IBM Information ON Demand **2010**

Create Insight. Transform. Go Beyond.

DB2 for z/OS Mini Conference
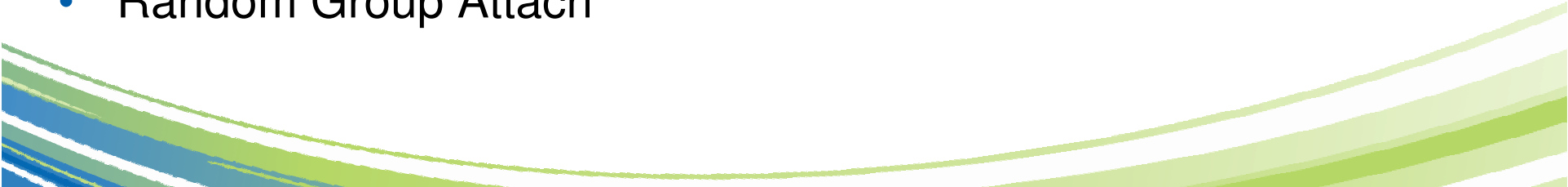*26-27 May 2010, Istanbul*

DB2 9 for z/OS Migration …
Are You Done Yet?

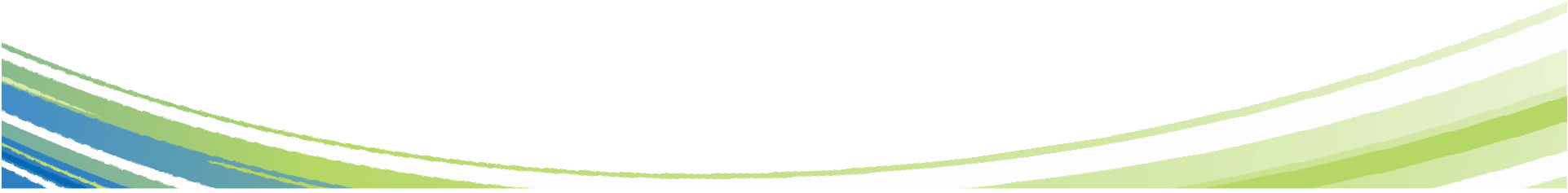Florence Dubois, IBM DB2 for z/OS Development

Agenda

- Quick hits

  – Preparing for the migration

- Migration overview

- What to expect?

  – DB2 9 CPU performance

  – DBM1 Virtual Storage relief below the 2GB bar

- Plan Stability

- Converged TEMP space

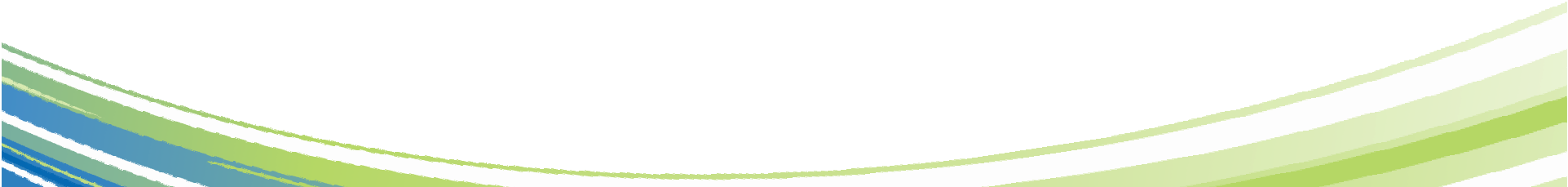- Reordered Row Format

- Random Group Attach

Quick Hits

- No need to fear migration with proper planning and testing
  - Follow step by step approach adopted by other successful customers
  - Recommended minimum maintenance level RSU0912 plus HIPERs
  - Review DB2 9 migration info APARs for list of prereq APARs and PTFs
    - Especially II14401, II14464, II4441
  - Make sure that the pre-conditioning APAR for Plan Stability (PK52522) is applied on all V8 (NFM) systems

- Minimum levels required for DB2 Connect, but should follow CST/RSU levels
  - Full support with V9.1 FP1 but strongly recommend FP8 (RSU0912)
  - Full Support with V9.5 GA but strongly recommend FP5 (RSU0912)
  - Full Support with V9.7 GA
  - 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

Quick Hits ...

- PDSE required for SDSNLOAD and SDSNLOD2

- 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, 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 …
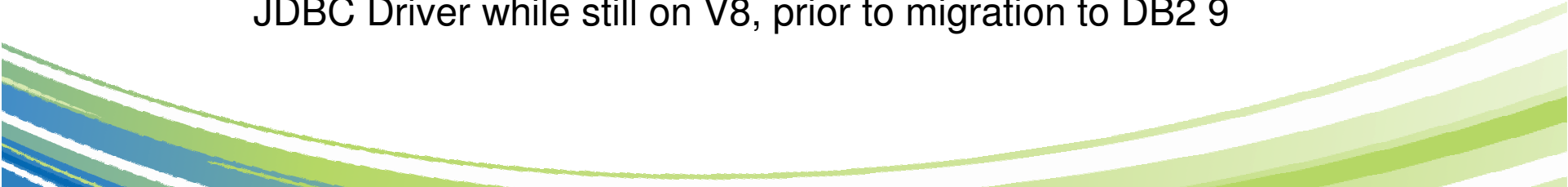
- Expand BSDS using V8 stand-alone utility DSNJCNVB

  - 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

- Move MSTR into service class SYSSTC in WLM policy

  - DB2 Service Monitor is built into and operates within MSTR

  - DB2 Service Monitor must be running higher than the AS it monitors

  - DB2 Service Monitor will be impacted if MSTR is pre-empted

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
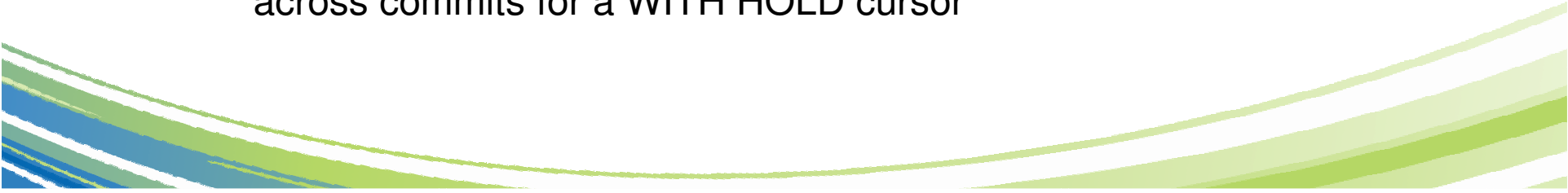
Quick Hits …

- Need to rebind all plans and packages that have not been rebound since DB2 V3

- 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
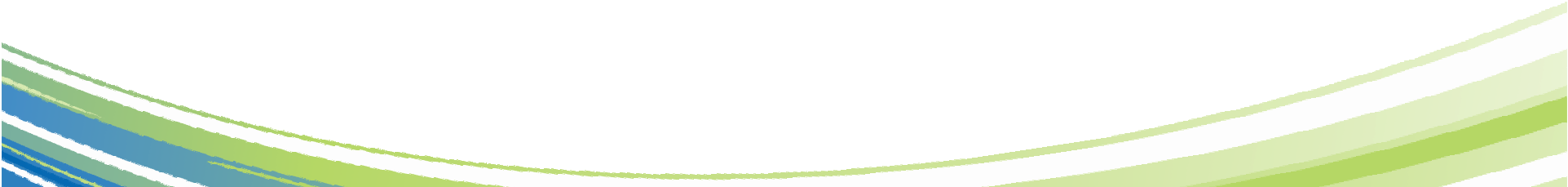
Quick Hits …

- 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 …

- 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
- APAR PK91610 allows "V7-like" Precompiler function

Migration Overview

DB2 V8 New Function Mode (NFM) with SPE

DB2 9 Conversion Mode (CM)

DB2 9 Enabling New Function Mode (ENFM)

DB2 9 New Function Mode (NFM)

CATMAINT UPDATE (DSNTIJTC)

CATENFM START (DSNTIJEN)

CATENFM COMPLETE (DSNTIJNF)

V8 Catalog

DB2 9 Catalog

1 – 2 months

Minutes

V8 Libraries

1 week

Data Sharing Coexistence

DB2 9 Libraries
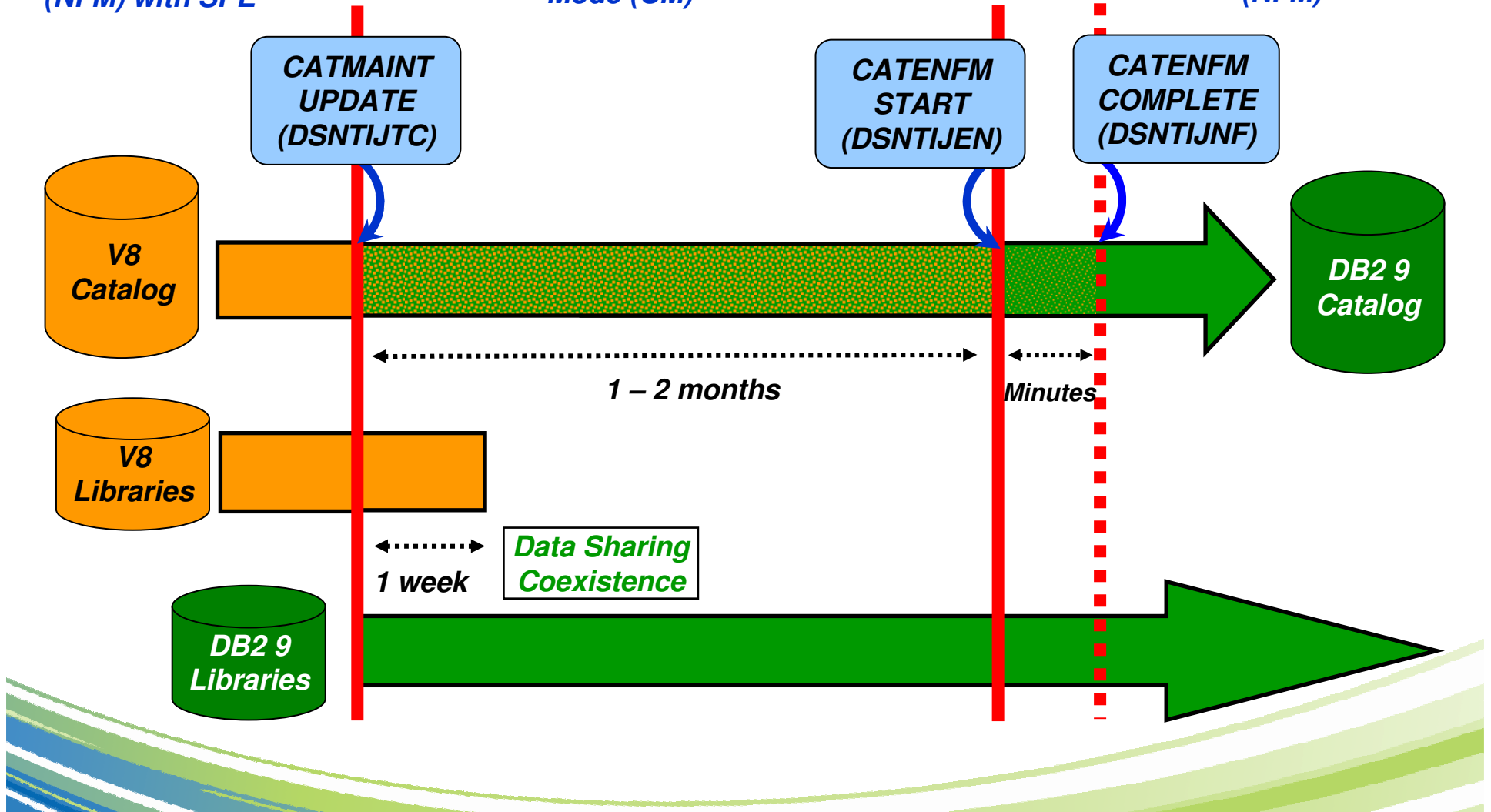
Migration and Fallback Paths

- 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*)
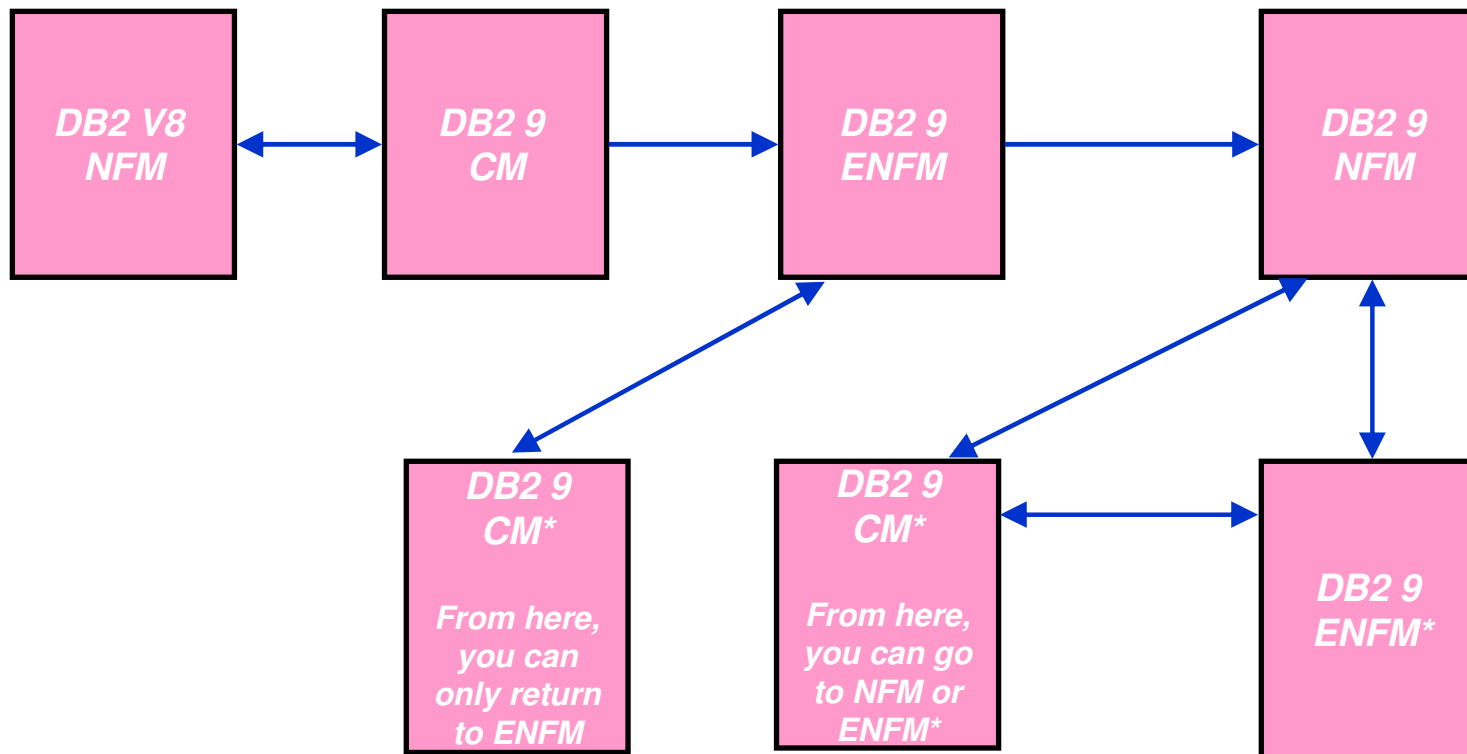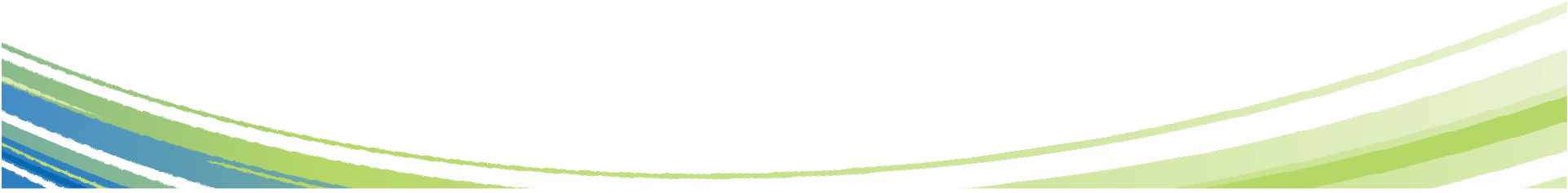
DB2 9 CPU Performance

- The target for DB2 9 CPU performance is to be roughly equivalent or marginally better relative to V8
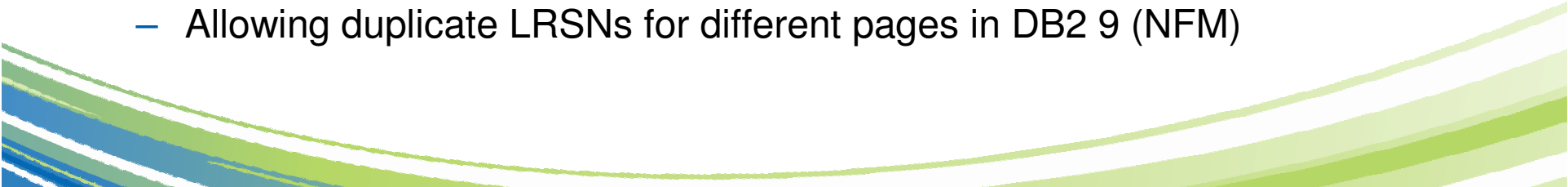
  - Assumes z890, z990, z9 or z10

  - Assumes no access path regression

  - Assumes REBIND on the new release

- Mileage in terms of reduced CPU reduction will vary

- Do not spend the benefits until you see them

- Customers running DB2 9 on old hardware (z800/z900) will definitely see CPU regression - may be 10-15% increase

- Data sharing customers may see significant savings from reduced LC19 contention and less spin to get unique LRSN

  - Spinning outside of the latch in DB2 9 (CM)

  - Allowing duplicate LRSNs for different pages in DB2 9 (NFM)

DB2 9 CPU Performance ...

- Dynamic prefetch replaces all sequential prefetch in SQL calls (CM), except in tablespace scan

    - No rebind is required to switch to dynamic prefetch as this change is transparent to Optimizer

    - In V8 when pages are read in via dynamic prefetch they are marked as sequential and when they are subsequently touched by random getpage they are reclassified as random

    - In DB2 9 the pages are not re-classified following subsequent touch by random getpage

DBM1 Virtual Storage below 2GB
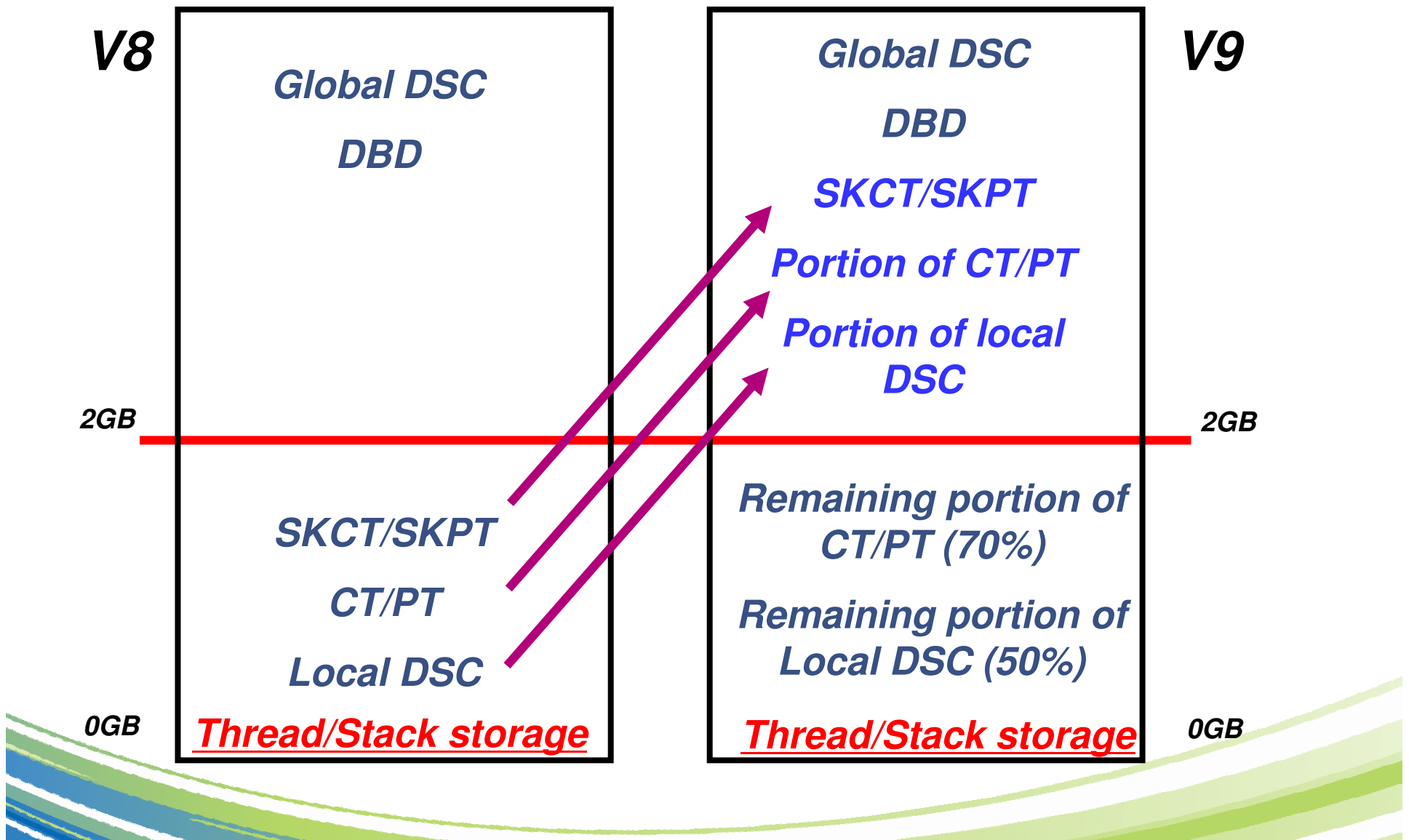
DBM1 Virtual Storage below 2GB …

- DBM1 Virtual Storage Constraint Relief for static SQL users
  - EDM pool in DB2 9 – need REBIND
    - SKCT/SKPT moved above 2GB
    - A portion (close to 30%) of CT/PT moved above 2GB
    - ** BUT **
      - There are no stealable EDM components left below 2GB
      - Increase in package size after REBIND
      - Increased likelihood of hitting EDM Pool full condition
  - Recommendation for EDM Pool below 2GB
    - On V8, identify the max number of pages held by CT/PT at peak
    - Plan on keeping at least 2 * 70% * CT/PT (V8 peak)
      - Intent of 2x factor is to provide some headroom
- DBM1 Virtual Storage Constraint Relief for dynamic SQL users
  - Local dynamic statement cache (KEEPDYNAMIC=YES)
    - Rough estimation of V9 = 50% of V8

DBM1 Virtual Storage below 2GB …

- User thread storage, System thread storage, Stack storage
    - Current expectation of less than 10% difference overall

- Potential reduction typically ranges from 0 to 15% depending on thread/stack storage usage
    - Very few installations will see as much as a 200-300MB reduction!
        - Especially if you are an IMS/TM customer who has very large ECSA and a small Extended Private Region (i.e., 1GB)
        - No VSCR for dynamic SQL users unless they are using local dynamic statement cache as a result of using BIND option KEEPDYNAMIC(YES)
        - VSCR from local dynamic statement cache savings will be small if the V8 size is heavily constrained by low MAXKEEPD
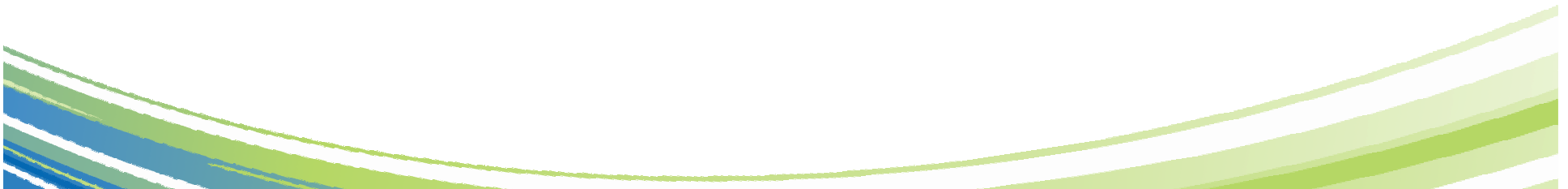
DBM1 Virtual Storage below 2GB …

- Introduced with V8 APAR PK20800 8/07

    - -DISPLAY THREAD(*) SERVICE(STORAGE)

    - Produces DSNV492I message that can be used by DB2 service for diagnostics
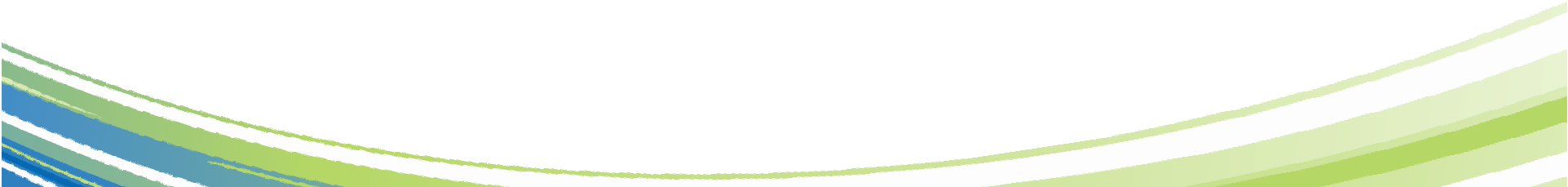
        ```
        V91A    N  *    0 003.RCRSC 02 SYSOPR           0067    0

        V490-SUSPENDED 07213-09:59:18.02 DSNRCRSC +00000230 01.51

        V492-LONG 252 K VLONG 40 K 64 1028 K
        ```

    - Includes Agent Local Non-System Storage usage

    - Does not include Getmained Stack Storage usage

    - The key values are the CT Long storage pool and the CT Very Long storage pool values. These reflects virtual storage consumption below the 2GB bar. They may be used to identify poorly behaved applications or DB2 code issues.

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)

- 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 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

Plan Stability

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

Plan Stability ...

- 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

- 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

Plan Stability ...

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

- Two flavours
  - 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 ...
  - Otherwise REBIND fails with DSNT216I

- 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)
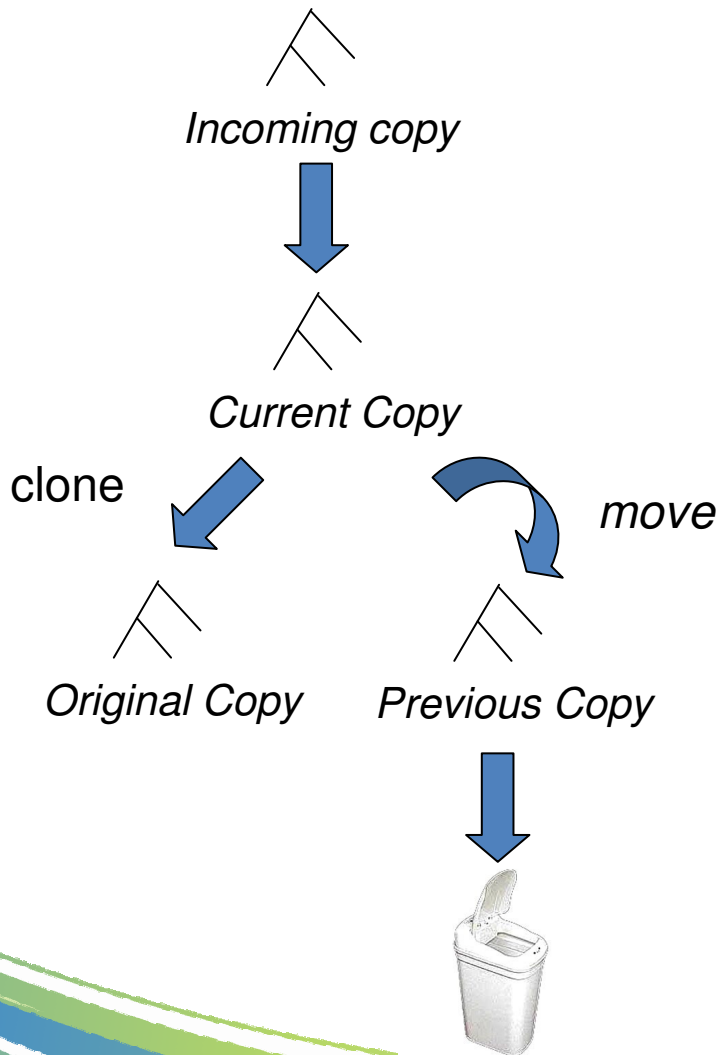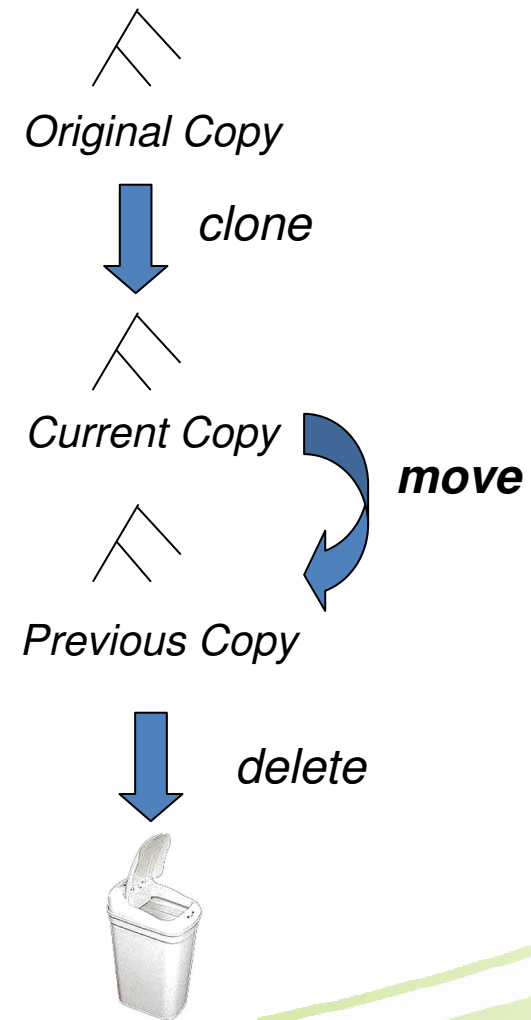
move

Current Copy

move

Previous Copy
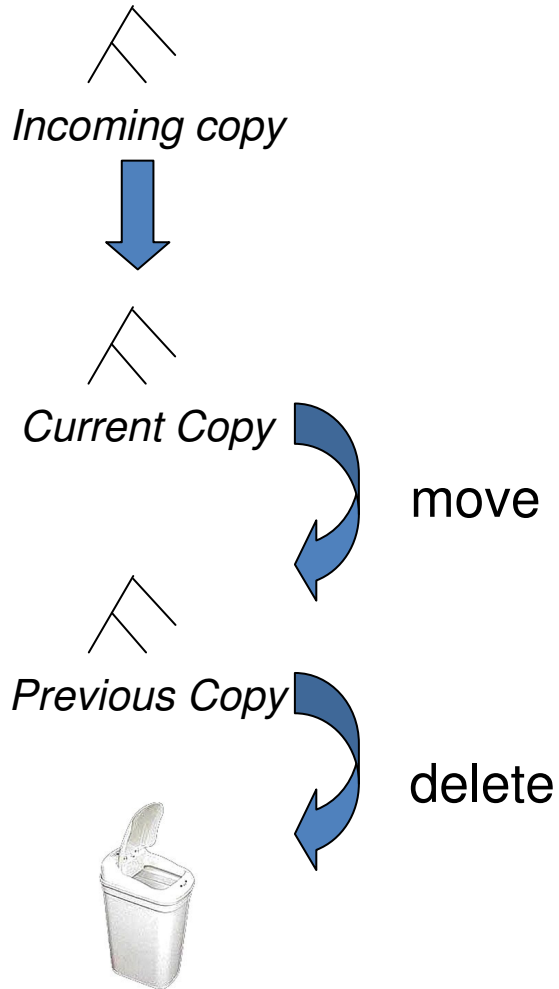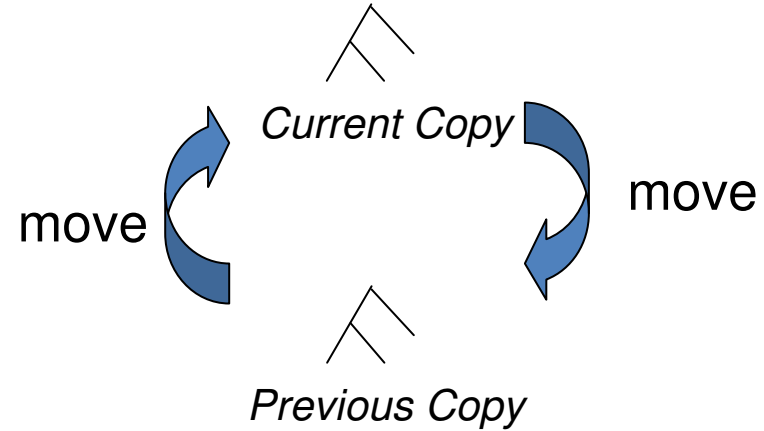
Similar processing for:

- EDM Sections
- SYSPACKDEP dependencies
- SYSPACKAGE record saved in EDM

Plan Stability …

REBIND … PLANMGMT(EXTENDED)

Incoming copy

Current Copy

clone

move

Original Copy

Previous Copy

REBIND … SWITCH(ORIGINAL)

Original Copy

clone

Current Copy

move

Previous Copy

delete
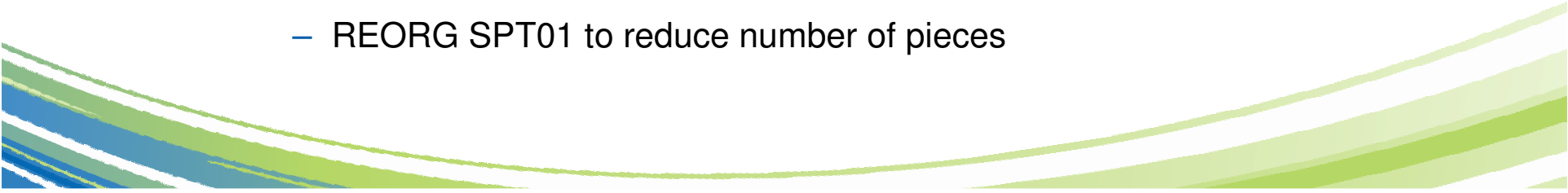
Sample Strategy for Migration using Plan Stability

- 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 …

- Recommended Optimizer ZPARM

  - Set OPTIOWGT=ENABLE (APAR PK75643 reflects this recommendation)

  - Set OPTIXOPREF=ON (APAR PK77426 reflects this recommendation)

  - No need to disable global query optimisation now

    - Set OPTXQB=ON which is the default

- Delay rebind on DB2 9 (CM) until running stable

  - Do not rebind on DB2 9 (CM) until RUNSTATS has been run

  - Execute RUNSTATS with TABLE(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

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)
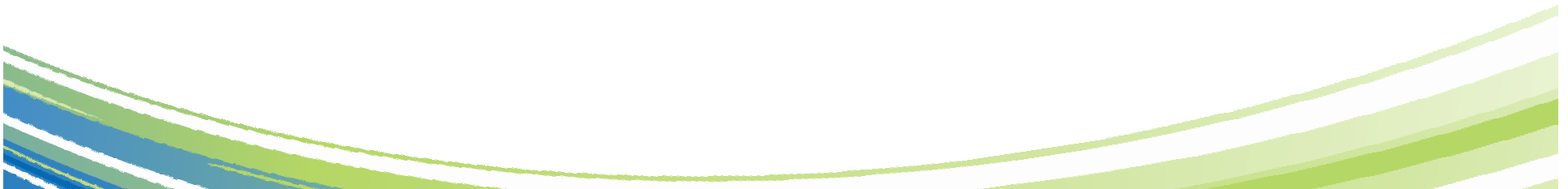
Temporary Space - The DB2 V8 Picture

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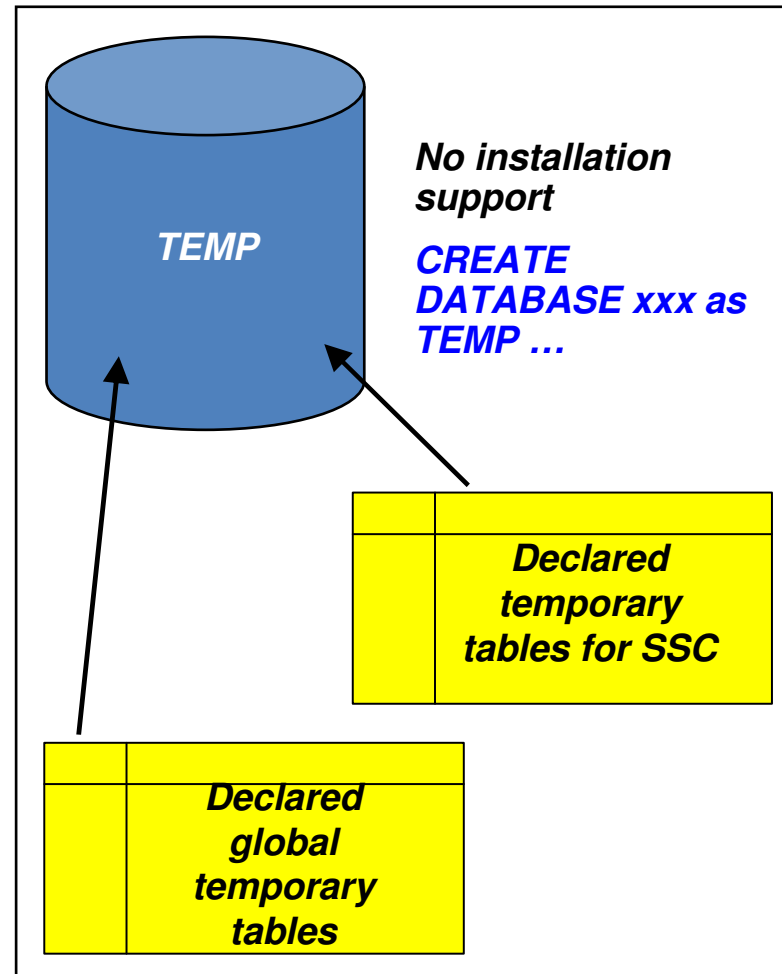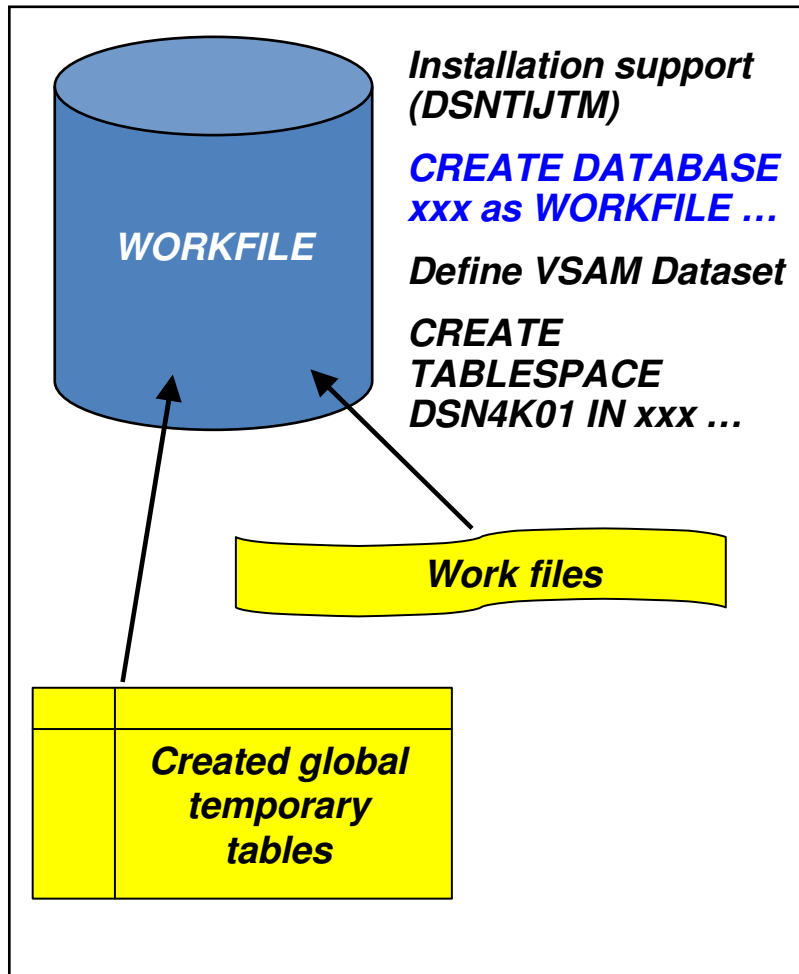
* Only in a data sharing environment – in non-data sharing syntax is CREATE DATABASE DSNDB07

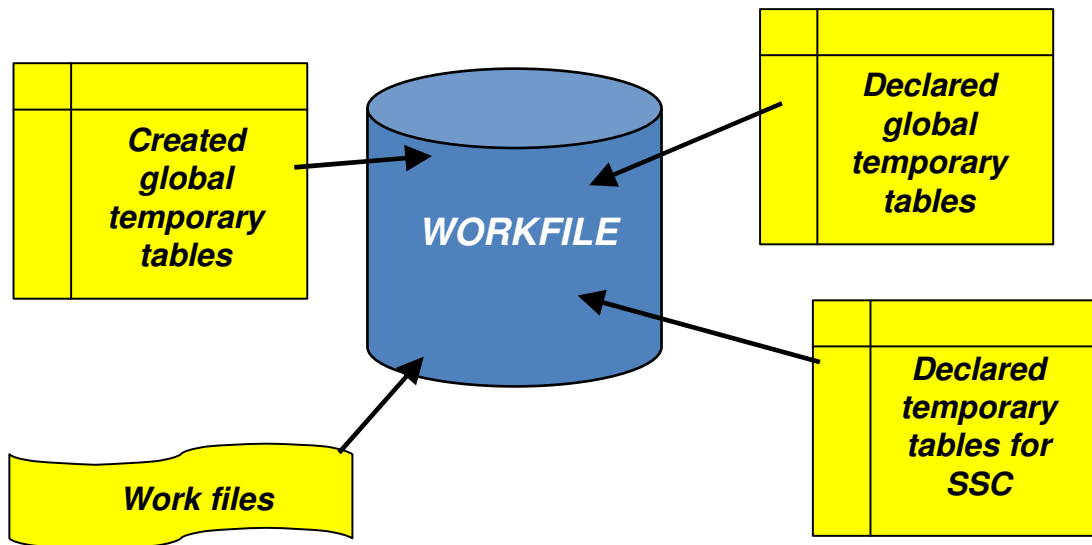# Temporary Space - The DB2 9 Picture

Created global temporary tables → **WORKFILE** ← **Declared global temporary tables**

Work files → WORKFILE ← **Declared temporary tables for SSC**

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

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 not return be falling back to V8, to avoid having to recreate it after fallback

- New installation panel for work file database definitions (DSNTIP9)

    - In migration mode, if you specify non-zero values

        - Migration job DSNTIJTM will create additional 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

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:
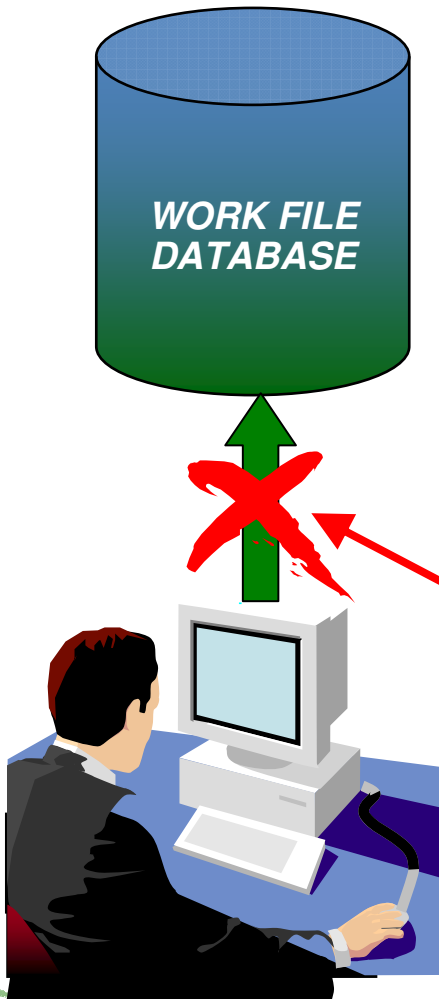
WORK FILE DATABASE

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

Planning For Converged TEMP Space …

- Heavier use of 32K workfiles to help performance (CM)

    - If the workfile record length is less than 100 bytes, then a 4KB page tablespace is used

    - In all other cases, DB2 tries to use a 32KB page tablespace

        - If no 32KB page TS is available, DB2 uses a 4KB page TS – lost performance benefit

    - Recommendations

        - Assign bigger 32KB page workfile buffer pool

        - Allocate bigger/more 32KB page workfile tablespaces
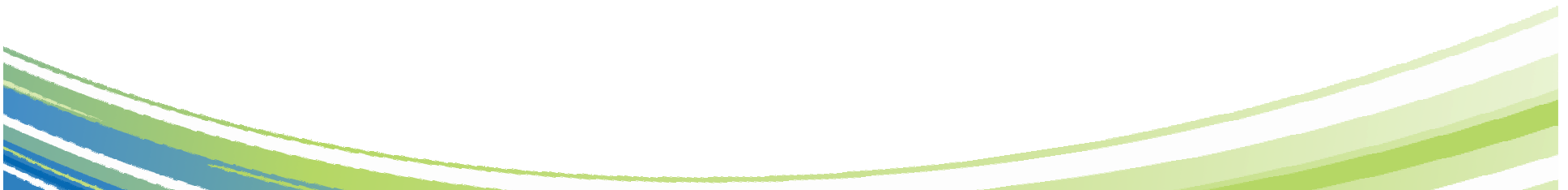
Planning For Converged TEMP Space ...

- IFCID 2 updated with new counters
  - Monitoring of temp space usage at the DB2 subsystem level
    - Number of times MAXTEMPS has been exceeded
    - Number of times a 4KB page tablespace was used when a 32K page tablespace was preferable (but not available)

Support in Omegamon XE for DB2 PM/PE V4.20

```
WORK FILE DATABASE                QUANTITY
---------------------------       --------

MAX TOTAL STORAGE        (KB)         5120

CURRENT TOTAL STORAGE    (KB)         1600
  STORAGE IN 4K TS       (KB)           64
  STORAGE IN 32K TS      (KB)         1536

4K USED INSTEAD OF 32K TS                0
32K USED INSTEAD OF 4K TS                0

AGENT MAX STORAGE        (KB)            0
  NUMBER OF MAX EXCEEDED                 0
```

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

Planning For Converged TEMP Space …

- Declared Global Temporary Tables (DGTTs)
  - Up to 20x increase possible in both CPU resource consumption and elapsed time without fixing maintenance
    - APAR PK67301 to reduce excessive logging for sequences of insert and mass delete within the same commit scope
      - With more frequent commits, the performance degradation is less and PK67301 makes it even less
    - APAR PK62009 to reclaim the space emptied by mass delete after commit for ON COMMIT DELETE DGTT
      - However, if you have a loop of Inserts/Mass Delete without commit, then Insert performance will steadily deteriorate and that is where DELETE WHERE can help
    - APAR PK70347 to reduce DBM1 31-bit storage usage when Performance Trace Class 8 active

Planning For Converged TEMP Space …
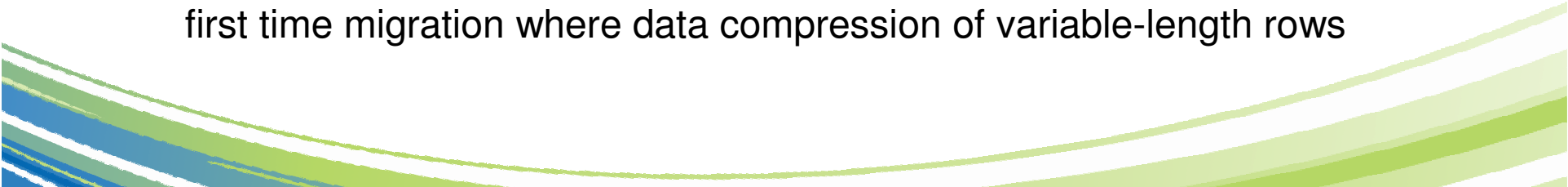
- Declared Global Temporary Tables (DGTTs) …

  – APAR PK70060
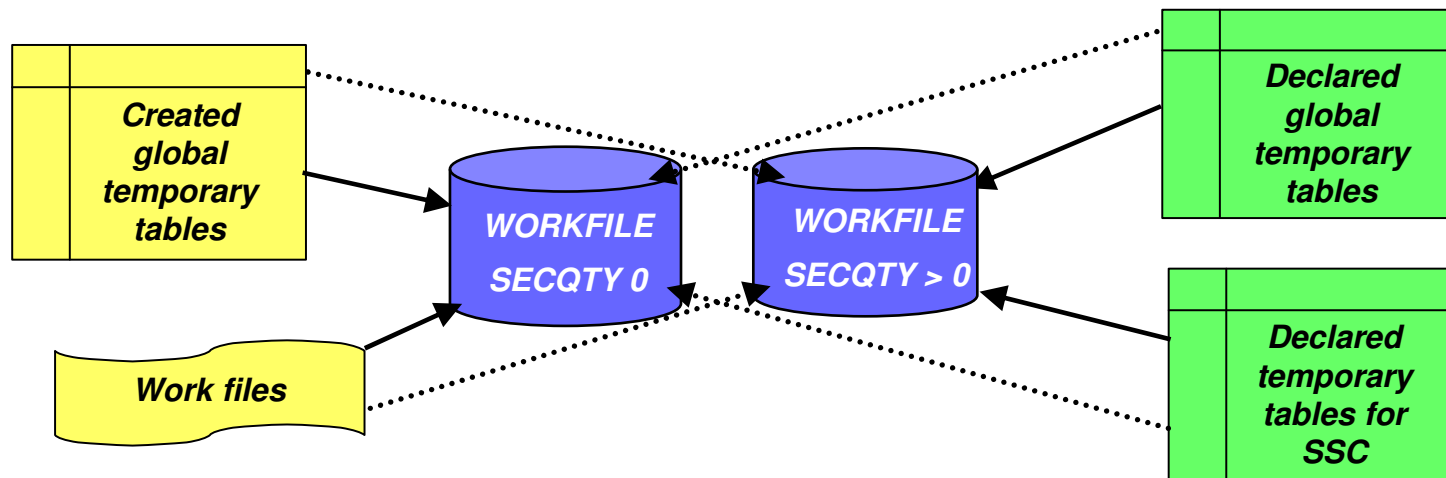
  – Recommendation: Define some tablespaces with zero secondary quantity and some with non-zero secondary quantity

    - Maximum primary quantity of workfile tablespace is 2GB. But DB2-managed workfile tablespace can grow up to 64GB like any classic segmented table space if secondary quantity is not zero
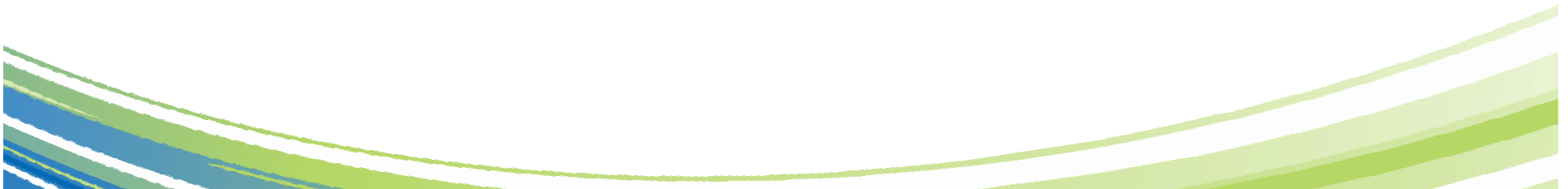
Reordered Row Format (RRF)

- Potential for significant reduction in CPU resource consumption when accessing many rows with many varying length columns

  – Implements CPU tuning recommendation to place fixed length columns ahead of varying length columns

  – Provides for direct access to each varying length column

  – In some few cases may lead to increased logging volume

- Application transparent – even for SELECT *

- On by default in DB2 9 (NFM) and applies to all tablespace types

- A pageset will be automatically converted from Basic Row Format (BRF) to RRF when pageset is re-allocated

  – REORG and LOAD REPLACE utilities override KEEPDICTIONARY during first time migration where data compression of variable-length rows

Reordered Row Format (RRF) …

- Be careful when using DSN1COPY to export/import data during the transition period when all DB2 systems and data sharing groups have not yet been migrated to DB2 9 (NFM)
  - Should consider disabling RRF on a temporary basis before migrating first system or data sharing group to DB2 9 (NFM), and re-enabling after all the systems and data sharing groups have been migrated to DB2 9 (NFM)

Reordered Row Format (RRF) …

- APAR PK87348 Enable BRF for UTS PBR/PBG
    - Hidden zparm SPRMRRF now converted to opaque zparm
        - SPRMRRF=<u>ENABLE</u>|DISABLE (online changeable)
    - SPRMRRF controls row format for new tablespaces
    - REORG and LOAD REPLACE will honour SPRMRRF setting
        - If SPRMRRF=ENABLE
            - Get BRF -> RRF conversion
            - COMPRESS YES|NO is no longer a factor
            - New PART via ALTER TABLE ADD PART or UTS PBG growth will be RRF
        - If SPRMRRF=DISABLE
            - No BRF -> RRF conversion
            - If already RRF then stay as RRF
            - New PART will be BRF
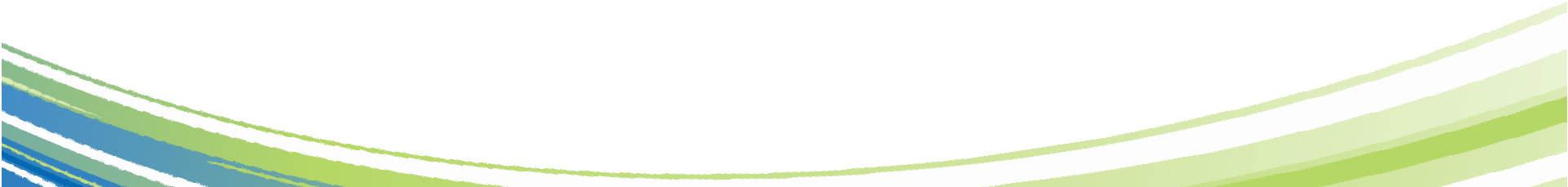
Reordered Row Format (RRF) …

- APAR PK85881 LOAD/REORG ROWFORMAT support
  - New keyword ROWFORMAT for LOAD REPLACE and REORG
  - Determines output row format
  - ROWFORMAT BRF | RRF
- Some restrictions…
  - SPRMRRF setting is ignored for
    - Existing tablespace with EDITPROC i.e., stays BRF
    - XML tablespace always RRF
      - New PART of existing XML tablespace will always be RRF
  - SPRMRRF and LOAD/REORG ROWFORMAT not honoured for CLONE tables relationship
    - UTS, LOB or XML
    - No conversion from BRF -> RRF or RRF -> BRF

Random Group Attach

- Different Group Attach behavior when running multiple DB2 members of the same data sharing group on the same LPAR

  - V8: DB2 attaches to first available member based on IEFSSNxx parmlib

    - Usermod available on V8 to change the behaviour and spread connections across available DB2 members on the same LPAR

  - V9: DB2 spreads connections across available members on the same LPAR

  - Co-requisite APARs PK79228 and PK79327 provide an option to re-instate the old V8 behaviour

    - New zparm RANDOMATT=<u>YES</u>|NO (online changeable)

    - If RANDOMATT=NO

      - DB2 member is considered "ineligible" for Random Group Attach

      - DB2 member will only be selected if no other members are available

    - To completely restore V8 behaviour, must specify RANDOMATT=NO for every member of the data sharing group

Convert Plans with DBRM to Packages

- Plans bound directly with DBRMs are not supported in DB2 10

- APARs PK79925 (V8) and PK62876 (V9)

  - New REBIND PLAN option COLLID('collection_id'|*)

  - Convertion from plans with DBRMs into plans with a package list

    1. Read SYSIBM.SYSDBRM to get all DBRM records bound with the plan

    2. Bind them into packages with the specified collection ID or use the default collection id (DSN_DEFAULT_COLLID_<planname>)

    3. Bind the package list into the plans

    4. Delete records in SYSIBM.SYSDBRM and SYSIBM.SYSSTMT tables

Convert Private Protocol to DRDA

- DB2 10 will no longer support <u>ANY</u> use of Private Protocol

  - Need to convert to DRDA prior to V10

  - Enhancements to V8 and V9 DRDA support to aid conversion

    - Tools to identify plans and packages requiring conversion (PK64045)

      - DSN1PPTP analyses IFCID157 trace records for input into DSNTP2DP

      - DSNTP2DP reports on applications using private protocol

      - DSNTPPCK scans SYSSTMT and SYSPACKSTMT for invalid syntax

    - Ability to enable or disable DRDA alias resolution processing (PK64045)

      - New zparm DRDA_RESOLVE_ALIAS

    - Ability to enable or disable Private protocol (PK92339)

      - New zparm PRIVATE_PROTOCOL

      - Enables testing to ensure private is eliminated