



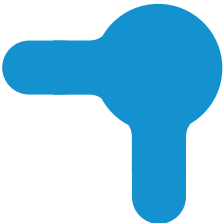
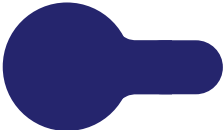
TurboTuneSQL[®] FOR DB2



TECHNICAL OVERVIEW SUMMARY

DB2 TOOLS THAT EXIST IN THE MARKET

Monitors for Subsystem, Query and Application

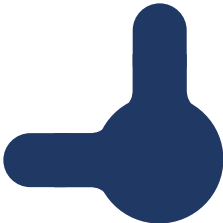


Analyzers for SQL Source, Plan Table and Indexes

Administration Tools



Statistics and Production Environment Simulation



Utilities and Automation Tools



TOOL EXAMPLES



DB2 Monitors	Real-time DB2 subsystem analyzers IBM-Omegamon, CA-Insight, BMC-Mainview, etc
Query Monitors	Real-time DB2 applications (SQL focus) IBM-QM, CA-Detector, BMC-Apptune
SQL Analyzers	SQL Source Code analyzers IBM SQL/PA, CA-Plan Analyzer, BMC- SQL EXPLORER
Administration	Tools to help DB2 administration IBM-DB2 Admin, Compuware DB-Expert ,etc
Application	Allows analysis of DB2 applications
Monitors	Allows analysis of DB2 applications as well as other resources. Strobe, FreezeFrame

Types of Tools	Functions	Risks
DB2 Monitors	Real-time DB2 subsystem analyzers	
Query Monitors	Real-time analyzers for DB2 applications	Too Expensive, Process causes High Overhead, Poor reporting results, firefighting
Source Analyzers / Plan Analyzer	Code Analyzers based on defined Rules. Plan Table comparison	
Index Analyzers	Analysis of DB2 indexes	
Administration	DB2 administration tools	
Application Monitors	On-line Analyzers for Mainframe applications	Analyze one application in a vertical analysis form. You must drill down to search for critical CPU consumption. Analysis of one application or program at a time and not the whole system

TurboTuneSQL[®] is one single tool

Types of Tools	Functions	Risks	Advantages
Unique!	On-line DB2 applications Analyzer and Index Analyzer	none	Never impacts DB2, Unique Features, Multi Functions (TSO / ISPF / PDF / DB2 Interactive (DB2I), SDSF, JCL (For reporting), SMF Processing and Reporting), Low Overhead, Global Analysis, Basis and much more...



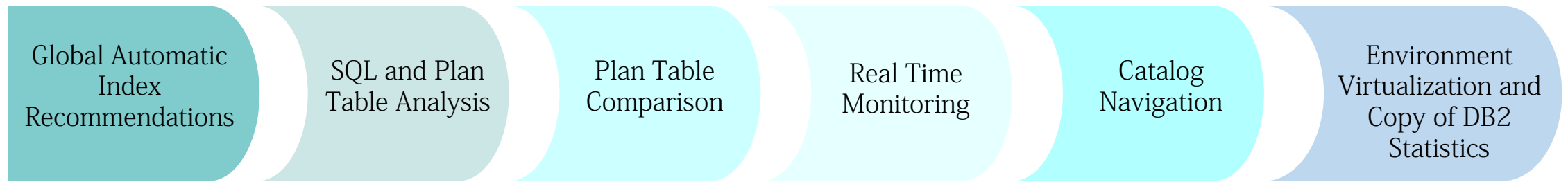
TurboTuneSQL®

- TurboTuneSQL® for DB2 is a complete solution to monitor and identify performance problems in z/OS DB2 applications.
- The unique features of TurboTuneSQL® are innovative methods that identify performance problems.
- The TurboTuneSQL® Integrated functionality allows DBAs and performance Analysts to be informed with the most important aspects related to DB2 application performance.
- Some of the unique features are only possible for the fact that the product is totally integrated



WHY TurboTuneSQL® IS COMPLETE AND INNOVATIVE?

Complete solution: Several features included in only one tool:



TurboTuneSQL® was built as a single product.

- ✓ Other vendors have separated features into several products.
- ✓ TurboTuneSQL® employs a tight integration of several innovative products with unique features.



TurboTuneSQL® - KEY POINTS



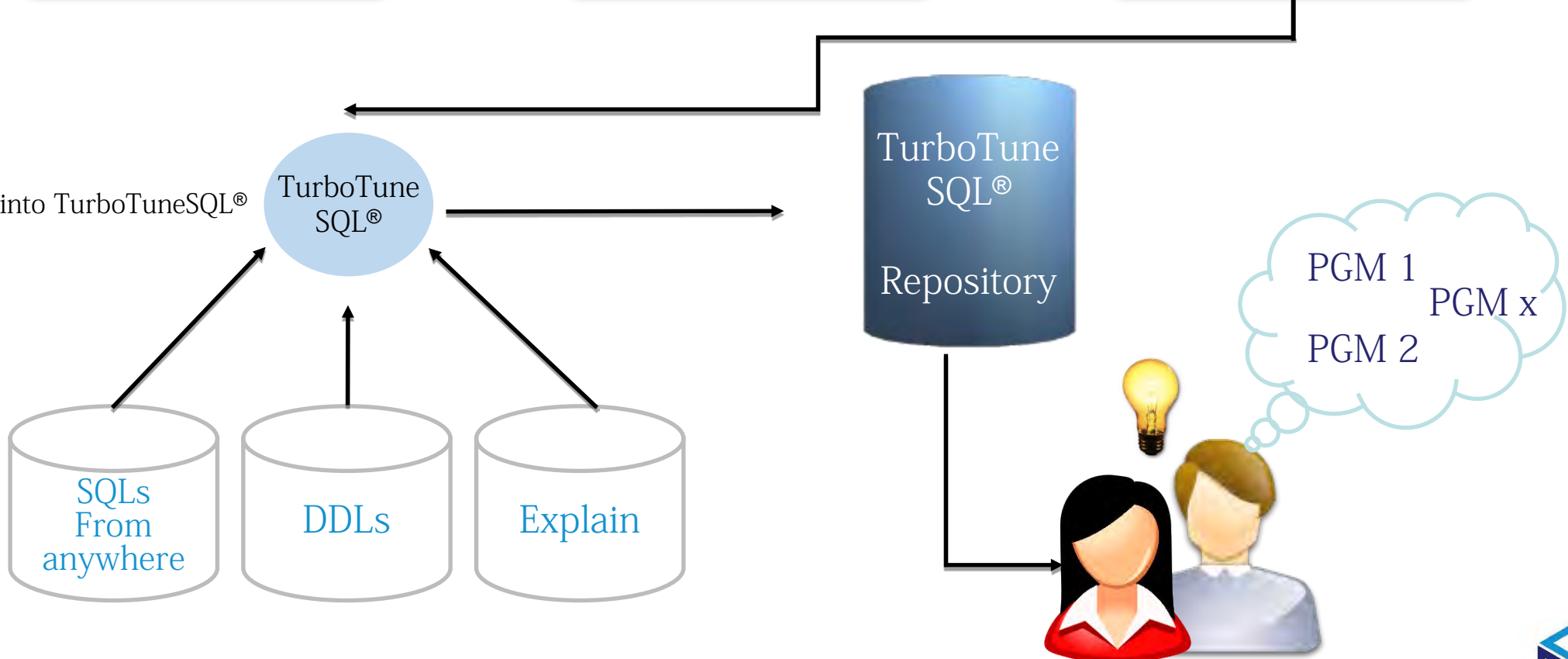
- 01 | Allows huge DB2 CPU savings
- 02 | Saves 85% of DBA time in analysis
- 03 | SQL Inventory recognizes IDENTICAL and SIMILAR SQLs
- 04 | No stability risk for the system - NO hooks! NO APF!
- 05 | TurboTuneSQL® has a DB2 Repository. May be used for Capacity Planning!
- 06 | Traces in sampling mode with low overhead. Built in function
- 07 | Permits monitoring of ALL DB2 applications. Not only one!
- 08 | Environment Virtualization and Copy of DB2 Catalog Statistics
- 09 | Real Time Monitor (DB2 CACHE)
- 10 | Manual and Automatic Index Recommendations



HOW TurboTuneSQL[®] WORKS



Loading DATA into TurboTuneSQL®



DBA



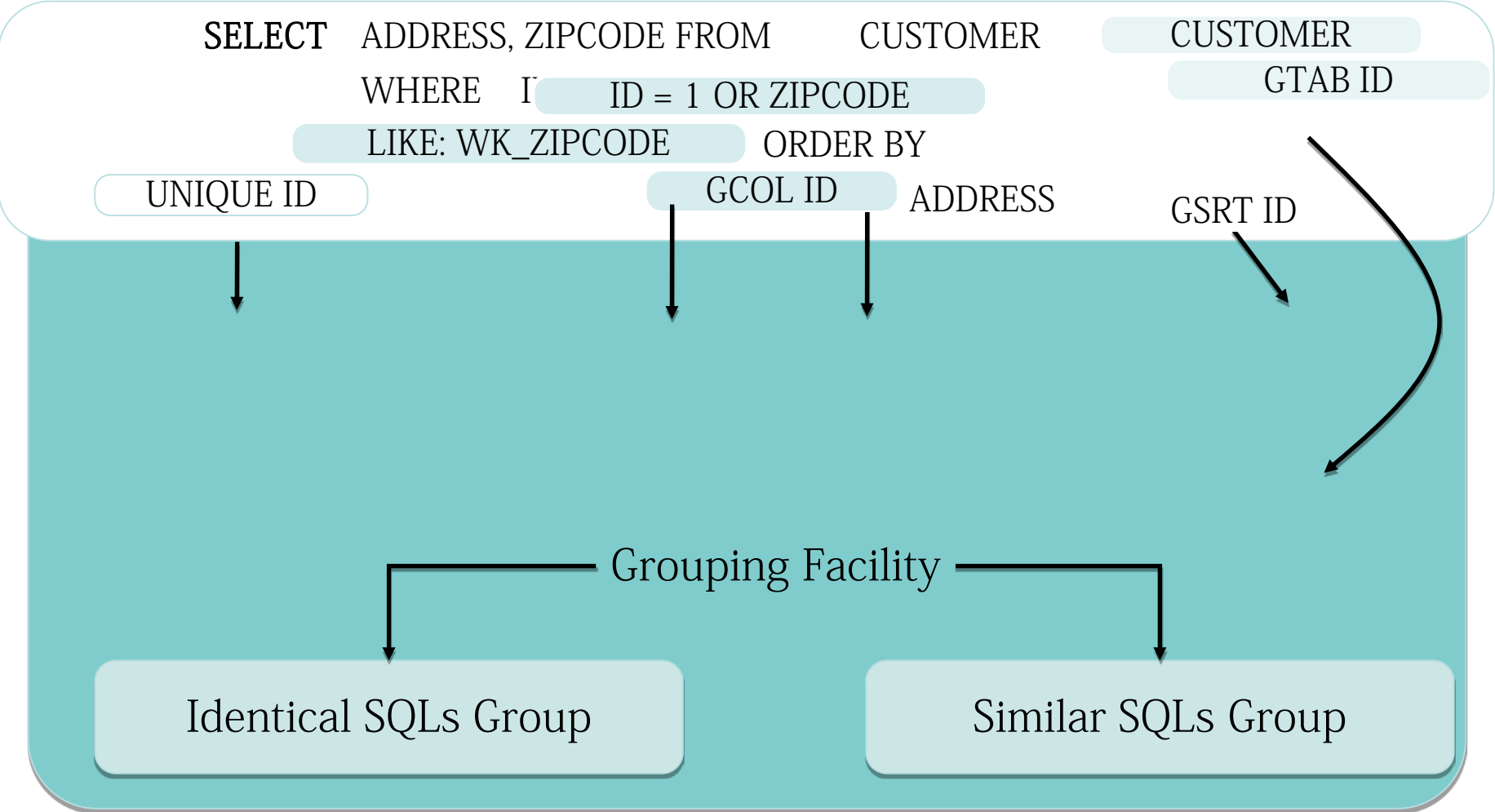
TurboTuneSQL[®] inventory

TurboTuneSQL[®] inventory

- IDENTICAL and SIMILAR SQLs can easily and instantly be identified.
- Consolidation of identical and similar low-cost SQLs may represent a significant part of the workload cost.
- Widely used in whole product (DB2 traces, Plan tables,etc)
- Stores both dynamic and static SQLs.
- Allows huge CPU savings.



Sql groupings



Seeing only the top of the iceberg can be a problem:



Ensure you are seeing the ENTIRE PROBLEM:



SQL Groups allow
us to see the
ENTIRE PROBLEM



----- Online Report ----- 09:15

Option ==> _____

Online Reports

Profile : IVPVA {E}
DB2 SSID : DBAG
Curr Loc : DALLASA

Report : _____

Filters -----

DateR : 2001-01-01 2013-01-01 Plan Name : _____ CnTy: ___
TimeR : 00.00.00 23.23.00 Correlation Name : _____
Program: _____ SSID: _____ Source/Explain Req Code IVP1 / IVP1
Unique : _____ Table Creator: _____ Table Name: _____

Workload (history)

AC00: Program Summary IMSM: IMS Attach MPP
ACNI: Connect ID Summary ST00: SQLs by Group Tble
ACNT: Connect Type Summar ST01: SQLs by Execution
ACOR: Correlation Id Suma ST02: SQLs by Identicals
APLN: Plan Name Summary ST03: SQLs by Similar
ASSI: SSID Summary ST04: SQLs with SCAN
CICS: CICS Transactions SNEG: SQLCODEs Summary
CO00: Collection Summary RF00: General XRef
DB10: Table Summ Workload

Source (history)

HT00: Table List
SRPG: Program List
SRPS: SQLs List
SRMI: Plan Table Compariso
SSCO: SQLs Comments
Source (real-time)

TB00: Table List (catlg)
TD00: Databas List (catlg)
SRIC: Program List (catlg)





SQL INVENTORY REPORTS – SCREEN EXAMPLE

1 similar SQL found **48 distinct programs!!!**

1 identical SQL found **27 distinct programs!!!**

```
ST03 - Similar SQLs Summary                                     Profile : PRDQV9SA
                                                                DB2 SSID : DB9G
-----
Filters -----
DateR      : 1900-01-01 2100-12-31 Timer: 01.00.00 23.59.59
Group Tab  :                               Group Col  :
Plan Name  :                               Database   :
Line Actions: -----
(S)SQLs (P)ProgW (D)Details (Z)Zoom
-----
C Gtab Gcol          DB2 CPU(ALL)          DB2 CPU Avg          DB2 Elapsed          Dprog          SQLs
-----
- E24D 9E11          40:17.834          0.000200          20:21.717          48          12,030,851
- E24D 0000          0.678          0.008805          0.885          19          77
- E24D 0000          0.294          0.006141          3.656          16          48
- CB85 51FA          0.250          0.000659          0.326          15          380
- CB85 0000          13:20.363          0.000200          6:51.166          11          4,000,084
-----
ST02 - Identical SQLs Summary                                   Profile : PRDQV9SA
                                                                DB2 SSID : DB9G
-----
Filters -----
DateR      : 1900-01-01 2100-12-31 Timer: 01.00.00 23.59.59
Stmt Uniq  :                               Table Name  :
Plan Name  :                               Database   :
Line Actions: -----
(D)Details (S)SQLs (L)SQLXref (N)Expand (E)Explain (P)ProgW (Z)Zoom
-----
C Uniq          DB2 CPU(ALL)          DB2 CPU Avg          DB2 Elapsed          Dprog          SQLs
-----
- A0B0          16.946          0.000557          19.891          27          30,377
- D7E8          13:20.254          0.000200          6:40.762          11          4,000,047
- 713A          0.089          0.000847          0.120          10          106
- 69BE          0.150          0.006253          5.229          10          24
- E66C          0.016          0.000959          0.019          9          17
```



WORKLOAD REPORT – SCREEN EXAMPLE

```
----- Online Report ----- Row 1 to 29 of 66
Option ==> _____
ACOR - DB2 CORRELATION Summary                               Profile : PRDQV9SA
                                                            DB2 SSID : DB9G
Filters -----
DateR      : 1900-01-01 2100-12-31 TimerR : 01.00.00 23.59.59
Program Name:                               Correlation Name :
Group Name  :                               SSIDs : DB9G
Line Actions: -----
(X)ProgXref (P)ProgW (D)Details (N)Expand (Z)Zoom
----->
C Correlation Connect DB2 CPU DB2 Wait DB2 Elapsed
-----
*CACHE* *CACHE* 4:13:32.967 52:46:47.335 2:07:01.857
URGENT1 TSO F/B 4:27.570 1:55.547 6:28.255
JRUNSTAT UTILITY 19.444 41.229 1:07.024
ZI9E CICS ATTACH 16.447 0.000 22.453
ZI9D CICS ATTACH 16.439 0.000 22.421
db2bp.exe DRDA 5.382 6.721 8.653
JDELINS TSO F/B 2.839 14.255 17.938
JSPUFV92 TSO F/B 1.518 2.149 8.444
JSPUFV94 TSO F/B 1.360 2.425 8.824
JSPUFV93 TSO F/B 1.326 2.066 9.846
JSPUFV91 TSO F/B 1.311 1.864 9.397
JOB1 TSO F/B 1.164 9.643 11.012
IBMUSER TSO F/B 1.163 0.240 1.727
JOB2 TSO F/B 0.856 0.848 1.947
UNICOV92 TSO F/B 0.823 5.521 9.486
UNICOV93 TSO F/B 0.790 5.471 9.416
UNICOV91 TSO F/B 0.772 0.616 5.328
LOAD UTILITY 0.751 22.170 22.205
```



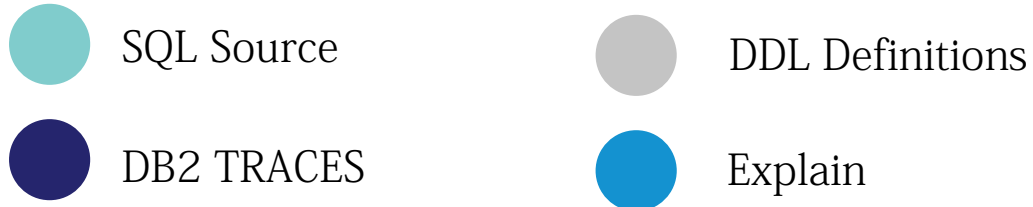
Other features

- Provides copy of DB2 STATISTICS
- Plan table comparison. Check Access Plan Changes
 - ✓ Change control over access paths during DB2 version migration
 - ✓ DB2 Configurations (Buffer Pool, Sort Pool, Etc)
 - ✓ New z/OS/ Hardware
 - ✓ New Table statistics
 - ✓ If 200 programs were migrated on the weekend, which programs had their access plan changed?
- Massive explain

Other features

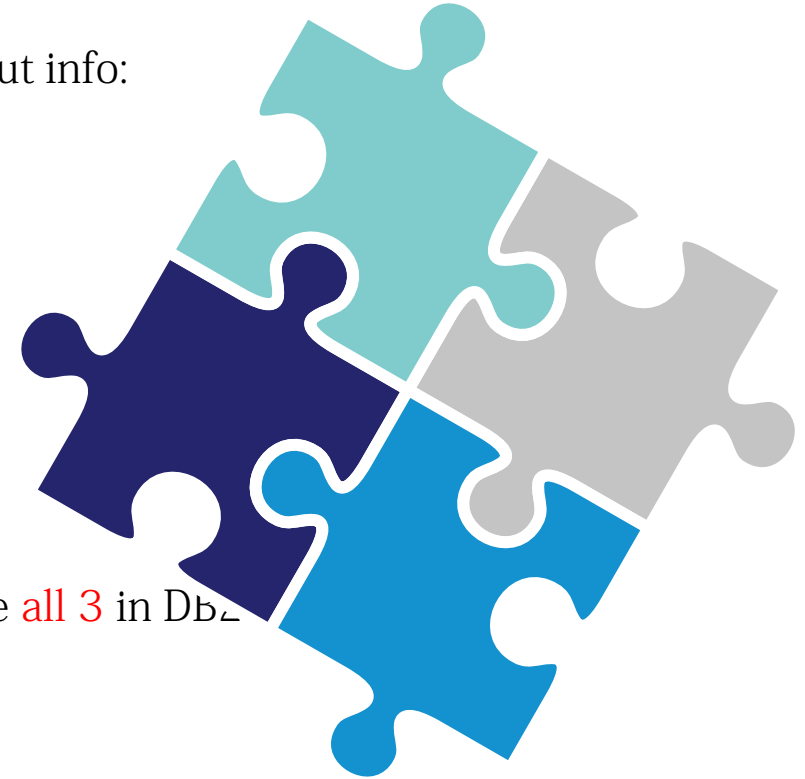
Shows the top SQL consumers (DB2 LOG and/or TCP/IP and FETCHs).

- TurboTuneSQL® can execute cross analysis using all possible input info:



Example:

- Create table table1 (cola char(1), colb char(100), colc char(1))
- Update table table1 set cola=1, colc=1 -> 102 bytes!
- Even if only 2 single columns are being updated, DB2 will store all 3 in DB2
- TurboTuneSQL® will report and find this situation.
- Changing table lay-out, much less log will be generated:
- Create table table1 (cola char(1), colc char(1), colb char(100))
- Update table table1 set cola=1, colc=1 -> Only 2 bytes now!!!





REAL TIME TRACEs & Environment Virtualization



INDEX RECOMMENDATIONS

(RE)DESIGN OF INDEXES ALLOW HUGE CPU SAVINGS

THERE ARE SEVERAL WAYS TO IMPROVE DB2 PERFORMANCE:

- SQL optimization (...application code changed...require tests)
- DB2 subsystem customization (...can be incredibly good or bad...)
- New hardware (...may be \$\$\$...)
- Table maintenance (Reorg, Runstats and Rebind) (..help but not much...)
- Design/Redesign of Applications (..application code changed. require tests)
- Design/Redesign Data Base
 - Database, Tablespace, Table and Views, (re)Design
 - (Re)design indexes

WHY (RE)DESIGN INDEXES IS THE BEST OPTION TO SAVE CPU?

- DB2 Indexes allow **exceptional gains** in CPU savings
- **Does NOT require** application SQL code changes and **do NOT require** application tests.

EXAMPLE: COMBINE 4 COLUMNS: A,B,C,D

A	ABCD
B	ABDC
C	ACBD
D	ACDB
AB	ADBC
AC	ADCB
AD	BACD
BA	BADC
BC	BCAD
BD	BCDA
CA	BDAC
CB	BDCA
CD	CABD
BA	CADB
BC	CBAD
BD	CBDA
DA	CDAB
DB	CDBA
DC	DABC
ABC	DACB
ACB	DBAC
BAC	DBCA
BCA	DCAB
CAB	DCBA
CBA	
DAB	
DBA	

COMBINATIONS FOR 4 COLUMNS:

- WITHOUT CONSIDERING ASCENDING/DESCENDING: 51
- CONSIDERING ASCENDING/DESCENDING: 2,601

COMBINATIONS FOR 10 COLUMNS:

- WITHOUT CONSIDERING ASCENDING/DESCENDING: 4,102,845
- CONSIDERING ASCENDING/DESCENDING: > 16 billions

- TOO MANY DB2 Explanations to check the best index combination!!!
- Multiple Index Accesses will demand even more combinations!!!



TurboTuneSQL® INDEXES ANALYSIS

TurboTuneSQL® has several methods to help users performing Indexes Analysis.

MANUAL method:

Batch Reports (examples: duplicated indexes, non used indexes, etc)

Online Reports (examples: columns being in used, all predicates and clauses in use)

Plan Table comparison Utility

AUTOMATIC Method:

A.I. (Artificial Intelligence) TurboTuneSQL® will automatically combine new indexes and cols.

“WHAT-IF” : Users will choose index and columns to be evaluated.

“What-If” method is also an automatic method because several other analysis and comparisons are still made automatically by TurboTuneSQL® .



TurboTuneSQL® INDEXES ANALYSIS

A.I. Method

Artificial Intelligence algorithm may recommend the following ACTIONS:

- **CREATE:** New indexes will be automatically recommended
- **DROP:** Drop will be recommended for:
 - Not used indexes (not found in plan table or catalog dependency)
 - Similar or identical indexes
- **KEEP:** Keep will be recommended for:
 - Index is in use
 - other cases
- **ATTENTION:** Warning will be issued for:
 - Index may have it's attribute changed from duplicated to unique
 - Checks for cluster and other attributes



TurboTuneSQL® INDEXES ANALYSIS

WHAT-IF Method

Allow user to test indexes recommendations by themselves:

- CREATE: If customer suggested index is good, it will be recommended by the tool
- DROP, KEEP and ATTENTION: Some rule as in A.I. Method



TurboTuneSQL® INDEXES ANALYSIS

Other Services

- DB2 Virtual Index facility may be explored. No DDL command is issued
- Static and Dynamic SQLs may be used as input
- Analysis of Identical and similar indexes
- SQL Execution frequency may be used (manually or from traces)
- SAVINGS: determine savings percentage according to SQL execution frequencies. Therefore, total insert/update/deletes will be also verified
- Automatic Access Path Comparison
- And more...



AUTOMATIC INDEX RECOMMENDATION

- AUTOMATIC COMPARISON

```

-----Automatic Analysis----- Row 26 to 50 of 78
Option ==> _

IXMI - Index Recommendation Full Comparison                               Profile : PRDQV9SA
                                                                           DB2 SSID : DB9G

Filters -----
Index ReqCode: TGK1 Table/Index: TGKINTMO /
Total Explain Cost WITH SQL executions | Total Explain Cost WITHOUT execution
Before SUs: 310,323 CPUms: 1:45.745 | SUs: 258,826 CPUms: 1:28.5490
After SUs: 275,351 CPUms: 1:41.486 | SUs: 223,803 CPUms: 1:16.5730
Savings SUs: % 11.26 | Savings SUs % 13.53

Line Actions: -----
(E)ExplainAll (S)SQLText (P)ProgW (R)ProgS (K)SUniqueS
(F)SQLComm (B)ExplainBefore (Y)ExplainAfter (Z)Zoom

C Uniq Desc SQLs Program COMPARISON COSTS ACCESS PATH Cost
----- SQLs Example Cost-MS Cost-SU AMIP IX SR TN Categ
-----
439A SELECT 1 GKRI40NB better-ms better-su Y Y - - -
559D SELECT 1 GKRI42NB worse-ms worse-su Y Y Y Y -
DF89 SELECT 1 GKRI87NB better-ms better-su Y Y - - -
5E22 SELECT 1 GKROGECB *stm with no mism* - - - - -
04DE SELECT 1 GKSCCONB same-ms same-su - Y - - -
0D2A SELECT 1 GKSCCONB same-ms same-su - Y - - -
84F6 SELECT 1 GKSE50NO better-ms better-su Y Y Y Y -
DD77 INSERT 1 GKWD95CB worse-ms worse-su - - - - -
02B5 SELECT 1 GKWD98CB better-ms better-su Y Y - - -
F082 DELETE 1 GK071TST worse-ms worse-su - - - - -
3B9C SELECT 1 GK071TST *stm with no mism* - - - - -
B1FB UPDATE 1 GK1031CB *stm with no mism* - - - - -
2B86 UPDATE 1 GK1031CB *stm with no mism* - - - - -
35AA DELETE 1 GK1031CB worse-ms worse-su - - - - -
453A SELECT 1 GK1031CB *stm with no mism* - - - - -
6B2C UPDATE 1 GK1031CB *stm with no mism* - - - - -
252A UPDATE 1 GK1032CB *stm with no mism* - - - - -
BBE5 SELECT 1 GK1071CB *stm with no mism* - - - - -
D44F SELECT 1 GK1071CB *stm with no mism* - - - - -
F908 DELETE 1 GK1071CB worse-ms worse-su - - - - -

```



MANUAL METHOD

SUMMARY OF ALL PREDICATES IN A SINGLE SCREEN

```

----- Online Report ----- Row 19 to 27 of 70
Option ==> _____
PR01 - Predicates and Sort Columns Summary                               Profile : IVPV9
                                                                           DB2 SSID : DB9G
Filters -----
Group Tab      :                Group Col      :                Stmt Uniq      :
Table Owner   : IVPQUAL      Table Name      : IVPTABLE_T001
Program Name  :
Source/Explain Request Code: ( IVPNE      / IVPNE      )
Line Actions: -----
(S)SSimilW (I)ColumnIndexH (J)ColumnIndexC (T)TableH (Q)TableC (Z)Zoom
-----
C Gcol Name                Colname                Operator  WPTR      DB2 CPU (ALL)
-----
_ 5FBE IVPTABLE_T001        COD_AREACLI           > ALL     WLCY      0.007
_ 5FBE IVPTABLE_T001        COD_AREACLI           <= SOME   WLCY      0.007
_ 4474 IVPTABLE_T001        COD_CLIENTE_T1       =         WLCY      0.001
_ 4474 IVPTABLE_T001        COD_CLIENTE_T1       R CY     0.001
_ 4474 IVPTABLE_T001        COD_AREACLI           R CY     0.001
_ 39E6 IVPTABLE_T001        NOME_CLIENTE_T1     =         WLCY      0.002
_ 3C00 IVPTABLE_T001        COD_AREACLI           =         WLCY      6:40.328
_ 3C00 IVPTABLE_T001        COD_AREACLI           G CY     6:40.328

```



SAVINGS per TABLE

```
-----Automatic Analysis----- Row 1 to 13 of 13
Option ==> _____
IXRT - Recommended Actions by Table                               Profile : PRDQV9SA
                                                                DB2 SSID : DB9G
Filters -----
Index ReqCode: TGK1
Table Owner   : SSWW           Table Name: TGK*           Database:
Line Actions: -----
(A)Actions   (M)FullPlanTableComparison   (X)PlanTable       (H)PlanTableSum
(C)Columns   (F)ForeignK                 (I)Indexes         (L)AllIxColumns   (S)SQLs
(D)CatlgDep (G)Predicates/Srt (T)TableH         (Z)Zoom
-----
C OWNER      TABLENAME      SAVINGS WITH EXEC %      ACTIONS
              YES          NO          Drop Keep Crea Attn Fail
-----
-- SSWW      TGKACUML        73.12      73.12      000  001  002  000
-- SSWW      TGKADICI        91.50      92.27      000  001  003  000
-- SSWW      TGKAUDIT        50.57      51.29      000  001  004  000
-- SSWW      TGKCAPRO        16.66      10.81      000  001  002  000
-- SSWW      TGKINTMO        11.26      13.53      001  003  009  000
-- SSWW      TGKMEUDE        26.99      27.03      000  001  001  000
-- SSWW      TGKMONAU        45.89      45.90      000  001  001  000
-- SSWW      TGKMONFI        22.07      22.07      002  002  008  001
-- SSWW      TGKMOPCR        23.09      23.09      001  002  009  000
-- SSWW      TGKMOPDE        77.74      77.75      000  006  010  000
-- SSWW      TGKPLACA        15.15      15.26      000  006  009  000
-- SSWW      TGKPROPT        48.02      48.07      000  003  009  000
-- SSWW      TGKUOAGE        23.07      23.07      000  001  001  000
***** Bottom of data *****
```

AUTOMATIC INDEX RECOMMENDATION

-ACTIONS per TABLE

```

----- Automatic Analysis --- Row 1 to 13 of 13
Option ==> _
IXRM - Indexes to drop,create,keep                               Profile : PRDQV9SA
                                                                DB2 SSID : DB9G
Filters -----
Index ReqCode: TGK1
Table Owner  : SSWW           Table Name: TGKINTMO           Database:
Line Actions: -----
(C)Columns (M)FullPlanTableCom (X)PlanTable (I)Index (D)CatlgDep (Z)Zoom
----->
C Action  Creator  IxName                U  Savings          Savings          Done  Phase
-----  -
KEEP     SSWW     DGKINTMO              D  - 0.34           -2              Y     3
KEEP     SSWW     XTGKINTMOA            P  - 2.44           -30             Y     3
DROP     SSWW     XTGKINTMOB            D   0.00            0              Y     2
KEEP     SSWW     XTGKINTMOC            D   0.00            0              Y     3
CREATE   TGK1     TGK1@0021000000284   D  98.36           17,781          1
CREATE   TGK1     TGK1@0021000000285   D  70.72            8,259           1
CREATE   TGK1     TGK1@0021000000286   D  91.35            1,162           1
CREATE   TGK1     TGK1@0021000000342   D  22.27            3,481           1
CREATE   TGK1     TGK1@0021000000450   D  98.88           11,169          1
CREATE   TGK1     TGK1@0021000000451   D  99.86            6,269           1
CREATE   TGK1     TGK1@0021000000563   D  47.91            4,719           1
CREATE   TGK1     TGK1@0021000000572   D  91.08            2,319           1
CREATE   TGK1     TGK1@0021000000848   D   0.01            6               1
***** Bottom of data *****

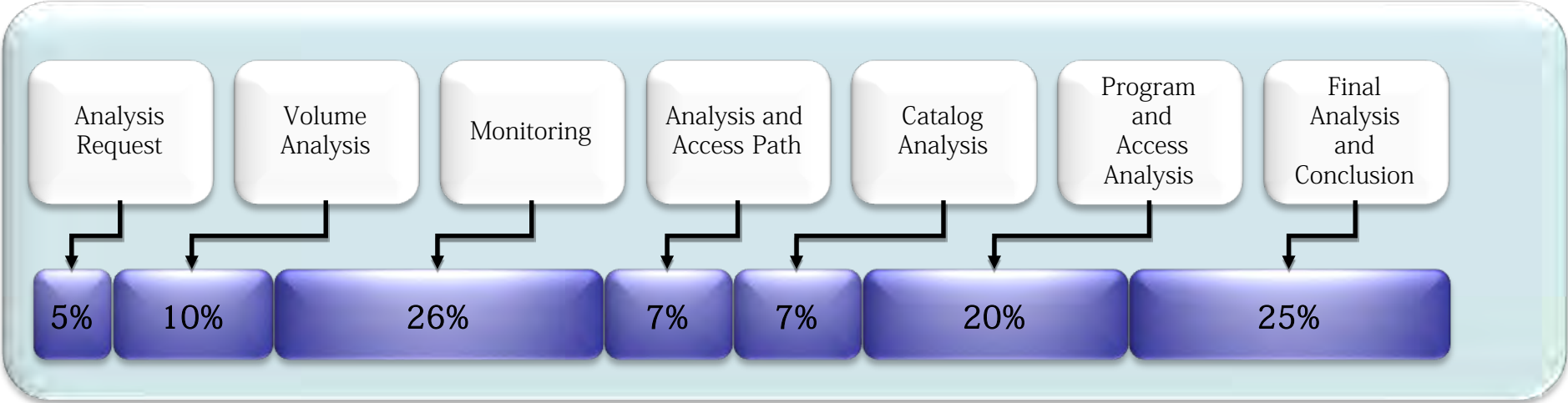
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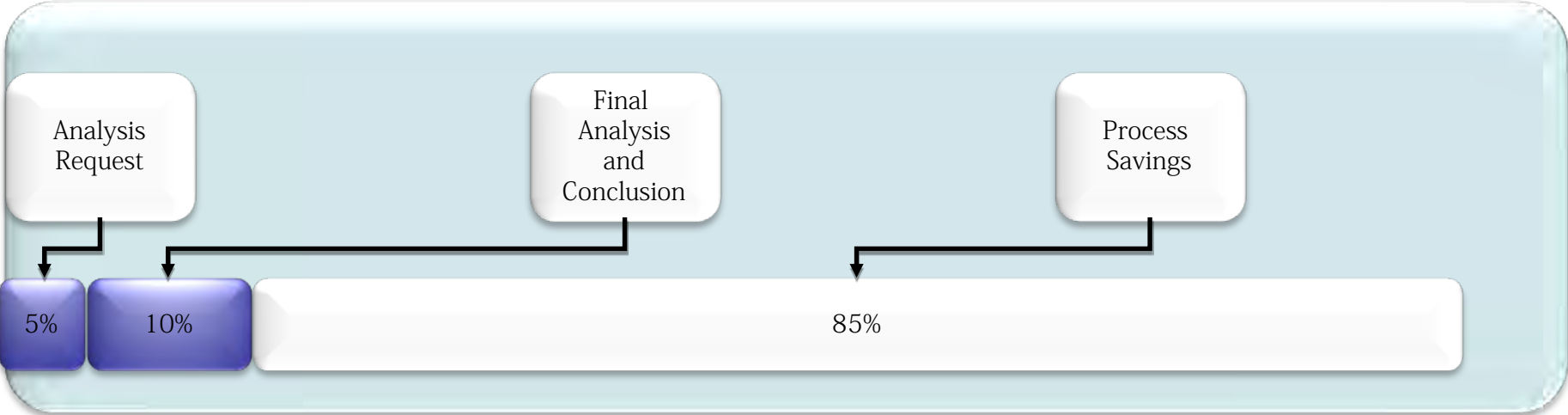

PRODUCTIVITY GAINS

Productivity Gains for Process (Analysis for just 1 SQL)

WITHOUT TurboTuneSQL®



WITH TurboTuneSQL®



NEW TurboTuneSQL® MAIN MENU



TurboTuneSQL® PROFILE

1. SQL REAL TIME MONITOR
2. ENVIRONMENT VIRTUALIZATION
3. MANAGING COPY OF STATISTICS
4. SQL INVENTORY AND WORKLOAD
5. AUTOMATIC INDEX RECOMMENDATION



THANK YOU