



Autonomic Utility Processing for DBA Maintenance Activities

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BNP PARIBAS
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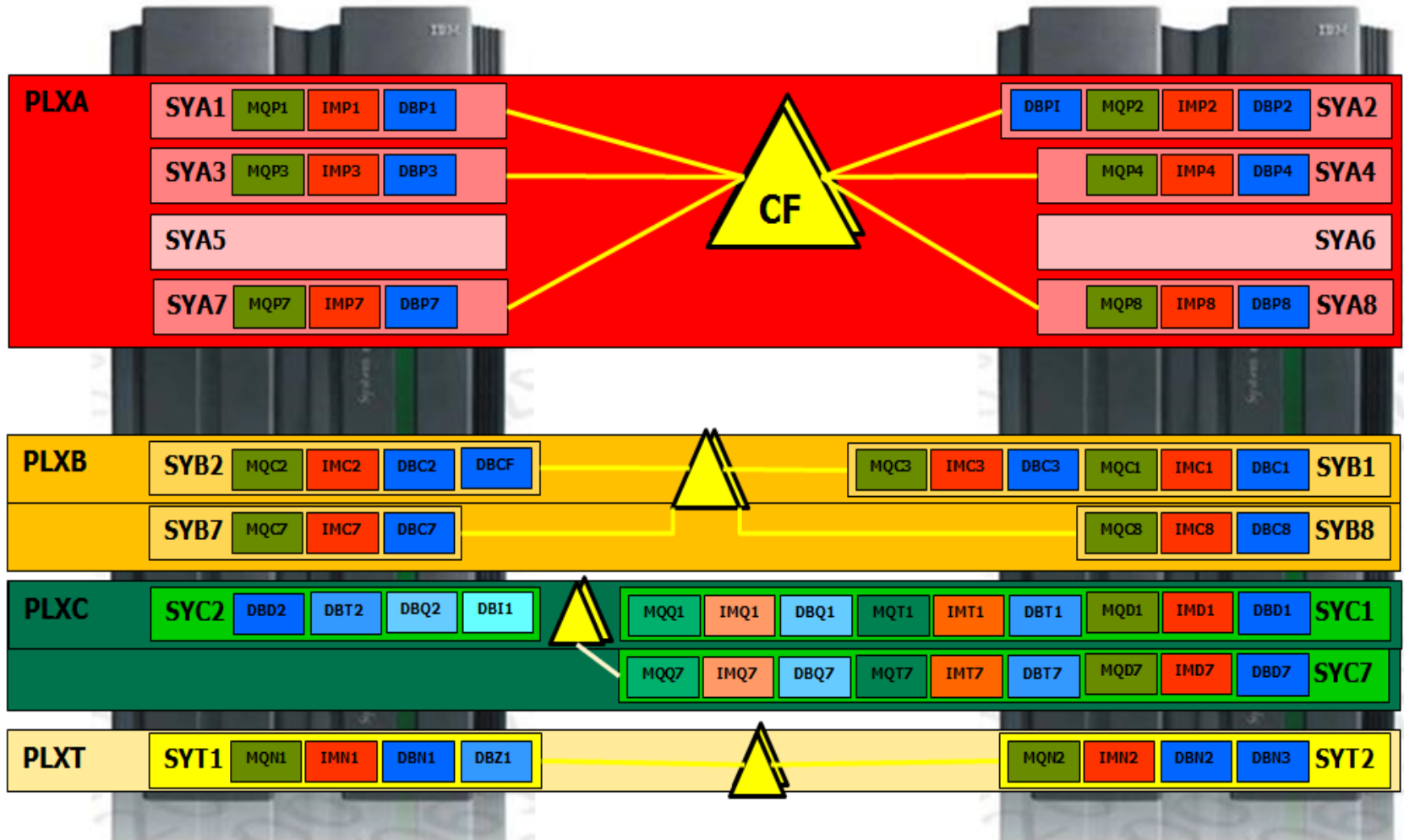
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Introduction



Introduction

Software used

- DB2 V10
- BMC Tools V11 – IC + Reorg
- IBM Utilities V10 – Runstats
- Control/M V8
- Rexx
- Criteria defined in DB2 tables
- Objects defined in DB2 tables



Introduction

Maximum respect of SLA

- Industrialised maintenance window switches from Sa-Su to Su-Mo
- Industrialised on request (eg.: @ application release) full availability of all databases on weekends even in batch
- Overall higher availability @week-end maintenance
- Industrialised dynamic switch : Silver (Ag) \leftrightarrow Platinum (Pt) database

Respect of architectural guideline RTO \leq 2 h due to

- More frequent backups based on behaviour statistics
- Parallel recovery (RPO=0) of multiple databases
- Parallel recovery (RPO=0) of the databases of one application within 2 hours
- No degradation of recovery possibilities

Statistics on databases

- Statistics gathering on all DB types
- Exploitation of Real Time Info

Reduce On Call interventions @week-end maintenance

- Most maintenance jobs will be defined as non-vital
- Industrialised follow-up guarantees operational quality



Object availability

Platinum DB's

- Db's used by transactions executed during Saturday or Sunday night
- 24x7 availability
- If one tablespace is used -> all the db become PT
- Stored in DB.DBSY08TTYPEDB on QFIX
- Maintenance will start from 03.00 hour Sunday morning

Silver DB's

- Db's not used by transactions executed during Saturday and Sunday night
- Maintenance will start from 23.00 hour Saturday evening



Real Time Statistics

- All decisions are made based on RTS
- Stored in 2 tables of the catalog

QUALIFIER: TABLESPACE=DSNDB06.SYSRTSTS

C	Table Name	Database	Tblspace
----	v-----1-----v-----2-----v-----3-----v-----4-----v-----5----		
	SYSIBM.SYSINDEXSPACESTATS	DSNDB06	SYSRTSTS
	SYSIBM.SYSTABLESPACESTATS	DSNDB06	SYSRTSTS



Real Time Statistics

- **SYSIBM.SYSINDEXSPACESTATS**
 - LOADRLASTTIME REORG/RUNSTATS
 - NACTIVE REORG/RUNSTATS
 - NLEAF REORG
 - PARTITION REORG/RUNSTATS
 - REORGDELETES REORG
 - REORGINSERTS REORG
 - REORGLASTTIME REORG/RUNSTATS
 - REORGLEAFFAR REORG
 - REORGLEAFNEAR REORG
 - REORGNUMLEVELS REORG
 - REORGPSEUDODELETES REORG
 - SPACE REORG/RUNSTATS
 - STATSDELETES RUNSTATS
 - STATSINSERTS RUNSTATS
 - STATSLASTTIME RUNSTATS
 - STATSMASSDELETE RUNSTATS
 - STATSUPDATES RUNSTATS
 - TOTALENTRIES REORG
 - TOTALROWS RUNSTATS



Real Time Statistics

- **SYSIBM.SYSTABLESPACESTATS**
 - COPYCHANGES IC
 - COPYLASTTIME IC
 - DBID IC
 - DBNAME IC
 - NACTIVE IC
 - NAME IC
 - PARTITION IC
 - SPACE IC
 - TOTALROWS IC



Imagecopy - Daily

- Daily IC executed depending on RTS
- Always Full Shrlevel Change
- Default criteria:

DB.DBSY02T_RTS_MAIN

NAME	TYPE	LENGTH	NULL	VALUE
MAINT_TYPE	CHAR	2		TS
DBNAME	VARCHAR	24		'\$DFLTBNP'
SPNAME	VARCHAR	24		'%'
PARTITION	SMALLINT	2		0
SEL_TYPE	CHAR	1		I
REMARKS	VARCHAR	128	N	'DEFAULT RULE'
LAST_UPD_USERID	CHAR	8		I20970
LAST_UPD_TIMESTAMP	TIMESTMP	26		2011-10-05-08.34.45.906199
COPYCHANGES	SMALLINT	2	N	10
COPYCHANGES_DAYS	SMALLINT	2		0
DAYS_CHANGES	SMALLINT	2		4
DAYS_NOCHANGES	SMALLINT	2		31



Imagecopy - Weekly

- Full copy of all db's during weekend
 - Default SHRLEVEL CHANGE
 - during the refresh weekend
 - SHRLEVEL CONSISTENT REQUIRED
- Selected tablespaces to be copied are inserted in table DB.DBSY06TUTILHIST



Imagecopy - Weekly

- Generated jcl

```
//DBCOPY    IF RC < 5 THEN
//* %%IF N EQ Y
//* %%ELSE
//DBCOPY    EXEC DBCOPY,
//          UID='DB.DBWIMK01',
//          OPTMOD='ACP$CHG'
//* %%ENDIF
//SYSIN     DD *
            OPTION DB2WAIT 3 DB2NTRY 10
            OUTPUT COPYLP UNIT CASS STACK YES BUFNO 20 RETPD 35 VOLCNT 99
                DSNAME Q2C.MK.DJ.&DB.&TS.P&PART.D027.T&HOUR&MIN
//          DD DISP=SHR,
//          DSN=Q2C.DB.DB.DBWCRICS.DBWICC#B.W0000.Z120128 (FC000002)
//DBCOPY    ENDIF
//*
```



Imagecopy - Weekly

- Generated sysin

```
EDIT          Q2C.DB.DB.DBWCRICS.DBWICC#B.W0000.Z120128(FC000002)
Command ===>
*****  ***** Top of Data *****
000001      COPY TABLESPACE MKAW01D.MKAW01S
000002                , MKAW01D.MKAW02S
000003                , MKAW01D.MKAW03S
000004      INDEXES NO
000005      COPYDDN COPYLP
000006      RESETMOD NO
000007      GROUP YES
000008      FULL YES
000009      SHRLEVEL CHANGE
```



Weekly Reorg

- Selection of tablespaces and indexes to be reorganized on friday morning based on RTS
- Selectioncriteria are stored in DB.DBSY03TREORGCRIT
- Selected tablespaces and indexes to be reorganized are inserted in DB.DBSY06TUTILHIST with its value of the selected criteria
- Default SHRLEVEL CHANGE



Weekly Reorg

- Default criteria:

DB.DBSY03TREORGCRIT

NAME	TYPE	LENGTH	NULL	VALUE
DBNAME	CHAR	8		DEFAULT
TSNAME	CHAR	8		%
IXCREATOR	CHAR	8		%
IXNAME	CHAR	30		%
PARTITION	SMALLINT	2		0
TS_ALTERED	CHAR	1	Y	
TS_TOTALROWS	INTEGER	4		99
TS_REORG_UNCLUST	SMALLINT	2		98
TS_REORG_INSERTS	SMALLINT	2		10
TS_REORG_DELETES	SMALLINT	2		10
TS_REORG_UPDATES	SMALLINT	2		10
TS_REORG_MASSDEL	SMALLINT	2		0
TS_REORG_INDREF	SMALLINT	2		4
TS_NBR_MONTH_LASTREORG	SMALLINT	2		6
IX_ALTERED	CHAR	1	Y	
IX_NLEAF	INTEGER	4		10
IX_REORG_LEAFLIMIT	SMALLINT	2		10
IX_REORG_NLEVELS	SMALLINT	2		0
IX_REORG_INSERTS	SMALLINT	2		10
IX_REORG_DELETES	SMALLINT	2		10
IX_REORG_PSEUODEL	SMALLINT	2		4
LAST_UPD_USERID	CHAR	8		G32093
LAST_UPD_TIMESTAMP	TIMESTMP	26		2012-01-12-15.03.52.686385
REMARKS	VARCHAR	200	N	'Default values'



Weekly Reorg

- Generated jcl

```
//DBREORG EXEC DBREORG,SIZE=0M,  
//      UID='DB.DBWESY02',  
//      UTPROC='NEW/RESTART',P='FORCE'  
//SYSIN  DD DISP=SHR,  
//      DSN=Q2Q.DB.CA.DBWCRICS.DBWREC#B.W0000.Z120128(WQ000954)
```



Weekly reorg

- Generated sysin

```
REORG TABLESPACE DBET60D.DBET64S
DDTYPE LOCPFCPY ACTIVE YES
UNIT (SYSDA,SYSDA) DATACLAS (BATL,NONE) MGMTCLAS (MCBATM,NONE)
COPYLVL PART
MAXTAPE 15
SHRLEVEL CHANGE
ANALYZE
REDEFINE YES
IFALLOC FREE
DELETEDFILES YES
FASTSWITCH YES
PREFORMAT
COPYDDN DBCPY UNLDDN UNLDD
COPY YES  INLINE YES  REGISTER ALL
DRAIN ALL
DRAIN_WAIT UTIL  RETRY 10  RETRY_DELAY 30
TIMEOUT TERM ,3
```



Weekly runstats

- Selection of tablespaces will be done after execution of the reorg and imagecopy
- Selectioncriteria stored in DB.DBSY04TRUNSTCRIT
- Default criteria:

DB.DBSY04TRUNSTCRIT

NAME	TYPE	LENGTH	NULL	VALUE
DBNAME	CHAR	8		DEFAULT
TSNAME	CHAR	8		%
PARTITION	SMALLINT	2		0
NBR_MONTH_LASTSTATS	SMALLINT	2		3
SAMPLING	CHAR	1		Y
SAMPLING_ROWS	DECIMAL	10,0		1000000
SAMPLING_VALUE	SMALLINT	2		25
GROWTH	SMALLINT	2		10
ADDITIONAL_SYSIN	CHAR	200		
LAST_UPD_USERID	CHAR	8		G32093
LAST_UPD_TIMESTAMP	TIMESTMP	26		2012-02-03-08.50.39.523738
REMARKS	VARCHAR	200	N	'Default value'



Weekly runstats

- Generated jcl

```
//DBRUNST IF RC < 5 THEN
```

```
//DBRUNST EXEC DBSTATS,P='NOP'
```

```
//SYSIN DD DISP=SHR,
```

```
// DSN=Q2Q.DB.CA.DBWCRICS.ZRBG01D.W000C.Z2028V00(RQ000001)
```



Weekly runstats

- Generated sysin of non partitioned tablespace

```
RUNSTATS TABLESPACE DBXXXXXX.TSYYYYYY  
TABLE ALL  
INDEX ALL  
KEYCARD FREQVAL NUMCOLS 1 COUNT 20  
FREQVAL NUMCOLS 2 COUNT 20  
FREQVAL NUMCOLS 3 COUNT 20  
HISTOGRAM  
SHRLEVEL CHANGE REPORT NO UPDATE ALL
```



Weekly runstats

- Generated sysin of partitioned tablespace

```
RUNSTATS TABLESPACE DBXXXXXX.TSYYYYYY
PART 1
TABLE ALL
INDEX ( IX.IX2
      , IX.IX1 PART 1
      )
KEYCARD FREQVAL NUMCOLS 1 COUNT 20
      FREQVAL NUMCOLS 2 COUNT 20
      FREQVAL NUMCOLS 3 COUNT 20
      HISTOGRAM
      SHRLEVEL CHANGE REPORT NO UPDATE ALL
RUNSTATS TABLESPACE DBXXXXXX.TSYYYYYY
PART 2
TABLE ALL
INDEX ( IX.IX1 PART 2
      )
KEYCARD FREQVAL NUMCOLS 1 COUNT 20
      FREQVAL NUMCOLS 2 COUNT 20
      FREQVAL NUMCOLS 3 COUNT 20
      HISTOGRAM
      SHRLEVEL CHANGE REPORT NO UPDATE ALL
```



Repository with all tablespaces

- Maintenance selection options (SEL_TYPE)
 - E(xclude)
 - F(orce)
 - N(ever)
 - I(nclude)
- Table DB.DBSY05TDB2MAINT
 - Unique image on QFIX
 - Contains info of all environments
- Table DB.DBSY07TDB2MAINEXEC
 - Every monday loaded on each environment in table
 - Used by DBA to deviate from global definitions
 - Used to generate on friday morning the schedules



Repository with all tablespaces

QUALIFIER: TABLE=DB.DBSY05TDB2MAINT

Cmd	Column Name	ColNo	Datatyp	Length
----	v-----1-----v-----2-----v-----3-----v-----4-----			
	ENV	1	CHAR	4
	DBNAME	2	CHAR	8
	TSNAME	3	CHAR	8
	PARTITION	4	SMALLINT	2
	AVAILABILITY	5	CHAR	2
	COMPANY	6	CHAR	1
	SEL_TYPE_IC	7	CHAR	1
	IC_SIZE	8	DECIMAL	10
	SEL_TYPE_REORG	9	CHAR	1
	REORG_PARTSIZE	10	DECIMAL	10
	REORG_SPECIAL	11	CHAR	2
	REORG_TYPE	12	CHAR	10
	SEL_TYPE_RUNST	13	CHAR	1
	RUNST_SIZE	14	DECIMAL	10
	PREDECESSOR	15	CHAR	8
	SUCCESSOR	16	CHAR	8
	LAST_UPD_USERID	17	CHAR	8
	LAST_UPD_TIMESTAMP	18	TIMESTMP	10
	REMARKS	19	VARCHAR	200



Follow up executions

- If utility (reorg-imagecopy-runstats) gives RC > 4
 - job will not be in Error
 - Jobname, dbname and tsname stored in DB.DBSY09TUTILERR

```
//LOGGING EXEC DB2TEP2
//DB2TEP2.SYSPRINT DD SYSOUT=*
//SYSIN DD *
INSERT INTO DB.DBSY09TUTILERR
VALUES ( CURRENT TIMESTAMP, 'UTILITY',
        'JOBNAME', 'DBXXXXXX', 'TSXXXXXX')
/*
```



Follow up executions

- Imagecopy

- if more then 10 imagecopies give an error -> job in Error

- Check presence of > 10 copy errors

```
UNLOAD DIRECT NO
SELECT 'COPY' FROM DB.DBSY09TUTILERR
WHERE CRE_TIMESTAMP > CURRENT_TIMESTAMP - 2 DAYS
AND UTILITY = 'COPY'
HAVING COUNT(*) > 10
```

- at refresh weekend always job in RED if error

- Check presence of > 0 copy errors



Follow up executions

- Reorg
 - in Error only if problem in UTILTERM phase of the utility
 - Check presence of utilid in BMCUTIL
 - Always job in abend when reorg with delete fails (Special reorgs)
 - Follow up on monday -> unload of DBSY09TUTILERR
- Runstats - Rebind
 - Never job in RED
 - Follow up on monday -> unload of DBSY09TUTILERR



Follow up executions

1. LIST OF JOBS IN ABEND OR RC > 4

```
+-----+
!          CRE_TIMESTAMP          ! UTILITY  ! JOBNAME  ! DBNAME  ! TSNAME  !
+-----+
1_! 2015-03-22-02.20.12.014659 ! REORG    ! DBWEZA1M ! ZAFT01D ! ZAFT42S !
2_! 2015-03-22-02.24.30.540568 ! RUNSTAT  ! DBWUH085 ! UHOB12D ! UHOB12S !
+-----+
```

2 ROW(S)

2. MISSING IMAGECOPIES

0 ROW(S)

3. REORGS TS + INDEX NOT EXECUTED

```
+-----+
! CREATION_DATE ! DBNAME  ! TSNAME  ! PARTITION !
+-----+
1_! 20.03.2015    ! BHTG01D ! BHTG09S !          0 !
2_! 20.03.2015    ! BHTG01D ! BHTG11S !          0 !
3_! 20.03.2015    ! PGFC01D ! PGFC01S !          0 !
4_! 20.03.2015    ! PGRF01D ! PGRF01S !          0 !
5_! 20.03.2015    ! PXIP01D ! PXIP19A0 !          0 !
+-----+
```

5 ROW(S)

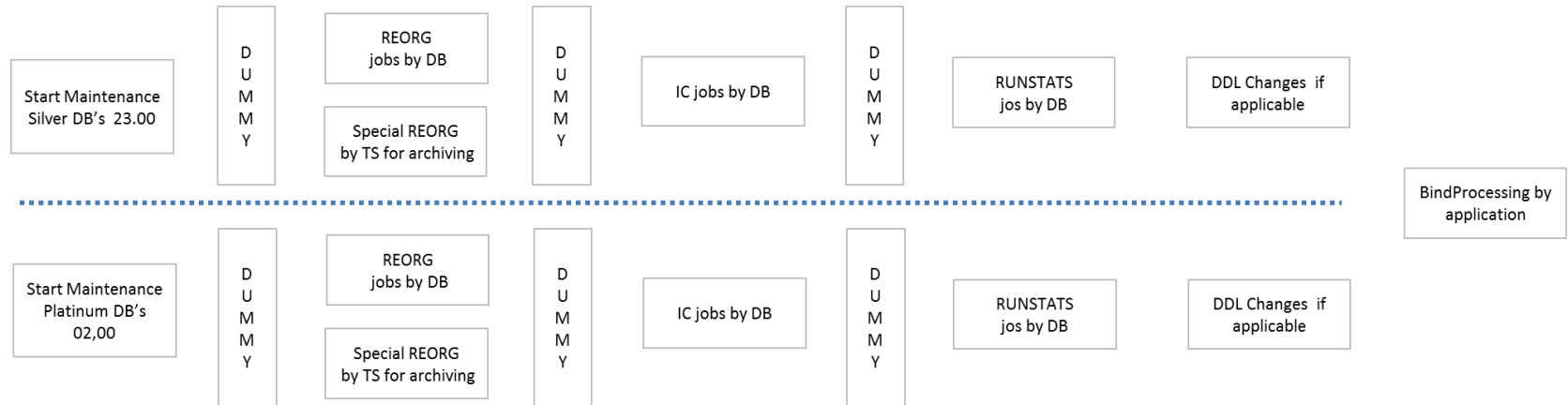


Schedules / jobs

- Monday morning
 - Maintenance of global repository
 - Unload of global repository by environment
 - Load of Execution repository on all environments
- Tuesday-Wednesday-Thursday-Friday morning
 - Add new objects in Execution repository
- Friday morning on all environments
 - Generation of maintenance schedules
 - Utility syntax
 - Job and scheduling information
 - Dynamicaly plan schedules
 - Verification of generated schedules
 - if mail sent : check with Planning
- Sunday morning
 - Check all maintenance jobs and send Mail



Schedule



- Silver maintenance takes about 2 hours for 1250 jobs
 - 300 Reorg + 550 IC + 350 Runstats + 50 Rebind
- Platinum maintenance takes about 2 hours for 1400 jobs
 - 600 reorg + 450 IC + 250 Runstats + 100 Rebind



Schedule

```
JOB LIST          LIB: Q0P.PP.DV.CTMRUN.G17.SCHEDULE          TABLE: DBWPIC0C
COMMAND ===>                                           SCROLL===> CRSR
OPT  NAME  -----  TYP  -----  DESCRIPTION -----  BROWSE-
      DBWDCC03      J  DBWDCC03-VITA-AB*-G-DMY START DB CCCR01D
      DBWECC01      J  DBWECC01-VITA-AB*-G-REORG TS CCCR01D.CCCR04S
      DBWDCC04      J  DBWDCC04-VITA-AB*-G-DMY BEFORE IC CCCR01D
      DBWICC02      J  DBWICC02-VITA-AB*-G-IMAGE COPY DB CCCR01D
      DBWSCC02      J  DBWSCC02-VITA-AB*-G-GEN RUNSTAT CCCR01D
      DBWDCC06      J  DBWDCC06-VITA-AB*-G-DMY START DB CCCR02D
      DBWICC03      J  DBWICC03-VITA-AB*-G-IMAGE COPY DB CCCR02D
      DBWSCC03      J  DBWSCC03-VITA-AB*-G-GEN RUNSTAT CCCR02D
      DBWDCC08      J  DBWDCC08-VITA-AB*-G-DMY START DB CC0001D0
      DBWECC02      J  DBWECC02-VITA-AB*-G-REORG TS CC0001D0.CCTRALS0
      DBWECC03      J  DBWECC03-VITA-AB*-G-REORG TS CC0001D0.CCTRANS0
      DBWDCC09      J  DBWDCC09-VITA-AB*-G-DMY BEFORE IC CC0001D0
      DBWICC04      J  DBWICC04-VITA-AB*-G-IMAGE COPY DB CC0001D0
      DBWSCC04      J  DBWSCC04-VITA-AB*-G-GEN RUNSTAT CC0001D0
      DBWRBCC      J  DBWRBCC -VITA-AB*-G-REBIND APPL CC
```



Questions ?



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