Data and AI

Getting Ready For Db2 13

New England DB2 Users Group
September 29, 2022

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Agenda

- Db2 Continuous Delivery Review
- Db2 12 Function Level Journey
- Migration plans/paths to Db2 12 Function level M510
- Db2 13 Migration
- Fallback and Release Coexistence
- Evolution of the Db2 catalog and test
- Summary
- Questions?


Continuous
Delivery Review

Continuous Delivery – What is it?

- From the IBM DB2 12 for z/OS Technical Overview Redbook (December 2016)
  - https://www.redbooks.ibm.com/redbooks/pdfs/sg248383.pdf

    "Each DB2 version delivers many enhancements in different areas that are welcomed by customers worldwide. However, sometimes certain functionalities are required sooner than the scheduled date of the next version. New release migration is also costly and time-consuming. Waiting for years to receive the much needed features in the next version might be impossible for certain business needs, thus the enhanced features must be retrofitted to the version in the current service stream. Continuous delivery is a solution to make enhancements available in the service stream sooner than the next version."

  - Notice that we used 'DB2' in 2016 and now use 'Db2' (starting in 2017)!

Db2 Continuous Delivery Review

- With Continuous Delivery, there is a **single delivery mechanism for defect fixes and enhancements**
  - PTFs (and collections of PTFs like PUTLEVEL and RSU) → same as today
- With Continuous Delivery, there are **five** Db2 for z/OS levels:
  - Maintenance level (ML) – changes with maintenance
    - Also known as code level - contains defect and new enhancement fixes
    - Some new functions are shipped disabled until the appropriate new function level is activated
  - Catalog level (CL) – function level prerequisites - cumulative (bundling possible)
  - Function level (FL) - needs to be activated - cumulative (skip level possible)
    - Introduces new Db2 features and functionality
    - No impact or change in existing application behavior
  - APPLCOMPAT level (AC) - set by application - provides an “island of stability” for a given application
    - AC level in BIND/REBIND of package must be <= current FL and overrides ZPARM
    - AC must be advanced to exploit new SQL function
    - Even if FL is regressed to an earlier level new function continues to be used by that application
  - clientApplCompat level - driver configuration keyword allows remote apps access to new functions

Group Display for Function Levels

- **The display itself will show you at a group level, where you are and where you have been with the HIGHEST ACTIVATED AND HIGHEST POSSIBLE levels**
  - You would still see the '*' level if you went forward and fell back

```
-DISPLAY GROUP DETAIL
...
*** BEGIN DISPLAY OF GROUP(.......) CATALOG LEVEL(V12R1M500)
                  CURRENT FUNCTION LEVEL(V12R1M100)
                  HIGHEST ACTIVATED FUNCTION LEVEL(V12R1M100)
                  HIGHEST POSSIBLE FUNCTION LEVEL(V12R1M100)
                  PROTOCOL LEVEL(2)
                  GROUP ATTACH NAME(....)
---------------------------------------------------------------------
DB2                                   DB2    SYSTEM    IRLM
MEMBER   ID  SUBSYS CMDPREF   STATUS   LVL    NAME      SUBSYS IRLMPROC
-------- --- ----   --------  -------- ------ --------  ----   --------
DB1A       1 DB1A   -DB1A     ACTIVE   121500 MVSA      DJ1A   DB1AIRLM
DB1B       2 DB1B   -DB1B     ACTIVE   111500 MVSB      DJ1B   DB1BIRLM
DB1C       3 DB1C   -DB1C     ACTIVE   121500 MVSC      DJ1C   DB1CIRLM
---------------------------------------------------------------------
```

Catalog level (CL)

Function level (FL)

Maintenance level (ML)

- **What if I try and active FL M500 now?**

GROUP NOT ELIGIBLE FOR FUNCTION LEVEL (V12R1M500)
MEMBER(S) NOT STARTED WITH REQUIRED CODE LEVEL

- Due to there being an active Db2 11 member

Chronological View of Function Level Details

- Querying SYSIBM.SYSLEVELUPDATES
  - Chronological view of function level details
    - Example of using abbreviated columns names:

	FUNCT_LVL	PREV_FL	HIGH_FL	CATALOG_LVL	OP
1_	V12R1M500	V12R1M100	V12R1M500	V12R1M500	M
2_	V12R1M500	V12R1M100	V12R1M500	V12R1M502	C
3_	V12R1M500	V12R1M100	V12R1M500	V12R1M503	C
4_	V12R1M500	V12R1M100	V12R1M500	V12R1M505	C
5_	V12R1M500	V12R1M100	V12R1M500	V12R1M507	C
6_	V12R1M500	V12R1M100	V12R1M500	V12R1M509	C
7_	V12R1M510	V12R1M500	V12R1M510	V12R1M509	F

	OPERATION_TEXT	TIME	MEMBER
1_	CATMAINT PROCESSING - DB2DEV	2016-06-27-07.31.11	DB2A
2_	CATMAINT PROCESSING - V12R1M502	2021-08-13-06.43.43	DB2A
3_	CATMAINT PROCESSING - V12R1M503	2021-08-13-06.43.45	DB2A
4_	CATMAINT PROCESSING - V12R1M505	2021-08-13-06.43.45	DB2A
5_	CATMAINT PROCESSING - V12R1M507	2021-08-13-06.43.45	DB2A
6_	CATMAINT PROCESSING - V12R1M509	2021-08-13-06.43.45	DB2A
7_	-ACTIVATE FUNCTION LEVEL (V12R1M510)	2021-08-13-06.44.54	DB2A

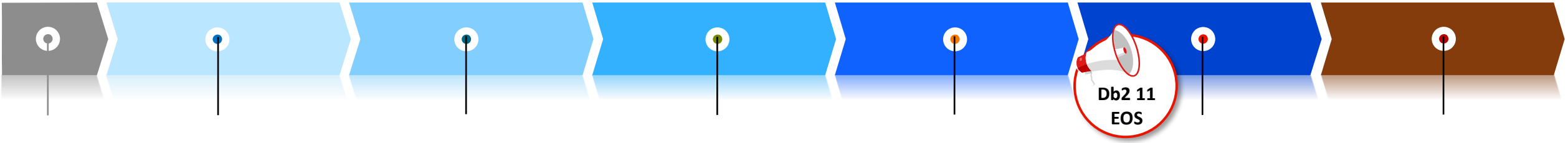
  - ** Note ** Only 8 of 9 columns are being displayed

Db2 Continuous Delivery Review

- New function/enhancements will be delivered via the maintenance stream in the form of new Function Levels
  - Customers should continue with the 'best practice' of 3-4 preventative service drops a year, continue to absorb fixes as well as dormant new function level support
  - **Do not execute CATMAINT to elevate catalog level (CL) until certain maintenance level that supports that new catalog level will not be backed off**
  - Once base code and (if necessary) catalog are at the appropriate level **–ACTIVATE FUNCTION LEVEL (V12R1M500)** command (as well as batch job option) allows that new function to be exploited
    - APPLCOMPAT bind option for static packages, dynamic JCC packages, as well as ZPARM → DML, DCL, DDL
      - Now APPLCOMPAT covers more than just DML due to continuous delivery needs
      - E.g., ALTER TABLE ALTER COLUMN to run as a pending alter requires APPLCOMPAT V12R1M500 or above, otherwise will default to an immediate alter
  - **New SQL functionality available in V12R1M500…501, etc. cannot be used until package is bound with APPLCOMPAT value of V12R1M50x**
    - Remember the ZPARM is always bringing you 'down'-level, so coordinate ZPARM and application changes on an aggressive schedule to up-level them
    - Be wary of NEW packages picking up ZPARM default, like NULLID packages, or Db2 Connect License
    - Recommended SQLLEVEL in DSNHDECP be set the the current activated function level
  - **CURRENT APPLICATION COMPATIBILITY special register** for dynamic SQL


Db2 12 Function
Level Journey

Db2 13 – Setting the Context for New Innovation



2016

Db2 12 for z/OS GA
Oct 2016

+ Over 100 new Db2 12 features delivered since GA that are not tied to specific Function Level

2017

FL 501 – 1st post-GA delivery
- LISTAGG

2018

FL 502 – Apr
APAR PI95511
- Transparent Dataset Encryption: Db2 DBA controls
- Casting numeric to GRAPHIC / VARGRAPHIC

FL 503 – Sep
APAR PH00506
- Db2 AI for z/OS (Db2ZAI) – prereqs FL500
- Migration support on DATA CHANGE OPERATION for temporal auditing
- Enable replication of system-period temporal tables and generated expression columns

2019

FL 504 – Mar
APAR PH07672
- Huffman data compression
- New SQL syntax alternatives
- Prevent new deprecated objects
- Passthru of Built-In Functions (OLAP to Db2 Analytics Accelerator)

FL 505 – Jun
APAR PH09191
- Rebind Phase-in
- New RUNSTATS sampling
- BIF for Transparent Column Encryption (TCE)
- Temporal and archive on WHEN clause of triggers
- Indexes for Decfloat

FL 506 – Nov
APAR PH16829
- DROP TABLE automatic drop of explicit table spaces
- Alternative spellings for existing SQL built-in scalar functions to improve compatibility

2020

FL 507 – Jun
APAR PH24371
- Application-level locking control
- Improved statistics management
- CREATE OR REPLACE
- Db2 Analytics Accelerator passthrough expressions

FL 508 – Oct
APAR PH29392
- Multi-table table space conversion to Universal Table Space (UTS)

2021

FL 509 – Feb
APAR PH33015
- Support for tamper-proof audit policies
- HA for AOTs
- Specify a compression algorithm at the table, table space, or partition level
- Temporal RI allows UPDATE or DELETE on the parent table

FL 510 – Apr
APAR PH33727
- Automation and groundwork to set up ease of migration from Db2 12 to Db2 VNext

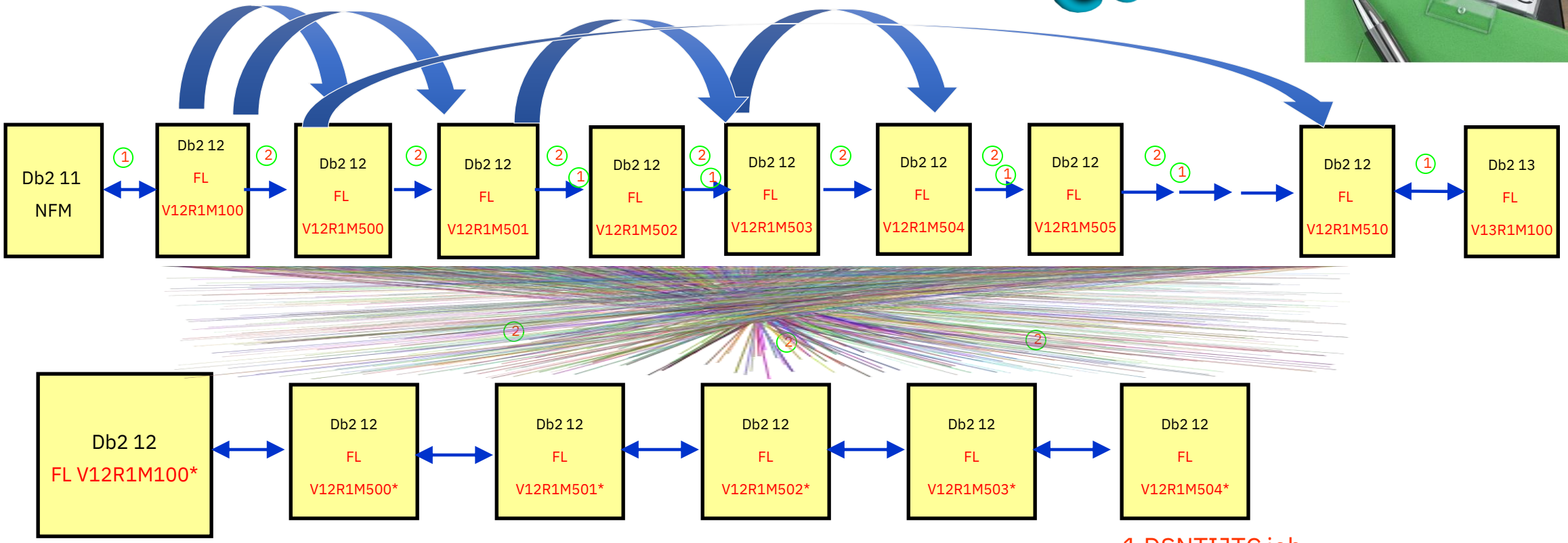
2022

Db2 13 - May
- Industry-first AI-infused insights into business data
- Enhanced operational flexibility with no application outages
- Improved interoperability with cloud applications
- Streamlined version upgrade with no application outages

Function Level cadence resumes with 1 in 2H22 and 2-3 planned for 2023

Activating Function Levels

- Can skip function levels if desired
  - Can return to an earlier function level, ‘star’ function level

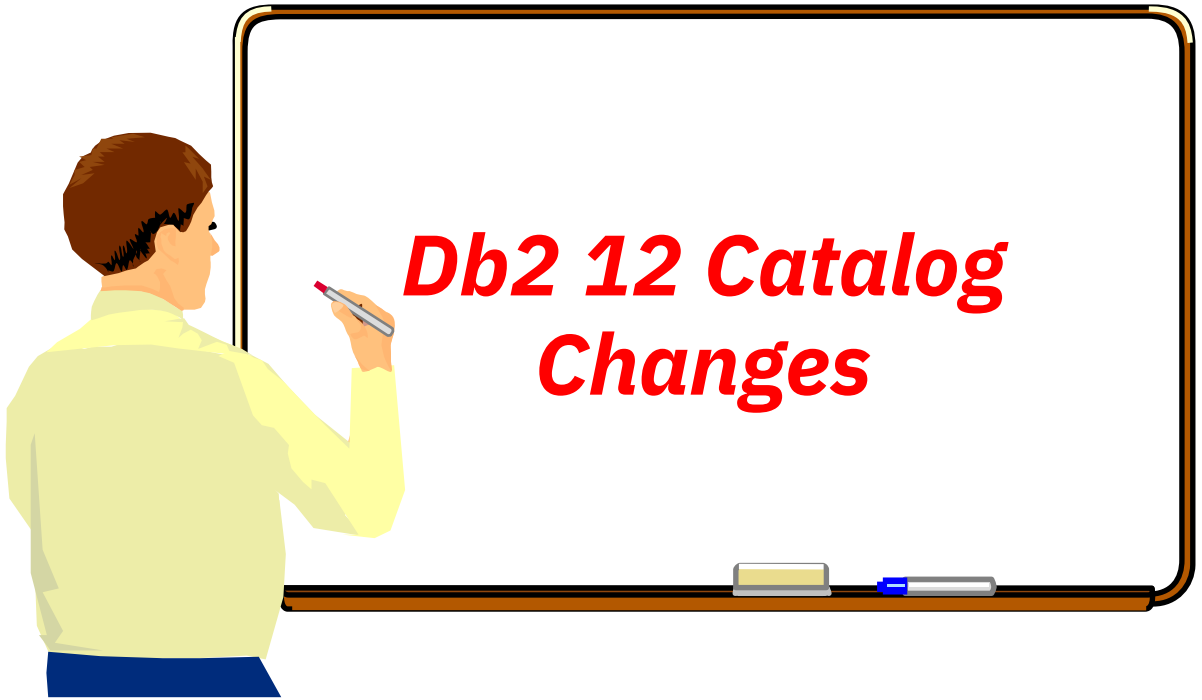


1 DSNTIJTC job
2 DSNTIJAF job or ACTIVATE command

Function and Member Code Levels

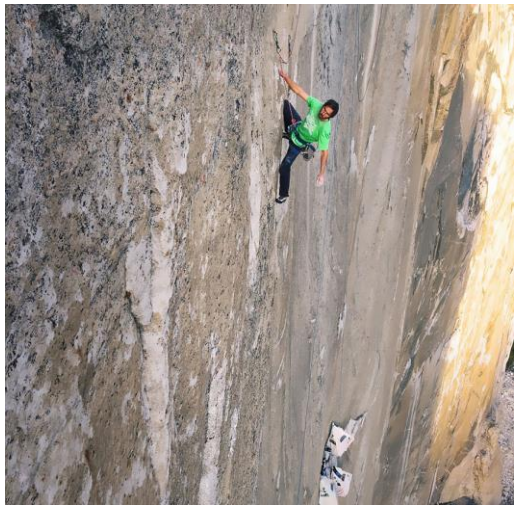
- Can only activate to a function level if **all** active members in a data sharing group are running with a level of code that understands the new function level!
  - Very much like fallback SPE code for release boundary

- **Each subsystem has it's own code level.** Same format as catalog and function levels (i.e. V12R1M500)
  - Each group member's code level can be different


Db2 12 Catalog
Changes

Db2 12 Catalog Changes

- Fear not, CATMAINT!!!



Db2 12 Catalog Changes …

- Post GA catalog changes in Db2 12
  - **Function levels V12R1M502, V12R1M503, V12R1M505, V12R1M507 and V12R1M509 have catalog changes:**
    - Catalog changes can be bundled. For example:
      - **CATMAINT** (**DSNTIJTC**) job specifying a level of V12R1M509
      - Will make all 5 required CATMAINT changes (or as many as necessary to get to a V12R1M509 catalog level):
        - V12R1M502, V12R1M503, V12R1M505, V12R1M507 and V12R1M509
        - **No need to do 5 separate CATMAINT jobs!!**
      - Specifying a catalog level of V12R1M509 or V12R1M510 gets you to the same catalog level since there is no catalog change for V12R1M510.
      - CATMAINT processing figures out the current catalog level and determines what processing needs to be done to take the catalog to the specified level.

Db2 12 Catalog Changes …

- Catalog changes in Db2 12
  - **Function levels V12R1M502, V12R1M503, V12R1M505, V12R1M507 and V12R1M509 have catalog changes:**
    - **FL 502** - KEYLABEL column added to 4 catalog tables
      - SYSSTOGROUP, SYSINDEXES, SYSTABLES and SYSTABLESPACE
    - **FL 503** - Create REPLICATION_OVERRIDE global variable and GRANT READ access
    - **FL 505** – COPYID column added to 2 catalog tables
      - SYSPACKDEP and SYSPACKSTMT
    - **FL 507** – Create two global variables and GRANT READ access:
      - SYSIBMADM. MAX_LOCKS_PER_TABLESPACE
      - SYSIBMADM. MAX_LOCKS_PER_USER
    - **FL 509** - COMPRESS_USED column added to 1 table
      - SYSTABLEPART
  - **Totals: 7 columns and 3 global variables in 5 CATMAINTs**

Chronological View of Function Level Details

- SYSIBM.SYSLEVELUPDATES
  - Chronological view of system updates: function, catalog and maintenance details
    - Example of using abbreviated columns names:

	FUNCT_LVL	PREV_FL	HIGH_FL	CATALOG_LVL	OP
1_	V12R1M500	V12R1M100	V12R1M500	V12R1M500	M
2_	V12R1M500	V12R1M100	V12R1M500	V12R1M502	C
3_	V12R1M500	V12R1M100	V12R1M500	V12R1M503	C
4_	V12R1M500	V12R1M100	V12R1M500	V12R1M505	C
5_	V12R1M500	V12R1M100	V12R1M500	V12R1M507	C
6_	V12R1M500	V12R1M100	V12R1M500	V12R1M509	C
7_	V12R1M510	V12R1M500	V12R1M510	V12R1M509	F

'Bundled'

	OPERATION_TEXT	TIME	MEMBER
1_	CATMAINT PROCESSING - DB2DEV	2016-06-27-07.31.11	DB2A
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  - ** Note ** Only 8 of 9 table columns are being displayed

Db2 12 Function Level Incompatibilities

- Best Practice:
  - While Db2 allows for a great deal of flexibility in how to move forward and backward between function levels, we **highly recommend that you pay attention to any incompatibilities that are introduced in the function levels above the function level you're currently at**.
    - **For example:** If your current function level is V12R1M503 and you're wanting to move to function level V12R1M507, look at the incompatibilities for function levels 504 to 507 inclusive.
    - Resolve any gotchas before activating a higher function level whether you're skipping function levels or not.

Db2 12 Function Level Incompatibilities

- Incompatible changes summary for Db2 12 function levels

  https://www.ibm.com/docs/en/db2-for-zos/12?topic=12-function-level-501-higher

- In Db2 12 the following function levels have incompatible changes :
  - **FL 502**
    - Only if UDFs are named GRAPHIC or VARGRAPHIC
  - **FL 503**
    - Result change for system-period temporal tables defined with ON DELETE ADD EXTRA ROW
    - SET_MAINT_MODE_RECORD_NO_TEMPORALHISTORY stored procedure is not supported when APPLCOMPAT is V12R1M503 or higher
  - **FL 504**
    - **Next two slides**
  - **FL 505**
    - RUNSTATS does not update real-time statistics by default
    - Newly supported user-defined functions
  - **FL 506**
    - Changes in explicitly created table space behavior

Db2 12 Function Level Incompatibilities …

- **FL 504**
  - Function level 504 introduces no incompatible changes. However, be aware of changes that might impact your Db2 environment applications for packages bound at APPLCOMPAT(V12R1M504) or higher, such as the following changes:
    - If your Db2 applications have unqualified references to existing user-defined functions, they might start invoking new built-in functions instead if the names and signatures match, in certain situations. For information about avoiding such situations, see Ensuring that Db2 executes the intended user-defined function.
    - If your Db2 environment contains existing columns or variables with names such as CURRENT_TIMEZONE or CURRENT_SERVER, you must modify your applications to delimit these names. For example, you can issue the following queries to identify columns and variables with these names. For columns, issue:
      - COMPAT(V12R1M504) or higher, such as the following changes:

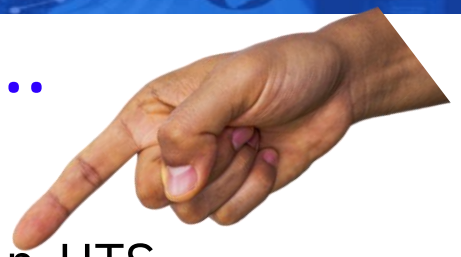
```
SELECT * FROM SYSIBM.SYSCOLUMNS
  WHERE NAME IN('CURRENT_SERVER','CURRENT_TIMEZONE');
```

      - For variables, issue:

```
SELECT * FROM SYSIBM.SYSVARIABLES
WHERE NAME IN('CURRENT_SERVER','CURRENT_TIMEZONE');
```

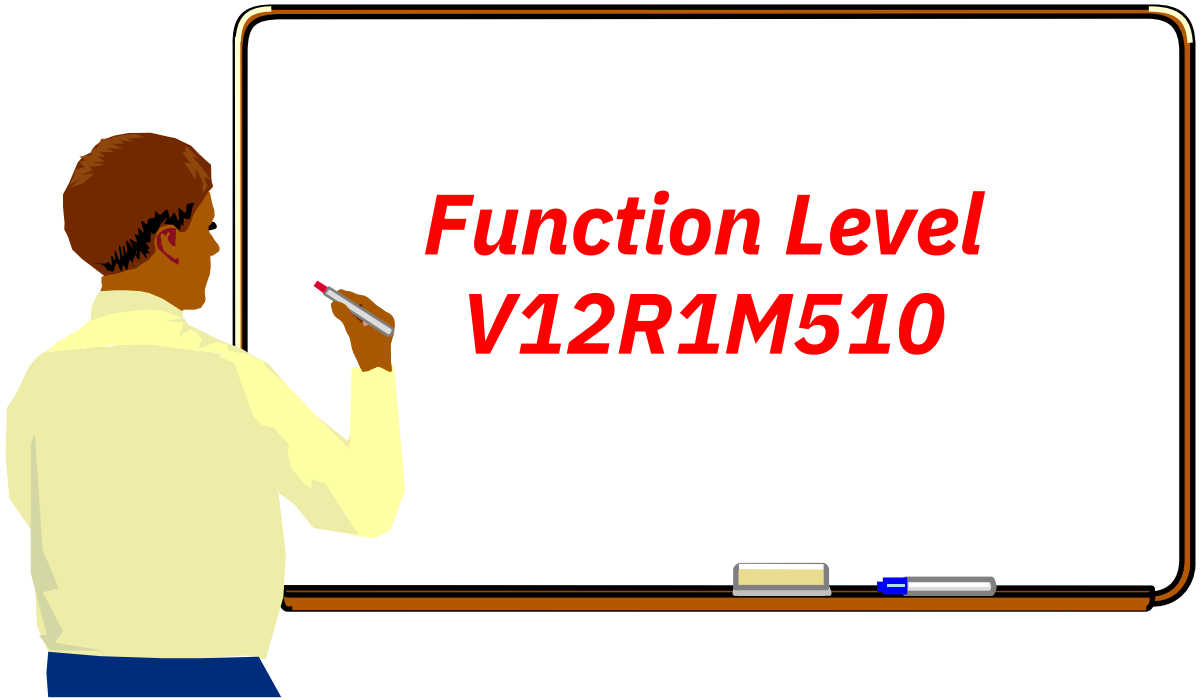
    - Based on the result, you can check dependencies, for example by querying SYSIBM.SYSPACKDEP catalog table, to identify any static applications that depend on nondelimited forms of names

Db2 12 Function Level Incompatibilities …



- **FL 504**
  - CREATE TABLESPACE statements that previously created non-UTS segmented or partitioned table spaces, now always create partition-by-growth (PBG UTS) or partition-by-range (PBR UTS) tablespaces
    - **After activating function level M504 and using an APPLCOMPAT value greater than or equal to V12R1M504, there are restrictions on DDL against legacy table space types**

  - The following SQL statements now return errors:
    - CREATE SYNONYM statements
    - CREATE TABLE statements that specify existing non-UTS tablespaces
    - CREATE TABLE and ALTER TABLE statements that specify ORGANIZE BY HASH
  - Unless UTS migration is complete prior to function level M504 and the packages executing DDL are bound with function level M504+
    - To manipulate non-UTS objects, special register needs to be set:
      - *CURRENT APPLICATION COMPATIBILITY* to less than *V12R1M504*


Function Level
V12R1M510

V12R1M510 – Last Db2 12 Function Level

- Little to no new release function
  - None gated by function level
- Prerequisite catalog level is V12R1M509
- **Can only migrate to Db2 13 from FL V12R1M510**
  - **Plus fallback SPE code (PH37108/UI79956)**

V12R1M510 – Last Db2 12 Function Level …

- V12R1M510 Fencing:
  - V12R1M510 activation will be prevented if there are any (> 0) packages actively being executed whose RELBOUND value is from before V11 (n-2+) and have a LASTUSED value that's less than or equal to 18 months (548 days):


```
SELECT *  FROM SYSIBM.SYSPACKAGE
    WHERE LASTUSED >= DATE(DAYS(CURRENT DATE) - 548)
          AND RELBOUND NOT IN ('P','Q','R')
          AND VALID <> 'N' AND OPERATIVE <> 'N';
```

- This should prevent AUTOBIND situations that can be problematic once a new release migration completes
- **DSNTIJPE** (Db2 12)/**DSNTIJPM** (Db2 13) jobs will have this same query
- Run the above query **now** to see if you have anything that needs to be resolved prior to the activation of FL V12R1M510

V12R1M510 – Last Db2 12 Function Level …

- Example of the DSNU757I message in the case where the SYSPACKAGE query returned any rows
- ACTIVATE with the TEST option reveals that the activation of FL V12R1M510 would be prevented in this case:

```
-ACTIVATE FUNCTION LEVEL (V12R1M510) TEST
DSNU757I  -DB2A DSNUGCCA
*** BEGIN ACTIVATE FUNCTION LEVEL (V12R1M510)
                SUBSYSTEM NOT ELIGIBLE FOR FUNCTION LEVEL (V12R1M510)
                SYSPACKAGE QUERY RETURNED ROWS. SEE DSNTIJPE OUTPUT.
                CATALOG LEVEL(V12R1M509)
                CURRENT FUNCTION LEVEL(V12R1M500)
                HIGHEST ACTIVATED FUNCTION LEVEL(V12R1M500)
                HIGHEST POSSIBLE FUNCTION LEVEL(V12R1M509)
------------------------------------------------------------------
DB2          CURRENT     CAPABLE FUNCTION LEVELS
MEMBER   ID  CODE-LEVEL  LOWEST      HIGHEST     STATUS
-------- --- ----------  ----------  ----------  -------------------
........   0 V12R1M510   V12R1M100   V12R1M510   ELIGIBLE
------------------------------------------------------------------
DSN9022I  -DB2A DSNZACMD '-ACTIVATE FUNC' NORMAL COMPLETION
```

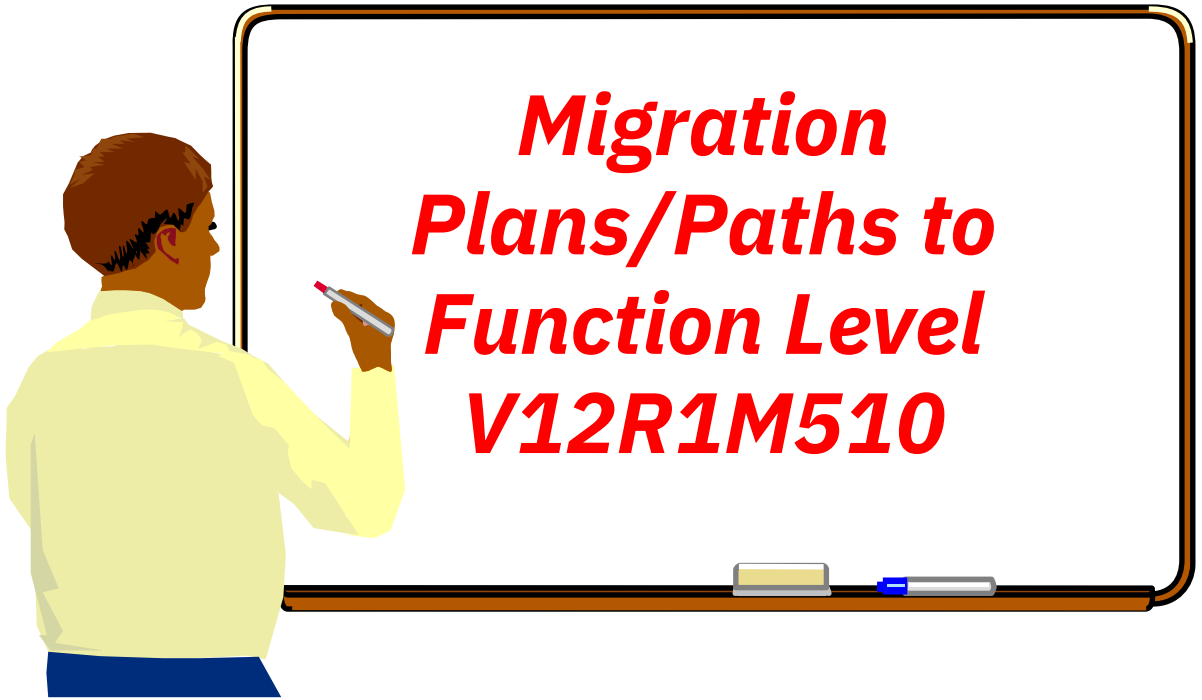
Db2 12 Catalog Changes

- Quickest way to get from function level V12R1M100 to V12R1M510?
  - **Can quickly be done in just three steps!**

    Assumption: all active members are running on a V12R1M510 code level

1. **ACTIVATE FUNCTION LEVEL (V12R1M500)** or **(V12R1M501)**
2. **CATMAINT** (DSNTIJTC) job specifying a level of V12R1M509
   - Will make as many of the Db2 12 catalog changes as is necessary (V12R1M502, V12R1M503, V12R1M505, V12R1M507 and V12R1M509) to get the catalog to the last Db2 12 catalog level (V12R1M509)
3. **ACTIVATE FUNCTION LEVEL (V12R1M510)**

  - **Note:** As stated earlier in the presentation, pay attention to incompatibilities and other restrictions introduced in all of the function levels between where you currently are and including where you're wanting to move to.


Migration
Plans/Paths to
Function Level
V12R1M510

Migration Plans/Paths to Db2 12 Function Level V12R1M510

- Continuous delivery offers enhanced flexibility during the journey through Db2 12 function levels
  - Scenario, currently at FL501 and objective is to get to FL510
    - 5 Catalog Levels need to be completed in journey to FL510 (FL502, FL503, FL505, FL507, FL509)
    - CATMAINT(s) and activating a matching function level do not need to occur at the same time
      - Not all Function Levels require a catalog level change (CATMAINT)
      - Can be executed during the same change window
      - **CATMAINT(s) can be executed well in advance and function levels activated at a later point in time**
    - Options:
      1. Each CATMAINT can be executed separately
         - During the same change window
         - Incrementally over time
      2. Allow Db2 to determine the CATMAINT(s) that are needed
    - **CATMAINT(s) can be run well in advance** i.e.,
      - Catalog level M509
      - **Function level activation can occur at a later point in time**
        - Incrementally when ready M502 … M505 … M509 … M510
        - Jump to latest level M509/M510
        - Incompatibilities need to be reviewed and acted on before moving to chosen Function Level
        - After activating a function level i.e., it is possible to revert to an older Function Level
    - DSNU757I shows result of the ACTIVATE FUNCTION LEVEL command

	FUNCT_LVL	PREV_FL	HIGH_FL	CATALOG_LVL	OP
1_	V12R1M500	V12R1M100	V12R1M500	V12R1M500	M
2_	V12R1M500	V12R1M100	V12R1M500	V12R1M502	C
3_	V12R1M500	V12R1M100	V12R1M500	V12R1M503	C
4_	V12R1M500	V12R1M100	V12R1M500	V12R1M505	C
5_	V12R1M500	V12R1M100	V12R1M500	V12R1M507	C
6_	V12R1M500	V12R1M100	V12R1M500	V12R1M509	C
7_	V12R1M510	V12R1M500	V12R1M510	V12R1M509	F

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Db2 Enhanced Migration Functionality

- Online Migration Problem
  - Customer unable to:
    - Successfully complete online migration
    - Determine when a system is likely compatible with online migration
    - Identify applications that are incompatible with online migration
  - Goal
    - Help system administrators identify applications/processes that are incompatible with online migration
      - Pre-migration options
      - Change applications/processes to be compatible
      - Plan migrations around incompatible applications/processes
      - Take other alternative mitigating steps i.e., stopping online monitor

Db2 Enhanced Migration Functionality …

- Online Migration Solution
  - Provide instrumentation to identify most common online migration blockers
    - Long running Catalog and Directory lock holders
    - Long running claims and drains on the Catalog and Directory
    - Package locks
    - Lock creation timestamp will be provided as well as the duration of how long the lock(s) are held
    - Dynamic statement cache where the statement involves the Catalog and Directory
- Online Migration Solution Design
  - Two methods are provided in Db2 11+ for users to obtain information about potential migration BLOCKERS
    - **BLOCKING_THREADS** function
    - **DISPLAY BLOCKERS** command
  - System databases were the initial design target
    - Can be used for any database
    - Output sorted by lock duration time in descending order
      - APAR PH10826/UI69855
      - IRLM pre-req APAR PH16439/UI65542

Db2 Enhanced Migration Functionality …

- DISPLAY BLOCKERS

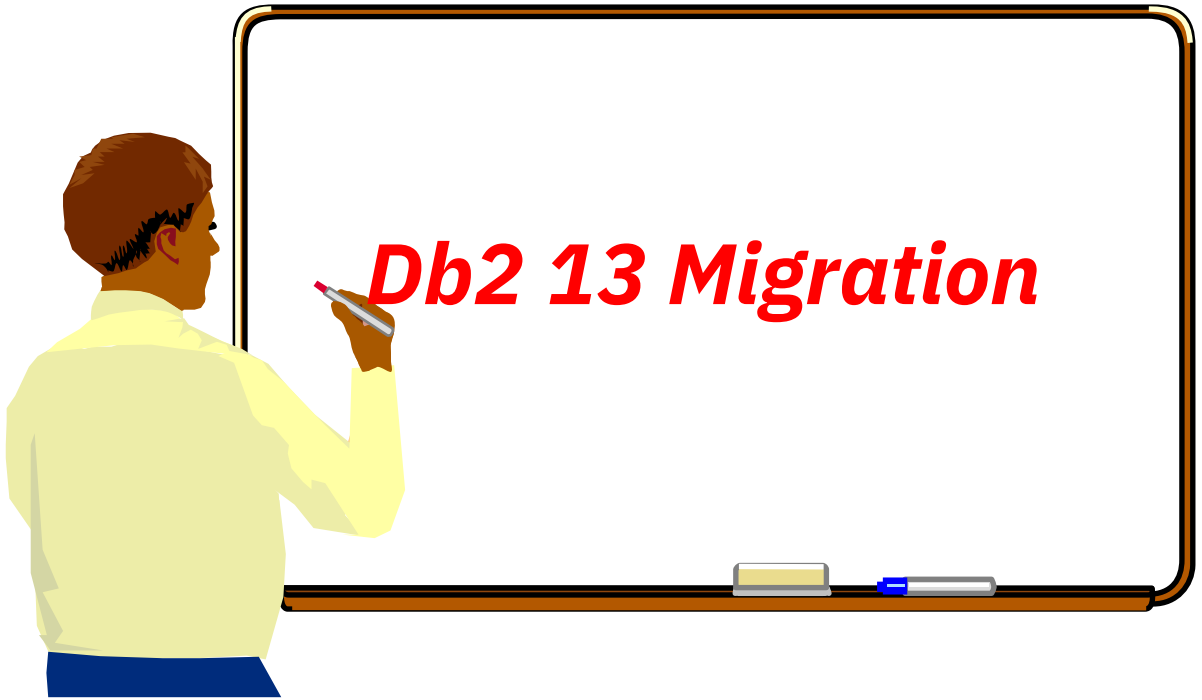
```
 -DISPLAY BLOCKERS (DSNDB06,DSNDB01)
DSNT360I   -DB2A ************************************
DSNT369I   -DB2A *  DISPLAY BLOCKERS SUMMARY REPORT
                 *     2021-10-03-14.16.20.502389
DSNT360I   -DB2A ************************************
DSNT397I   -DB2A
-----------------------------------------------------------------
REPORT: DISPLAY BLOCKERS REPORT
-----------------------------------------------------------------
T LT DBNAME    DBID  NAME      OBID  AGE (SHORT)  TOKEN   MEMBER
- -- --------  ----  --------  ----  -----------  ------  --------
C 80 DSNDB06   0006  SYSTSQRY  06C1  2 H 3 M      10      DB2A
C 80 DSNDB06   0006  SYSTSDQY  08C2  2 H 3 M      10      DB2A
C 80 DSNDB06   0006  DSNQYX04  06CB  2 H 3 M      10      DB2A
C 80 DSNDB06   0006  DSNDQX02  08DE  2 H 3 M      10      DB2A
C 80 DSNDB06   0006  SYSTSDQY  08C2  1 H 54 M     13      DB2A
C 80 DSNDB06   0006  DSNQYX04  06CB  1 H 54 M     13
C 80 DSNDB06   0006  DSNDQX02  08DE  1 H 54 M     13
C 80 DSNDB06   0006  SYSTSQRY  06C1  1 H 54 M     13
C 80 DSNDB06   0006  DSNKDX03  015A  0.005924 S
C 80 DSNDB06   0006  SYSTSPKD  0812  0.005924 S
-----------------------------------------------------------------
INFO: DIAGNOSTIC AND INFORMATIONAL MESSAGES
-----------------------------------------------------------------
T DBNAME    MEMBER    INFORMATIONAL DESCRIPTION
- --------  --------  -------------------------------------
I DSNDB01             NO LOCKS OR CLAIMS FOR THE DATABA
-----------------------------------------------------------------
DSN9022I   -DB2A DSNZACMD '-DISPLAY BLOCKERS' NORMAL COM
```

- DISPLAY BLOCKERS DETAIL

```
 -DIS BLOCKERS (DSNDB06,DSNDB01) DETAIL
DSNT360I   -DB2A ************************************
DSNT369I   -DB2A *  DISPLAY BLOCKERS DETAILED REPORT
                 *     2021-10-03-14.16.20.829657
DSNT360I   -DB2A ************************************
DSNT397I   -DB2A
-----------------------------------------------------------------
REPORT: DISPLAY BLOCKERS REPORT
-----------------------------------------------------------------
T LT DBNAME    DBID  NAME      OBID  AGE (SHORT)  TOKEN   MEMBER
- -- --------  ----  --------  ----  -----------  ------  --------
C 80 DSNDB06   0006  SYSTSQRY  06C1  2 H 3 M      10      DB2A
                     CONNID:   BATCH
                     CORRID:   SELTPT
                     AGE:      2 H 3 M 45.715939 S
                     USERID:   SYSADM
                     LUWID:    USIBMSY.SYEC1DB2.DA687DCF53DD=10
                     DURATION: CM
                     ACQUIRED: 2021-10-03-12.12.35.096816837890
-----------------------------------------------------------------
T LT DBNAME    DBID  NAME      OBID  AGE (SHORT)  TOKEN   MEMBER
- -- --------  ----  --------  ----  -----------  ------  --------
C 80 DSNDB06   0006  SYSTSDQY  08C2  1 H 54 M     13      DB2A
                     CONNID:   BATCH
                     CORRID:   SELLVLUP
                     AGE:      1 H 54 M 37.298529 S
                     USERID:   SYSADM
                     LUWID:    USIBMSY.SYEC1DB2.DA687FDA5725=13
                     DURATION: CM
                     ACQUIRED: 2021-10-03-12.21.43.514227028320
```

Migration Plans/Paths to Db2 12 Function Level M510

- Db2 12 online migration testing methodology
  - In a non-production environment, the goal would be disruptive testing with the intent of producing the migration job to fail
  - In a non-production environment test the Db2 12 online migration job at the most disruptive time
    - If more than one non-production environment, choose different disruptive scenarios to migrate against
  - If you can produce a failure with normal activity, think about crashing Db2 during the migration to simulate a restart scenario
  - ***The ultimate objective is to acquire confidence in the process***
    - Migration is designed to fail
    - Restarting a failed migration step
    - Supplying as much noise and disruptive testing in worst case scenarios
  - **Db2 12 online migration should still be executed at a quiet time and after taking all necessary precautions**


Db2 13 Migration

Db2 13 Migration Process

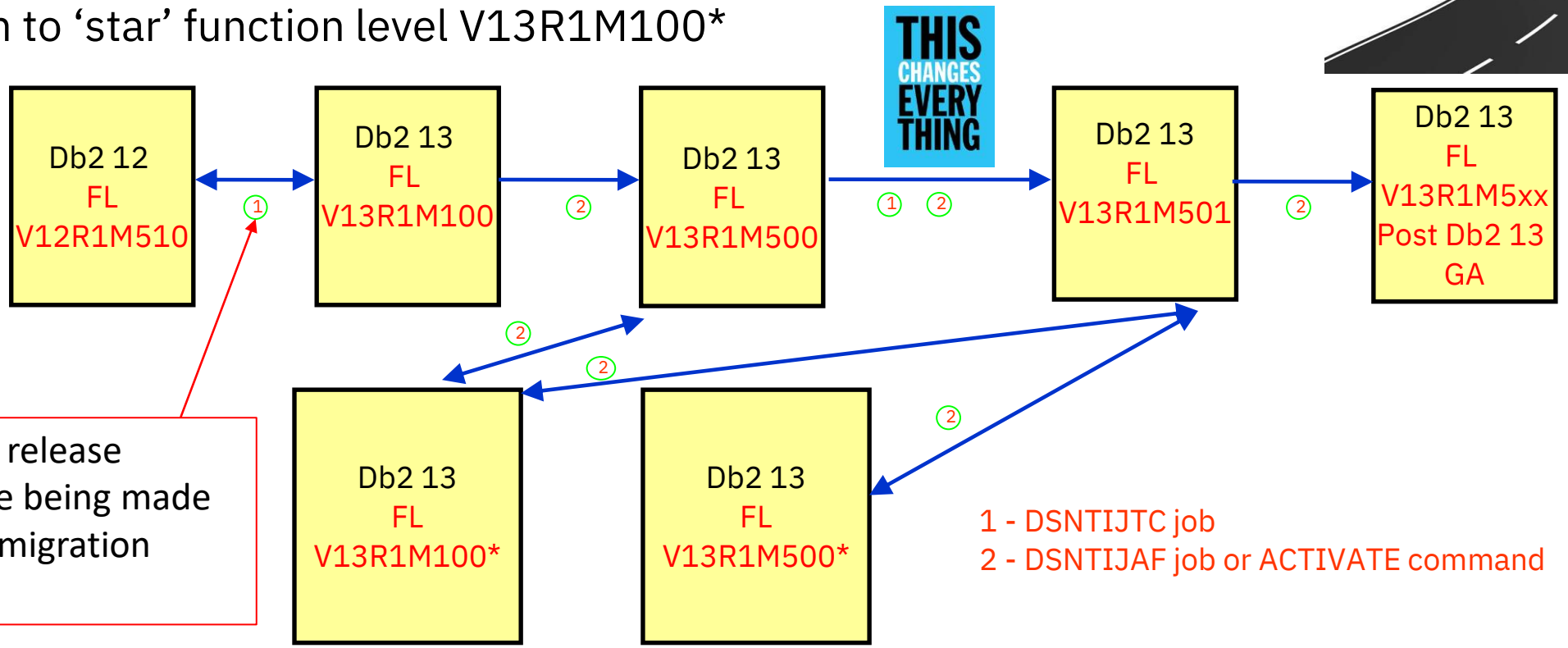
- Can only migrate to Db2 13 from Db2 12 function level V12R1M510
  - Code on all active Db2 12 members must contain the fallback SPE code: **PH37108/UI79956**

- Catalog changes in Db2 13:
  - **There will be a release migration CATMAINT, but it will not contain any migration SQL!**
    - Sets internal level and release markers and updates the SYSLEVELUPDATES catalog table
    - Allows customers to control migration timing with CATMAINT
    - No Db2 12 fallback SPE code needed specifically for Db2 13 catalog changes because Db2 12 will never 'see' any Db2 13 catalog changes
      - Eliminates need for a great deal of fallback SPE code
      - Reduces large amount of internal testing effort
      - Huge reduction in recompiles needed in fallback SPE APARs (catalog macro changes and their recompiles are **not** needed as in previous releases)

    - **This is THE major migration enhancement for Db2 13**
      - **Db2 13 migrations won't fail due to contention with application programs, no AUTOBIND issues, Catalog and Directory RNA, etc. Much easier to migrate ONLINE!**
    - Note: initial Db2 13 catalog level is V13R1M100 (not VnnR1M500 as it was in Db2 12)

Db2 13 Migration and Fallback Paths

- Can only migrate to Db2 13 from Db2 12 function level V12R1M510
  - No skip release support
- Cannot fall back to Db2 12 after activating Db2 13 function level V13R1M500 or above
  - Can return to 'star' function level V13R1M100*

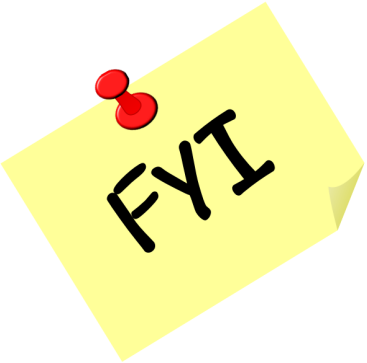


No traditional new release catalog changes are being made during the Db2 13 migration process!!

1 - DSNTIJTC job
2 - DSNTIJAF job or ACTIVATE command

Db2 13 Catalog Changes

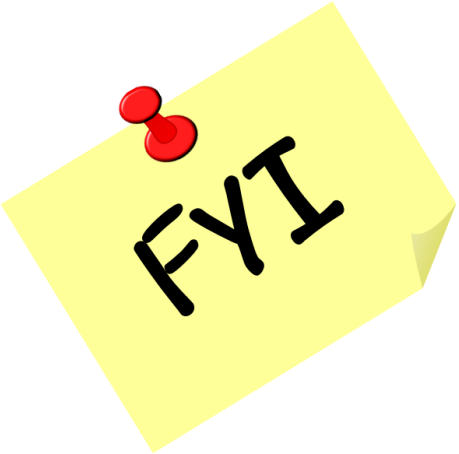
- First Db2 13 catalog changes are made **after** function level **V13R1M500** has been activated
  - No fallback capability once function level V13R1M500 has been activated
  - Db2 12 will therefore never be exposed to any Db2 13 catalog changes
- This catalog level is **V13R1M501**
- Function level **V13R1M501** can only be activated if the catalog level is **V13R1M501**
- Db2 13 development life cycle will follow the same Db2 12 continuous delivery model *



Db2 13 New Function Availability

- New function/enhancements will be delivered via the maintenance stream in the form of new Function Levels. Same as in Db2 12.

- New function that **does** require a Db2 13 catalog change will be available in a function level that comes **AFTER** the catalog change is made. At GA time, this would be catalog level **V13R1M501**.
  - **Notes:**
    - Not all new Db2 13 functions are tied to a function level
    - Lots of new function will be available in Db2 13 on GA day
    - Post GA implications?
    - Some new function requires an appropriate APPLCOMPAT level to exploit




Fallback and
Release
Coexistence
Stuff

Capabilities in Db2 12 after falling back from Db2 13

- After falling back to Db2 12 or after stopping all Db2 13 members
  - The current function level is still: **V13R1M100**
    - No action was taken to change it so it remains the same as it was in Db2 13
  - You CAN ACTIVATE an earlier Db2 12 ‘star’ function level after falling back to Db2 12
    - As long as there are no active Db2 13 members
- Can start up a V13 member and the function level will remain as it was in Db2 12.
  - No action was taken to change it.
- Highest possible function level will be different between a Db2 12 member and a Db2 13 member

Capabilities in Db2 12 after falling back from Db2 13

- After falling back to Db2 12, activating a ‘star’ FL, and restarting Db2 13
  - The function level will remain as it was in Db2 12.
  - Db2 12 member DISPLAY GROUP example:

```
*** BEGIN DISPLAY OF GROUP(DSNCAT   ) CATALOG LEVEL(V13R1M100)
                  CURRENT FUNCTION LEVEL(V12R1M505*)
                  HIGHEST ACTIVATED FUNCTION LEVEL(V13R1M100)
                  HIGHEST POSSIBLE FUNCTION LEVEL(V12R1M510)
                  PROTOCOL LEVEL(2)
                  GROUP ATTACH NAME(DSNG)
-------------------------------------------------------------------
DB2            SUB                        DB2    SYSTEM    IRLM
MEMBER    ID   SYS  CMDPREF   STATUS      LVL    NAME      SUBSYS IRLMPROC
-------- --- ---- -------- -------- ------ -------- ---- --------
DB2A        1 DB2A -DB2A     ACTIVE    131501 UTEC5     PR21   PRLM21
DB2B        2 DB2B -DB2B     ACTIVE    121510 UTEC5     QR21   QRLM21
-------------------------------------------------------------------
DB2       PARALLEL    PARALLEL
MEMBER    COORDINATOR ASSISTANT
-------- ----------- ---------
DB2A                NO        NO
DB2B                NO        NO
-------------------------------------------------------------------
DISPLAY SUBGROUP ATTACH INFORMATION FOR GROUP ATTACH DSNG
-------------------------------------------------------------------
-------------------------------------------------------------------
SCA    STRUCTURE SIZE:     12288 KB, STATUS= AC,    SCA IN USE:     6 %
LOCK1 STRUCTURE SIZE:      12288 KB
NUMBER  LOCK ENTRIES:       1048576
NUMBER  LIST ENTRIES:         23151, LIST ENTRIES  IN USE:          3
SPT01 INLINE LENGTH:          32138
*** END DISPLAY OF GROUP(DSNCAT   )
DSN9022I  -DB2B DSN7GCMD 'DISPLAY GROUP ' NORMAL COMPLETION
```

Capabilities in Db2 12 after falling back from Db2 13

- In release coexistence with Db2 12 and 13
  - Highest possible function level will be different between a Db2 12 member and a Db2 13 member:

```
*** BEGIN DISPLAY OF GROUP(DSNCAT   ) CATALOG LEVEL(V13R1M100)
                  CURRENT FUNCTION LEVEL(V13R1M100)
                  HIGHEST ACTIVATED FUNCTION LEVEL(V13R1M100)
                  HIGHEST POSSIBLE FUNCTION LEVEL(V13R1M100)
                  PROTOCOL LEVEL(2)
                  GROUP ATTACH NAME(DSNG)
--------------------------------------------------------------------
DB2             SUB                          DB2     SYSTEM     IRLM
MEMBER    ID    SYS   CMDPREF    STATUS      LVL     NAME       SUBSYS IRLMPROC
-------- ---    ----  --------   --------    ------  --------   ----   --------
DB2A        1    DB2A  -DB2A      ACTIVE      131501  UTEC5      PR21   PRLM21
DB2B        2    DB2B  -DB2B      ACTIVE      121510  UTEC5      QR21   QRLM21
--------------------------------------------------------------------
```

DB2A DISPLAY GROUP
Db2 13 member

```
*** BEGIN DISPLAY OF GROUP(DSNCAT   ) CATALOG LEVEL(V13R1M100)
                  CURRENT FUNCTION LEVEL(V13R1M100)
                  HIGHEST ACTIVATED FUNCTION LEVEL(V13R1M100)
                  HIGHEST POSSIBLE FUNCTION LEVEL(V12R1M510)
                  PROTOCOL LEVEL(2)
                  GROUP ATTACH NAME(DSNG)
--------------------------------------------------------------------
DB2             SUB                          DB2     SYSTEM     IRLM
MEMBER    ID    SYS   CMDPREF    STATUS      LVL     NAME       SUBSYS IRLMPROC
-------- ---    ----  --------   --------    ------  --------   ----   --------
DB2A        1    DB2A  -DB2A      ACTIVE      131501  UTEC5      PR21   PRLM21
DB2B        2    DB2B  -DB2B      ACTIVE      121510  UTEC5      QR21   QRLM21
--------------------------------------------------------------------
```

DB2B DISPLAY GROUP
Db2 12 member

Capabilities in Db2 12 after falling back from Db2 13

- In release coexistence with Db2 12 and 13
  - Highest possible function level will be different between a Db2 12 member and a Db2 13 member
  - Note that the DB2B member cannot ACTIVATE FL V12R1M510 because there is an active Db2 13 member

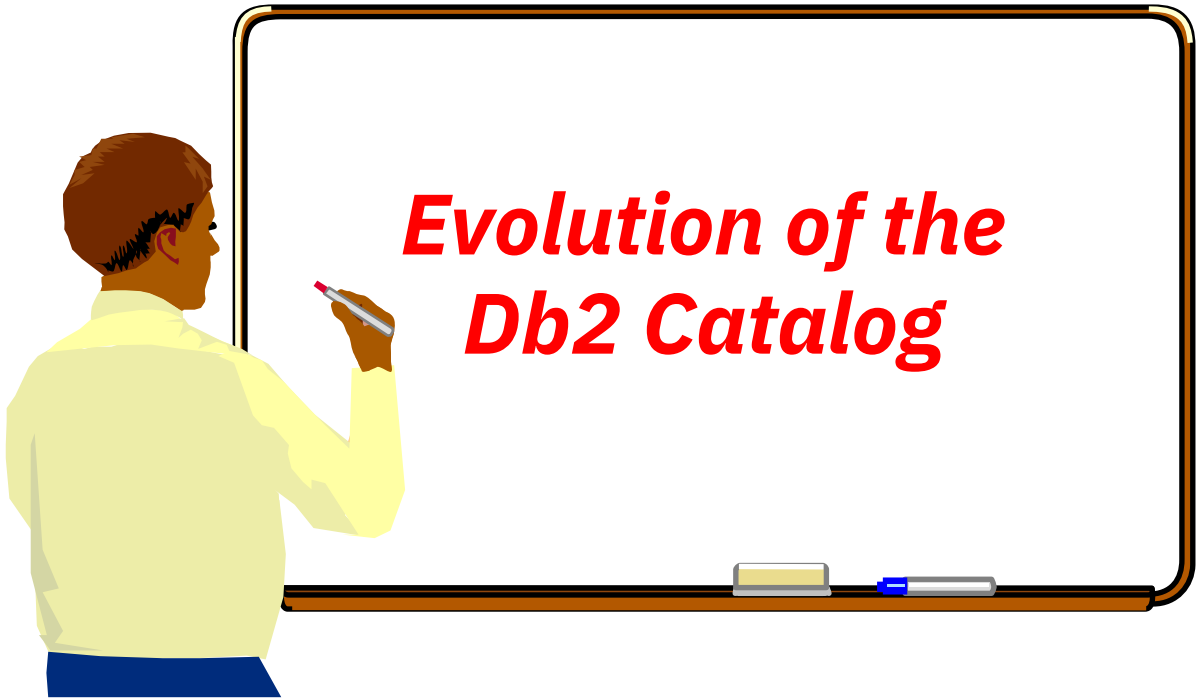
```
*** BEGIN DISPLAY OF GROUP(DSNCAT   ) CATALOG LEVEL(V13R1M100)
                  CURRENT FUNCTION LEVEL(V13R1M100)
                  HIGHEST ACTIVATED FUNCTION LEVEL(V13R1M100)
                  HIGHEST POSSIBLE FUNCTION LEVEL(V12R1M510)
                  PROTOCOL LEVEL(2)
                  GROUP ATTACH NAME(DSNG)
-------------------------------------------------------------------
DB2            SUB                          DB2     SYSTEM     IRLM
MEMBER    ID   SYS  CMDPREF    STATUS       LVL     NAME       SUBSYS IRLMPROC
-------- --- ---- --------  -------- ------ -------- ---- --------
DB2A        1 DB2A -DB2A     ACTIVE   131501 UTEC5    PR21   PRLM21
DB2B        2 DB2B -DB2B     ACTIVE   121510 UTEC5    QR21   QRLM21
-------------------------------------------------------------------
```

DB2B DISPLAY GROUP
Db2 12 member

  - If the Db2 13 member stopped then this member COULD ACTIVATE V13R1M510 or any other Db2 12 function level.

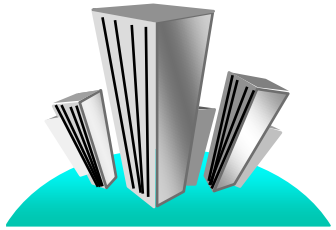
Summary

- **Can get from function level V12R1M100 to V12R1M510 in only 3 steps**
  - Pay attention to function level incompatibilities
- **Can only migrate to Db2 13 from FL V12R1M510**
- **Migrations to Db2 13 are very different than they were in any previous release. Change is good!**
  - The catalog structure does NOT change during migration processing
    - Won't invalidate packages, etc. that have dependencies on catalog objects that change
  - Expectation for migrations to be fully online
    - Use DISPLAY BLOCKERS and/or BLOCKING THREADS during migration window to see if there are any blockers


Evolution of the
Db2 Catalog

Evolution of the Db2 Catalog

The Catalog continues to grow with every Db2 Release:



Version	Tables Spaces	Tables	Indexes	Columns	LOB columns
V1	11	25	27	269	0
V3	11	43	44	584	0
V5	12	54	62	731	0
V7	20	84	118	1212	2
V9	28	104	165	1643	3
V10	95	134	233	2051	21
V11	108	143	250	2287	24
V12	142/161	176/195	275	2853	29/31
V13	145/167	179/182	280/286	2983	29/31

Evolution of the Db2 Catalog

- Fun question/test:

  How many releases of Db2 have their been to date?

17!

V1.1 – 1.3 (3) +
V2.1 – 2.3 (3) +
V3 – 13 (11)

IBM Db2 13 Redbook now available!

Take a read through the new IBM Redbook on Db2 13 for z/OS and its ecosystem

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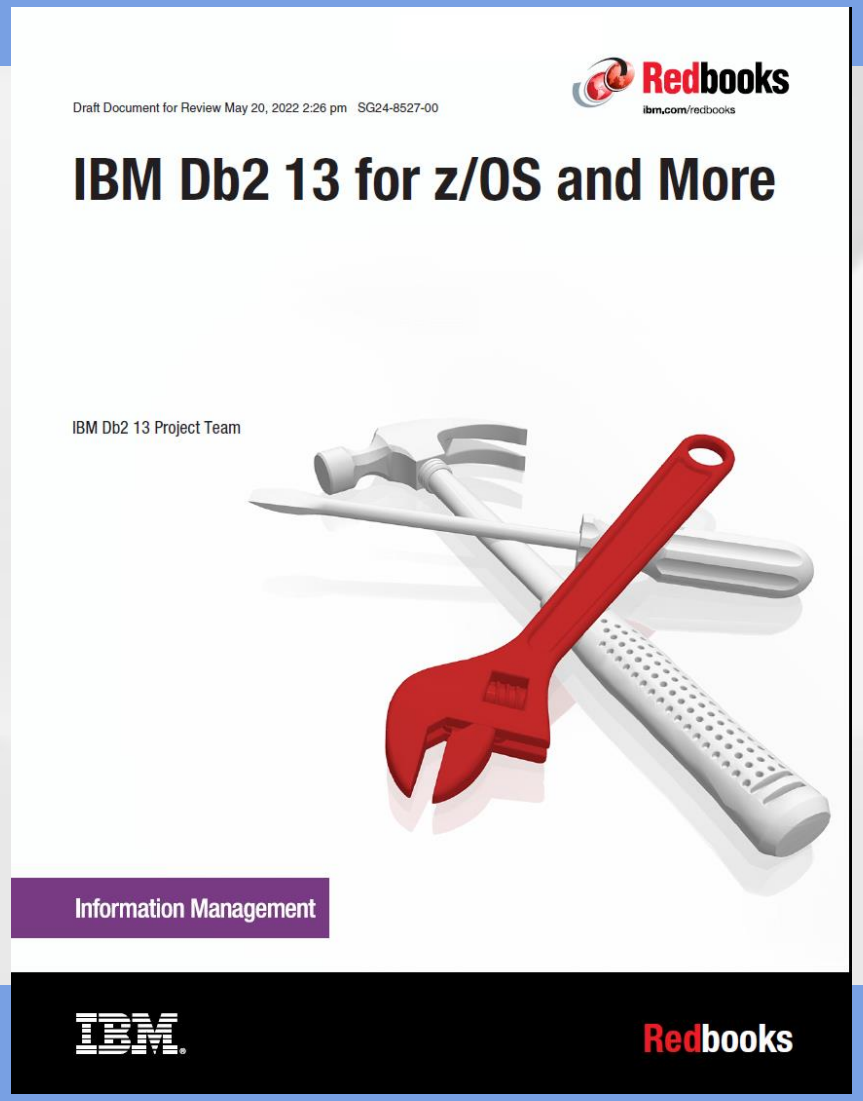
Coming next!

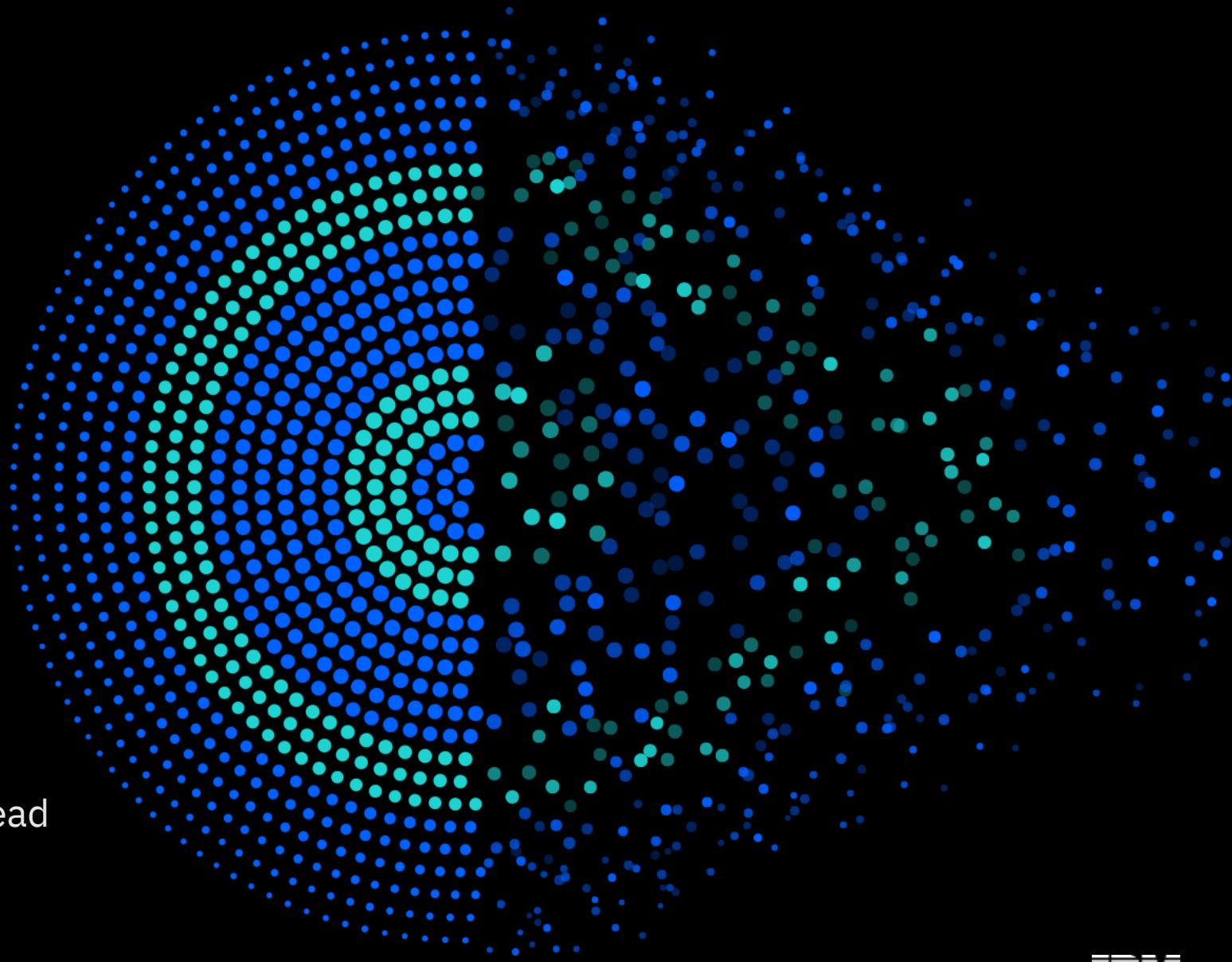
Db2 13 for z/OS Performance Redbook



Thank You

IBM®

Getting Ready For Db2 13



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