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DB2 11 for z/OS Migration Planning Workshop

- One-day, No Charge, Comprehensive Workshop
- More migration & project information
- Review of Systems, Application Development, and DBA Topics
- Access to online community of electronic content, including:
  - DB2 Catalog/Directory Poster annotated for migration
  - Checklists
  - Project Framework
  - Updated monthly
- Application Development Overview is coming
DB2 11 for z/OS Migration Agenda

- Packaging
- Prerequisite Summary & Planning
- Summary of removed & deprecated items
- New / Changed System Parameters
- Summary of migration steps
- Review of incompatibilities

DB2 11 for z/OS Packaging

DB2 QMF V11 is supported with:
- DB2 11 for z/OS
- DB2 10 for z/OS (all modes) with PM50434
- DB2 9 for z/OS NFM with PM45482

Base
- DB2 Base
- IRLM V2R3
- REXX
- MQListener
- IMS Attach
- RACF Auth Exit
- Panels (English / Kanji)
- JDBC / SQLJ / ODBC

Orderable No-Charge Features
- z/OS Appl Connectivity to DB2 for z/OS

Chargeable Features
- DB2 QMF V11
- - DB2 QMF Enterprise Edition
- - DB2 QMF Classic Edition

Related No-Charge Product
- DB2 Accessories Suite 5697-Q04
  - See announcement 213-395 for details
DB2 11 for z/OS Related No Charge Product

- **IBM DB2 Accessory Suite, V3.1**
  - 5697-Q04
  - V3.1 (Announcement letter 213-395)
    - IBM DB2 Accessories Suite V11
    - Data Studio 4.1
  - IBM DB2 Accessories Suite V11 Feature
    - Spatial Support
    - IBM Text Search for DB2 for z/OS
    - Internationalization Components for Unicode
      - Needed for Spatial Support
    - Installable Information Center Framework
    - See Program Directory GI10-8957
  - IBM DB2 Accessories Suite V10 Feature
    - Includes what is in the V11 Accessories Suite
    - JSON Support is coming (II14727, is available for DB2 10)
    - See Program Directory GI10-8958
  - Also includes the IBM DB2 Accessories Suite V9 Feature

Prerequisite Summary & Planning ...

- **PID 5615-DB2**
  - FMIDs HDBBB10, HIYBB10, HIZBB10, HIR2230, HDREB10

- **z/Architecture (z10 and subsequent 64-bit z/Architecture Processors)**

- **z/OS 1.13 or above**
  - Data Sharing: CF Level 12, with 13 or 14 recommended
  - GBP Enhancements require CFLEVEL 17 or higher

- **DB2 LUW / Connect / Data Server Driver / JDBC / ODBC**
  - Any in-support IBM Information Managements clients / drivers
  - V10.5 FP2 advised for new features
  - See the Program Directory for more details (ex DB2 for z/OS client to DB2 LUW server)

- **Migrate from**
  - DB2 10 for z/OS NFM
  - With Fallback SPE PM31841
    - With associated coreqs & prerequisites
    - Reassemble DSNHDECP module
    - See Informational APARs II14660 (Migration), II14730 / II14732 (Client & DDF)

- **Establish performance benchmarks**
Prerequisite Summary & Planning ...

- **Check / correct incompatibilities**
  - Run a current V10 DSNTIJPB pre-migration job (PM94057)
    - Same as V11 DSNTIJPM
    - Check maintenance for currency
  - Release Incompatibilities documented in:
    - Installation Guide
    - Application Programming and SQL Guide

- **Check programming language requirements**
  - DSNHPC7 included in the base for older COBOL and PL/I
  - See the Program Directory

- **IBM InfoSphere Data Replication (IIDR) 10.2.1**

- **IBM DB2 Analytics Accelerator V4**

- **IBM DB2 Tools Compatibility**

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Prerequisite Summary & Planning ...

- **Configure a minimum of (IEASYSxx):**
  - 1TB of contiguous shared private per DB2 – HVSHARE
    - Default is 510TB
  - 6GB of contiguous shared extended private per DB2 – HVCOMMON
    - Same as DB2 10
    - Default 66GB

- **No significant storage usage differences**
  - OnDemand Buffer Pool allocation from DB2 10 was removed
    - This likely does not represent a storage requirement
    - VPSIZE will be allocated when Buffer Pool is allocated
  - Early testing indicates 0 – 5% additional memory dependent on query workload
    - Consider 10% cushion for potential growth with less behaved workloads

- **SMS managed catalog and directory**
  - This was a requirement for DB2 10
    - Data Class attributes of
      - Extended Format
      - Extended Addressability
  - New areas of the Cat / Dir moved under SMS management during migration to 11
  - Additional migrated areas REORGed after V10 ENFM would also have been converted
  - DSNTIJSS provided as a sample for configuration
Prerequisite Summary & Planning ...

- **Reestablish V10 IVP to test DB2 11 before NFM**
  - COBOL 5 will require modification program preparation PROCs generated by DSNTIJMV
    - This is not a migration specific incompatibility
    - SYSLMOD needs to be a PDSE
    - May need additional SYSUTx and SYSMDECK DDs

- **Assess ISV Requirements / Readiness**
  - Tools and applications (Check your IBM DB2 Tools)
  - Some vendors may add instructions for migration and / or require maintenance

- **Assess the training requirements for your organization**

- **PDSEs required for SDSNLOAD, SDSNLOD2, ADSNLOAD, ADSNLOD2**
  - Same as V10

- **Establish a project team and project plan**
  - Review the Installation Guide checklists and MPW Project Framework
  - Consider Single Version Charging when building your plan

- **Develop conversion and coexistence goals**
  - How did your V10 test plans work?
  - Reuse and improve upon your experiences

- **Migration occurs in three familiar phases**
  - Conversion Mode (CM)
    - Data Sharing may see an X mode during coexistence
  - Enable New Function Mode (ENFM)
  - New Function Mode (NFM)

- **Use the proactive PMR process**
  - This is to notify IBM DB2 Support of your up coming migration activity
  - It is typically routed to the DB2 Duty Manager on call for that time
  - If problems occur during the migration, open a new Sev 1 PMR / SR

- **REBIND while in CM**
  - Use Plan Management (Package / Bind Stability)
    - Consider FREEing Original Packages to establish a new DB2 10 back up
  - Consider:
    - REBIND ... EXPLAIN (YES) ... APREUSE (WARN or ERROR)
    - REBIND ... EXPLAIN (YES) ... APCOMPARE (WARN or ERROR)
DB2 11 for z/OS Migration Modes / NFM Decisions

- Fallback SPE applied and incompatibilities mitigated.

Removed Features Summary

- No pre-V9 bound Packages
  - Require REBIND, including PLANMGMT copies
- Password protection of Active / Archive Logs
- Previous NEWFUN values
- DB2 Supplied Routines
  - SYSPROC.DSNAEXP
  - AMI based DB2 MQ Functions
  - See JPB/JPM report
- Sysplex Query Parallelism
- DSN1CHKR
Deprecated Features Summary

- **EXPLAIN tables in a previous release format**
  - V9 & V10 format accepted

- **DSNUTILS stored procedure**

- **REORG TABLESPACE SHRLEVEL NONE on a LOB**
  - V10 returned RC=0 (without performing the REORG)
  - V11 returns RC=8

- **Synonyms**
  - Should be using Aliases

- **Simple Table Spaces remain deprecated**
  - Can not create Simple Table Spaces (since V9)

- **See Parameters for more information**

New Parameters ...

- **APPLCOMPAT**
  - Default BIND / REBIND parameter
  - Determines static SQL statement behavior
  - Defaults to V10R1 for migrations and V11R1 for installations
    - Migrations must be V10R1 until NFM

- **AUTHEXIT_CACHEREFRESH**
  - When DSNX@XAC is active and this is set to ALL
    - DB2 listens for RACF signals for User Profile and Resource Access changes
    - Refreshed DB2 cache entries accordingly
  - Not online changeable

- **AUTHEXIT_CHECK (PRIMARY)**
  - Indicates if the Primary Auth ID or the Owner is used for Autobind authorization checking when DSNX@XAC is active
    - "DB2" indicates that DYNAMICRULES drive the authorization ID provided
  - Not online changeable

- **INDEX_CLEANUP_THREADS (10)**
  - Specifies the maximum number of threads for Pseudo-deleted index entry clean up processes
New Parameters ...

- **LIKE_Blank_Insignificantly (NO)**
  - YES strips trailing blanks before comparison
  - For SAP

- **MAXCONQN / MAXCONQW (OFF)**
  - Monitors the Connection queue depth (N) and time (W)
  - Also added to 10

- **MAXSORT_IN_MEMORY (CLIST calculation or 1000)**
  - Max allocated storage (KB) for a query with an:
    - ORDER BY or
    - GROUP BY

- **OBJECT_CREATE_FORMAT**
  - Default BASIC for migration and EXTENDED for installation
  - Indicates if new Table Spaces and Indexes should be created with 6 byte or 10 byte RBA / LRSN support

- **PARAMDEG_DPSI (0 or PARAMDEG)**
  - Maximum degree of parallelism for a DPSI
  - 0 – 254, DISABLE
  - 1, Child tasks are worked one at a time
  - DISABLE, DPSI will not drive parallelism

- **PARAMDEG_UTIL (0, or no constraint)**
  - Max parallel subtasks for some utilities
    - REORG TABLESPACE
    - REBUILD INDEX
    - CHECK INDEX
    - UNLOAD
    - LOAD
  - 0 - 32767

- **PCTFREE_UPD (0)**
  - Default for the PCTFREE FOR UPDATE clause of CREATE / ALTER TABLESPACE
  - Reserved from INSERTs
  - AUTO, 0 - 99

- **PKGREL_COMMIT (YES)**
  - Indicates default behavior for “breaking in” on persistent threads bound with RELEASE(DEALLOCATE)
  - PM95929 needed with V11 Early Code
  - PM96001 toleration / PM96004 enablement
New Parameters ...

- **REORG_DROP_PBG_PARTS (DISABLE)**
  - ENABLE: removes empty trailing Parts when REORG is run:
    - As a Full Table Space REORG
    - On a PBG
    - That is not organized by hash
  - Includes LOB spaces and Aux indexes

- **REORG_MAPPING_DATABASE (Implicit Database)**
  - The default database for automatic mapping tables for
  - REORG TABLESPACE SHRLLEVEL CHANGE

- **REORG_IGNORE_FREESPACE (NO)**
  - YES ignores PCTFREE and FREEPAGE for REORG TABLESPACE of PBGs
  - Returned to V10 as well

- **REORG_LIST_PROCESSING (PARALLEL)**
  - Defaults REORG TABLESPACE default to the PARALLEL YES option
  - SERIAL defaults to PARALLEL NO

- **REORG_PART_SORT_NPSI (AUTO)**
  - Indicates that REORG TABLESPACE PART is to determine when it's most effective to sort the entire NPSI(s)
  - Also in V10

New Parameters

- **STATFDBK_SCOPE (ALL)**
  - Scope of SQL statement for which DB2 provide statistics recommendations
  - DYNAMIC, STATIC, and NONE are other options

- **TEMPLATE_TIME (UTC)**
  - Default TIME option for a Template
  - LOCAL or UTC

- **UTILITY_OBJECT_CONVERSION (NONE)**
  - Control of the RBA/RPS_CONV keyword in utilities
  - BASIC, EXTENDED, NOBASIC (Utility keyword uses EXTENDED)
  - EXTENDED or NOBASIC before NFM, with Utility default will cause an RC=04
  - EXTENDED & NOBASIC require OBJECT_CREATE_FORMAT=EXTENDED

- **WFSTGUSE_AGENT_THRESHOLD (0)**
  - Warning threshold percentage of work file available to a single agent
  - Off by default, 0 – 100
  - WFDBSEP=YES, applies to both Temporary and Sort work file space

- **WFSTGUSE_SYSTEM_THRESHOLD (90)**
  - Warning threshold percentage of work file used by all
  - 0 (OFF) – 100
  - WFDBSEP=YES, applies to both Temporary and Sort work file space
Deprecated / Removed Parameters

- **Deprecated**
  - PRIVATE_PROTOCOL
  - CACHE_DEP_TRACK_STOR_LIM
  - DPSEGSZ

- **Removed**
  - ASSIST
  - COORDNTR
  - DISABSCL
  - DISALLOW_DEFAULT_COLLID
  - MSVGP
  - MSVGP2
  - QJPERFEH
  - OPTIOPIN
  - OPTIOWGT
  - OPTIXIO
  - PTCDIO
  - RETVLCFK
  - SEQCACH
  - SEOPRES
  - SMSDCFL
  - SMSDCIX
  - STATCLUS
  - CHARSET

Parameters Default & Maximum Changes

- **Default**
  - DESCSTAT
    - Is now the default for a new BIND/REBIND PACKAGE... DESCSTAT keyword when there is no existing value
  - REORG_PART_SORT_NPSI
    - Changed from NO to AUTO
    - Also added to DSNTIP62
  - SUBQ_MIDX
    - Changed from DISABLE to ENABLE

- **Maximum**
  - DSMAX
    - From 100,000 to 200,000
  - EDM_SKELETON_POOL
    - From 2097152 to 4194304
  - EDMDBDC
    - From 2097152 to 4194304
  - EDMSTMTC
    - From 1048576 to 4194304
  - MAXKEEPD
    - From 65535 to 204800
Release Incompatibilities Aren’t Just for DBAs

- **Application and SQL release incompatibilities**
- **Utility release incompatibilities**
- **Command release incompatibilities**
- **Storage release incompatibilities**
- **Other release incompatibilities**

Release incompatibilities can change over time. Ensure that current documentation is reviewed when constructing your plan.

Application Incompatibilities ...

- **ASUTIME** may be applied differently for dynamic statements of nested routines in NFM
  - SQLCODE -905 returned is limit for nested routine is exceeded
  - Previously had to exceed the top level package limit
- **Packages requiring rebind**
  - Previously to V9
- **ODBC LIMITEDBLOCKFETCH** is default in NFM
  - Default to ENABLED in NFM
Application Incompatibilities ...

- **XML**
  - XPath fewer XPath processing errors due to:
    - Predicate filtering before operations that could be invalid
    - Example: division by 0
    - Castable expressions avoiding incompatible data types
  - Implicit XML Document nodes
    - The XMLDOCUMENT function is not needed to avoid SQLCODE -20345

- **Client Information Special Register expansion**

- **ALTER Limit Key**
  - Now a Pending Alter for PBRs and Table Partitioned Classic
  - Not allowed with Immediate ALTERs

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Application Incompatibilities

- **SYSPUBLIC Schema**
  - Used for Public Aliases and cannot be in the SQL Path for Routines
  - SYSPUBLIC (and SESSION) should not be Schema Names

- **SYSIBMADM Schema**
  - Schema for administrative Global Variables (GET_ARCHIVE)
  - Added to CURRENT PATH in V11 NFM / V11R1

- **CAST(string AS TIMESTAMP)**
  - String input is interpreted as a TIMESTAMP string representation in V11 NFM / V11R1
  - Previously 8 bytes were considered a Store Clock value and 13 bytes a GENERATE_UNIQUE value.
    - ‘1/1/2013’ (8 bytes) returned year 2034.
    - Corrected in NFM / V11R1, but GENERATE_UNIQUE returns -180 (use TIMESTAMP BIF instead)

- **Check:**
  - New Reserved Words
  - Changed Messages
  - Changed SQLCODEs
Utility Incompatibilities ...

- **REBUILD INDEX, COPY, and RECOVER parallelism**
  - May increase in CM, governed by the PARALLEL or PARAMDEG_UTIL parameters

- **REORG**
  - TABLESPACE / INDEX: DRAIN defaults to ALL (was WRITERS)
  - TABLESPACE: NOPAD is the default for
    - UNLOAD EXTERNAL or
    - DISCARD

- **REORG on LOB w/ SHRLEVEL NONE**
  - Will now return RC=8

Utility Incompatibilities

- **The RECOVER RBA/LRSN Expansion**
  - TOLOGPOINT, TORBA, RESTOREBEFORE accept 6 or 10 byte format

- **DSNACCOX**
  - The Ratio-of-space-allocated-to-used is now turned off by default (-1)
    - Was 2.0
  - XML & LOB spaces now accepted
  - Now checks DBET states
  - CHKLVL 8, a new row is not inserted of an object already has a recommendation

- **ALTER Limit Key**
  - Now a Pending Alter for PBRs and table-controlled Classic partitioning table spaces
  - REORG SHRLEVEL NONE and LOAD REPLACE will not materialize
    - Must be Online REORG
Command & Storage Incompatibilities

- **Command**
  - DISPLAY UTILITY
    - Now includes date / time of job submission
  - DISPLAY THREAD
    - Shows expanded RBA / LRSN

- **Storage**
  - HVSHARE minimum is now 1 TB
    - Was 128 GB

Other Incompatibilities

- **IVP**
  - ADMIN_INFO_SYSPARM used instead of DSNWZP
  - DSNTEJ6Z

- **Log Capture Exit Routine**
  - Must be invoked in 64 bit mode
  - Buffers are moved above the bar into key 0 protected common storage
  - Uses 64 bit pointers

- **Trace Records**
  - Any IFCIDS that have RBA or LRSN values are expanded to 10 bytes in CM
  - In most cases these fields are moved so other offsets are not impacted
    - IFCID 0204 is an exception (DDF Partner Cold Start)

- **Client Information in messages**
  - Expands in CM changing the length of several messages
  - User ID, Workstation Name, Application Name, Accounting Information
Migration Process

- **Preparations**
- **Customization / Tailoring**
- **Migration**
  - Before CM
  - Migration to CM
  - Fallback to V10
  - Remigration to CM
  - Conversion to ENFM
  - Conversion to NFM
  - Application Compatibility
  - Extended RBA / LRSN
- **Testing**

Note: These steps will iterate

Migration Preparations ...

- **Justification**
  - Performance, New features, eventually Support
  - Attend the full MPW (Functional Inventory)

- **Review & incorporate DB2 10 migration findings**

- **Perform V10 migration consideration / incompatibilities checking**
  - DSNTIJPB in V10
  - Delivered via PM94057
  - Check for current maintenance

- **Review the documented release incompatibilities**
Migration Preparations DSNTIJPM / DSNTIJPB...

- JPB shipped for V10 with APAR PM94057

Checks for:

1. Check for previous-release sample database
2. Catalog user defined indexes (user-managed storage)
   - Will need shadow data sets created before DSNTIJEN
3. Catalog user defined indexes (DB2-managed storage)
   - Will be converted during DSNTIJEN. Review space allocations
4. Plans last bound prior to V9
5. Packages last bound prior to V9
6. EXPLAIN tables prior to V10
7. Report eliminated
8. MQTs on the Catalog, drop before ENFM
9. AMI based DB2 MQSeries functions (dropped by JRT)
10. AMI based DB2 XML MQSeries functions (dropped by JRT)
11. Simple table spaces
12. Triggers with invalid SECTNOI. Recreate...
13. Views with a period specification must be dropped
14. MQTs with a period specification must be dropped
15. SQL Functions with a period specification must be dropped
16. Catalog Table Spaces with a versioning problem, requires MODIFY RECOVERY & REORG before CM
17. Packages which will be invalidated by TIJEN (ENFM) due to catalog changes
18. Orphaned SYSCOPIY or SYSOBDS rows created during V10 ENFM w/o PM41956. No operational impact, but may impact migrations.
19. Orphaned rows in SYSTABSTATS that could impact migration
20. Orphaned rows in SYSCOLAUTH
22. Plans invalidated in ENFM
23. Packages invalidated in CM (JTC)
24. Plans invalidated in CM
Migration Preparations DSNTIJKZ ...

- Job to update the installation CLIST input (DSNTIIDxx) to reflect current:
  - System parameters
  - Buffer pool settings

The V10 Catalog could be checked in advance
- REORG to clean up
- DSN1COPY w/CHECK
- Catalog CHECK DATA, INDEX & LOB

Identify migration stakeholders and knowledge requirements

Develop your plan to meet your business goals
- Start with the DB2 11 for z/OS Migration Framework
- Incorporate discoveries from your analysis and known company events

Order DB2 11 for z/OS
- Also order the DB2 Utilities Suite (5655-W87) and
- Accessories Suite (5697-Q04) if required
- Tools versions / maintenance prerequisites

Perform the SMPE work
Migration Customization / Tailoring ...

- **Prepare your system to run the installation CLIST**
  - Ensure that the CLIST input member is current
  - To avoid messages from overlaying the field, deselect "Long message in pop-up" in ISPF Settings

- **Use V11 DSNTIDX (XB for SAP) as the input member**
  - For Data Sharing, subsequent members use the output member from the previous member

- **Identify new SQLIDs to be used**

- **Complete panel process with Install Type of Migrate**

- **Panels**
  - Storage Naming
  - Object Information
  - Thread Management
  - Buffer Pools
  - Systems Management
  - Application Programming
  - IRLM

- **Utilities**
  - Security
  - Subsystem
  - Distributed
  - Routines
  - Miscellaneous

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**Migration Customization / Tailoring – DSNTIPG (New)**

- **Added**
  - ROUTINES CREATOR & SEC DEF CREATOR from DSNTIPP1

- **New**
  - Installation IDs
    - 3 SQL ID
      - SQLID used when processing SQL in more install / IVP jobs
    - 4 Package Owner
      - Specify the OWNER of the Plans / Packages bound by most install / IVP jobs
    - 5 Grantees (PUBLIC)
      - Specifies Grantees for most install / IVP jobs
      - Can specify several separated by commas (up to 44 chars)
    - The above do not apply to JRT / JRV
      - See fields 1 & 2, and panels DSNTIPRA / DSNTIPRP
  - Data set prefixes for Copy and Other data sets

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**Migration Planning Workshop**

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Migration Customization / Tailoring

- **Calculations**
  - The DB2 11 CLIST incorporates step-wise calculations
  - Similar to those documented in the *Planning for DB2 Storage* documentation
    - Small
    - Medium
    - Large
    - Extra Large

```
  1 DB122  DB1222 DBCA (100000)  100000  (1-100000)
  2 DB122  DB1222 DBCA (100000)  100000  100000
  3 DB122  DB1222 DBCA (100000)  100000  100000
  4 DB122  DB1222 DBCA (100000)  100000  100000
  5 DB122  DB1222 DBCA (100000)  100000  100000
  6 DB122  DB1222 DBCA (100000)  100000  100000
  7 DB122  DB1222 DBCA (100000)  100000  100000
  8 DB122  DB1222 DBCA (100000)  100000  100000
  9 DB122  DB1222 DBCA (100000)  100000  100000
 10 DB122  DB1222 DBCA (100000)  100000  100000
```

Let's take a break
Migration: Pre-Conversion Mode ...

- **Iterate Pre-CM / CM steps across landscapes before proceeding to ENFM**
  - There are exceptions, like Sandbox environments and purchased applications
  - Check with your vendors

- **Review all migration steps**
  - Meet with others that are needed to complete the tasks
  - Understand requirements / concerns of others involved

- **Apply the V11 Fallback SPE on the V10 system (PM31841)**
  - Review II14660 for additional maintenance
  - See II14730 & II14732 for Client & DDF migration information

- **Validate the Catalog / Directory**
  - DSN1COPY with PARM='CHECK'
    - May produce DSN1985I, which can be ignored on
      - SYSSTR, SYSTATS, SYSDDF, SYSUTILX, SPT01
    - CHECK DATA, INDEX, and LOB
    - DSNTESQ Queries (checks for logical correctness)

- **Activate the DB2 11 EARLY Code**
  - IPL or
  - LLA, REFRESH & REFRESH, DB2 EARLY
    - DB2 must be down, but an IPL can be avoided
Collect V10 Performance Baselines
- Save SMF Data
  - Aggregate accounting by connection type
  - Statistics COMMITs / ROLLBACKs
  - DML per COMMIT
  - LOCK / UNLOCK requests
  - Buffer Pool statistics
- System Service, DBM1, IRLM, DDF CPU (Total and Preempt IIP SRB)
- Storage statistics (IFCID 225)
- Save critical access paths
- Optim Workload Replay (OWR) could capture pre-migration baseline test scenarios

DSNTIJIN
- Defines application libraries

DSNTIJMV
- Sets up 27 PROCs by default
  - 5: DB2 subsystems
  - 12: WLM
  - 10: For language support
- Sets up USS files / paths

DSNTIJUZ
- System Parameters

DSNTIJEX
- Sample or user exit routines for Signon, Authorization, and Access
- If in use for V10

V10 DSNTIJIC
- Backup the Catalog / Directory

Restart DB2 (V10) in ACCESS(MAINT)
- While DB2 is down, optional full volume dumps can provide additional protection

Ensure that V10 is stopping clean
- DISPLAY Utilities, Threads, and Database / Spaces
- Clean up any potential problem conditions
- Optional ARCHIVE LOG before stopping V10
Migration: Conversion Mode ...

- Cycle DB2, restarting with V11 Procedures & Libraries
  - Catalog level being reported as 111 is being fixed
  - Expect several messages related to needing to run JTC
    - DSNT501I & DSNL700I messages with 00C900A6
    - Resource unavailable messages
    - DDF may abend

- DSNTIJTC
  - Tailors the DB2 Catalog in a single unit of work
  - In the case of failure, changes are rolled back
  - Run this with DB2 in ACCESS(MAINT)
    - Allow workload to flow to other members
  - 00C200EF would indicate the SMS is not set up properly for new spaces created
    - See DSNTIJSS
    - MODE(X) = Coexistence

Online Migrations
- Data Sharing configuration
- Run in Coexistence (V10 & V11 members in the same group)
- Use ACCESS(MAINT) while running JTC on first member to migrate
- Cycle one member at a time
- Online for application SQL access to user data
- Not meant to run other utilities, DDL, DCL, or commands
Migration: Conversion Mode ...

**Initial checkout**
- Start components (like DDF) reporting issue during initial V11 start
  - Or cycle DB2
- SYSROUTINES CDC was disabled and can be re-enabled
- Update data set Aliases, Includes, and/or direct references to libraries
  - Optional; consider Catalog verification steps

**DSNTIJTM**
- Prepares DSNTIAD
- Binds REXX
- Creates additional Work Files (if requested via DSNTIP9) via DSNTWFG

**DSNTIJSG**
- Prepares SPUFI, DCLGEN, SQL Utility,
  - Extended Optimization Tables
    - DSN_STAT_FEEDBACK, DSN_PREDICATE_SELECTIVITY
  - Creates the Program Authorization Database
  - Existing DSNRLMTxx tables are used until NFM (expanded Client Info fields).

**DSNTIJRW**
- Sets up the WLM environments for DB2 Supplied Routines
  - May not be needed for migration
- Check for recommended WLM changes
  - Table of NUMTCB, authorization requirements

**DSNTIJRT**
- Maintains the DB2 Supplied Routines and dependent objects
  - Review the comments in this job
  - If running the Administrative Schedule (ADMT), it will not run until JRT is completed in CM
- RC=0 does not mean that all routines are usable
  - For JDBC / ODBC, see comments about possible need for remote bind
- XML Schema Repository (DSNXSR) is set to DROP RESTRICT
  - Must be reversed if running in REINITIALIZE mode
Migration: Conversion Mode ...

- **DSNTIJRV**
  - Often ends with an RC=08
  - Example: If the Administrative Scheduler is not set up, those stored procedures fail verification

- **Verify Views**
  - SQL documented in Migration Step 26

- **DSNTIJIC (V11 CM Version)**
  - Back up the Catalog / Directory
  - A back up of the Catalog / Directory is recommended before ENFM

- **Continue using V10 Dynamic programs (TEP2, TEP4, TIAUL, etc.)**

---

**Set up attachments**

- TSO, CICS, IMS, etc. – Establish the Logon CLIST provided to others
- Checking on LE, WLM set up, etc.
- See Migration Steps 6, 7, and 8

**Coexistence considerations**

- See the referenced documentation for considerations
- One example is for Utility execution from DB2 10 members
  - Release-dependent load module (DSNUT101) and
  - Utility-dependent load modules (DSNU10*)
  - Need to be copied or concatenated in / with the V11 SDSNLOAD
Migration: Conversion Mode ...

- **REBIND Packages**
  - Re-enables xPROCs/zPROCs
  - Enacts most performance advantages in the new release (out of the box savings)
  - Consider using Plan Management (if not already)
    - Consider FREEing Original copies that may exist to establish new Package baselines
    - Consider using APCOMPARE or APREUSE if concerned about access path changes
    - For Data Sharing, consider your ABIND ZParm and workload coexistence plans
  - Consider using Plan Management (if not already)
  - Consider FREEing Original copies that may exist to establish new Package baselines
  - Consider using APCOMPARE or APREUSE if concerned about access path changes
  - For Data Sharing, consider your ABIND ZParm and workload coexistence plans

- **REBIND Plans**
  - There are runtime structures within the Plan which should be recreated on the new code base

- **Test, test, test**
  - Compare results to your Pre-CM benchmark collections
  - Replay OWR test scripts, if available
  - Function behavior differences will not be part of this test phase
    - APPLCOMPAT must be V10R1 until NFM and therefore this testing must wait

- **Convert REORG Mapping Tables to new format**

- **Fallback / Remigration test**
  - Become familiar with these steps in a Sandbox-like environment
  - DSNTIJFV / modified DSNTIJMV

- **Upgrade EXPLAIN / Optimization Tables**
  - See DSNTESC, DSNTESH for DDL
  - DSNTIJXA for table migration assistance
    - Does not create DSN_PREDICATE_SELECTIVITY, DSN_STAT_FEEDBACK, or DSN_VIRTUAL_KEYTARGETS

- **Administrative Scheduler**
  - If not established, this task and supporting Database could be configured at this time

- **Maintenance**
  - If applying maintenance, make sure to review HOLDDATA for actions
  - REBINDs may be required

- **CM ends the MLC SVC timing for this subsystem / member**
  - As long as a Fallback to V10 is not performed
  - Structure your project plan to reach CM within 12 months to avoid dual version charging
    - Specific customer terms and country consideration must be assessed
Migration: Enable New Function Mode ...

- Iterate this mode across environments
  - Previous exceptions apply
  - May combine with NFM to consolidate maintenance windows

- Before proceeding to ENFM ...
  - Complete the Installation CLIST ENFM panels and generate jobs
    - DSNTIPPT has a new field to display JDBC AND SQL DLLS
    - ENFM & NFM conversion and reversion jobs
    - DB2 11 IVP jobs
    - Catalog RBA / LRSN expansion jobs
  - Checkpoint with project stakeholders
  - All testing should indicate no need for Fallback to V10
    - Regression testing & CM REBINDs should be complete
  - Review user defined catalog indexes
    - Create shadow data sets for user defined Indexes on user managed storage
      - Report 2 of JPM / JPB
    - Review allocations for user defined Indexes on DB2 managed storage
      - Report 3 of JPM / JPB
    - For impacted user defined Indexes with additional pieces (A002 or higher)
      - SQL in DSNTIJEN comments
  - All active members of data sharing groups must be migrated to CM before proceeding
Before proceeding to ENFM
– This is a group wide event
– Table Spaces (Tables) involved:
  • SYSUTILX (SYSUTILX, SYSUTIL)
  • SYSLGRNX (SYSLGRNX)
  • SYSCOPY (SYSCOPY)
  • SYSRTSTS (SYSTABLESPACESTATS, SYSINDEXSPACESTATS)
  • SYSTIXS (SYSINDEXES)
  • SYSTSTAB (SYSTABLES)
  • SYSSP (SYSCHECKDEP, SYSCHECKS, SYSCHECKS2, SYSSTRINGS)

DSNTIJEN ...
– Converts to ENFM
– Do not attempt to modify this job
– Issues commands
  • Displays any utilities
  • Terminates previously run DSNTIJEN, if exists
    – Utility ID DSNENFM.*
  • DISPLAY GROUP DETAIL
– Verifies that the Catalog is at the right level
– Checks for impacted objects in COPY or ICOPY status
  • Backs up any found in these statuses
– Avoid running other processes that modify the Catalog / Directory during JEN execution
Migration: Enable New Function Mode ...

**DSNTIJEN ...**
- Establishes metadata about DSND01 tables for serviceability SQL access
  - Cleans up existing
    - SYSDATABASE DBID=1
    - SYSTABLESPACE DBID=1
  - INSERTs metadata data for Database DSND01
    - Table Space (Table)
    - SYSGRNX (SYSLGRNX)
    - SYSUTILX (SYSUTILX, SYSUTIL)
    - SCT02 (SCTR)
    - SPT01 (SPTR)
    - SYSSPXA (SYSSPTSEC_DATA)*
    - SYSSPXB (SYSSPTSEC_EXPL)*
    - DB01 (DBDR)
    - SYSSDBXA (SYSSDB_DATA)*
    - Except for "*" items, Columns, Index, Keys, and Relationship metadata is also created
    - Note that some meta data values for the directory may not follow documented values (PI08928 is resolving this).

Enable New Function Mode

Migration: Enable New Function Mode ...

**DSNTIJEN ...**
- Converts (CATENFM)
  - SYSUTILX
  - SYSUTIL
- Converts (CATENFM) & Online REORG ... CONVERTV11
  - SHRLEVEL REFERENCE when a Table Space change is made
  - SHRLEVEL CHANGE when Table Space remains the same
    - SYSGRNX SHRLEVEL CHANGE
    - SYSCOPY SHRLEVEL REFERENCE
    - SYSTRTS SHRLEVEL REFERENCE
    - SYSTIXS SHRLEVEL CHANGE
    - SYSTSTAB SHRLEVEL CHANGE
    - SYSSTR SHRLEVEL REFERENCE
- Uses Automatic Mapping Table support
  - See PM94690 for -551 during migration
- Repeats DISPLAYs and TERM
Migration: Enable New Function Mode ...

**DSNTIJEN**
- Considerations
  - SYSUTILX is reset during conversion
  - DSNTIJNH can be used to halt this job (CATENFM HALTENFM)
  - Multiple data sets for a page set may be consolidated
    - Everything converted now uses 64GB Extended Format & Addressability
  - In case of failure:
    - Isolated to the Table Space being processed at that time
    - Online REORG shadows will be thrown away
    - Resolve the problem
      - Do not attempt any recoveries
      - Resubmit DSNTIJEN unaltered
  - DB2 will operate with the Catalog / Directory in a partially converted state
    - Make plans to complete the conversion as soon as practical
    - Avoid other utilities on the Catalog / Directory during this time

**DSNTIJCI**
- Checks indexes of the Catalog and Directory from the ENFM conversion
  - CHECK INDEX(ALL)...on changed Catalog and Directory objects

**DSNTIJCS**
- Reverts to CM*
  - No Fallback available from this mode
  - Return to ENFM (DSNTIJEN) before NFM

**DSNTIJIC (ENFM)**
- Backup the converted Catalog / Directory

**Testing**
- Application testing does not need to be repeated
- Light check out should be considered

**DB2 10 Libraries**
- At this point, fallback is no longer an option
- Consider cleaning up any reference to V10 libraries to avoid future SVC issues
  - Link List
  - STEPLIBs
  - Aliases
  - Etc.

**Update shadow Catalogs if they exist**
Migration: New Function Mode ...

- **Planning for NFM**
  - Consider converting to NFM with ENFM
    - Pause for brief checkout, and proceed to NFM
  - For non-Production environments
    - May want to delay NFM to avoid development using new features that cannot be promoted during this project timeframe
  - Consider client behavior
    - Drivers sometimes exhibit behavior changes when “seeing” that the server is now NFM
  - This is a group wide event
  - Should reversion be necessary
    - DSNTIJES will return to EN*
    - DSNTIJCS will return to CM*

- **Before converting to NFM**
  - Updates to the Catalog / Directory should be avoided while converting

- **DSNTIJNF**
  - Converts to NFM & Extends SCA LRSNs
    - DB2 11 SQL capabilities are now enabled
      - New functions are not available until Packages are rebound APPLCOMPAT V11R1
        - While V10R1 (default), new SQL features return SQLCODE -4743
        - Functions will retain V10 behavior until APPLCOMPAT is addressed

- **Reverting**
  - DSNTIJCS will return to CM*
    - Cannot fallback from CM*
    - DSNTIJES will return to EN*

- **DSNTIJNG**
  - Changed DSNHDECP NEWFUN to V11

- **DSNTIJRT / JRV**
  - This job was generated during the MIGRATE execution of the panels
    - Find it in the SDSNSAMP library from this generation
  - For DB2 Supplied Routines / Objects that require NFM
    - Ex. The MVS_CMD_OUTPUT CGTT
Migration: New Function Mode

- **DSNTOJNX**
  - REBINDs SPUFI and DSNREXX for
  - APPLCOMPAT(V11R1)
  - ARCHIVESENSITIVE(YES)
  - BUSTIMESENSITIVE(YES)
  - SYSTIMESENSITIVE(YES)
  - Consider doing the same for client Packages
    - Note these keywords must be explicitly stated or the REBIND can default to the existing setting which will be V10R1
  - DSNRLMTxx expanded Client Info fields
    - ALTERs provided to modifies this table if it exists, or
    - CREATE at this time to if needed

- **Prepare V11 Dynamic Sample programs**
  - DSNTEJ2A
  - DSNTEJ1L/P
  - Make sure references to V10 programs is removed

Consider the ZParm APPLCOMPAT setting
- See APPLCOMPAT section
- Begin DB2 11 feature exploitation
- Probably want this left at V10R1 until majority of applications complete new function testing

Consider RBA / LRSN expansion

DB2 11 IVP testing can be performed
- Consider the previous reviewed COBOL 5 change if appropriate

Conduct a DB2 11 project review
- What worked well?
- What didn’t work well?
- Where there any surprises?
- Any new tests included for this migration?
- Document all items that can assist your next migration project
Application Compatibility ...

- Allows applications to continue experiencing SQL DML & XML behavior from a previous release (DB2 10)
  - APPLCOMPAT ZParm
    - Must be V10R1 until NFM
  - Migrations default to the migrate-from release (V10R1)
  - Installations default to the migrate-to release (V11R1)

- DDL and DCL is *not* fenced by APPLCOMPAT

- This includes new functions, not just changes to existing behavior

- May not be possible when conforming to SQL standards

Application Compatibility ...

- Similar limited capability in DB2 10
  - BIF_COMPATIBILITY
  - DDF_COMPATIBILITY (Disabled when APPLCOMPAT set to (V11R1) via PM94719)

- Static SQL is governed by the Package APPLCOMPAT
  - Cannot bind with V11R1 until NFM

- Dynamic SQL is governed by the:
  - CURRENT APPLICATION COMPATIBILITY
  - Which defaults to the Package APPLCOMPAT if not SET

- Once in NFM:
  - CURRENT APPLICATION COMPATIBILITY can be set to either level
  - RE/BIND PACKAGE can choose either level
Application Compatibility ...

- **BIND / REBIND (TRIGGER) ... APPLCOMPAT Defaults**
  - Must be V10R1 until NFM
    - V11R1 before NFM returns error
  - During REBIND, if already rebound with a compatibility level
    - Defaults to this level
    - Including Autobind
  - If BINDind, or not yet set, defaults to APPLCOMPAT ZParm

- **CREATE / ALTER PROCEDURE /FUNCTION**
  - Same rules as BIND / REBIND

- **On DB2I defaults panels for**
  - BIND: DSNEBP10
  - REBIND: DSNEBP11

---

Application Compatibility ...

- **CURRENT APPLICATION COMPATIBILITY**
  - Defaults to the Package RE/BIND
  - If not rebound, defaults to the ZParm
  - SET this Special Register overrides all
    - Must be in NFM to SET this register

- **IFCID 239**
  - Indicates Packages using a function that changes in DB2 11
  - Field QPACINCOMPAT
  - See SDSNMACS(DSNDQPAC) for mapping

- **IFCID 366/376**
  - Records indicate SQL using the V10 code path which is different from the V11 code path
  - Use these in CM to identify programs needing review
  - 376 is new in V11 and is a roll up of activity reported in 366
    - Attempts once per dynamic and static statement (bound V10 or later)
    - Once per Plan, Package, Statement # bound prior to V10
  - See SDSNMACS(DSNDQW05) for detailed description
### Application Compatibility...

<table>
<thead>
<tr>
<th>10 NFM</th>
<th>11 CM</th>
<th>11 ENFM</th>
<th>11 NFM</th>
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<tr>
<td>ZParm V10R1</td>
<td>Same as CM</td>
<td>ZParm V10R1</td>
<td>Same as CM</td>
</tr>
<tr>
<td>- Can set to V11R1 but will not operate that way</td>
<td></td>
<td>- V10R1 or V11R1</td>
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</tr>
<tr>
<td>BIND/REBIND</td>
<td></td>
<td>BIND/REBIND</td>
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<tr>
<td>- Must be V10R1</td>
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<td>- V10R1/V11R1 available</td>
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<tr>
<td>CREATE/ALTER</td>
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<td>REBIND &amp; Autobind</td>
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<tr>
<td>- Must be V10R1</td>
<td></td>
<td>- Defaults to ZParm</td>
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</tr>
<tr>
<td>SET CAC* not available</td>
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<td>CREATE/ALTER</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>- Defaults to previous Catalog value first</td>
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<tr>
<td></td>
<td></td>
<td>- ZParm second</td>
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<tr>
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<td>SET CAC* available</td>
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<td>New features</td>
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<tr>
<td></td>
<td></td>
<td>- Require V11R1</td>
<td></td>
</tr>
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</table>

*CAC = CURRENT APPLICATION COMPATIBILITY

### Application Compatibility

- **System Profiles Support**
  - Post-GA in V11 (PM93658)
  - Ability to use SPECIAL_REGISTER Keyword to establish several Special Registers for a
    - Client
    - Application
    - User
  - Including APPLICATION COMPATIBILITY
RBA / LRSN Expansion ...

- **DB2 10 and prior used a 6 byte (Basic) RBA / LRSN**
  - Some customers have had to take RBA action to keep systems running
    - RBA reset
      - Manual recovery action to reset
    - Bring up new data sharing members
  - Represents 256 TBs of logging space
  - Messaging (DSNJ032I) and system actions
    - F000 0000 0000 warning threshold surfaces at log switch & restart
    - FFFF 0000 0000 critical threshold, DB2 will only run ACCESS(MAINT)
  - The LRSN also has a limit in Year 2042 if there’s no DELTA RBA
  - STORCLK is 8 bytes, and therefore LRSN spin can occur

- **DB2 11 offers the option to convert to a 10 byte RBA / LRSN**
  - Almost 4 Billion times the logging space
  - RBA extended with high-end (left) 4 bytes
    - Extended value represents 1 YB of logging space (1 YB = 1 Trillion TBs)
  - LRSN
    - 1 byte on high-end
    - 3 bytes on the low-end
    - Adding 30,000 years of logging
  - Conversion is optional if not nearing the 6 byte limit
    - However, DB2 11 uses 10 bytes internally and converts to 6 on writes
  - Convert earlier than required to:
    - Avoid internal conversions
    - Resolve LRSN spin conditions
    - Disabling Data Sharing requires 10 byte RBA/LRSN for surviving members

- **Additional information**
  - Technote
  - DB2 11 Technical Overview Redbook, Chapter 3
RBA / LRSN Expansion ...

- Must restart the subsystem / member on NFM before expansion
- There are 3 areas for conversion which can be done in any order and schedule IF NOT NEARING 6 byte limit
  - BSDS (DSNTIJCB)
    - DB2 is down
    - BSDSs are reformatted and will grow
    - A checkpoint will be taken at restart
  - Catalog (DSNTIJCV)
    - Some of these may have been converted during DSNTIJEN (ENFM)
    - User Data / Indexes
    - REORG, REBUILD, LOAD REPLACE with any SHRLEVEL
    - At the PART level, except for XML* & Hashed
    - Data & Indexes can be converted independently
    - Growth is not expected, as there is enough room in the pages
- DB2 11 internals are always using a 10 byte RBA / LRSN
  - But can be converted to 6 byte for objects in BASIC format for writes
  - As long as DB2 is not close to the 6 byte limit

* Research options for XML. Based on the options and if previously was Expanded, PART may be an option

---

RBA / LRSN Expansion ...

- DSNTIJCB
  - Tailored during the MIGRATE execution of the CLIST
  - DB2 must be down
    - Recommend –STOP DB2 MODE(QUIESCE)
  - Defines new BSDSs (suffix NEWFMT1) & Converts into the new BSDS data sets
  - Renames:
    - existing to .OLDFMT
    - NEWFMT1 to existing
  - DSNJCNVT could find differences between the BSDSs not shown in DSNJU004
    - This will terminate the conversion
    - Removing SYSUT2 will cause SYSUT1 (BSDS01) to be written out to both BSDS outputs

```
DSNJ2001  DSNJCNVT CONVERT UTILITY PROCESSING COMPLETED SUCCESSFULLY FOR MEMBER
```

---
RBA / LRSN Expansion ...

- **DSNTIJCV**
  - Tailored during the ENFM execution of the CLIST
  - Consider MODIFY RECOVER & REORG prior to conversion
    - For large / active Catalogs
    - When executed outside of the migration project to clean up again
  - All converted areas are COPYed
  - As with JEN, SYSUTILX cannot be REORGed and therefore is reset
    - Make sure it is empty and quiesced before running JCV
    - CATMAINT converts SYSUTILX
  - REORG ... SHRLEVEL CHANGE converts the rest
  - Builds LISTDEF with BASIC YES, so already converted objects are skipped
  - This job can be split apart, but review PM95430
    - When SYSLGRNX is Extended & SYSCOPY is Basic
    - COPY SHRLEVEL REFERENCE is not recorded

- **In CM:**
  - IFCID 306 & Log Capture Exit products (Replication) see 10 bytes
  - Work files are Extended when opened
  - DISPLAY THREAD and restart status messages are 10 bytes

- **In ENFM**
  - JEN REORGed Catalog / Directory objects converted based on UTILITY_OBJECT_CONVERSION

- **In NFM**
  - JNF converts SCA to 10 bytes
  - DSNTIJCB & DSNTIJCV available to convert BSDS & Cat/Dir
  - Use utilities RBALRSN_CONVERSION keyword for user data/indexes
Clone tables must be dropped to convert

SYSTABLEPART & SYSINDEXPART indicate format (RBA_FORMAT)
- All migrated objects will indicate blank
- At open time, REORG, REBUILD, LOAD, or REPAIR these values will be set as “B” or “E”
- CREATE sets RBA_FORMAT
  - DEFINE NO = “U”
    - DEFINE NO objects created according to OBJECT_CREATE_FORMAT in effect

Utilities and Service Aids accept either format
- UTILITY_OBJECT_CONVERSION defaults utility RBALRSN_CONVERSION keyword.
  - Prior to NFM, Utilities can return RC=04 if conversion attempted
- DSN1COPY may need REPAIR to correct the Catalog definition
  - Must be TO a DB2 11 NFM system if Expanded
- RECOVER of Expanded object with a Basic copy will reset the object to Basic
  - Cannot roll forward across an RBA / LRSN change

IFCIDs
- Many are reformatted.
- The RBA/LRSN was moved when possible to not impact other fields

V11 6 byte Thresholds
- RBA
  - F000 0000 0000
    - DSNJ032I Warning with each log switch and DB2 restart
  - FFF8 0000 0000
    - 904 00C2026D Soft Limit
    - No SQL Updates allowed for Basic Objects
  - FFFF 0000 0000
    - DSNJ033E Critical Threshold
    - DB2 stops with 00D10251
    - DB2 only runs in ACCESS(MAINT)
    - If you manage to reach all ‘F’s, then previous RBA reset procedure is still likely
- LRSN
  - 1 Year left
    - DSNJ034I Warning with each log switch and DB2 restart
  - 2 Months left
    - 904 00C2026D Soft Limit
    - No SQL Updates allowed for Basic Objects
  - 2 Weeks left
    - DSNJ033E Critical Threshold
    - DB2 stops with 00D10251
    - DB2 only runs in ACCESS(MAINT)
Migration Summary

- Run checks against your V10 system
- Review documentation
- Resolve / research inconsistencies and release incompatible changes
- Establish a Project Plan and Project Team
- Assess new features & training plans
- Complete any prerequisite projects
- Collect Performance Baselines
- Establish Test Plans
- Determine Conversion & Coexistence (data sharing) goals
- Determine your Application Compatibility and RBA Expansion plans
- Keep your IBM team informed
## Migration: CM Catalog Visualization ...

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## Migration: CM Catalog Visualization ...

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### Migration: CM Catalog Visualization...

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### Migration: ENFM Catalog / Dir Visualization

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Tip: All new non-AUX create Table Spaces are PBGs
- MAXPARTITIONS 1
- DSSIZE 64G
- 108 Unicode; 7 EBCDIC; 1 ASCII

Tip: TS Page Size Counts
- 4K = 76 -> 94
- 8K = 10
- 16K = 5 -> 6
- 32K = 4 -> 6