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Session: A15

DB2 9 for z/OS Migration Planning and Experiences (Part 1)

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Platform: z/OS

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The Worldwide DB2 User Community

Objectives

- Share lessons learned, surprises, pitfalls

- Provide hints and tips

- Address some myths

- Provide additional planning information

- Information on new enhancements

Agenda

- Quick hits
  - Preparing for the migration
- Migration
  - Overview
  - Plan stability
  - Converged TEMP space
- What to expect?
  - DB2 9 CPU performance
  - DBM1 Virtual Storage relief below the 2GB bar
- More quick hits
  - New Functions

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Quick Hits

- No need to fear migration with proper planning and testing
  - Follow step by step approach adopted by other successful customers
- Migrate only from DB2 V8 (NFM) with fallback SPE (PK11129)
  - See DB2 9 migration info APAR (II12423) for list of prereq APARs and PTFs
  - Make sure that the pre-conditioning APAR for Plan Stability (PK52522) is applied on all V8 (NFM) systems
- z/OS 1.8 required for
  - Full RACF support of trusted context and roles
  - Volume-level utilities enhancements
- Minimum levels required for DB2 Connect, but should follow CST/RSU levels
  - Full support with V9.1 FP1 but strongly recommend FP7 (RSU0906)
  - Full Support with V9.5 GA but strongly recommend FP4 (RSU0906)
  - Need extended support contract in place for V8.1 FP13 or V8.2 FP6+
  - V9.5 FP3 introduces Sysplex Failover/Workload balancing and XA support for DB2 Connect Client
- New plan to provide allow "V7-like" Precompiler function

Quick Hits …

- Sound maintenance strategy is essential for all customers
    - Strong recommendation to exploit CST/RSU process
    - Apply 2 'major' and 2 'minor' preventative service drops annually
        - 'Major' = Quarterly RSU + HIPERs + PE fixes
        - 'Minor' = Rollup of all HIPERs + PE fixes since last 'Major'
    - Exploit Enhanced HOLDDATA to be vigilant on HIPERs and PEs
    - No one-size-fits-all strategy
    - Review installation guide and the material supplied to ensure that RSU only service is installed
    - Can enforce installing RSU only service by adding the SOURCEID (RSU*) option in the supplied APPLY and ACCEPT jobs
    - Note '*' will pull ALL RSUs off of a particular tape

Quick Hits …

- PDSE required for SDSNLOAD and SDSNLOD2
    - PDSE may only be shared by z/OS systems which are part of the same z/OS Sysplex
    - In other cases, a separate copy must be created for each z/OS system
    - See II14067 (z/OS 1.7) or II14255 (z/OS 1.8) for related maintenance
    - See APAR PK59069 for DB2 Precompiler
    - See APARs OA24410, UA35620 for PDSE

- Make PDSE address space restartable
    - Recommendation only applicable if datasets (e.g., SDSNLOAD) not in linklist
    - Allows user restart (refresh) of PDSE address space to circumvent hangs, abends and user errors
    - Must specify PDSE_RESTARTABLE_AS(YES) in IGDSMSxx parmlib member
    - If a PDSE issue is discovered with datasets then use the following command to refresh the SMSPDSE1 address space:
        - V SMS,PDSE1,RESTART
    - During IPL, SMSPDSE starts by default and SMSPDSE1 will start if PDSE_RESTARTABLE_AS(YES) is specified

Quick Hits …

- Expand BSDS using V8 stand-alone utility DSNJCNVB
  - Or let DSNTIJUZ run the DSNJCNVB module during migration to DB2 9 (CM)

- Need to configure HVSHARE (64-bit shared private storage) in IEASYSxx parmlib at a minimum of 128GB per DB2 subsystem running on LPAR
  - Even if DDF is not used
  - Use DISPLAY VIRTSTOR,HVSHARE or D VS,HVSHARE to check

Quick Hits …

- Need to reset advisory REORG-pending (AREO*) status on all table spaces and indexes before migrating to DB2 9 (CM)

- Rebind all packages containing SQL LOCK TABLE statements in DB2 9 CM
  - Proactive rebinds under V8 with the PTF UK14099 for APAR PK21103 will avoid the problem

- Rebind all plans and packages that have not been rebound since DB2 V3

- No need for data sharing group-wide shutdown after entry to DB2 9 (NFM) to switch to Locking Protocol 3 (LP3)
  - Apply APAR PK62027 PTF UK38906
  - Will automatically get the LOB locking improvements on entry to NFM
  - With this fix on there is no LP3 any more

Quick Hits …

- DB2 9 did not eliminate DDF Private Protocol
  - Plan is to eliminate in DB2 9+1 release
  - If do not convert from Private to DRDA protocol, will not be able to migrate to DB2 9+1 release
  - DSNTP2DP (Private to DRDA Protocol Catalog Analysis Tool) introduced with APAR PK27413 to assist the conversion
    - REXX program which looks at the DB2 Catalog
    - Generates CREATE ALIAS statements for remote locations that will probably need 2-part aliases
    - Generates the commands to convert packages and plans which have a remote location dependency (or can be detected to have)

Quick Hits …

- DB2 9 did not eliminate DDF Private Protocol …
  - There may be packages or plans remaining with DBPROTOCOL(PRIVATE) where there are no SQL statements within the respective package or plan which refer to remote object i.e., remote location dependency cannot be detected
    - For example
      - SQL statements in the Catalog which do not refer to any 3-part name directly
      - Aliases the SQL statements reference which do not
    - Possible reasons
      - Use of dynamic SQL
      - Package bound from a remote requestor/client
    - These packages will have to be rebound with DBPROTOCOL(DRDA) to flip the package/plan from private protocol access to DRDA protocol access

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Quick Hits …

- DDF functionality
    - See DB2 9 Info APAR II14203 for DDF/DRDA related maintenance
    - If an IP address is specified, it must only be done in one place:
        - Either in the BSDS (via DSNJU003) – New in DB2 9
            - DDF will listen on INADDR_ANY
        - Or, on the PORT statement of TCP/IP profile (via the BIND keyword)
            - DDF will listen on a specific IP address
        - BSDS (INADDR_ANY) & PORT (BINDSPECIFIC) are mutually exclusive
            - Once DDF binds to a specific IP address, it cannot listen on INADDR_ANY
    - SSL support:
        - DDF only supports secure ports when it is listening on the INADDR_ANY
        - If a secure port (SECPORT) is defined in the BSDS, no IP address can be specified on the PORT statement in the TCP/IP profile

Quick Hits …

- Removed functions and incompatibilities
  - All stored procedures must be modified to become WLM enabled
  - The legacy JDBC driver will not work
    - In DB2 9, existing WLM environments configured to use the legacy driver will encounter a failure on address space initialization. This will happen in CM as well as NFM.
      - Data sharing groups with V8 in coexistence with DB2 9 (CM) will experience failure if a Java routine is invoked on any DB2 9 members where the WLM-SPAS JCL does not reference the Universal JDBC driver
    - Recommendation: Modify your WLM-SPAS JCL to use the Universal JDBC Driver while still on V8, prior to migration to DB2 9

Quick Hits …

- Removed functions and incompatibilities …

  - Classic simple table space creation support removed in DB2 9

    - New defaults:
      - Implicitly created TS: Segmented (CM)   or UTS - Partition by Growth (NFM)
      - Explicitly created TS: Segmented

    - Aim at converting existing classic simple table spaces to segmented, or UTS PBG, or single part partitioned with EA

  - The DBPROTCL ZPARM is removed

    - The default distributed protocol for BIND will always be DRDA

  - The RELCURHL=NO ZPARM option is removed

    - Incompatibility for applications dependent on retaining page or row locks across commits for a WITH HOLD cursor

Quick Hits …

- **Deprecated functions**
  - Plans containing DBRMs, ACQUIRE(ALLOCATE)
    - Consider switching to packages ahead of DB2 V9+1

- **Changes to defaults**
  - Default setting for MGEXTSZ (secondary extent allocation) is YES
    - Changed by the installation CLIST from NO to YES
  - BIND options: ISOLATION defaults to CS, CURRENTDATA defaults to NO
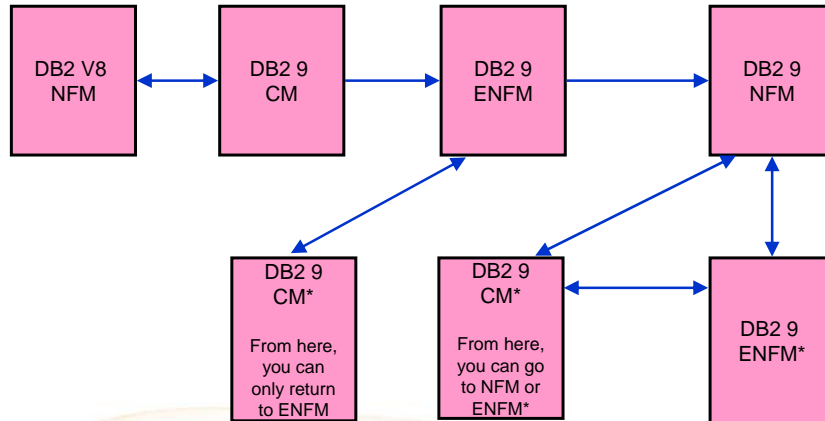   - Not changed for REBIND i.e., use the existing value
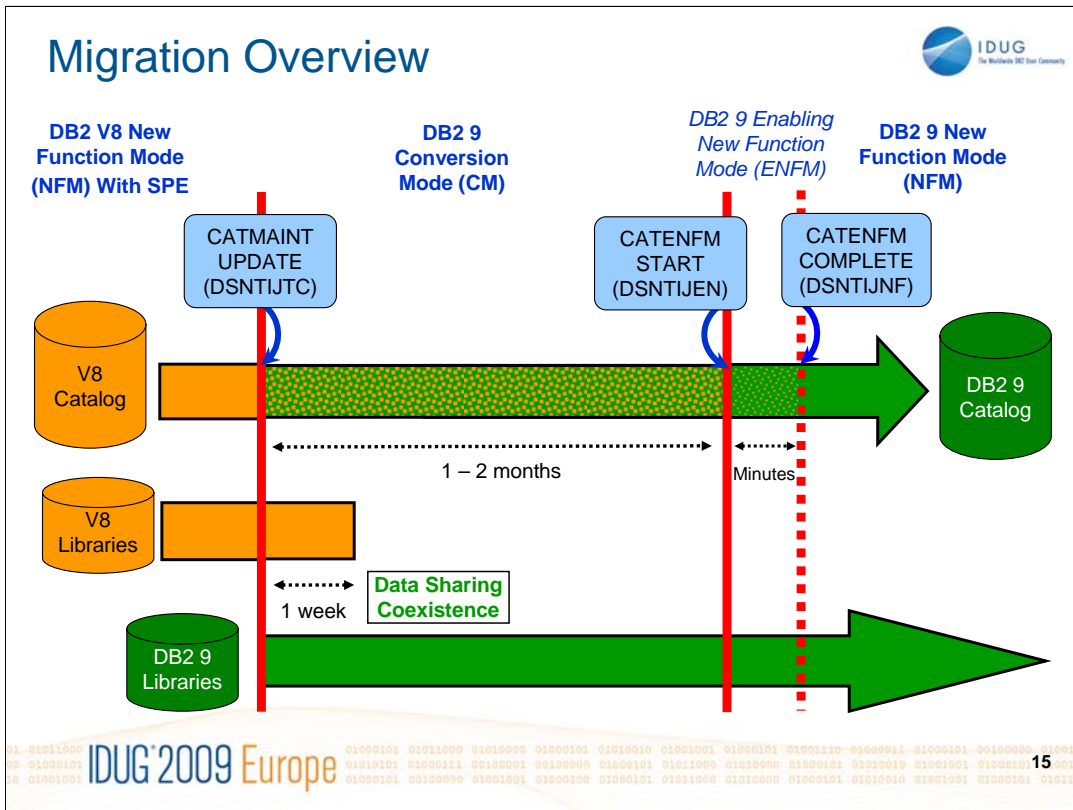
Note – this is not necessarily to scale!

Note – ONE WAY – fallback to CM* (covered later) is possible but not to V8

Migration and Fallback Paths

- With DB2 9, you can always drop back to the previous stage

- Cannot fallback to V8 after entry to DB2 9 (ENFM), but can fallback to DB2 9 (CM*)

```
┌──────────┐     ┌──────────┐     ┌──────────┐     ┌──────────┐
│  DB2 V8  │◄──►│  DB2 9   │───►│  DB2 9   │───►│  DB2 9   │
│   NFM    │     │   CM     │     │   ENFM   │     │   NFM    │
└──────────┘     └──────────┘     └──────────┘     └──────────┘
                                        ▲                ▲
                      ┌──────────┐     ┌──────────┐     ┌──────────┐
                      │  DB2 9   │     │  DB2 9   │◄──►│          │
                      │   CM*    │     │   CM*    │     │  DB2 9   │
                      │          │     │          │     │  ENFM*   │
                      │From here,│     │From here,│     │          │
                      │ you can  │     │you can go│     │          │
                      │only return│    │ to NFM or│     │          │
                      │ to ENFM  │     │  ENFM*   │     │          │
                      └──────────┘     └──────────┘     └──────────┘
```

Plan Stability

- New function of DB2 9 (PK52523)
    - Protects customers against access path regression
    - Allows for a "safe" way to REBIND (fall back)
    - Available even in DB2 9 (CM) as it can benefit migration and fallback
    - Strongly recommended
    - Make sure that the pre-conditioning APAR for Plan Stability (PK52522) is applied on all V8 (NFM) systems
- What is the problem?
    - REBINDs can cause access path changes
    - Most of the time, this improves query performance …
    - … But when it does not
        - No easy way to undo the REBIND
        - Can lead to a lot of grief to our customers and to IBM

Plan Stability …

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- Existing "solutions" inadequate
    - Preventing REBINDS altogether
    - REBINDing into alternate 'dummy' collections
    - Using hints

- What is the solution?
    - At REBIND, DB2 will save old copies of packages
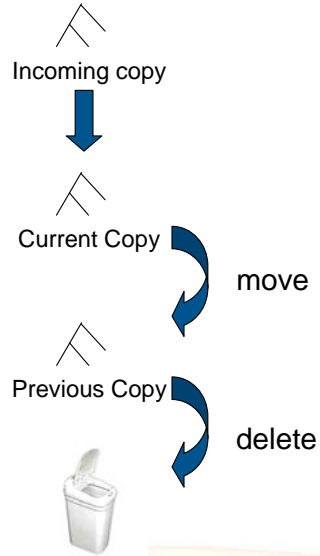   - In the event of a performance regression, users will have a way to fallback to an older copy
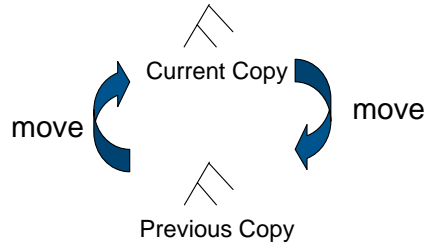
Plan Stability …

- At REBIND, save old copies of packages
  - Catalog tables
  - Directory

- Two flavors
  - BASIC and EXTENDED
  - Controlled by new ZPARM PLANMGMT
  - Default is OFF
  - Also supported as REBIND options

- REBIND PACKAGE …
  - PLANMGMT(BASIC)
    - 2 copies: Current and Previous
  - PLANMGMT(EXTENDED)
    - 3 copies: Current, Previous, Original

- Most bind options can be changed at REBIND
  - But a few must be the same …

- REBIND PACKAGE …
  - SWITCH(PREVIOUS)
    - Switch between current & previous
  - SWITCH(ORIGINAL)
    - Switch between current & original

- FREE PACKAGE …
  - PLANMGMTSCOPE(ALL) – Free package completely
  - PLANMGMTSCOPE(INACTIVE) – Free all old copies

- Catalog support
  - SYSPACKAGE reflects active copy
  - SYSPACKDEP reflects dependencies of all copies
  - Other catalogs (SYSPKSYSTEM, …) reflect metadata for all copies

- Invalidation and Auto Bind
  - Each copy invalidated separately
  - Auto bind replaces only the current copy – previous and original are not affected

Plan Stability …

REBIND … PLANMGMT(BASIC)

Incoming copy

Current Copy

move

Previous Copy

delete

REBIND … SWITCH(PREVIOUS)
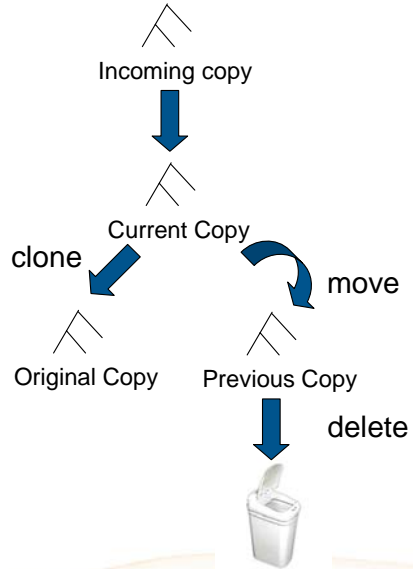
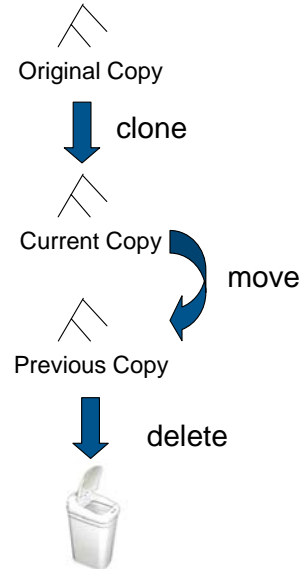Current Copy

move   move

Previous Copy

Similar processing for:

• EDM Sections

• SYSPACKDEP dependencies

• SYSPACKAGE record saved in EDM

Plan Stability …

REBIND … PLANMGMT(EXTENDED)

Incoming copy

Current Copy

clone

move

Original Copy   Previous Copy

delete

REBIND … SWITCH(ORIGINAL)

Original Copy

clone

Current Copy

move

Previous Copy

delete

Sample Strategy for Migration using Plan Stability

- Migration strategy with Plan Stability
  - Before migrating to DB2 9 (CM), ensure V8 plan table information is available
  - On migration to DB2 9 (CM), set ZPARM PLANMGNT to EXTENDED
    - Objective:
      - Make sure that the V8 version of package is kept as the original in case a fallback to DB2 V8 is required
    - Restriction:
      - EXTENDED means that DB2 always keeps 3 versions of the package (even if they are the same)
    - Watch out for SPT01 space growth as limit is still 64GB with DB2 9
      - Apply APAR PK80375 to turn on ESA Compression for SPT01
      - REORG SPT01 to reduce number of pieces

Sample Strategy for Migration using Plan Stability ...

- Migration strategy with Plan Stability …
  - Delay rebind on DB2 9 (CM) until running stable
    - Do not rebind on DB2 9 (CM) until RUNSTATS has been run
    - Execute RUNSTATS withTABLE(ALL) INDEX(ALL) <u>KEYCARD</u>
    - Make sure new ZPARM STATCLUS=ENHANCED (default)
      - Introduces major change to CLUSTERRATIO calculation and introduction of new statistic DATAREPEATFACTOR
    - Use DB2 supplied RUNSTATS utility if ISV utility does not yet support the enhanced statistics collection
  - Recommended Optimizer ZPARM changes
    - Set OPTIOWGT=ENABLE (APAR PK75643 will reflect this new recommendation)
    - Set OPTIXOPREF=ON (APAR PK77426 will reflect this recommendation)
    - No need to disable global query optimisation now
      - Set OPTXQB=ON which is the default

Sample Strategy for Migration using Plan Stability ...

- Why REBIND plans and packages?

  – As a general rule it is always a good recommendation to rebind on the new release to get the best performance

  – Almost all Optimizer enhancements available in DB2 9 (CM)

  – To avoid special DB2 handling to compensate for the different package structure in DB2 9 i.e., to avoid "puffing" of CTs/PTs/SLTEs

  – Re-enable SPROCs

    • Many plans/packages have SPROCs for fast column processing

    • All plans/packages with SPROCs that were bound prior to DB2 9 will be disabled

    • As a result DB2 will build SPROCs dynamically at execution time

    • Typical CPU performance impact in 0 to 10% range

    • Non-zero value for BYPASS COL indicator of problem

    • Performance trace of IFCID 224 identifies plans and packages which need rebinding to re-enable SPROCs

  – Exploit DBM1 31-bit virtual storage constraint relief for static SQL

Sample Strategy for Migration using Plan Stability ...

- REBIND in DB2 9 (CM)

  - DB2 now stores 3 versions of the package

  - Initial REBIND

    - Current version = DB2 9 version

    - Previous version = Original version = V8 version

    - If needed because of V9 access path regression, use REBIND PACKAGE … SWITCH(PREVIOUS) to fallback to the V8 version

  - Subsequent REBINDs

    - Current version = "New" DB2 9 version

    - Previous version = Latest DB2 9 version

    - Original version = V8 version

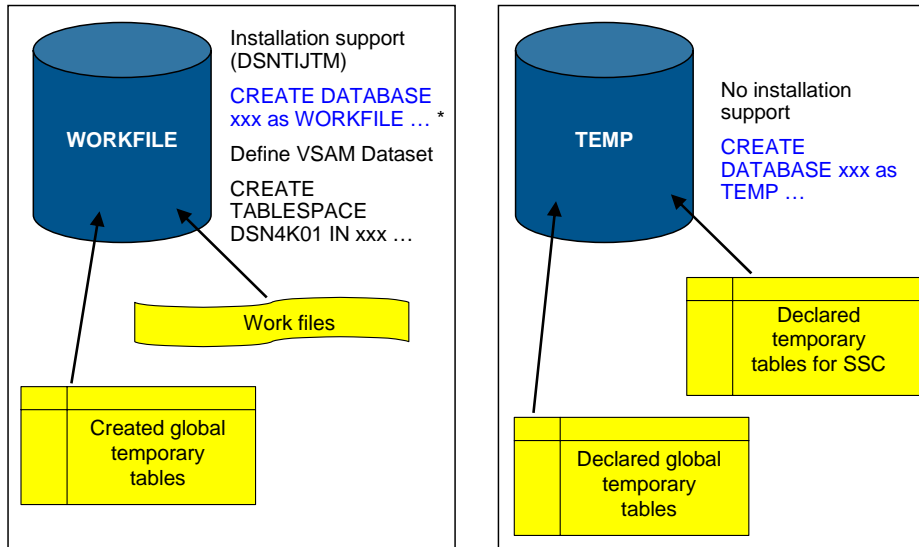   - Use REBIND PACKAGE … SWITCH(PREVIOUS) to fallback to the previous V9 version

Sample Strategy for Migration using Plan Stability ...

- In case of fallback to DB2 V8, before falling back to V8
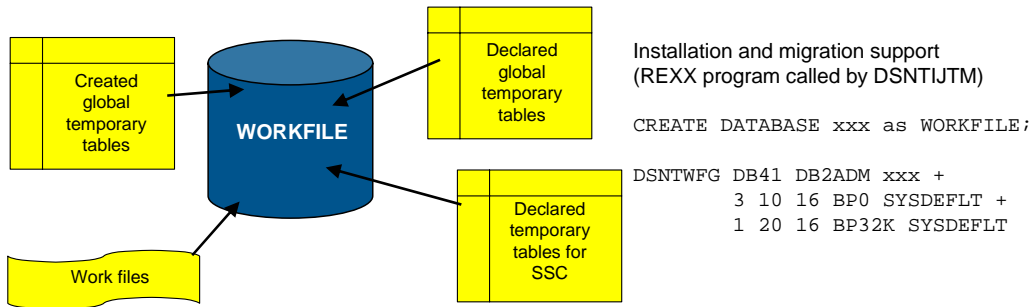 - Use REBIND PACKAGE … SWITCH(ORIGINAL) to fall back to original version of package (V8 version)

- In the future, to establish a new original version e.g., to move forward to the version after DB2 9
  - Use FREE PACKAGE … PLANMGMTSCOPE(INACTIVE) to free off the original (will also free off the previous version)

Temporary Space
The DB2 V8 Picture

WORKFILE

Installation support (DSNTIJTM)

CREATE DATABASE xxx as WORKFILE … *

Define VSAM Dataset

CREATE TABLESPACE DSN4K01 IN xxx …

Work files

Created global temporary tables

TEMP

No installation support

CREATE DATABASE xxx as TEMP …

Declared temporary tables for SSC

Declared global temporary tables

* Only in a data sharing environment – in non-data sharing syntax is CREATE DATABASE DSNDB07

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Temporary Space
The DB2 9 Picture

Created global temporary tables

WORKFILE

Declared global temporary tables

Declared temporary tables for SSC

Work files

Installation and migration support
(REXX program called by DSNTIJTM)

```
CREATE DATABASE xxx as WORKFILE;

DSNTWFG DB41 DB2ADM xxx +
        3 10 16 BP0 SYSDEFLT +
        1 20 16 BP32K SYSDEFLT
```

- Declared Global Temporary Tables and Static Scrollable Cursors now use the WORKFILE database instead of the TEMP database
- Uses DB2-managed (instead of user-managed) storage in SYSDEFLT storage group
- Segmented table space organisation (user-defined SEGSIZE or default of 16)
- 4KB and 32KB page sizes only – no 8KB or 16KB

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Planning For Converged TEMP Space

- **Migration from DB2 V8**
  - To reclaim TEMP database storage, *YOU* must drop the TEMP database and reallocate the storage
  - Recommendation: Do not drop the TEMP database until you are sure that you will be returning to V8 (NFM) by falling back, to avoid having to recreate it after the fallback

- **New installation panel for work file database definitions (DSNTIP9)**
  - In migration mode, if you specify non-zero values
    - Migration job DSNTIJTM will create <u>additional</u> DB2-managed WORKFILE table spaces in the SYSDEFLT storage group → new REXX program DSNTWFG
    - DB2 does not take into account the existing work file table spaces

- **Recommendation: set the 'DSVCI' ZPARM to YES to allow DB2 to match VSAM CI size to table space page size**

- **Ensure you have 32KB WORKFILE table spaces for Declared Global Temporary Tables and Static Scrollable Cursors**

When migrating from DB2 Version 8, if you wish to reclaim the storage associated with your existing TEMP database, it is *YOUR* responsibility to drop the TEMP database and reallocate the storage for use by the WORKFILE database or something else.

It is probably better not to DROP the TEMP database until you are sure that you will not be falling back to Version 8, to avoid having to recreate it after fallback.

Before Version 9, the DB2 installation process defines user managed data sets for table spaces in the WORKFILE database. The Version 9 installation process generates the DDL to create table spaces in the WORKFILE database using DB2-managed storage in the SYSDEFLT storage group.

If you want to allocate the WORKFILE table spaces on user managed data sets, then you need to provide your own AMS statements to define them, and modify the installation-generated DDL to specify the VCAT clause in place of the STOGROUP clause.

It is recommended that you set the 'DSVCI' ZPARM to YES. This enables DB2 to create the DB2-managed data sets with a VSAM control interval size that matches the page size for the table spaces.

The fact that 8KB and 16KB page sizes are not supported means that Declared Global Temporary Tables and Static Scrollable Cursors require a table space with a page size of 32KB.

The syntax for the DECLARE GLOBAL TEMPORARY TABLE statement or for declaring a static scrollable cursor is not affected, but some messages are.

Before defining a Declared Global Temporary Table, ensure that the WORKFILE database exists with at least one 32KB page size table space.

DB2 does not create an implicit table space for Declared Global Temporary Table.

If the workfile database does not exist, or if a tablespace of the required size does not exist, then the DECLARE GLOBAL TEMPORARY TABLE statement will fail SQLCODE -904 RC00E7009A – watch out for changed message text.

Controlling Temporary Space Utilization
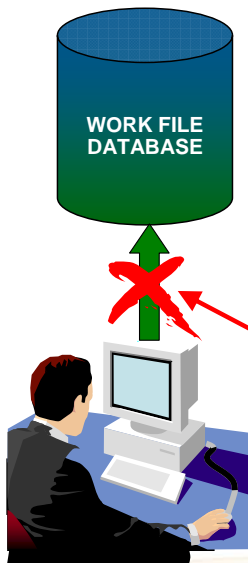
- Control of temporary space utilization at the agent level
- New ZPARM: MAXTEMPS
  - Macro DSN6SYSP, panel DSNTIP9
- If MAXTEMPS is exceeded for any given agent:

WORK FILE DATABASE

```
SQLCODE = -904, ERROR:
UNSUCCESSFUL EXECUTION CAUSED BY AN
UNAVAILABLE RESOURCE.
REASON 00C90305,
TYPE OF RESOURCE 100, AND
RESOURCE NAME = 'WORKFILE DATABASE'
SQLSTATE = 57011
```

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It is now possible to control temporary space utilization at the agent level.

> This can be used to prevent applications monopolizing temporary space at the expense of others.

A new ZPARM, MAXTEMPS, is added to DSN6SYSP.

> This specifies the maximum amount of space that can be used by a single agent at any single time.

> If the value is 0, then no limit is enforced.

> MAXTEMPS can be specified in MB or GB.

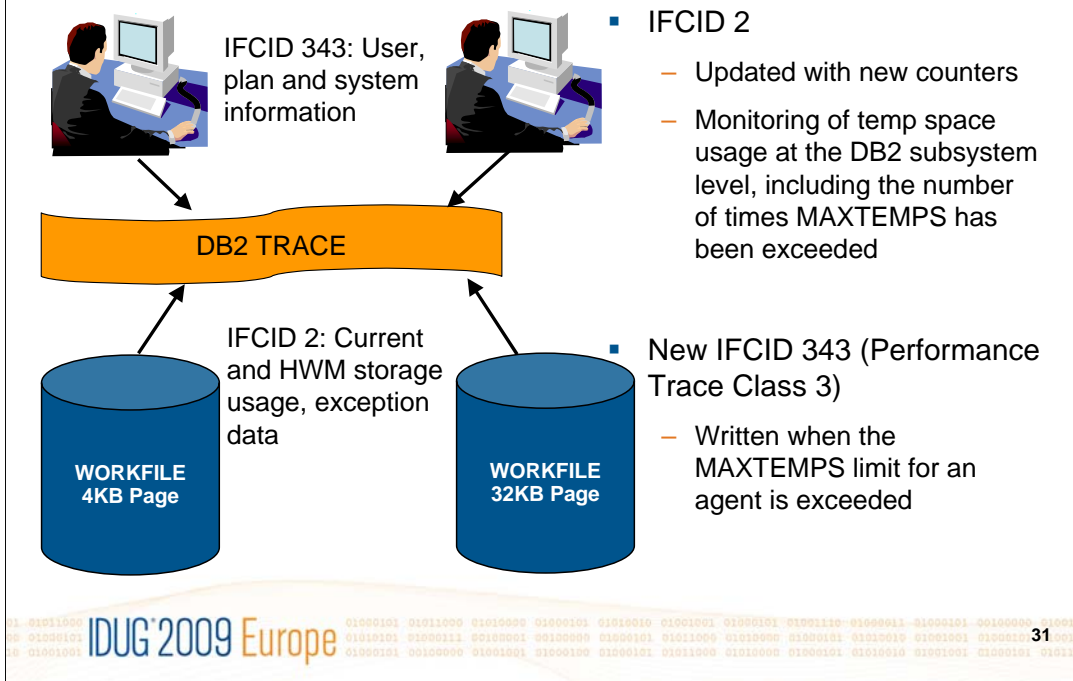> The value for MAXTEMPS is obtained from installation panel DSNTIP9.

>> The default value is 0.

>> This is specified in MB.

Table spaces in the temporary database are used for temporary tables such as Created and Declared Global Temporary Tables as well as for DB2 sort work files, and other purposes. DB2 does not distinguish or place priorities on the uses of the WORKFILE data sets. Temporary WORKFILE tables are never shared by different processes. Excessive activity from one type of use can interfere with the processing of other agents and affect their performance.

Be aware that the message is formatted slightly differently from what would be actually be seen – 'unsuccessful execution' to 'unavailable resource' is of course all on one line.

Monitoring Temporary Space Utilization

IFCID 343: User, plan and system information

DB2 TRACE

IFCID 2: Current and HWM storage usage, exception data

WORKFILE 4KB Page

WORKFILE 32KB Page

- IFCID 2
  - Updated with new counters
  - Monitoring of temp space usage at the DB2 subsystem level, including the number of times MAXTEMPS has been exceeded

- New IFCID 343 (Performance Trace Class 3)
  - Written when the MAXTEMPS limit for an agent is exceeded

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IFCID 2 (Statistics) new counters:

The current total storage used, in MB.

The high watermark – the maximum space ever used – in MB.

The maximum allowable storage limit (MAXTEMPS) for an agent, in MB.

The number of times the maximum allowable storage limit per agent was exceeded

The current total 4KB-page table space storage used, both in MB and in KB.

The current total 32KB-page table space storage used, both in MB and in KB.

How many times a 32KB-page table space was used when a 4KB one was preferable but not available.

How many times a 4KB-page table space was used when a 32KB one was preferable but not available.

IFCID 343 information:

The authorization ID.

The package collection ID and name.

The plan name.

The MAXTEMPS ZPARM value.

The current total system-wide usage of workfile storage.

The maximum total system-wide usage of workfile storage.

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DB2 9 for z/OS
Migration Planning and Experiences (Part 1)

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DB2 for z/OS Development

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