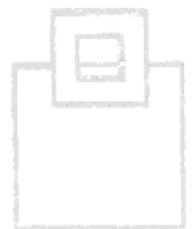
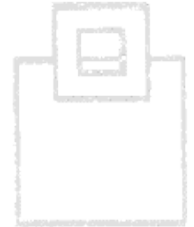
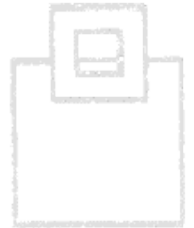


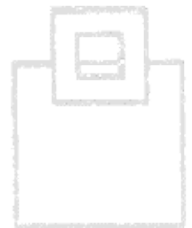
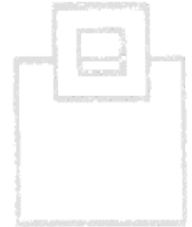
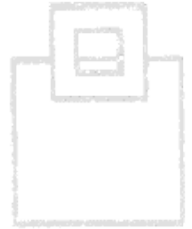
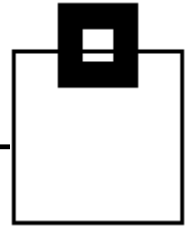
Access Path Recovery using 📁 **RUNSTATS Rescue for DB2 z/OS***



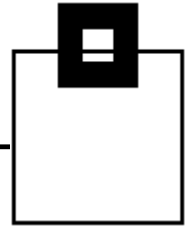
*this presentation focusses on dynamic SQL, however static is supported as well

RUNSTATS Rescue at a glance

- Add-on component to recover from bad RUNSTATS
- Keeps a stats repository and allows to consistently restore statistics
- Quick and easy to use
- Supports dynamic SQL out-of-the-box
- Supports static SQL when Plan Management fails:
 - BINDs resulting from modified programs
 - Schema changes
- Verifies RUNSTATs as the reason of performance degradations
- Cross checks affected objects



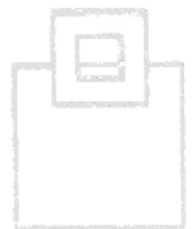
RUNSTATS Rescue procedure



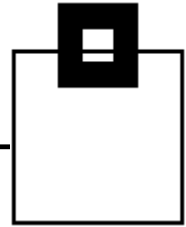
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 - flush the dynamic statement from the cache



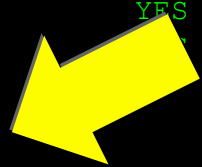
RUNSTATS Rescue



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

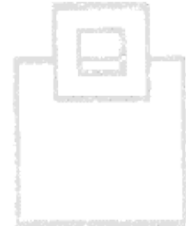
```
Primary cmd: END, S(ettings), C(leanup), F(filter Jobs), H(istory), A(bout), FAQ
Line cmd: S(elect), I(nfo), F(filter Jobs)
```

Scenario	Base / Recent	Dyn Expl	Migr. Rules	Convert Qual.	DRDA	VOX
REBIND Analysis	Catalog	YES	<u>N</u>	-	-	-
Pre-BIND Local	Catalog / DBRM	YES	-	-	-	-
Post-BIND Local	History / Catalog	NO	-	-	-	-
Pre-BIND Prod-Baseline	Export / DBRM (*)	YES	-	<u>N</u>	<u>N</u>	<u>N</u>
Post-BIND Prod-Baseline	Export / Catalog (*)	NO	-	<u>N</u>	<u>N</u>	-
Early Precheck Static	Export (*)	YES	<u>Y</u>	<u>N</u>	<u>N</u>	<u>N</u>
Early Precheck Dynamic	Export (*)	YES	<u>Y</u>	<u>N</u>	-	<u>N</u>
DSC Protection	Export (*)	YES	-	<u>N</u>	-	-
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	-	-	-	-	-

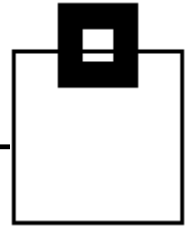


**Start
RUNSTATS
Rescue (RR)
from the
main menu**

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



RUNSTATS Rescue – setup



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

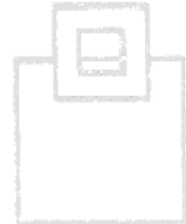
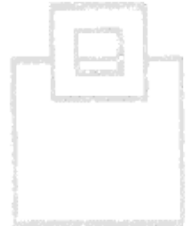
Primary cmd: END, S(ettings), C(leanup), F(filter Jobs), H(istory), A(bout), FAQ
Line cmd: S(elect), I(nfo), F(filter Jobs)

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
+-----+ 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.
```

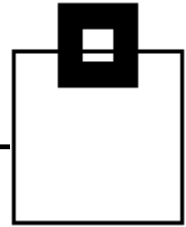


S Setup RUNSTATS Rescue

Use the first option to directly access the RR setup



RUNSTATS Rescue – setup



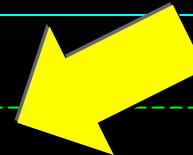
```
ImpactExpert for DB2 z/OS ----- RUNSTATS Rescue Settings ---- Setting 1 from 4
Command ==> _____ Scroll ==> CSR
                                         DB2: QB1A

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

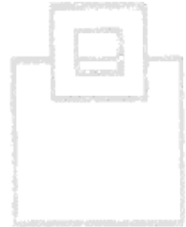
```
Profile: HEINRIC      Creator . .: HEINRIC
                   Description: Default profile for IQA
```

Category	Setting	Value	Valid Input

BIX RUNSTATS Rescue	USE GDG FILES	<u>Y</u>	Y/N
	GDG NAME	<u>SETEST..</u>	CHAR(35)
	VSAM PREFIX FOR RUNSTATS RESCUE	<u>SETEST..</u>	CHAR(33)
	SHOW CATALOG BROWSER	<u>Y</u>	Y/N



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



RUNSTATS Rescue – statistics reposit

```
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 TCA
```

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

BIX RUNSTATS Rescue

! ----- RUNSTATS Rescue -----

! Command ==>

! Primary cmd: END

! Setup RUNSTATS Rescue

! **S** Extract statistics from production DB2 catalog

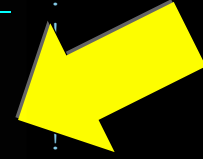
! Prepare RUNSTATS Rescue - Dynamic

! Prepare RUNSTATS Rescue - Static

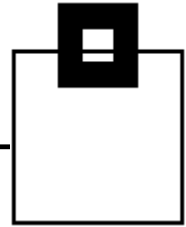
! Generate RUNSTATS Rescue batch job

! RUNSTATS Rescue Autonomic ACTIVE

RR generates the job to maintain the repository



RUNSTATS Rescue – statistics reposit



```
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

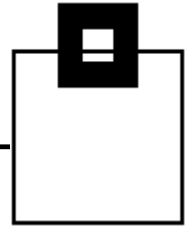


RUNSTATS Rescue – statistics reposit

```
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,IQAP06QB,IQA061QB,Y,N')
000137 //STEPLIB   DD DISP=SHR,DSN=SE.PRODUCT.PTFQB.IQA061QB(PTF)
000138 //           DD DISP=SHR,DSN=CEE.SCEERUN
000139 //           DD DISP=SHR,DSN=DSNB10.SDSNEXIT.QB1A
000140 //           DD DISP=SHR,DSN=DSNB10.SDSNLOAD
000141 //BIXGDG    DD DISP=SHR,DSN=*.REPRO2.OUT
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

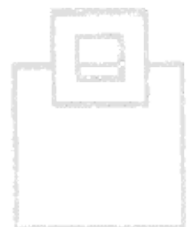
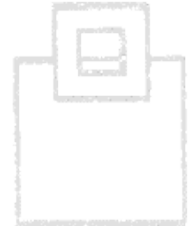
RUNSTATS Rescue procedure



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

If a (dynamic) SQL statement performs badly:

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 - flush the dynamic statement from the cache



RUNSTATS Rescue – dynamic SQL

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

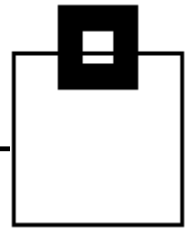
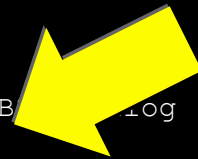
```
Primary cmd: END, CAN(ce), F(ilter), T(ext on/off), L(ocate) setting
Line cmd: S(elect), R(eset to DEFAULT)
```

```
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 !
! !
+-----+
```

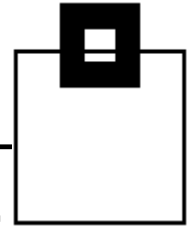


RUNSTATS Rescue – dynamic SQL

```
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(35)
SHOW CATALOG BROWSER Y I/N
```

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

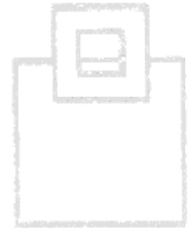
RUNSTATS Rescue procedure



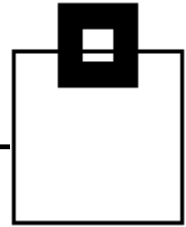
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RUNSTATS Rescue – dynamic SQL



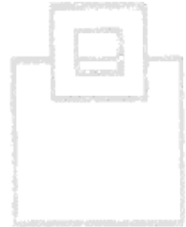
```
ImpactExpert for DB2 z/OS ----- Tables of Explained SQL ----- Table 1 from 4
Command ==> _____ Scroll ==> CSR
MODE: _____ DB2: QB1A
Primary cmd: END, CAN(ce), Z(oom), L(ocate) creator
Line cmd: C(olumns), D(atabase), I(ndexes), L(CoLdist), P(artitions),
T(ablespace), Z(oom)
```

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

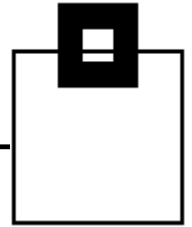
If desired

the spaces determined are shown

```
VSAM PREFIX FOR RUNSTATS RESCUE SEIES1.. CHAK
SHOW CATALOG BROWSER Y Y/N
```



RUNSTATS Rescue procedure



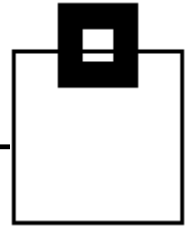
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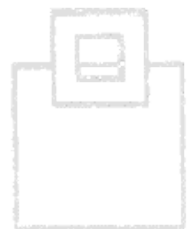
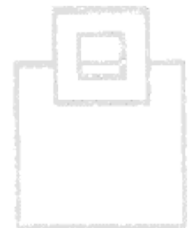
RUNSTATS Rescue procedure



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RUNSTATS Rescue – dynamic SQL

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

RR transparently shows which object was RUNSTATSed

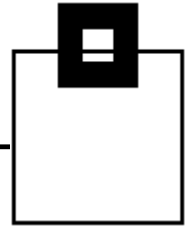
```
-----
Timestamp of GDG generation : 2016-07-18-13.49.25.570000
Dataset of GDG generation : SETEST.BIX-RR.STATS.G0002V00
Specified search timestamp : 2016-07-18-13.50.00.000000
Determined minimum statstime: 2016-07-18-13.51.22.065344
Determined maximum statstime: 2016-07-18-13.51.33.036285
Determined 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. !
+-----+
```

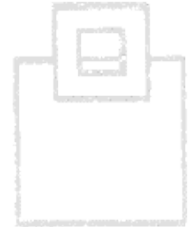
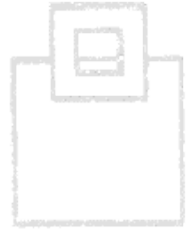
RUNSTATS Rescue procedure



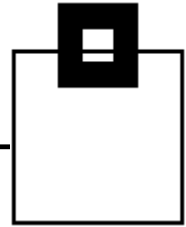
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 - RR verifies potential object (re-) creation in the timeframe
- **RR generates a job to**
 - **restore the stats from it's repository**
 - flush the dynamic statement from the cache



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 +-----+
```

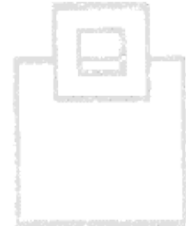


**S Use file SETEST.BIX-RR.STATS.G0002V00
of 2016-07-18-13.49.25.570000
_ Select GDG generation from list**

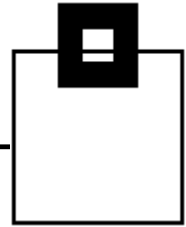
```
Queryno :      11111          EXPLAIN_TIME : 2016-07-18-13.48.24.460000
Tablespace IQAD06QB.IQASI009      Statstime : 2016-07-18-13.51.22.065344
Table IQA061QB.IQATI009          Statstime : 2016-07-18-13.51.22.065344
Created : 2016-06-27-13.40.17.146617
- Index IQA061QB.IQAXI0091        Statstime : 2016-07-18-13.51.22.065344
Indexspace: IQAD06QB.IQAXI009     Created : 2016-06-27-13.40.17.146617
```

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

```
Queryno :      2773          EXPLAIN_TIME : 2016-07-18-13.52.12.260000
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 ----- 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 : _____
!
+-----+
```

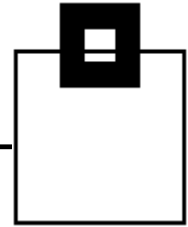
**Verify your
jobcard for
statistics
restore**



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

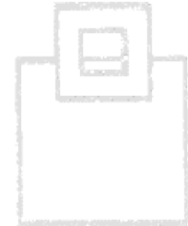
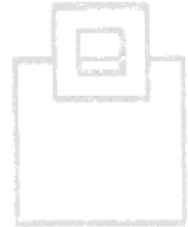
Tablespace IQAD06QB.IQASI009      Statstime : 2016-07-18-13.51.22.065344
Table IQA061QB.IQATI009          Statstime : 2016-07-18-13.51.22.065344
                                   Created      : 2016-06-27-13.40.17.146617
```

RUNSTATS Rescue – dynamic SQL

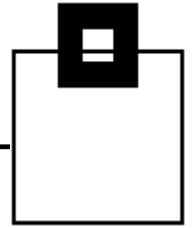


```
ImpactExpert for DB2 z/OS ----- Change Data -----
EDIT      SYS16200.T134620.RA000.HEINRIC.R0118781      Columns 00001 00072
Command ==> _____ Scroll ==> CSR
000106 //          DD DISP=SHR,DSN=CEE.SCEERUN
000107 //          DD DISP=SHR,DSN=DSNB10.SDSNEXIT.QB1A
000108 //          DD DISP=SHR,DSN=DSNB10.SDSNLOAD
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 *****
```

Restore job is tailored for execution



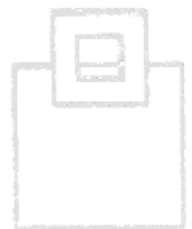
RUNSTATS Rescue procedure



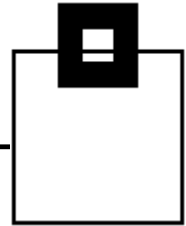
Schedule RR-batch job to maintain a history of optimizer relevant statistics (using a GDG).

If a (dynamic) SQL statement performs badly:

- Point RR on 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 in the timeframe
- **RR generates a job to**
 - restore the stats from it's repository
 - **flush the dynamic statement from the cache**



RUNSTATS Rescue – dynamic SQL

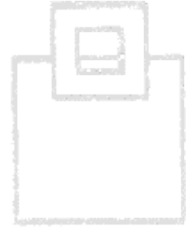
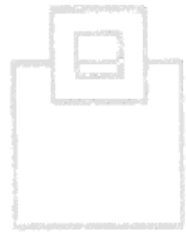


```
ImpactExpert for DB2 z/OS ----- LINE 00000001 COL 001 080
Command ==>                               Scroll ==> PAGE
Press END to continue                       DB2: QB1A
```

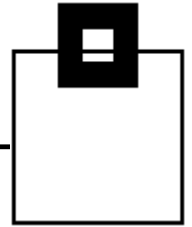
```
-----
Timestamp of GDG generation : 2016-07-18-13.49.25.57000
Dataset of GDG generation : SETEST.BIX-RR.S TATS.G0002V00
Specified search timestamp : 2016-07-18-13.50.00.00000
Determined minimum statstime: 2016-07-18-13.51.22.065344
Determined maximum statstime: 2016-07-18-13.51.13.136888
Determined maximum create TS: 2016-06-27-13.40.17.365875
-----
```

RR also generates a job to invalidate 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
! -- Setup RUNSTATS Rescue ! .40.17.146617
- ! -- Extract statistics from production DB2 data ! .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
```



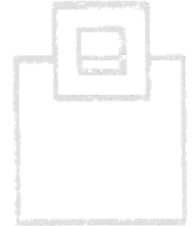
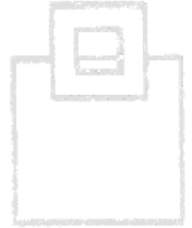
RUNSTATS Rescue – dynamic SQL



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

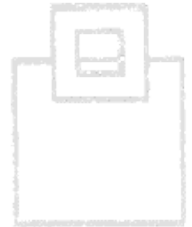
```
+-----+
! ImpactExpert for DB2 z/OS ----- Jobcard ----- !
! Command ==> _____ !
!
! The following jobcard is used. Type in your changes. !
!
! //&JOBNAME JOB (),CLASS=A,NOTIFY=&SYSUID _____ !
! //* _____ !
! //* _____ !
! //* _____ !
! //* _____ !
! //* _____ !
! //* _____ !
! //* _____ !
! //* _____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

**Verify your
jobcard for DSC
invalidation**

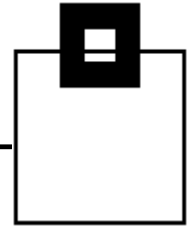


```
Queryno :          2773          EXPLAIN_TIME : 2016-07-18-12.51.12.260000

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
000067 ALIAS-CREATOR=IQA061QB
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 *****
```

**DSC invalidation by
RS UPDATE NONE**



RUNSTATS Rescue summary

- 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 simple, guided semi-automatic process
- Helps to automate a rescue process
- Works for both dynamic and static SQL
- Cost-effective and time-saving
- Buy much-needed time during critical events

