

DB2-z/OS Specific Enhancements to the SAP Dictionary



Applies to:

SAP Basis Releases 6.20, 6.40, 7.00, 7.01, and 7.10.

Summary

The article describes various DB2 for z/OS specific enhancements to the SAP Data Dictionary, in particular the automated usage of the REBUILD INDEX utility for all index creations and the support for range- and growth-partitioned universal table spaces.

Author: Dr. Bernd Kohler

Company: SAP AG, Germany

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Author Bio



Bernd Kohler is a development architect with SAP AG, Germany. He joined the DB2 for z/OS platform team in 1996 and has worked in a variety of development areas: dictionary, upgrade, installation, PTF check tool, and incremental migration.

Bernd holds a Ph.D. in Theoretical Physics from the Technical University, Berlin.

He can be reached at bernd.kohler@sap.com.

Table of Contents

I.	Introduction.....	3
II.	Requirements and Implementation.....	3
III.	Automated REBUILD INDEX.....	4
	Technical Details.....	4
	Use	5
	Activating the REBUILD INDEX feature	5
	Traces and Error Handling.....	6
IV.	Support of Universal Table Spaces	7
	General Information	7
	Partitioning a Table	7
V.	Additional Features	9
	Table Attributes.....	9
	Table Space Attributes.....	9
	Index Attributes.....	10
	Adjustment on Database.....	10
	Related Content.....	11
	Copyright.....	12

I. Introduction

The creation of new indexes has a considerable impact on down-time during imports and SPAM/SAINT activities. Using the utility REBUILD INDEX instead of a standard CREATE INDEX has many advantages:

- It is much faster, in particular if it runs in parallel.
- The statistic columns of the DB2 catalog are automatically updated.
- The REBUILD INDEX options provide a handle to optimize the index generation.

With the enhancements described in *Section III* it is now possible to use REBUILD INDEX for all index creations within the Data Dictionary (DDIC).

The remaining parts of this article cover further enhancements: *Section IV* describes the use of universal table spaces which were introduced with DB2 9 for z/OS, while *Section V* lists DB2 for z/OS storage attributes that have been added to transaction SE14.

II. Requirements and Implementation

To enable the new functions described in this article, proceed as follows:

- Apply the Support Packages and LIB_DBSL Patch Levels listed in Table 1. Note that the new functionality is also shipped with all Netweaver Enhancement Packages (7.01, 7.11, etc.).
- Ensure that the DSNUTILS stored procedures are set up as described in the *SAP DBA Guide: DB2 for z/OS*.

SAP Basis Release	LIB_DBSL Patch Level	Basis Support Package	Selection of Application Components based on SAP Basis Release
6.20	6.40/229	SAPKB62065	Web AS 6.20, BW 3.10, R3E 4.7x200, CRM 4.0
6.40	6.40/229	SAPKB64023	NW 04, ERP 2004, CRM 5.1, CRM 5.2, SCM 4.1, SRM 4.0, SEM 4.0
7.00	7.00/156	SAPKB70016	NW 7.0, ERP 6.0, CRM 5.0, SCM 5.0, SRM 5.0, CRM 2007, SCM 2007, SRM 2007
7.01	7.01/0	Included	NW 7.0 EHP1, ERP 6.0 EHP4, CRM 7.0, SCM 7.0, SRM 7.0
7.10	7.10/100	SAPKB71007	NW PI 7.10, NW Mobile 7.1, Banking Services 6.0

Table 1: Requirements

III. Automated REBUILD INDEX

Technical Details

Once the REBUILD INDEX functionality is switched on (see section *Use* below) all index creations triggered by DDIC activations, imports or SAINT/SPAM activities are handled as follows:

- 1) The index is created with storage attribute DEFER YES.
- 2) The utility REBUILD INDEX is called using the associated DSNUTILS stored procedure to physically build up the index.
- 3) The output of the utility is written to the developer trace of the work process which can be accessed with transactions ST11 or AL11 (directory DIR_HOME).

The screenshot displays the SAP configuration interface for 'DB2 Storage Attributes: Table'. The main window title is 'DB2 Storage Attributes: Table'. Below the title bar, there are navigation tabs: 'Jobs', 'Logs', 'Tablespace', and 'Indexes'. The 'Table' field is set to 'ZTEST' and the 'Source' is 'DBS'. The 'Location' section shows 'Database' as 'U130X0FD' and 'Tablespace' as 'ZTEST'. The 'Target Tablespace' section has four buttons: 'Single-Table', 'Partitioned', 'Multi-Table', and 'Existing'. The 'Automatic Rebuild Index' section has two rows: 'System-wide default' (NOT USED) and 'This table's indexes' (USED). The 'General Attributes' section includes fields for 'EDITPROC', 'AUDIT', 'NONE', 'VOLATILE', 'NO', and 'APPEND', 'NO'. The bottom status bar shows 'D5C (1) 000', 'isplp23', and 'INS'.

Figure 1: Screen *DB2 Storage Attributes: Table*

Use

As soon as the relevant LIB_DBSL patch and the Support Package (Table 1) are applied to the system, an additional screen area called *Automatic REBUILD INDEX* appears within the DB2 for z/OS specific part of transaction SE14 → *Edit* → *Storage parameters* (Figure 1). It offers the following options:

System-wide default

The first row *System-wide default* serves to administrate the system-wide setting of the REBUILD INDEX handling. It contains the following fields and buttons:

- The fields or indicate whether the system-wide usage of REBUILD INDEX is switched on or off.
- Button serves to switch on the system-wide usage of REBUILD INDEX for all index creations. If chosen, a popup appears which lets you specify the REBUILD INDEX options.
- Button serves to switch off the system-wide usage of the REBUILD INDEX feature.
- Button enforces the system-wide setting of REBUILD INDEX (switched on/off, options) for all indexes. All individual settings are switched off. For more information see section *This table's indexes* below.
- Button serves to modify the system-wide options.
- Button offers a direct link to **SAP Note [1158203](#)** which contains a short documentation and updates related to this feature.

This table's indexes

Within the second row labeled *This table's indexes*, individual REBUILD INDEX settings for the table displayed can be specified:

- The fields or indicate whether REBUILD INDEX is used or not used for the indexes of this table.
- Buttons and switch on/off the usage of the REBUILD INDEX for this table's indexes.
- If you choose , the individual table settings are overwritten by the system-wide default (switched on/off, options).
- Button serves to modify the REBUILD INDEX options for this table's indexes.

Activating the REBUILD INDEX feature

To use the REBUILD INDEX feature choose one of the button. The popup displayed in Figure 2 appears and lets you specify the REBUILD INDEX options to be used.

Choose the button. Subsequently, the status is switched to and the feature is activated.

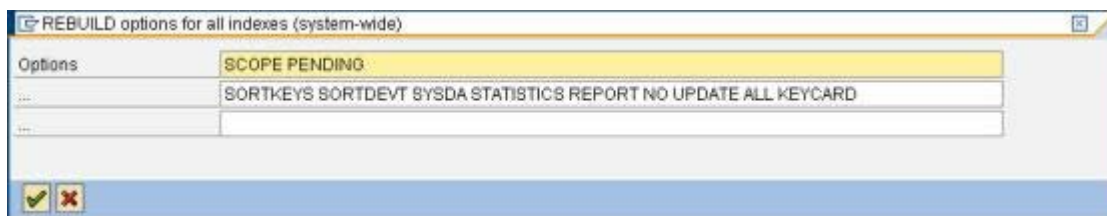


Figure 2: Popup to specify REBUILD INDEX options

Traces and Error Handling

The output of the utility REBUILD INDEX is written to the developer trace which is accessible using transaction ST11 (Figure 3). In case of an error, part of the utility output is also written to the standard SAP Dictionary log (Figure 4).

The screenshot shows a SAP Trace Data window titled 'Trace Data: isplp23_D5C_01 dev_w0'. The window contains a list of system messages from the REBUILD INDEX utility. The messages include the start of the utility, processing of SYSIN AS EBCDIC, and the execution of REBUILD INDEX(SAPR3."ZTEST~2") with a scope of PENDING SO. It also shows statistics reports for the unload phase and sort phase, indicating the number of records and keys. The utility execution is marked as complete with a highest return code of 0.

```

C
C Fri Oct 10 15:42:15 2008
C dbdb2dic.c 3853 DSNU000I 284 15:42:02.38 DSNUGUTC - OUTPUT START FOR UTILITY, UTILID = 00942212#CCW
C dbdb2dic.c 3853 DSNU1044I 284 15:42:02.54 DSNUGTIS - PROCESSING SYSIN AS EBCDIC
C dbdb2dic.c 3853 DSNU050I 284 15:42:02.55 DSNUGUTC - REBUILD INDEX(SAPR3."ZTEST~2") SCOPE PENDING SO
C dbdb2dic.c 3853 STATISTICS REPORT NO UPDATE ALL KEYCARD
C dbdb2dic.c 3853 DSNU555I -D5C0 284 15:42:05.52 DSNUCRUL - UNLOAD PHASE STATISTICS - NUMBER OF RECORDS
C dbdb2dic.c 3853 DSNU705I 284 15:42:05.54 DSNUCRIB - UNLOAD PHASE COMPLETE - ELAPSED TIME=00:00:02
C dbdb2dic.c 3853 DSNU394I -D5C0 284 15:42:09.05 DSNURBXC - SORTBLD PHASE STATISTICS - NUMBER OF KEYS=64
C dbdb2dic.c 3853 ST~2
C dbdb2dic.c 3853 DSNU391I 284 15:42:09.07 DSNUCRIB - SORTBLD PHASE STATISTICS. NUMBER OF INDEXES = 1
C dbdb2dic.c 3853 DSNU392I 284 15:42:09.07 DSNUCRIB - SORTBLD PHASE COMPLETE, ELAPSED TIME = 00:00:03
C dbdb2dic.c 3853 DSNU610I -D5C0 284 15:42:09.08 DSNUSUIP - SYSINDEXPART CATALOG UPDATE FOR SAPR3.ZTEST~2
C dbdb2dic.c 3853 DSNU610I -D5C0 284 15:42:09.09 DSNUSUCO - SYSCOLUMNS CATALOG UPDATE FOR SAPR3.ZTEST~2
C dbdb2dic.c 3853 DSNU610I -D5C0 284 15:42:09.09 DSNUSUIX - SYSINDEXES CATALOG UPDATE FOR SAPR3.ZTEST~2
C dbdb2dic.c 3853 DSNU610I -D5C0 284 15:42:09.11 DSNUSUCD - SYSCOLDIST CATALOG UPDATE FOR SAPR3.ZTEST~2
C dbdb2dic.c 3853 DSNU620I -D5C0 284 15:42:09.12 DSNUSEOF - RUNSTATS CATALOG TIMESTAMP = 2008-10-10-15.4
C dbdb2dic.c 3853 DSNU010I 284 15:42:09.15 DSNU6BAC - UTILITY EXECUTION COMPLETE, HIGHEST RETURN CODE=

```

Figure 3: REBUILD INDEX output within the developer trace

The screenshot shows a SAP Log display window titled 'Log display'. The log entry is for 'INDXZTEST2' and shows the execution of a CREATE TYPE 2 INDEX statement. The log includes the SQL statement and its parameters, followed by the execution time (DDL time) of 468 milliseconds. The log also shows several error messages: 'The SQL statement was not executed', 'Index could not be created completely in the database', and 'Index ZTEST-2 could not be created'. The final message is 'Request for ZTEST could not be executed'.

```

CREATE TYPE 2 INDEX "ZTEST~2" ON "ZTEST"
("AUTHOR" )
USING STOGROUP SAPU1I PRIQTY 16
SECQTY 2560 FREEPAGE 0 PCTFREE 10
GBPCACHE CHANGED
BUFFERPOOL BP8KB CLOSE NO COMPRESS YES
COPY NO PIECESIZE 2097152 K DEFER YES
NOT PADDED
|REBUILD INDEX (SAPR3."ZTEST~2") SCOPE PENDING SORTKEYS SORTDEVT SYSDA
STATISTICS REPORT NO UPDATE ALL KEYCARD
1DSNU000I 284 15:45:41.87 DSNUGUTC - OUTPUT START FOR UTILITY, UTI
LID = 00385068#EGB DSNU1044I 284 15:45:41.90 DSNUGTIS - PROCESSING
SYSIN AS EBCDIC DSNU050I 284 15:45:41.90 DSNU6PRS - REBUILD INDEX
(SAPR3."ZTEST~2") SCOPE PENDING SORTKEYS SORTDEVT SYSDA ST DSNU049I
284 15:45:41.90 DS
DDL time(__1): .....468 milliseconds
⚠ The SQL statement was not executed
⚠ Index could not be created completely in the database
⚠ Index ZTEST-2 could not be created
⚠ Request for ZTEST could not be executed

```

Figure 4: DDIC activation log with REBUILD INDEX error

IV. Support of Universal Table Spaces

General Information

With DB2 9 for z/OS, IBM introduced a new table space type called Universal Table Space (UTS) which is a combination of partitioned and segmented table space schemas. There are two flavors:

- **Range-partitioned universal table spaces** are based on ranges defined during creation (or alter).
- The use of **growth-partitioned universal table spaces** is similar to single-table segmented table spaces. However, with the new type, DB2 **automatically** adds a new partition when more space is needed to satisfy an insert.

Both table space types can hold up to 128TB and are fully supported once the required **Basis Support Packages** and **Patch Levels** (see Table 1) have been applied to the SAP system.

Partitioning a Table

To move tables to a universal table space, proceed as follows:

- 1) Call transaction SE14, specify table name, and choose *Edit* and *Storage Parameters*.
- 2) Within screen *DB2 Storage Attributes: Table* (Figure 1) choose *Display <--> Change*.
- 3) Within screen area *Target Tablespace* choose *Partitioned*. The popup displayed in Figure 5 appears.

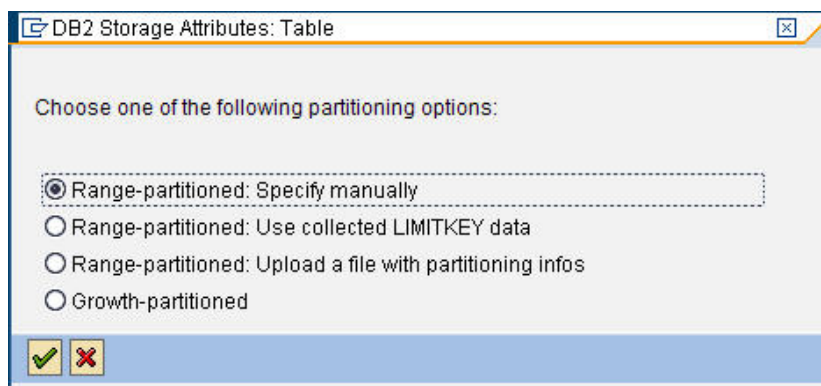


Figure 5: Popup with partitioning options

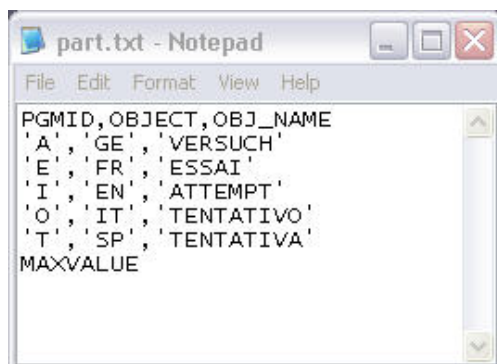


Figure 6: File with specification for range-partitioning

- 4) You have the following options:
- The first three options serve to specify the parameters of a **range-partitioned universal tablespace**. Particularly interesting is the third option which allows the upload of a file that contains the partitioning specifics. Figure 6 shows a sample input file. The first row contains the partitioning key. The remaining rows are filled with ordered ranges. The partition numbers are not specified. The uploaded information is automatically pasted into the respective input fields within screen area *Partitioning* (Figure 7).
 - The last option *Growth-partitioned* invokes the storage attributes for a **growth-partitioned universal table spaces**. The default value of parameter MAXPARTITIONS is 256.
- 5) If necessary, modify additional storage parameters (e.g. the tablespace attributes MAXPARTITIONS, DSSIZE or SEGSIZE). To access the related screens choose *Goto* → *Tablespace* or *Goto* → *Indexes*.
- 6) Choose *Save and Back*, thus returning to transaction SE14's main screen *ABAP Dictionary: Utility for Database Tables*.
- 7) Perform a table conversion using *Extras* → *Force conversion*.

Partitioning		
Partitions	6	
Key	PGMID, OBJECT, OBJ_NAME	
logic.	phys.	LimitKey
1	1	'A','GE','VERSUCH'
2	2	'E','FR','ESSAI'
3	3	'I','EN','ATTEMPT'
4	4	'O','IT','TENTATIVO'
5	5	'T','SP','TENTATIVA'
6	6	MAXVALUE

Figure 7: Screen area *Partitioning* after upload of file with partitioning information

V. Additional Features

Table Attributes

The screen area *General Attributes* on the screen *DB2 Storage Attributes: Table* (Figure 1) offers the following new parameters:

- **EDITPROC** allows the designation of a program as the edit routine of the table. This routine is invoked during the execution of LOAD, INSERT, UPDATE, and all row retrieval operations on the table. The feature can be used to encrypt the table's content (see SAP Note [1091859](#) for details). Note that each change of the structure of a table with edit routine (e.g. during the SAP upgrade or triggered by DDIC activities) causes a time-consuming table conversion.
- **VOLATILE YES/NO** switches the VOLATILE attribute. If set to YES, index access is used for SQL operations whenever this is possible.
- **AUDIT NONE/CHANGES/ALL** controls the table attribute AUDIT. This feature is only supported with DB2 9 for z/OS. For additional details, refer to IBM's *DB2 Version 9.1 for z/OS Administration Guide*. The default setting of the storage attribute AUDIT can be set with the profile parameter `dfs/db2/use_audit`.
- **APPEND YES/NO** specifies whether append processing is used for the table. The feature is only supported for DB2 9 for z/OS.

Table Space Attributes

On the screen *DB2 Storage Attributes: Tablespace*, the following parameters have been added. They are only visible with DB2 9 for z/OS:

- **LOG YES/NO** specifies whether changes that are made to the data in the specified table space are recorded in the log. **Note that the usage of attribute LOG NO is not supported for productive SAP systems.**
- **MAXPARTS [NR]** controls the MAXPARTITIONS parameter (for a partition-by-growth universal tablespace). The maximum value of [NR] depends on the page size (i.e. buffer pool) chosen.

The screenshot shows the SAP screen 'DB2 Storage Attributes: Tablespace'. At the top, there is a 'Jobs' icon. Below it, the 'Tablespace' is set to 'U130X0FD ZTESTX' and the 'Source' is 'REV' with a note 'Revised (not saved)'. The 'General Attributes' section includes: CLOSE (YES), MEMBER CL. (NO), LOG (YES), BUFFERPOOL (BP2), NUMPARTS (1), MAXPARTS (256), DEFINE (YES), LOCKPART (YES), SEGSIZE (28), and DSSIZE (4 GByte). The 'Space Parameters' section includes: Part (1), STOGROUP (SAPU1D), PRIQTY (232), SECQTY (2560), FP (empty), PCT (20), GBPCACHE (CHANGED), and COMPRESS (YES).

Figure 8: Screen *DB2 Storage Attributes: Tablespace*

Index Attributes

With DB2 9 for z/OS, the following adjustments become active on screen *DB2 Storage Attributes: Index*:

- For parameter **BUFFERPOOL**, you can specify buffer pools larger than 4K.
- **COMPRESS NO/YES** controls the COMPRESS setting. If set to YES, the buffer pool is automatically switched to BP8K0.

Adjustment on Database

To adjust one or more of the above parameters, proceed as follows:

- 1) Call transaction SE14, specify table name, and choose *Edit* and *Storage Parameters*.
- 2) Within screen *DB2 Storage Attributes: Table* choose *Display <--> Change*.
- 3) Modify the parameter(s). Navigate to associated indexes and table spaces if necessary.
- 4) Choose *Save* and *Alter in database*. If possible DDIC directly executes an ALTER statement.
- 5) If an online adjustment is not feasible, the error message "ALTER not possible" is displayed. This is for instance the case if you want to add or change an edit routine. In that case you have to execute a table conversion using transaction SE14 → *Edit* → *Extras* → *Force conversion*.

Related Content

The following references offer additional details and/or updates on the described functionalities:

- SAP Notes [407663](#) and [686905](#) (DDIC corrections 6.10 – 7.10)
- SAP Note [1158203](#) (Automatic REBUILD INDEX within DDIC)
- SAP Note [1091859](#) (Data Encryption)
- *SAP DBA Guide: DB2 for z/OS*
- *SAP Planning Guide: DB2 for z/OS*
- *IBM DB2 Version 9.1 for z/OS Administration Guide*

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