

Access Path Recovery for Db2 11 + 12 using **RUNSTATS Rescue** Still important in an AI/ML world?

Roy Boxwell, SEG

Realworld Experiences from:



RUNSTATS Rescue – Why?

A fact of life is:

Access Paths change...

Sometimes they get better...

Sometimes they don't!

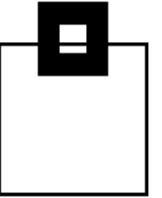
Why does that happen? The classic reasons are:

Statistics changes

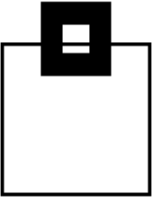
Index changes

Any other reason... (APAR, Version, Rainy day
etc.)

Wouldn't it be great if you could „turn back time“ – To
get the last „good“ statistics and then be rescued from
your bad access path?



RUNSTATS Rescue – Db2 Help?



What does Db2 offer when this situation occurs?

For Static SQL – Plan Stability and BIND QUERY

Original Package

Previous Package

Current Package



Does Plan Management work all the time?

With Schema changes it fails... (View, Index etc.)



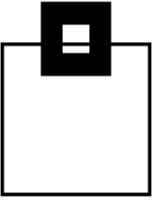
RUNSTATS Rescue – Db2 Help?

For Dynamic SQL you get:

Dynamic SQL – BIND QUERY

However BIND QUERY has one major limitation:

“Ensure that object names and SQL keywords in the statement text are specified by uppercase characters, especially for dynamic SQL statements.”



RUNSTATS Rescue – Db2 Help?

New in Db2 12 is:

IBM Analytics **Dynamic Plan Stability**

- DB2 12 plan – base infrastructure
 - Opaque parameter CACHEDYN_STABILIZATION
 - Capture
 - Command with / without monitoring
 - Global variable
 - FREE
 - EXPLAIN (current, invalid)
 - Invalidation
 - LASTUSED (identify stale statements)
 - Instrumentation (query hash, explain, cache + catalog hit ratio)
 - APPLCOMPAT is part of matching criteria
- Key DB2 12 limitations
 - Temporal stabilization not currently included
 - REBIND support not included
 - No PLANMGMT/SWITCH/APREUSE



How many SQLs are “worth” locking down? Top 10, 20?

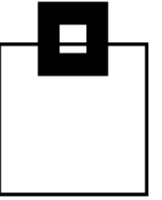
RUNSTATS AI/ML – Db2 Help?

Well, as you are all aware, AI and ML should come and rescue us from bad access paths as well.

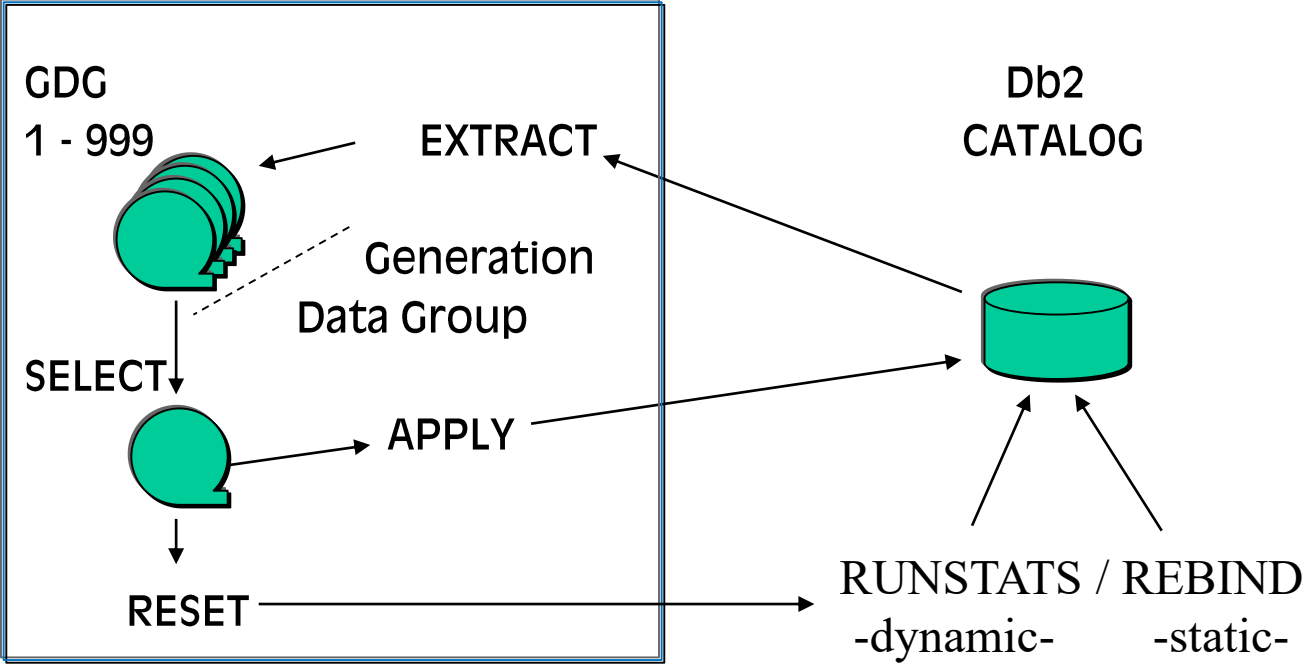
How?

The problem is the well known outlier problem. The AI/ML learns on 1000's of SQLs that all run "nominally".

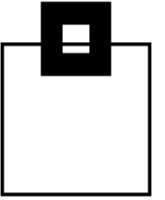
When your application gets a deviant or outlier access path that the AI/ML has not seen before how will it react? Ignore it and hope to learn more for next time... or something completely different?



RUNSTATS Rescue – At a glance



RUNSTATS Rescue at a glance

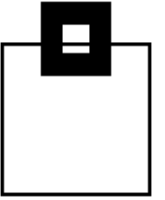


- Keeps a repository and allows to consistently restore statistics
- Quick and easy to use
- Supports dynamic SQL out-of-the-box
- Supports static SQL where Plan Management fails:
 - BINDs resulting from modified programs
 - Schema changes – VIEW changes etc.
- Verifies RUNSTATs as the **reason** for performance degradations



RUNSTATS Rescue (RR)

- RR is a part of Software Engineering's ImpactExpert family of products for Db2 z/OS and as such is a selection from the ImpactExpert Main Menu
- Along with RR there are various tools to help in checking that access paths are **not** going to get worse after a REBIND, a BIND, or a RUNSTATS
- This presentation is only going to go into detail about RR and not all the other functionality that is available in the other tools

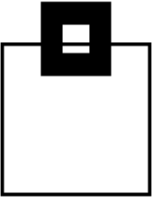


RUNSTATS Rescue procedure

Schedule RR-batch job to maintain a history of optimizer relevant statistics (using a GDG).

If a (dynamic) SQL statement performs badly:

- Point RR to the STMT
 - RR shows the associated tablespaces/indexspaces for stats recovery
- Specify since when it degraded
 - RR checks if a RUNSTATS was executed since then and shows the details per object
 - RR verifies potential object (re-) creation within the timeframe
- RR generates jobs to
 - Extract the stats from its repository
 - Rescue the stats



RUNSTATS Rescue – Embedded or Stand-alone

```
ImpactExpert for DB2 z/OS ----- Main Menu ----- Version 6.10
Command ==> _____ DB2: QB1A

Primary cmd: END, S(ettings), C(leanup), F(ilter Jobs), H(istory), A(bout), FAQ
Line cmd: S(elect), I(nfo), F(ilter Jobs)

Scenario                               Base / Recent   Dyn   Migr. Convert
-----                               -
REBIND Analysis                        Catalog         YES   N      -      -      -
Pre-BIND Local                         Catalog / DBRM  YES   -      -      -      -
Post-BIND Local                        History / Catalog NO      -      -      -      -
Pre-BIND Prod-Baseline                 Export / DBRM  (*) YES   -      N      N      N
Post-BIND Prod-Baseline                 Export / Catalog (*) NO      -      N      N      -
Early Precheck Static                  Export (*)      YES   Y      N      N      N
Early Precheck Dynamic                  Export (*)      YES   Y      N      -      N
DSC Protection                         Export (*)      YES   -      N      -      -
Dynamic SQL                            DynStmtCache   YES   -      -      -      -
Static and dynamic SQL                  Trace          YES   -      -      -      -
Local APAR Check Static                 Catalog         -      -      -      -      -
Local APAR Check Dynamic                DynStmtCache   -      -      -      -      -
S RUNSTATS Rescue                       Plan table
Plan_table compare                      Plan_table
DBRM reconstruct                       Catalog

NOTE (*): Use export/import function to update product internal copy tables.
```

**Start
RUNSTATS
Rescue from
the main
menu**

RUNSTATS Rescue – setup

```
ImpactExpert for DB2 z/OS ----- Main Menu ----- Version 6.10
Command ==> DB2: QB1A

Primary cmd: END, S(ettings), C(leanup), F(ilter Jobs), H(istory), A(bout), FAQ
Line cmd: S(elect), I(nfo), F(ilter Jobs)

Scenario                Base      / Recent      Dyn  Migr. Convert
                        -----
REBIND Analysis         Catalog
Pre-BIND Local          Catalog / DBRM   YES  -      -
Post-BIND Local         History / Catalog NO   -      -
Pre-BIND Prod-Baseline  Export  / DBRM  (*) YES  -      N      N      N
+-----+-----+-----+-----+-----+-----+-----+
! ----- RUNSTATS Rescue ----- ! N      N      N
! Command ==> ----- ! N      -      N
! Primary cmd: END ! N      -      -
!
! S Setup RUNSTATS Rescue
! - Extract statistics from production DB2 catalog
! - Prepare RUNSTATS Rescue - Dynamic
! - Prepare RUNSTATS Rescue - Static
S ! - Generate RUNSTATS Rescue batch job
!
! RUNSTATS Rescue Autonomic ACTIVE
!
NO !
+-----+-----+-----+-----+-----+-----+-----+
! 1 copy tables.
```



Use the first
option to
directly
access the RR
setup

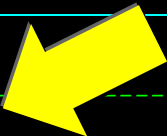
RUNSTATS Rescue – setup

```
ImpactExpert for DB2 z/OS ----- RUNSTATS Rescue Settings ----- Setting 1 from 4
Command ==> _____ Scroll ==> CSR
DB2: QB1A

Primary cmd: END, CAN(cel), F(ilter), T(ext on/off), L(ocate) setting
Line cmd: S(elect), R(eset to DEFAULT)

Profile: HEINRIC Creator . .: HEINRIC
Description: Default profile for IQA

Category Setting Value Valid Input
-----
BIX RUNSTATS Rescue
  USE GDG FILES Y Y/N
  GDG NAME SETEST.. CHAR(35)
  VSAM PREFIX FOR RUNSTATS RESCUE SETEST.. CHAR(33)
  SHOW CATALOG BROWSER Y Y/N
-----
```



**A GDG is
perfect for a
stats history**

RUNSTATS Rescue – statistics repository

```
ImpactExpert for DB2 z/OS ----- RUNSTATS Rescue Settings ---- Setting 1 from 4
Command ==> CSR
DB2: QB1A

Primary cmd: END, CAN(cel), F(ilter), T(ext on/off), L(ocate) setting
Line cmd: S(elect), R(eset to DEFAULTT)
```

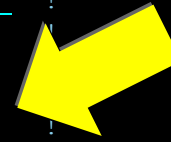
```
Profile: HEINRIC Creator . .: HEINRIC
Description: Default profile for IQA
```

Category	Setting	Value	Valid Input
----------	---------	-------	-------------

BIX RUNSTATS Rescue

```
+-----+
! ----- RUNSTATS Rescue ----- !
! Command ==>                      !
! Primary cmd: END                  !
!                                  !
! Setup RUNSTATS Rescue             !
! S Extract statistics from production DB2 catalog !
! - Prepare RUNSTATS Rescue - Dynamic !
! - Prepare RUNSTATS Rescue - Static  !
! - Generate RUNSTATS Rescue batch job !
!                                  !
! RUNSTATS Rescue Autonomic ACTIVE  !
!                                  !
+-----+
```

**RR generates
the job to
maintain the
repository**



RUNSTATS Rescue – statistics repository

```
ImpactExpert for DB2 z/OS ----- RUNSTATS Rescue Settings ---- Setting 1 from 4
+-----+
! ImpactExpert for DB2 z/OS ----- Jobcard ----- !
! Command ==> _____ !
!
! The following jobcard is used. Type in your changes. !
!
! //&JOBNAME JOB (),CLASS=A,NOTIFY=&SYSUID
! //*
! //*
! //*
! //*
! //*
! //*
! //*
! //*
! //*
! //*
!
! STEP ACCT : _____
!
+-----+
```

**Verify your
jobcard to
maintain the
statistics
repository**

RUNSTATS Rescue – statistics repository

```
ImpactExpert for DB2 z/OS ----- Change Data -----
EDIT      SYS16200.T134620.RA000.HEINRIC.R0118781      Columns 00001 00072
Command ==> _____ Scroll ==> CSR
000125 </PROD-SIM>
000126 //REPRO2 EXEC PGM=IDCAMS,COND=(0,LT)
000127 //SYSPRINT DD SYSOUT=*
000128 //SYSIN DD *
000129 REPRO INFILE(IN) OUTFILE(OUT)
000130 //IN DD DISP=SHR,
000131 // DSN=SETEST.BIX-RR.CATSTTS.STATS
000132 //OUT DD DISP=(,CATLG),SPACE=(CYL,(50,10
000133 // DCB=(RECFM=VB,LRECL=8500),
000134 // DSN=SETEST.BIX-RR.STATS(+1)
000135 //BIX6RSCG EXEC PGM=BIX6RSCG,
000136 // PARM=('QB1A,IOAP060B,IOA0610B,Y,N')
000137 //STEPLIB DD DISP=SHR,DSN=SE.PRODUCT.PTF0010A0610.QB1A.LOAD
000138 // DD DISP=SHR,DSN=SE.CATSTTS.STATS
000139 // DD DISP=SHR,DSN=SE.CATSTTS.STATS
000140 // DD DISP=SHR,DSN=SE.CATSTTS.STATS
000141 //BIXGDG DD DISP=SHR,DSN=SE.CATSTTS.STATS
000142 //BIXPROT DD SYSOUT=*
000143 //BIXINPUT DD *
000144 //SYSOUT DD SYSOUT=*
000145 //ERRORLOG DD SYSOUT=*
000146 //SEDYNSQL DD SYSOUT=*
000147 //
***** Bottom of Data *****
```

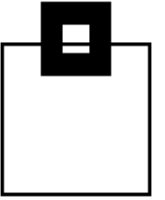
Using a GDG is a simple way to keep n generations of statistics. In z/OS 2.2 the limit was raised from 255 -> 999

RUNSTATS Rescue procedure

Schedule RR-batch job to maintain a history of optimizer relevant statistics (using a GDG).

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- **Specify since when it degraded**
 - RR checks if a RUNSTATS was executed since then and shows the details per object
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 - Extract the stats from its repository
 - Rescue the stats



RUNSTATS Rescue – dynamic SQL

```
ImpactExpert for DB2 z/OS ----- RUNSTATS Rescue Settings ---- Setting 1 from 4
Command ==> Scroll ==> CSR
DB2: QB1A

Primary cmd: END, CAN(cel), F(ilter), T(ext on/off), L(ocate) setting
Line cmd: S(elect), R(eset to DEFAULT)

Profile: HEINRIC Creator . .: HEINRIC
Description: Default profile for IQA

Category
Setting Value Valid Input
-----
BIX RUNSTATS Rescue
+-----+
! ----- RUNSTATS Rescue ----- !
! Command ==> ----- !
! Primary cmd: END !
! !
! - Setup RUNSTATS Rescue !
! - Extract statistics from production DB log !
! S Prepare RUNSTATS Rescue - Dynamic !
! - Prepare RUNSTATS Rescue - Static !
! - Generate RUNSTATS Rescue batch job !
! !
! RUNSTATS Rescue Autonomic ACTIVE !
! !
+-----+
```

RUNSTATS Rescue – dynamic SQL

```
ImpactExpert for DB2 z/OS ----- RUNSTATS Rescue Settings ----- Setting 1 from 4
C +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
! ----- Prepare RUNSTATS Rescue - Dynamic ----- !
P !
L ! PLAN_TABLE OWNER : HEINRIC
!
P ! EXPLAIN QUERYNO :
! or
! TIMESTAMP FROM : 2014-01-01-00.00.00
! TIMESTAMP TO : 2016-12-31-00.00.00
!
! If QUERYNO is left blank the range of TIMESTAMPS
! will be used to identify the EXPLAIN data.
!
!
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
VSAM PREFIX FOR RUNSTATS RESCUE SETEST.. CHAR(33)
SHOW CATALOG BROWSER Y Y/N
```

**To map a STMT
against table(s) to
associated table-
/indexspaces explain
data is key**

RUNSTATS Rescue – static SQL

```
ImpactExpert for DB2 z/OS ----- Main Menu ----- Version 6.10
C +-----+-----+-----+-----+-----+-----+ B2: QA1B
! ----- Prepare RUNSTATS Rescue - Static ----- ! e: +
P !
L ! COLLECTION : MDB2VNEX_TEST + !
! PACKAGE : O2DB7X + !
! VERSION : + ! RDA VOX
! STATEMENT NO : * (All statements) / StmtNo ! --- ---
!
! REBIND ALL? : Y N(o - REBIND only specified package) ! -
! Y(es - REBIND all depending packages) ! -
!
! Note: VERSION is optional and if not given the last bound ! -
! version will be used. ! N
!
!
+-----+-----+-----+-----+-----+-----+
Local APAR Check Static Catalog YES
Local APAR Check Dynamic DynStmtCache YES
```

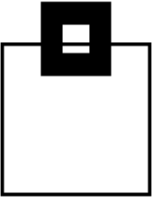
**To map static SQL the
Collection, Package,
and Statement
number are key**

RUNSTATS Rescue procedure

Schedule RR-batch job to maintain a history of optimizer relevant statistics (using a GDG).

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RUNSTATS Rescue – dynamic SQL

```
ImpactExpert for DB2 z/OS ----- Tables of Explained SQL ----- Table 1 from 4
Command ==> _____ Scroll ==> CSR
MODE: DB2: QB1A
Primary cmd: END, CAN(cel), Z(oom), L(ocate) creator
Line cmd: C(olumns), D(atabase), I(ndexes), L(CoLdist), P(artitions),
T(ablespace), Z(oom)
```

Creator	+	Name	+	Database	Tablespace	Statstime	+
IQA061QB		IQATI004		IQAD06QB	IQASI004	2016-07-18-13.51.33	
IQA061QB		IQATI006		IQAD06QB	IQASI006	2016-07-18-13.51.29	
IQA061QB		IQATI007		IQAD06QB	IQASI007	2016-07-18-13.51.27	
IQA061QB		IQATI009		IQAD06QB	IQASI009	2016-07-18-13.51.22	

VSAM PREFIX FOR RUNSTATS RESCUE SELEST.. CHAN

SHOW CATALOG BROWSER Y Y/N

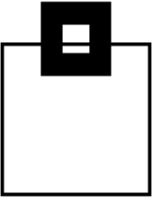
The determined spaces are shown

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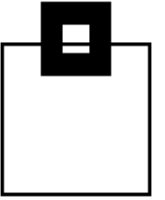


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RUNSTATS Rescue – dynamic SQL

```
ImpactExpert for DB2 z/OS ----- LINE 00000001 COL 001 080
Command ==>
Press END to continue

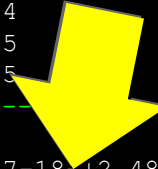
-----
Timestamp of GDG generation : 2016-07-18-13.49.25.570000
Dataset of GDG generation : SETEST.BIX-RR.STATS.G0002V00
Specified search timestamp : 2016-07-18-13.50.00.000000
Determined minimum statstime: 2016-07-18-13.51.22.065344
Determined maximum statstime: 2016-07-18-13.51.33.036285
Determined maximum create TS: 2016-06-27-13.40.17.365875
-----

Queryno :      11111          EXPLAIN_TIME : 2016-07-18-12.48.24.460000

Tablespace IQAD06QB.IQASI009      Statstime : 2016-07-18-13.51.22.065344
Table IQA061QB.IQATI009          Statstime : 2016-07-18-13.51.22.065344
                                Created : 2016-06-27-13.40.17.146617
- Index IQA061QB.IQAXI0091        Statstime : 2016-07-18-13.51.22.065344
  Indexspace: IQAD06QB.IQAXI009   Created : 2016-06-27-13.40.17.365875

+-----+
! RSCU002B Either object(s) with statstime greater than the specified time !
! found or recreated object(s) with created timestamp greater than the    ! --
! specified time found.                                                    !
+-----+
```

**RR transparently
shows which object
was RUNSTATED**

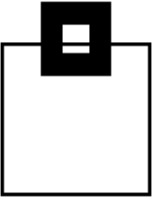


RUNSTATS Rescue procedure

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- Specify since when it degraded
 - RR checks if a RUNSTATS was executed since then and shows the details per object
 - RR verifies potential object (re-) creation within the timeframe
- **RR generates jobs to**
 - **Extract the stats from its repository**
 - Rescue the stats



RUNSTATS Rescue – dynamic SQL

```
ImpactExpert for DB2 z/OS ----- LINE 00000001 COL 001 080
C +-----+ o11 ==> PAGE
P ! ----- Confirm GDG Generation ----- ! DB2: QB1A
! !
- ! S Use file SETEST.BIX-RR.STATS.G0002V00 ! -----
T ! of 2016-07-18-13.49.25.570000 !
D !
S ! _ Select GDG generation from list !
D !
D !
D +-----+
```

```
Queryno : 11111 EXPLAIN_TIME : 2016-07-18-12.48.24.460000
```

```
Tablespace IQAD06QB.IQASI009 Statstime : 2016-07-18-13.51.22.065344
Table IQA061QB.IQATI009 Statstime : 2016-07-18-13.51.22.065344
Created : 2016-06-27-13.40.17.146617
- Index IQA061QB.IQAXI0091 Statstime : 2016-07-18-13.51.22.065344
Indexspace: IQAD06QB.IQAXI009 Created : 2016-06-27-13.40.17.365875
```

```
Queryno : 2773 EXPLAIN_TIME : 2016-07-18-12.51.12.260000
```

```
Tablespace IQAD06QB.IQASI009 Statstime : 2016-07-18-13.51.22.065344
Table IQA061QB.IQATI009 Statstime : 2016-07-18-13.51.22.065344
Created : 2016-06-27-13.40.17.146617
```

**RR automatically
selects the right
Stats for fallback,
but an override
option is available
as well**

RUNSTATS Rescue – dynamic SQL

ImpactExpert for DB2 z/OS ----- LINE 00000001 COL 001 080

```
+-----+
! ImpactExpert for DB2 z/OS ----- Jobcard ----- !
! Command ==> _____ !
!
! The following jobcard is used. Type in your changes. !
!
! //&JOBNAME JOB (),CLASS=A,NOTIFY=&SYSUID
! //*
! //*
! //*
! //*
! //*
! //*
! //*
! //*
! //*
! //*
!
! STEP ACCT : _____
!
!
+-----+
```

**Verify your
jobcard for
statistics
restore**

Queryno : 2773 EXPLAIN_TIME : 2016-07-18-12.51.12.260000

Tablespace IQAD06QB.IQASI009	Statstime : 2016-07-18-13.51.22.065344
Table IQA061QB.IQATI009	Statstime : 2016-07-18-13.51.22.065344
	Created : 2016-06-27-13.40.17.146617

RUNSTATS Rescue – dynamic SQL

```
ImpactExpert for DB2 z/OS ----- Change Data -----
EDIT      SYS16200.T134620.RA000.HEINRIC.R0118781      Columns 00001 00072
Command ==> _____ Scroll ==> CSR
000106 //      DD DISP=SHR,DSN=CEE.SCEERUN
000107 //      DD DISP=SHR,DSN=DSNB10.SDSNEXIT.QB1A
000108 //      DD DISP=SHR,DSN=DSNB10.SDSNLOAD
000109 //SYSOUT DD SYSOUT=*
000110 //ERRORLOG DD SYSOUT=*
000111 //BIXINPUT DD DISP=OLD,DSN=*.REPRO.IN1
000112 //PDB2OUT DD SYSOUT=*,RECFM=FBA
000113 //PDB2RUNI DD DISP=OLD,DSN=SETEST.BIX-RR.STATS.GDG
000114 //PDB2RUNO DD DISP=OLD,DSN=SETEST.BIX-RR.CATSTTS.RESCUE
000115 //PDB2IN DD *
000116 <PROD-SIM>
000117 <DB2-SYSTEM ALIAS-CREATOR="IQA061QB"
000118 CATALOG-CREATOR="SYSIBM"
000119 GTT-IX-BPOOL="BP0"
000120 >
000121 </DB2-SYSTEM>
000122 </PROD-SIM>
000123 //PDB2TSIN DD *
000124 IQAD06QB.IQASI004
000125 IQAD06QB.IQASI006
000126 IQAD06QB.IQASI007
000127 IQAD06QB.IQASI009
000128 //
***** Bottom of Data *****
```

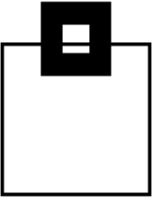
**Extract job is
tailored for
execution**

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- RR generates jobs to
 - Extract the stats from its repository
 - **Rescue the stats**



RUNSTATS Rescue – dynamic SQL

```
ImpactExpert for DB2 z/OS ----- LINE 00000001 COL 001 080
Command ==>                               Scroll ==> PAGE
Press END to continue                      DB2: QB1A
```

```
-----
Timestamp of GDG generation : 2016-07-18-13.49.25.570000
Dataset of GDG generation : SETEST.BIX-RR.STATS.G1002V01
Specified search timestamp : 2016-07-18-13.50.00.000000
Determined minimum statstime: 2016-07-18-13.51.22.065344
Determined maximum statstime: 2016-07-18-13.51.33.036285
Determined maximum create TS: 2016-06-27-13.40.17.365875
-----
```

**RR not only Rescues
but also invalidates
the bad access path
from the DSC**

```
+-----+
Qu ! ----- RUNSTATS Rescue ----- ! .48.24.460000
! Command ==> !
Ta ! Primary cmd: END ! .51.22.065344
Ta ! ! .51.22.065344
! ! .40.17.146617
! - Setup RUNSTATS Rescue !
- ! - Extract statistics from production DB2 (stat) ! .51.22.065344
! - Prepare RUNSTATS Rescue - Dynamic ! .40.17.365875
! - Prepare RUNSTATS Rescue - Static !
-- ! S Generate RUNSTATS Rescue batch job ! -----
! !
Qu ! RUNSTATS Rescue Autonomic ACTIVE ! .51.12.260000
! !
Ta ! ! .51.22.065344
Ta +-----+ .51.22.065344
Created : 2016-06-27-13.40.17.146617
```


RUNSTATS Rescue – dynamic SQL

```
ImpactExpert for DB2 z/OS ----- Change Data -----
EDIT      SYS16200.T134620.RA000.HEINRIC.R0118781      Columns 00001 00072
Command ==> _____ CSR
000067 ALIAS-CREATOR=IQAD061QB
000068 //PDB2OUT DD SYSOUT=*,RECFM=FBA
000069 //PDB2RUNS DD DISP=SHR,DSN=SETEST.BIX-RR.CATSTTS.RESCUE
000070 //*-----
000071 //RUNSTATS EXEC PGM=DSNUTILB,REGION=32M,
000072 // PARM='QB1A,RSCURUNS'
000073 //STEPLIB DD DISP=SHR,DSN=DSNB10.SDSNEXIT.QB1A
000074 // DD DISP=SHR,DSN=DSNB10.SDSNLOAD
000075 //SYSPRINT DD SYSOUT=*
000076 //SYSIN DD *
000077 RUNSTATS TABLESPACE IQAD06QB.IQASI004
000078 UPDATE NONE REPORT NO
000079
000080 RUNSTATS TABLESPACE IQAD06QB.IQASI006
000081 UPDATE NONE REPORT NO
000082
000083 RUNSTATS TABLESPACE IQAD06QB.IQASI007
000084 UPDATE NONE REPORT NO
000085
000086 RUNSTATS TABLESPACE IQAD06QB.IQASI009
000087 UPDATE NONE REPORT NO
000088
000089 //
***** Bottom of Data *****
```

Runstats Rescue

**DSC invalidation by
UPDATE NONE**

RUNSTATS Rescue – static SQL

- Basically the same as dynamic but the starting data requirement is a package and/or a statement id
- From this basis the rest of RR is the same as dynamic apart from the final recover step where RR generates a REBIND instead of a RUNSTATS of course!



RUNSTATS Rescue summary I

- When you have 1000's of partitions on a multi tera-byte database - Without a tool you have no chance to react effectively!
- Buys much-needed time during critical events
- Cost-effective and time-saving
- Identifies whether or not RUNSTATS was guilty (ZPARM, SQL New Release, or Bufferpool etc.)



RUNSTATS Rescue summary II

- Complements IBM-Plan Management where it does not work (any changed object e.g. views, dynamic SQL)
- Saves statistics and recovers back to them using a simple, guided semi-automatic process
- Helps to automate a rescue process
- Guarantees stable Access Paths for Dynamic as well as Static SQL in Db2 11 & 12 and not just for your “Top 10 or 20”



REWE GROUP – AT HOME IN TRADE AND TOURISM

As one of the leading trade and tourism groups in Europe, REWE Group is a constant companion in life – whether it is for daily food shopping, DIY and garden products or the next holiday.

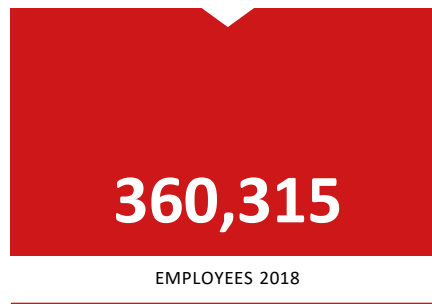
REWE Group comprises REWE and BILLA supermarkets and consumer markets, the discounters PENNY, toom Baumarkt DIY stores and BIPA drugstores.

DER Touristik Group, as the tourism division of REWE Group, is one of Europe's leading travel and tourism groups. It relies on brand diversity, meets customer wishes individually and is driving forward its own digitisation strategy.



SUCCESSFUL IN GERMANY AND EUROPE

REWE Group in figures:



ACTIVE IN 22 EUROPEAN COUNTRIES WITH STORES AND TRAVEL AGENCIES

in Germany and the following countries:

AUSTRIA BILLA, MERKUR, PENNY, BIPA, ADEG, DERTOUR, JAHN REISEN, MEIERS WELTREISEN, ADAC REISEN, BILLA REISEN · **BELGIUM** KONING AAP · **BULGARIA** BILLA · **CROATIA** BIPA · **CZECH REPUBLIC** BILLA, PENNY, DERTOUR, JAHN REISEN, MEIERS WELTREISEN, ITS BILLA TRAVEL, EXIM HOLDING · **DENMARK** APOLLO · **FINLAND** APOLLO · **FRANCE** KUONI · **GREAT BRITAIN** KUONI · **HUNGARY** PENNY, DERTOUR, JAHN REISEN, MEIERS WELTREISEN, ITS BILLA TRAVEL, EXIM HOLDING · **ITALY** PENNY · **LITHUANIA** IKI · **NETHERLANDS** PRIJSVRIJ.NL · **NORWAY** APOLLO · **POLAND** DERTOUR, JAHN REISEN, MEIERS WELTREISEN, ITS BILLA TRAVEL, EXIM HOLDING · **ROMANIA** PENNY · **RUSSIA** BILLA · **SWEDEN** APOLLO · **SWITZERLAND** KUONI, HELVETIC TOURS, ITS COOP TRAVEL · **SLOVAKIA** BILLA, DERTOUR, JAHN REISEN, MEIERS WELTREISEN, ITS BILLA TRAVEL, EXIM HOLDING · **UKRAINE** BILLA



REWE GROUP AT A GLANCE

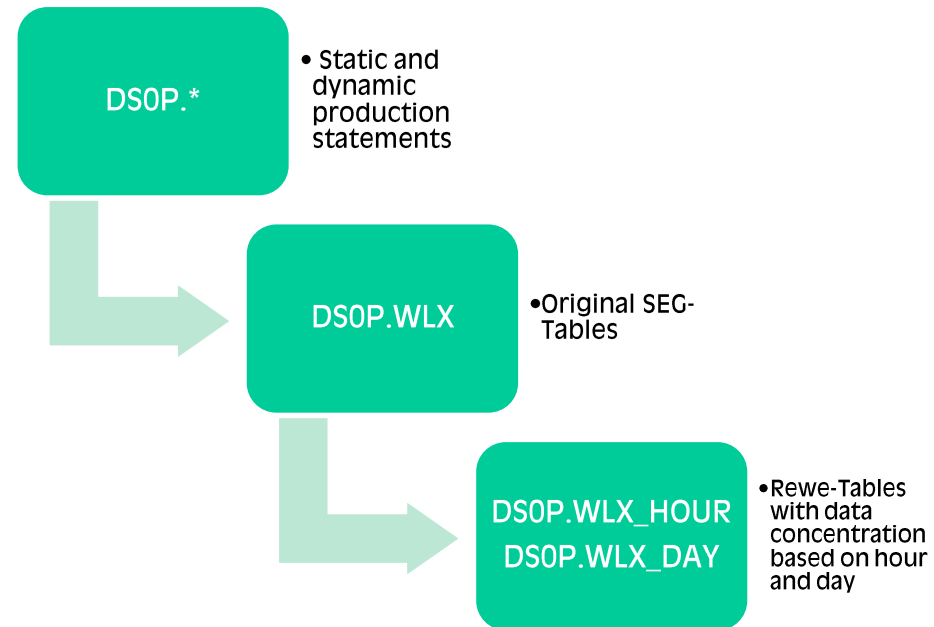
RETAIL GERMANY	      
	   
RETAIL INTERNATIONAL	       
DIY STORE	 
TRAVEL AND TOURISM	                  
OTHER	       

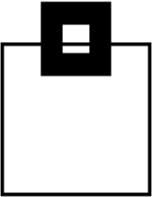
	2015	2020
Hardware	2 x EC12	1 x EC13, 1 x EC14
LPAR	12	12
Data-Sharing-Group	1	2
Data-Sharing-Member	20	15 / 2
Tables	25,000	30,000
Table Creators	530	645
Tables distinct	6,000	7,500
Plans	350	357
Packages	130,000	132,000
Packages distinct	13,000	13,400
Package Statements	3,000,000	3,500,000
Dynamic Statements	??	1,400,000

REWE-SYSTEMS – AGGREGATION OF A DAILY WORKLOAD

	Dynamic	Static
Statements distinct	1,400,000	65,000
Executions	6,000,000,000	24,000,000,000
CPU	382 Hours	135 Hours
Elap	1,598 Hours	453 Hours
Getpage	217,000,000,000	76,000,000,000

Workload from the 30th March 2020 as gathered by SEG-WLX





REWE-SYSTEMS – SEG-WLX-OUTPUT TOP 10 (SPLIT BY APPLICATION - CLASSIC)

DB2 WLX-DATEN VON MONTAG 30.03.2020

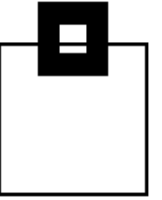
BEZEICHNUNG	CPU-ZEIT	LAUF-ZEIT	GETPAGES	ROWS-PROCESSED	EXECUTIONS	WAIT-TIME
GESAMT:	511:46:22	2042:06:45	293.970.540.843	52.263.380.050	29.681.884.880	735:09:04
PRODUKT_ZAM	47:44:17	176:28:16	28.875.210.572	3.406.181.283	762.052.616	74:55:02
SELECT T4191.MBBK AS wwIdent, T4191.WVZ_LIEF_DAT AS wvzLief	3:33:07	4:30:00	2.447.023.548	1.250.298	59.621	3:15
SELECT T4100.MBBK, T4100.VORGANG_DATUM, T4100.VORGANG_NR, T4	3:17:15	9:08:53	1.458.034.156	165.588.483	176.327	2:14:33
SELECT t4902a.LP_MANDANT, t4902a.LP_BILANZST, t4902a.LP_BERE	2:06:22	2:46:53	578.636.037	1.539	29.661	1:29
SELECT mbbk , vorgangDatum , vorgangNr , gegenID , bewertArt	1:56:13	2:42:27	166.940.766	1.696.734	47.886	14:43
INSERT INTO RKWWC0.T4734_BO_BON_UMS (MBBK, ARTIKELNR, EINSTE	1:42:20	19:42:11	924.920.116	73.061.928	73.061.928	14:06:23
SELECT erg.bewertart, erg.streckembbk, erg.sblmbbk FROM (SE	1:35:03	2:13:54	460.715.086	2.128.237	46.470	12:05
SELECT mbbk as empfaengerID, vorgangDatum , vorgangNr AS vor	1:32:57	2:20:26	109.114.983	1.250.100	20.289	16:02
SELECT T4403.LIEFERANT_NR AS lieferantNummer, T1300.NAME AS	1:21:07	2:38:16	341.896.601	3.334.318	13.009	21:58
SELECT	1:05:02	2:27:50	269.071.437	11.090.856	69.002	56:41
SELECT T4190.MBBK ,T4190.WVZ_LIEF_NR ,T4190.WVZ_LIEF_DAT ,T4	1:04:07	3:07:17	889.914.790	74.012.780	428.073	1:38:29
PRODUKT_ZMOB	39:34:23	155:40:39	28.227.464.880	2.298.441.630	359.128.353	67:06:16
SELECT LISTUNGSBEREICH as listungsbereich , BAUSTEIN as baus	13:24:20	21:59:30	4.795.031.852	87.786.324	530.130	5:05
SELECT T4100.MBBK, T4100.VORGANG_DATUM, T4100.VORGANG_NR, T4	1:43:46	18:01:06	809.456.819	38.729.246	3.535.171	15:49:44
SELECT DISTINCT T4201.KOMM_KLAMMER_ID, T4100.NVE FROM rkwwc0	1:33:27	2:20:42	1.789.610.461	96.971	18.268	17:05
. . .						

- **Monitoring from**
 - **KPIs of a product or an application**
 - **KPIs of REWE „Standard Statements“**



REWE-SYSTEMS – SEG-RUNSTATS-RESCUE

- Current Runstats values are secured daily using the standard Runstats-Rescue job
 - It takes about 10 minutes to complete
 - We keep the data for one year
 - Regular training and testing for all nine DBAs
-
- ➔ Important fallback system to insure production keeps running smoothly
 - ➔ Only used twice so far – Once is enough...
 - ➔ Rescue took less than 30 minutes



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- ➔ Rescue took less than 30 minutes

- Possible enhancements:
 - Before the actual rescue, the ability to review the values that will be used (insert into sys-shadow?)
 - Backup the changed runstats value before doing the Rescue in case of a newer statstime

- If the timestamp when „everything was fine“ is unknown:
 - Display and Fallback to older disparate Runstats values (E.g. from two different days)

RUNSTATS Rescue @ DATEV



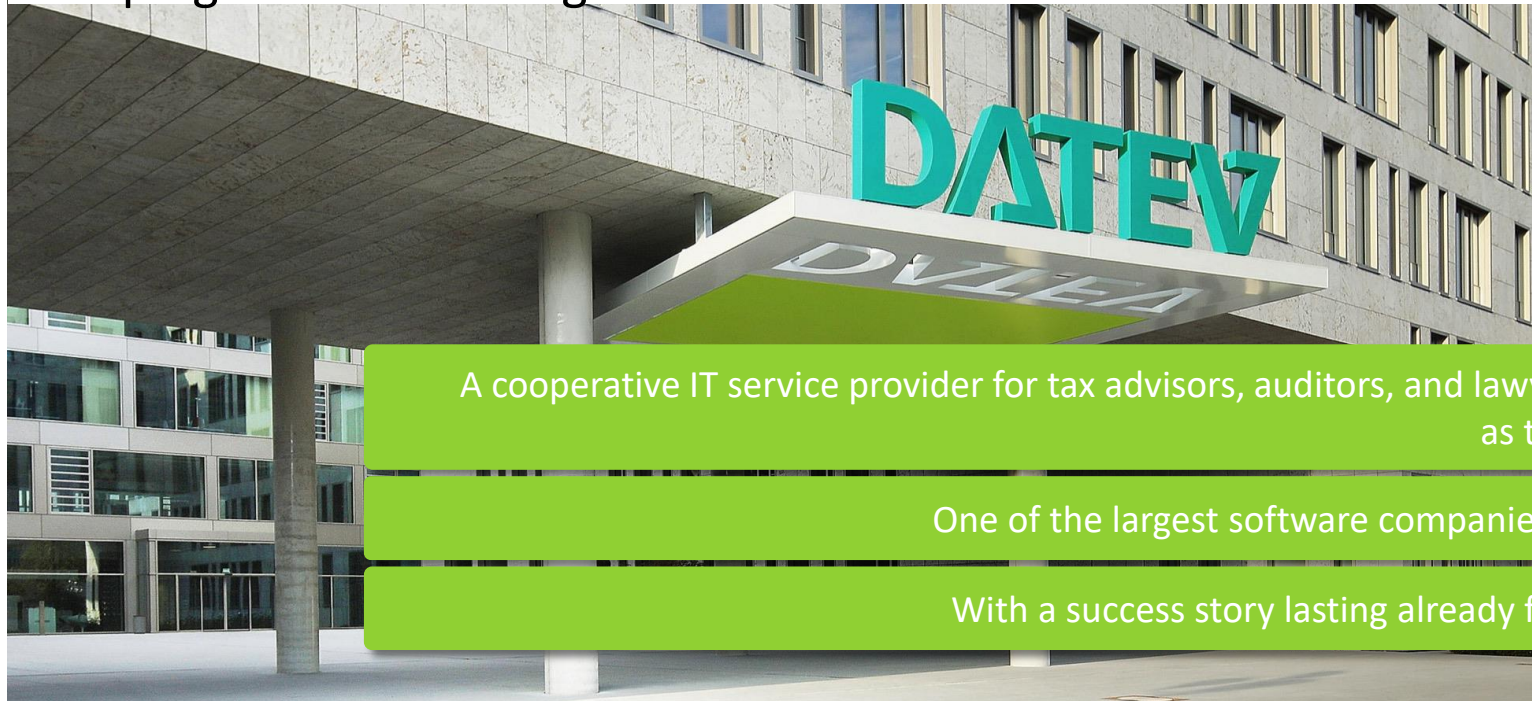
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Our Offer

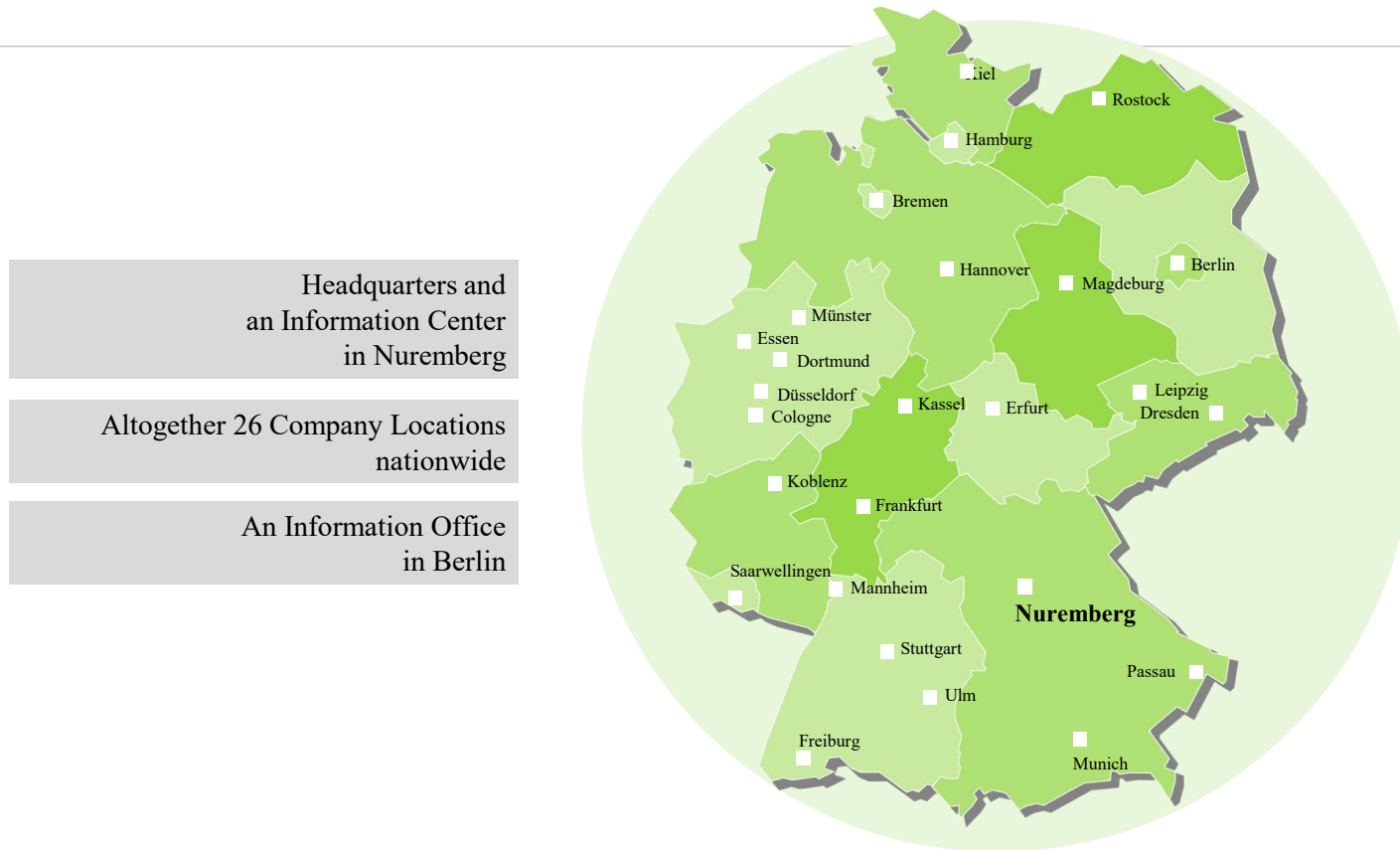


04.05.2020

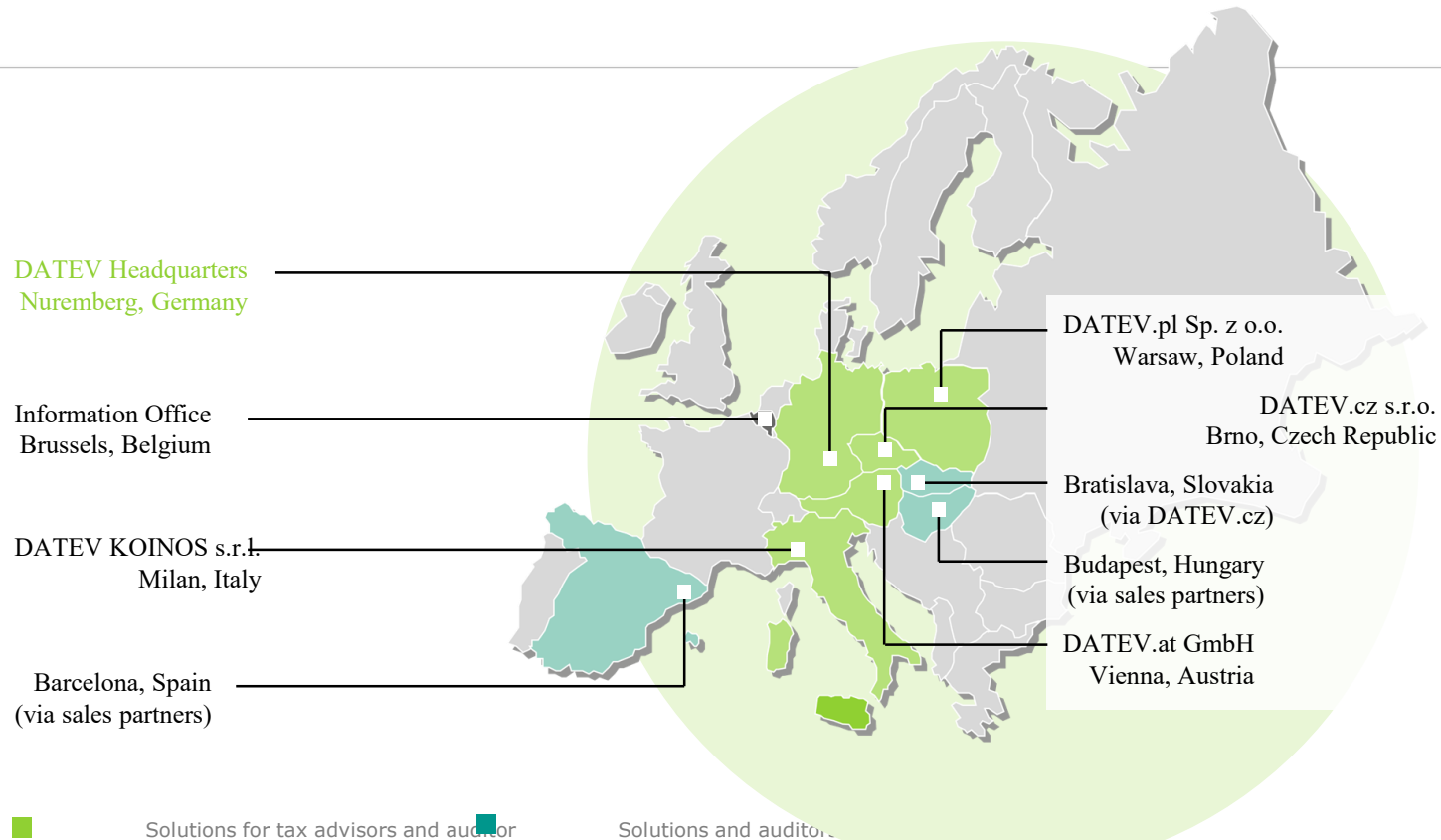
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DATEV eG On site throughout Germany



DATEV eG Cooperating throughout Europe

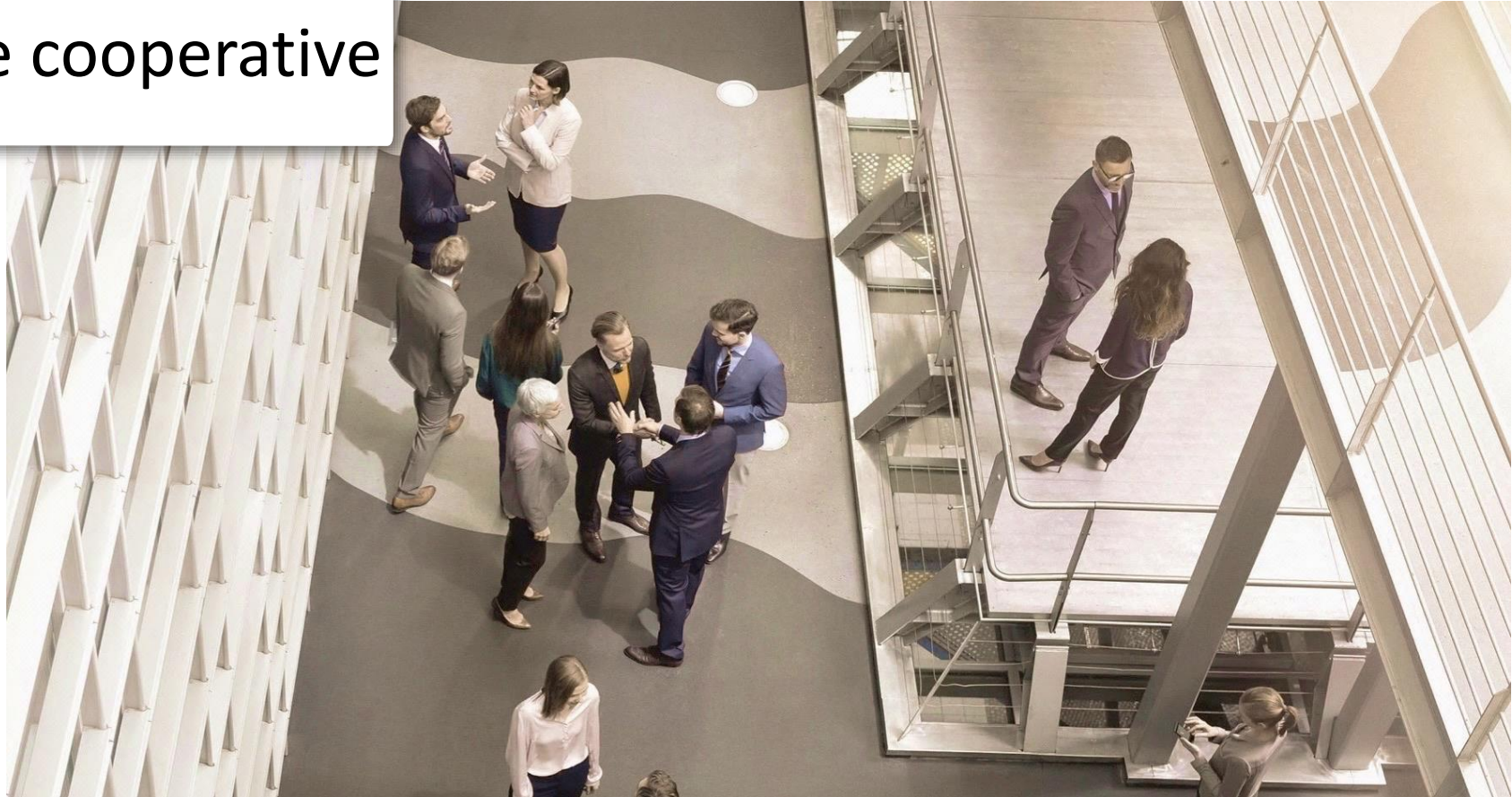


04.05.2020

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Seite 53

The cooperative



The cooperative

Our members



The cooperative Our sustainability

The cooperative
funding principle stands for
sustainability instead of short-term profit maximization

Economic



Ecological



Social



Why RUNSTATS Rescue?

- 2015: Negative experience with RUNSTATS
 - Performance degradation after RUNSTATS
 - RUNSTATS has no real „reset“ option
- DATEV-Workload: JDBC/dynamic SQL
 - DB objects with a complex topology
 - DATEV did quite some scientific research about RUNSTATS possibilities



Buy or Homegrown?

Market analysis at the end of 2015

- Exactly one tool in the market
- DATEV: not enough people to do it alone

→ Decision: Buy!



Case study RUNSTATS Rescue

- Two cases of RUNSTATS Reset in Membership management/Access control SQLs
 - CPU usage after RUNSTATS increased by a factor of 100
 - New RUNSTATS hat no effect
 - Elapsed time from alarm to reset: < 1 hour
- One case of suddenly occurring SQLCODEs -420



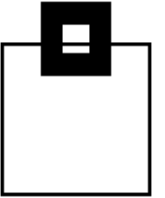
Lessons Learned

- Fast reset from statistics, especially for dynamic SQL, is very important
- New running of RUNSTATS does not always solve the problem
- Regular RUNSTATS Rescue training
- Exclude the just rescued objects from new RUNSTATS / REORG Jobs – Do not forget!
- RUNSTATS problems are not predictable
- Db2 V12 does not deliver a solution





Zukunft gestalten. Gemeinsam.



What we **GIVE**:

- 1) 90 days free trial – even in production
- 2) Two webinars covering installation and all pre-reqs
- 3) Two days – free of charge – onsite support
- 4) Offer of two days – free of charge – for potential realization of customer requests and enhancements

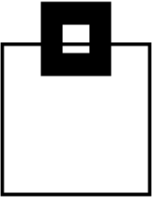


What we **TAKE**:

- 1) Your Real World Experiences
- 2) Your permission to use the gathered data in our presentations (Anonymous or, if you allow it, with your customer name)



Give and Take Program, Germany 2020



The 2020 Program offers:

January – March (1Q): Db2 11 + 12 Audit + SIEM (Security Information Event Management) with optional framework Eclipse or ZOWE



April – June (2Q): Access Path Recovery – The first participant of this program is the FiduciaGAD IT AG



July – September (3Q): Space Assurance – K-no-w your limits

October – December (4Q):  **Zowe** and SQL Workload Performance for Db2 11 & 12



Ready for the Future.

The IT Experts in the Cooperative Financial Network.



Diverse Target Markets

More than 1,100 customers and owners in four target markets are the basis of our successful business strategy.



Our Customers: Efficient and Effective

Our banking system improves our customers' level of competitiveness.

166,690 workstations in banks

over 7 m accounting entries per year

82.2 m active accounts

34,185 self-service terminals

500 m ATM cash withdrawals per year



Computer Center Performance

The performance of our four computer centers – More than just zeros and ones.

Performance



Virtual servers: **42,959**

Nine mainframe computers: **230,780 MIPS**

Mainframe transactions: **64,300m per year**

Utilized cartridge capacity: **53,284 Terabyte**

Mainframe storage: **4,468 Terabyte** / Open system storage: **21,305 Terabyte**



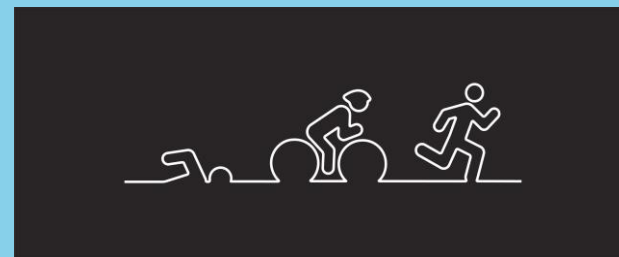
RUNSTATS management: An Iron Man Event?

We have recently had major problems with Access Paths changing after Db2 maintenance or migration. To make it even worse the problems do not appear on all systems so we have used “Dynamic Plan Stability” to stabilize a good access path. Then we copy over all the required data to where there is a bad access path and try to use an OPTHINT to get the good access path back.

These problems, just like history, keep repeating and further when application DBAs do a ROTATE partition we have to start all over again.

All this work is doable, and manageable, but it is a lot of work and there is lots of room for errors and mistakes.

RUNSTATS Rescue could offer us a new, quicker, simpler, faster and more reliable way to get back to good access paths without having to swim 4km, cycle 181km, and run 42km!

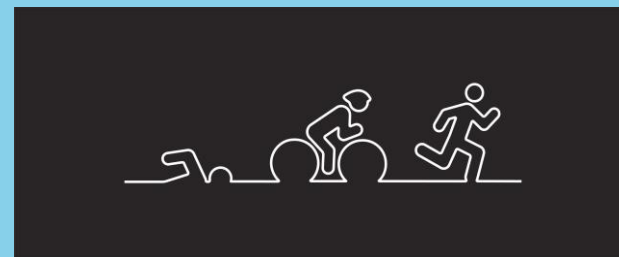


RUNSTATS management: An Iron Man Event?

Swim 4km

Dynamic Prefetch and Sequential Prefetch.

One Db2 subsystem completely killed with one SQL statement due to RID list failures.



RUNSTATS management: An Iron Man Event?

Cycle 181km

Dynamic Plan Stability in a very dynamic world! Trying to get “good” access paths and propagating them across Db2 systems is a real trial. It gets worse when the SQL you need is quickly flushed out of the Dynamic Statement Cache by batch jobs running in the background.



RUNSTATS management: An Iron Man Event?

Run 42km

Then you finish the cycling only to see someone ROTATE in front of you... All Your work is destroyed. It can even get worse when using query stability when the creator of the explain and the creator in the SYSQUERYPLAN do not match 100%



Questions???

Many thanks for your attention and now....

