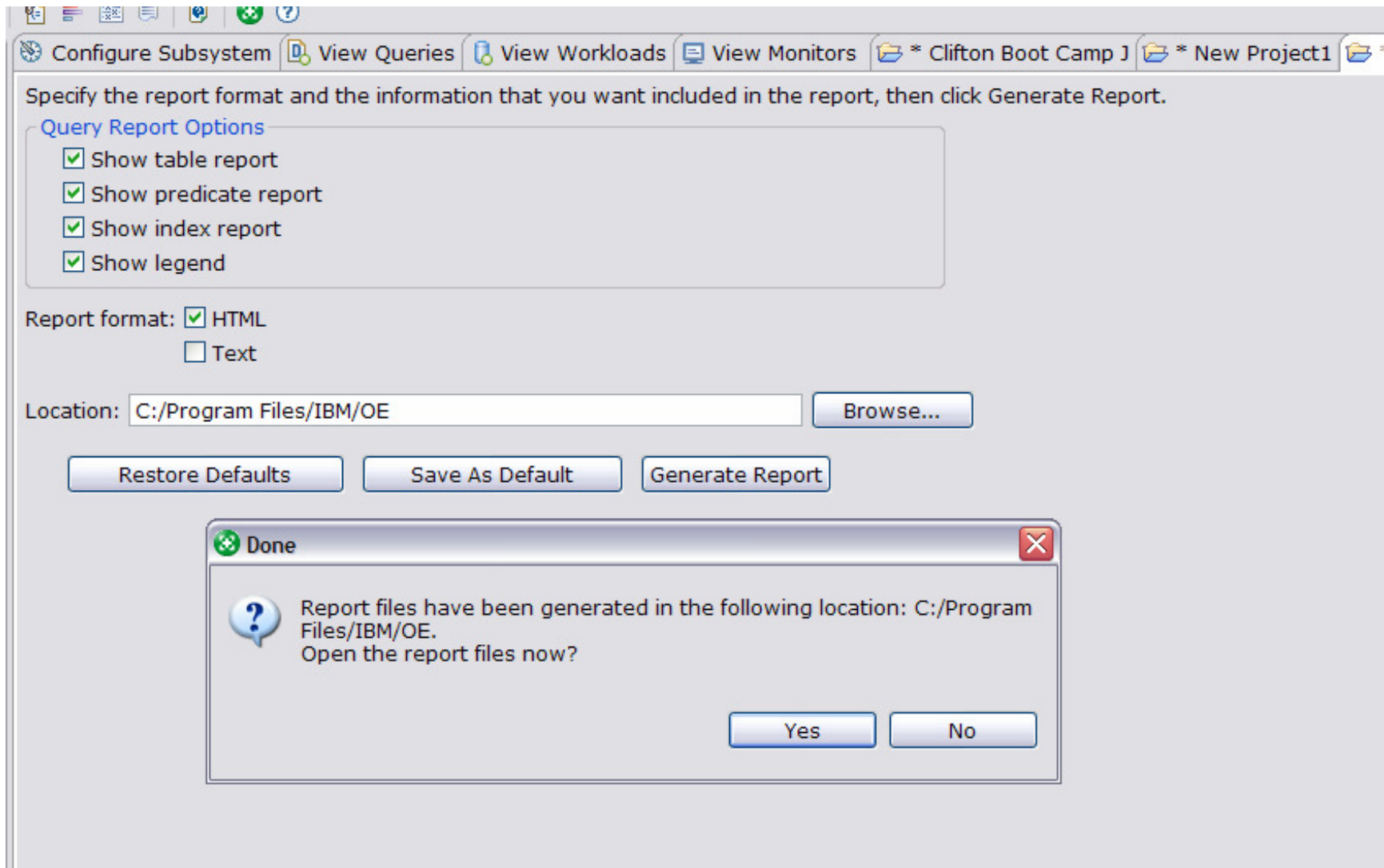
Deselect All

DDL Details

Save

```
CREATE INDEX "DB2OE"."SYSTABLES_VIRT_IDX_1180582222453" ON
"SYSIBM"."SYSTABLES" ( "CREATOR" ASC, "NAME" ASC, "TYPE" ASC,
"TBNAME" ASC, "TBCREATOR" ASC) NOT PADDED FREEPAGE 0 PCTFREE
10
```

Generate detail html or text reports



Select options for the advisors

Recommendations

Select any advisors that you want to run and receive recommendations. View the details in each advisor to obtain more information about the advisor recommendations.

<input checked="" type="checkbox"/>	Run	Status	Summary	Recommendation
<input checked="" type="checkbox"/>	<input type="button" value="Options..."/>	<input type="radio"/>	Statistics Advisor Priority: Not applicable	<input type="button" value="Details..."/>
<input checked="" type="checkbox"/>	<input type="button" value="Options..."/>	<input checked="" type="radio"/>	Query Advisor Priority: Not applicable Analysis successful. No query changes are recommended for this statement.	<input type="button" value="Details..."/>
<input checked="" type="checkbox"/>	<input type="button" value="Options..."/>			<input type="button" value="Details..."/>
<input checked="" type="checkbox"/>	<input type="button" value="Options..."/>			<input type="button" value="Details..."/>

EXPLAIN options: Run

Options

Query Advisor

Select rules for the query advisor to consider when making recommendations:

- Add missing join predicates for referential integrity.
- Use local predicates for joining tables.
- Use local predicates for single tables.
- Push predicates down.
- Copy local predicates to different tables in a join.
- Rewrite stage-1 predicates as indexable predicates.
- Rewrite stage-2 predicates as indexable or stage-1 predicates.
- Write specific select lists.

Review the recommendations

▼ Query Advisor Recommendations List

Select a recommendation to view more details. To implement the recommendation, change the SQL statement in the source from which it came.

No	Severity	Confidence	Line Number	Description
1	Low	Medium	9	Consider copying the following predicate on...
2	Low	Low	3	Consider replacing the asterisk (*) or the lo...
3	Low	Low	4	Consider replacing the asterisk (*) or the lo...
4	Low	Low	2	Consider replacing the asterisk (*) or the lo...

▼ SQL Text

```
FROM SYSADM.SUPPLIER AS S
, SYSADM.LINEITEM AS L
, SYSADM.ORDER AS O
WHERE ( L.L_RECEIPTDATE <= '1999-12-31'
AND L.L_SHIPDATE BETWEEN '1998-01-01' AND '1998-12-31'
AND L.L_RETURNFLAG IN ( 'A', 'R' )
AND L.L_SHIPMODE IN ( 'SHIP', 'AIR', 'RAIL', 'TRUCK' )
AND S.S_SUPPKEY IN ( 1, 22, 333, 4444, 55555 )
```

▼ Selected Recommendation:

Description	Explanation
<p>Consider copying the following predicate on column S_SUPPKEY in table SYSADM.SUPPLIER to column L_SUPPKEY in table SYSADM.LINEITEM: S.S_SUPPKEY IN (1, 22, 333, 4444, 55555) which might filter the table earlier. Check the explanation for this warning for more details about possible impact and examples.</p>	<p>Adding local transitive closure predicates might improve the performance of the specified query. Predicate transitive closure is the process whereby DB2 copies a local predicate from one table to another before joining the tables. For example, consider the following predicate: WHERE T1.C1 = T2.C1 AND T1.C1 = X</p>

Easy to understand explanations

Query Advisor Recommendations List

Select a recommendation to view more details. To implement the recommendation, change the SQL statement in the source from which it came.

No	Severity	Confidence	Line Number	Description
1	Medium	Low	12	The following predicate on column C_CUSTK...
2	Low	Medium	13	Consider rewriting the following predicate s...

SQL Text

```

LEFT OUTER JOIN SYSADM.NATION
ON ( SYSADM.LINEITEM.L_ORDERKEY = 1
   OR SYSADM.ORDER.O_ORDERKEY = 1
  )
)
LEFT OUTER JOIN SYSADM.CUSTOMER
ON ( SYSADM.LINEITEM.L_ORDERKEY = SYSADM.CUSTOMER.C_CUSTKEY
   AND SYSADM.ORDER.O_ORDERDATE = SYSADM.CUSTOMER.C_NAME

```

Selected Recommendation:

Description	Explanation
<p>The following predicate on column C_CUSTKEY in table SYSADM.CUSTOMER has better selectivity than other predicates in this query. Consider rewriting it to be indexable:</p> <pre> SYSADM.DSNWFQB(03).L_ORDERKEY = SYSADM.CUSTOMER.C_CUSTKEY </pre> <p>to filter out unnecessary rows earlier. Check the explanation for this warning for more details about possible impact and examples.</p>	<p>The following examples show how to rewrite a stage 1 predicate as an indexable predicate:</p> <p>Example 1: Suppose that the column GENDER in table EMP represents the gender of each employee and has only two possible values: 'F' and 'M'. An index is created on column GENDER. Stage 1 predicate: EMP.GENDER <> 'F' Indexable predicate: EMP.GENDER = 'M'</p> <p>Example 2: Suppose that an index exists on the column DATE with type CHAR(8)</p>

Identify the most serious problems

Configure Subsystem | View Queries | View Workloads | View Monitors | * Clifton Boot Camp J | * New Project1 | * New Project2

Access Path Warning List

The following list shows potential problems in the selected statement's access path. Select a warning to view a more detailed description. Make the necessary changes to avoid this warning in the future.

Severity	Query Block Number	Plan Number	Description
Disaster	1	3	1 columns are joined in a sort merge join, but 2 join predicates are used. T...

Access Path Warning Details

Description	Explanation
1 columns are joined in a sort merge join, but 2 join predicates are used. This discrepancy in number means that some join predicates are applied after the join. If a large number of records are returned after the join, this query is a potential problem. Check the explanation for this warning for more details about the possible cause and solution.	DB2 used a sort merge join to process the specified query. For such queries, ensure that all join predicates are in the form TABLE1.COL1 = TABLE2.COL2 and that the two columns have the same data type. If you are using DB2 for z/OS, Version 7 or earlier, also ensure that these two columns have the same length and nullability. Otherwise, DB2 does not evaluate these predicates before the join, and the query processing might take a long time.

Identify potential new indexes for an entire workload

Workload Index Advisor Recommendations

The following information shows the index recommendations for this workload. You can view the performance improvement when all recommendations are applied. There is the option to run index analysis again with different values to see if there are better recommendations.

Workload performance improvement is an estimate based on applying all recommendations.

Estimated performance improvement: %
 Disk space required(DASD space): MB

Recommendation

Feature Details	Action	Object...	Columns	Estimated Disk Space
<input checked="" type="checkbox"/> PART				
<input checked="" type="checkbox"/> Index	Create	PART_V...	P_PARTKEY(ASC), P_...	17.1953125 M
<input checked="" type="checkbox"/> PARTSUPP				
<input checked="" type="checkbox"/> Index	Create	PARTSU...	PS_SUPPKEY(ASC)	1.05078125 M
<input checked="" type="checkbox"/> Index	Create	PARTSU...	PS_SUPPLYCOST(AS...	4.71875 M
<input checked="" type="checkbox"/> LINEITEM				
<input checked="" type="checkbox"/> Index	Create	LINEITE...	L_SHIPMODE(ASC), ...	59.40234375 M
<input checked="" type="checkbox"/> Index	Create	LINEITE...	L_QUANTITY(ASC), L...	152.65625 M
<input checked="" type="checkbox"/> Index	Create	LINEITE...	L_RETURNFLAG(ASC)...	218.24609375 M
<input checked="" type="checkbox"/> Index	Create	LINEITE...	L_SUPPKEY(ASC), L_...	134.015625 M
<input checked="" type="checkbox"/> ORDER				
<input checked="" type="checkbox"/> Index	Create	ORDER...	O_CUSTKEY(ASC), O...	40.703125 M
<input checked="" type="checkbox"/> Index	Create	ORDER...	O_ORDERKEY(ASC), ...	27.62109375 M
<input checked="" type="checkbox"/> Index	Create	ORDER...	O_ORDERSTATUS(AS...	8.72265625 M

Buttons: Show DDL..., Show Related SQL..., **What-If Analysis...**, Run..., Select All, Deselect All

The following settings relate to the selected index recommendations. Use what-if analysis to change settings and to view different sets of

View the DDL for the recommended indexes

The screenshot displays a software interface with a 'Recommendation' panel on the left and a 'DDL Details' dialog box in the center. The 'DDL Details' dialog box contains the following SQL code:

```

CREATE INDEX DB2OE.LINEITEM_VIRT_IDX_115953554645 ON
SYSADM.LINEITEM ( L_SHIPMODE ASC, L_ORDERKEY ASC) FREEPAGE 0
PCTFREE 10

CREATE INDEX DB2OE.LINEITEM_VIRT_IDX_1159535563807 ON
SYSADM.LINEITEM ( L_QUANTITY ASC, L_EXTENDEDPRICE ASC, L_TAX
ASC) FREEPAGE 0 PCTFREE 10

CREATE INDEX DB2OE.LINEITEM_VIRT_IDX_1159535564028 ON
SYSADM.LINEITEM ( L_RETURNFLAG ASC, L_LINESTATUS ASC,
L_EXTENDEDPRICE ASC, L_TAX ASC, L_DISCOUNT ASC, L_QUANTITY
ASC, L_SHIPDATE ASC) FREEPAGE 0 PCTFREE 10

CREATE INDEX DB2OE.LINEITEM_VIRT_IDX_1159535563777 ON
SYSADM.LINEITEM ( L_SUPPKEY ASC, L_EXTENDEDPRICE ASC, L_TAX
ASC) FREEPAGE 0 PCTFREE 10
    
```

The 'Recommendation' panel on the left shows a tree view of features:

- PART
 - Index
- PARTSUPP
 - Index
 - Index
- LINEITEM
 - Index
 - Index
 - Index
 - Index
- ORDER
 - Index
 - Index
 - Index

Buttons on the right side of the dialog include: Show DDL..., Show Related SQL..., What-If Analysis..., Run..., Select All, and Deselect All. An 'OK' button is located at the bottom of the dialog.

View the related SQL

Workload Index Advisor Recommendations

The following information shows the index recommendations for this workload. You can view the performance improvement when all recommendations are applied. There is the option to run index analysis again with different values to see if there are better recommendations.

Workload performance improvement is an estimate based on applying all recommendations.

Estimated performance improvement: %
 Disk space required(DASD space): MB

Recommendation | What-if Analysis 1 | What-if Analysis 2

Feature Details	Action	Object...	Columns	Estimated Disk Space
<input checked="" type="checkbox"/> PART				
<input checked="" type="checkbox"/> Index	Create	PART_V...	P_PARTKEY(ASC), P_...	17.1953125 M
<input type="checkbox"/> PARTSUPP				
<input type="checkbox"/> Index	Cre			
<input type="checkbox"/> Index	Cre			
<input type="checkbox"/> LINEITEM				
<input type="checkbox"/> Index	Cre			
<input type="checkbox"/> Index	Cre			
<input type="checkbox"/> Index	Cre			
<input type="checkbox"/> Index	Cre			
<input type="checkbox"/> ORDER				
<input type="checkbox"/> Index	Cre			
<input type="checkbox"/> Index	Cre			
<input type="checkbox"/> Index	Cre			

Related Statements

Save

```
SELECT P_PARTKEY,P_NAME,P_BRAND FROM SYSADM.PART P WHERE
EXISTS (SELECT PS_SUPPKY FROM SYSADM.PARTSUPP WHERE
P.P_PARTKEY=PS_PARTKEY);
```

OK

Show DDL...

Show Related SQL...

What-If Analysis...

Run...

Select All

Deselect All

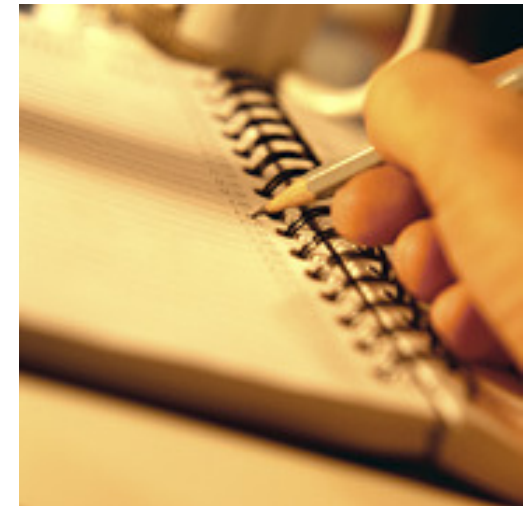
The following settings relate to recommendations.

Amount of disk space to allocate for index recommendations: MB

Estimated number of index recommendations:

Agenda

- Overview
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Q & A



Conclusion

- For More Information
 - For more information about IBM DB2 and IMS Tools, visit our website:

www.ibm.com/software/data/db2imstools
 - Contact your IBM zOS Database Tool Sales Specialist
 - Or Sally Touscany at touscany@us.ibm.com
 - Or Pat Zakhar at zakhar@us.ibm.com

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