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Changes to the system catalog for DB2 Version 5

The DB2 catalog is contained in a single database, DSNDB06, and, as of Version 5, consists of 54 tables. These tables collectively describe the objects and resources available to DB2. With each new release of DB2, IBM modifies and tunes the DB2 catalog and directory structure. This is done to enable new capabilities, to extend the features of capabilities available in previous releases of DB2, and for various other tuning and/or performance reasons. DB2 V5 causes modifications to be made to older DB2 catalog tables, as well as adding new tables and indexes.

THE NEW TABLES

Eight tables were added to the DB2 catalog for DB2 Version 5. Prior to DB2 V5, six of these tables were stored in the communication database, also known as the CDB. The CDB was used to describe the connections of a local DB2 subsystem to other systems. The CDB tables were housed in a separate database – DSNDDF. As of V5, the tables were renamed and moved into the DB2 Catalog. The CDB tables affected are as follows:

Old CDB table name	*New DB2 catalog table name*
SYSIBM.SYSLOCATIONS	SYSIBM.LOCATIONS
SYSIBM.SYSLULIST	SYSIBM.LULIST
SYSIBM.SYSLUMODES	SYSIBM.LUMODES
SYSIBM.SYSLUNAMES	SYSIBM.LUNAMES
SYSIBM.SYSMODESELECT	SYSIBM.MODESELECT
SYSIBM.SYSUSERNAMES	SYSIBM.USERNAMES

The definitions for the CDB tables have changed, in some cases substantially.

- SYSIBM.LOCATIONS contains a single row for each accessible server, equating a location with its SNA or TCP/IP network

attributes.

- SYSIBM.LULIST enables you to specify multiple LUNAMES for any given LOCATION. It is used to assign a VTAM LUNAME to a LINKNAME (from SYSIBM.LOCATIONS).
- SYSIBM.LUMODES contains conversation limits for a specific LUNAME/MODENAME combination. It is used to control change-number-of-sessions (CNOS) negotiations at DDF start-up.
- SYSIBM.LUNAMES contains a single row for each LU associated with one or more other systems accessible to the local DB2 subsystem.
- SYSIBM.MODESELECT assigns mode names to conversations supporting outgoing SQL requests.
- SYSIBM.USERNAMES is used to enable outbound and inbound ID translation.

The two other tables added to the DB2 Catalog for DB2 V5 are SYSIBM.IPNAMES and SYSIBM.SYSDUMMY1. SYSIBM.IPNAMES contains a single row for each LU associated with one or

LINKNAME	Must match the LINKNAME of the associated row in SYSIBM.LOCATIONS.	
SECURITY_OUT	An indicator specifying the DRDA security option used when DB2 SQL applications connect to any remote server associated with this TCP/IP host. Contains the following:	
	USERNAMES	Indicates whether outbound authid translation is to occur.
	IBMREQD	An indicator specifying Y if the row was supplied by IBM, or N if it was not.
	IPADDR	Contains the IP address or domain name of a remote TCP/IP host.

Figure 1: The columns of SYSIBM.IPNAMES

more other systems accessible to the local DB2 subsystem. It has one unique index, DSNFPX01, defined on the LINKNAME column. A definition of the columns in this table is shown in Figure 1.

SYSIBM.SYSDUMMY is a 'dummy' table that contains a single row. It is designed to be used in SQL statements in which a table reference is needed but the table contents are unimportant. There are no indexes on this table. It consists of a single column, IBMREQD.

THE SYSTEM CATALOG CHANGES

There are 65 new columns, 59 revised columns, 8 new indexes (all in SYSDDF), and one revised index in the DB2 V5 system catalog. The new and changed columns and indexes are provided to support the new features of DB2 V5 and to optimize performance and administration.

SIZE-RELATED CHANGES

The first major change is to the cardinality columns. Since DB2 V5 support large tablespaces, more data can be stored in a single DB2 table. The cardinality columns that existed in the DB2 catalog prior to V5 were defined as INTEGER data types. This was insufficient to store the new maximum size of large tablespaces, which can hold up to 1TB of data. Therefore, new floating point columns were added with new names. Likewise, the near-off and far-off positioning columns for indexes have been modified as well. All of the columns impacted by this change are outlined in Figure 2.

The TYPE, COLGROUPCOLNO, and NUMCOLUMNS columns were also added to both SYSCOLDIST and SYSCOLDISTSTATS to indicate what type of statistics were gathered by RUNSTATS. As of DB2 V5 there are two types of statistics that RUNSTATS can accumulate – cardinality and frequent value.

As of DB2 V5, the KEYCARD and FREQVAL parameters can be used with RUNSTATS. DB2 typically views any two columns as independent from one another. However, frequent value statistics enable DB2 to capture information about correlated columns. Columns

Table name	Old column name	New column name
SYSCOLDIST	CARD	CARDF
	FREQUENCY	FREQUENCYF
SYSCOLDISTSTATS	CARD	CARDF
	FREQUENCY	FREQUENCYF
SYSCOLUMNS	COLCARD	COLCARDF
SYSINDEXES	FIRSTKEYCARD	FIRSTKEYCARDF
	FULLKEYCARD	FULLKEYCARDF
SYSINDEXPART	FAROFFPOS -	FAROFFPOSF
	NEAROFFPOS	NEAROFFPOSF
	CARD	CARDF
SYSTABLES	CARD	CARDF

Figure 2: The columns of SYSIBM.IPNAMES

are considered to be correlated with one another when their values are related in some manner. Consider, for example, CITY and STATE columns. If the CITY column is set to 'CHICAGO' it is much more common for the STATE to be set to 'IL' than any other state. However, without frequent value statistics, DB2 would consider Chicago, FL to be just as common as Chicago, IL.

Several other size-related changes were made. To accommodate large tablespaces the TYPE column was added to the SYSTABLESPACE table. If type contains the value 'L' then the tablespace is a large tablespace, instead of a regular tablespace. Large tablespaces, new to DB2 V5, can have up to 254 partitions, each containing up to 4GB.

Finally, the MAXROWS column was added to the SYSTABLESPACE table. MAXROWS indicates the maximum number of rows per page that can be stored for the tablespace. The MAXROWS parameter indicates the maximum number of rows that can be stored on a tablespace page. The default is 255, but it can range from 1 to 255.

PROCEDURE-RELATED CHANGES

Many changes were made to DB2 V5 to broaden the support provided for stored procedures. As of DB2 V5, you can use multiple Stored Procedure Address Spaces (SPAS). Doing so requires the use of the MVS Workload Manager (WLM). It allows stored procedures to be isolated in a particular address space – based on the type of processing being performed. Using multiple SPAS, you can create an environment with multiple physical address spaces for stored procedures executing at the same dispatching priority as the calling program.

Additionally, as of DB2 V5, a stored procedure can return multiple row result sets back to the calling program. If you enable result sets to be returned, stored procedures become more efficient and effective. Benefits include the following:

- Reduced network traffic, because an entire result set requires only a single network request.
- Better application design, because stored procedures do not need to loop artificially through cursors to return data one row at a time.
- Better flexibility, because more work can be done using stored procedures.

The RESULT_SETS, WLM_ENV, PGM_TYPE, EXTERNAL_SECURITY, and COMMIT_ON_RETURN columns were added to the SYSPROCEDURES table to enable features such as returning multiple result sets and Workload Manager.

DATE-RELATED CHANGES

Also, new columns were added to the system catalog to indicate when objects were created and altered. The columns ALTEREDTS and CREATEDTS contain a TIMESTAMP that indicates when the object was first created and last altered. If the object has never been altered after creation then ALTEREDTS will be the same value as CREATEDTS. These two columns have been added to the following system catalog tables: SYSDATABASE, SYSINDEXES, SYSSTOGROUP, SYSTABLESPACE, and SYSSYNONYMS (only

CREATEDTS has been added to SYSSYNONYMS because, once created, synonyms can not be altered).

Another new column, GRANTEDTS, has been introduced that is similar to CREATEDTS and ALTEREDTS. It contains a timestamp indicating when authority has been granted. This column has been added to the following system catalog tables: SYSCOLAUTH, SYSDBAUTH, SYSPLANAUTH, SYSRESAUTH, SYSTABAUTH, and SYSUSERAUTH.

Finally, columns were added to indicate bind and precompile time. The BOUNDTS column was added to the SYSPLAN table indicating the timestamp when the plan was bound. The PRECOMPTS was added to the SYSDBRM table indicating the timestamp when the DBRM was precompiled.

MISCELLANEOUS OTHER CHANGES

Many other changes were made to the system catalog tables to support DB2 Version 5. This list provides a short highlight of each change:

- ENCODING_SCHEME and several other columns were added to SYSDATABASE, SYSTABLES, and SYSTABLESPACE to enable ASCII server support and different encoding schemes. Likewise, the TRANSTYPE column in SYSSTRINGS was modified to hold more transition types.
- Check pending information, stored in a column named CHECKRID5B, was added to SYSTABLEPART and SYSTABLES.
- The KEEPDYNAMIC column was added to SYSPACKAGE and SYSPLAN to support cacheing of prepared dynamic SQL statements.
- The REOPTVAR column was added to SYSPACKAGE and SYSPLAN to indicate whether access paths are to be re-determined at execution time.
- The PIECESIZE column was added to SYSINDEXES to support the new PIECESIZE clause. PIECESIZE is used to specify the largest dataset size for a non-partitioned index.

- CREATETMTABAUTH was added to SYSUSERAUTH to control the creation of temporary tables and the TYPE column in SYSTABLES was augmented to store 'G' to specify that the table is temporary.
- The LOCKPART column was added to SYSTABLESPACE to support selective partition locking.
- The REFCOLS column was added to SYSTABAUTH and the PRIVILEGE column was added to SYSCOLAUTH to support the new REFERENCES privilege.
- The REFCOLS column was also added to the bottom of the column list for the DSNATX02 index on SYSTABUTH.
- Stored procedures can run as a main routine or a subroutine as of DB2 V5 and the PGM_TYPE column was added to SYSPROCEDURES to support this feature.
- The STATUS column was added to SYSPACKSTMT and SYSSTMT to indicate the status of the bind for each statement.
- Several new host language codes were added to the list of valid values for HOSTLANG in SYSDBRM and SYSPACKAGE. The current list of valid languages is shown in Figure 3.

Code	Programming Language
B	Assembler
C	OS/VS COBOL
D	C
F	FORTRAN
P	PL/I
2	VS COBOL II
3	IBM COBOL (Release 2 and later releases)
4	C++

Figure 3: DB2 V5 Host Language Support

- Of course, the IBMREQD column was modified by adding the dependency indicator for DB2 V5. The value 'H' indicates DB2 Version 5.
- Many other columns were modified to support new parameters, options, and features. And several other columns were deactivated (such as the old cardinality columns CARD, FULLKEYCARD, etc).

SYNOPSIS

There have been many changes to the structure of the system catalog to support DB2 Version 5. The wise DBA will study the changes and plan for the impact of these changes on their administrative functions.

Craig S Mullins
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REXX extensions for DB2 – part 2

This month we continue the set of functions and subroutines that extend IBM REXX. These functions interface with DB2. Requests to DB2 are made under TSO using standard SQL language through the ADDRESS DB2 statement.

IRXDB2

```
$IRXDB2  START Ø
$IRXDB2  AMODE ANY
$IRXDB2  RMODE ANY
*********************************************************************
* $IRXDB2 . SET UP DB2 ENVIRONMENT.
*********************************************************************
         STM   R14,R12,12(R13) SAVE REGISTERS
         BALR  R1Ø,Ø           INIT BASE REGISTER
         USING *,R1Ø           ADRESSABILITY
         LR    R12,R13
         LA    R13,72(,R13)    NEXT SAVE AREA
```