

Db2 for z/OS Continuous Delivery – Five Years Later

Chris Crone

Broadcom

November 2021

Session **4BI**



GSE UK Conference 2021 Charity Raffle

- The GSE UK Region team hope that you find this presentation and others that follow useful and help to expand your knowledge of z Systems.
- Please consider showing your appreciation by kindly donating to our charities this year, Royal National Lifeboat Institution (RNLI) & Guide Dogs for the Blind. Then follow the link on your receipt to enter your receipt number & amount donated into the GSE Raffle. You will get a raffle entry for every pound donated.
- Follow the link below or scan the QR Code:

<http://uk.virginmoneygiving.com/GuideShareEuropeUKRegion>



Supporting



Disclaimer

Certain information in this presentation may outline Broadcom's general product direction. This presentation shall not serve to (i) affect the rights and/or obligations of Broadcom or its licensees under any existing or future license agreement or services agreement relating to any Broadcom software product; or (ii) amend any product documentation or specifications for any Broadcom software product. This presentation is based on current information and resource allocations as of January 1, 2020 and **is subject to change or withdrawal by Broadcom at any time without notice. The development, release and timing of any features or functionality described in this presentation remain at Broadcom's sole discretion.**

Notwithstanding anything in this presentation to the contrary, upon the general availability of any future Broadcom product release referenced in this presentation, Broadcom may make such release available to new licensees in the form of a regularly scheduled major product release. Such release may be made available to licensees of the product who are active subscribers to Broadcom maintenance and support, on a when and if-available basis. The information in this presentation is not deemed to be incorporated into any contract.

Copyright © 2020 Broadcom. All rights reserved. All trademarks, trade names, service marks and logos referenced herein belong to their respective companies. IBM, System z, zEnterprise, zSeries, z/OS, z/VM, RACF, CICS, IMS and Db2 are trademarks of International Business Machines Corporation in the United States, other countries, or both. Linux® is the registered trademark of Linus Torvalds in the U.S. and other countries.

THIS PRESENTATION IS FOR YOUR INFORMATIONAL PURPOSES ONLY. Broadcom assumes no responsibility for the accuracy or completeness of the information. TO THE EXTENT PERMITTED BY APPLICABLE LAW, BROADCOM PROVIDES THIS DOCUMENT "AS IS" WITHOUT WARRANTY OF ANY KIND, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NONINFRINGEMENT. **In no event will Broadcom be liable for any loss or damage, direct or indirect, in connection with this presentation, including, without limitation, lost profits, lost investment, business interruption, goodwill, or lost data, even if Broadcom is expressly advised in advance of the possibility of such damages.**

Broadcom does not provide legal advice. Neither this document nor any Broadcom software product referenced herein shall serve as a substitute for your compliance with any laws (including but not limited to any act, statute, regulation, rule, directive, policy, standard, guideline, measure, requirement, administrative order, executive order, etc. (collectively, "Laws")) referenced in this document. You should consult with competent legal counsel regarding any Laws referenced herein.

AGENDA



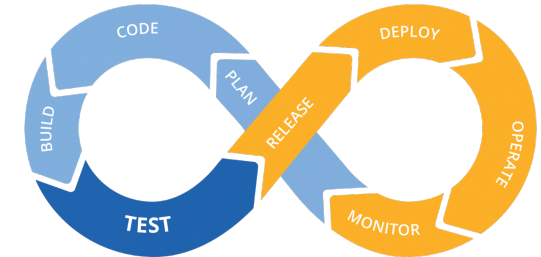
- Db2 Continuous Delivery Overview
- How Vendors are Adapting
- Db2 Continuous Delivery – M501 – M510
- Results



Db2 Continuous Delivery Overview

Db2 12 for z/OS

Db2 Continuous Delivery



• One stream for fixes & enhancements

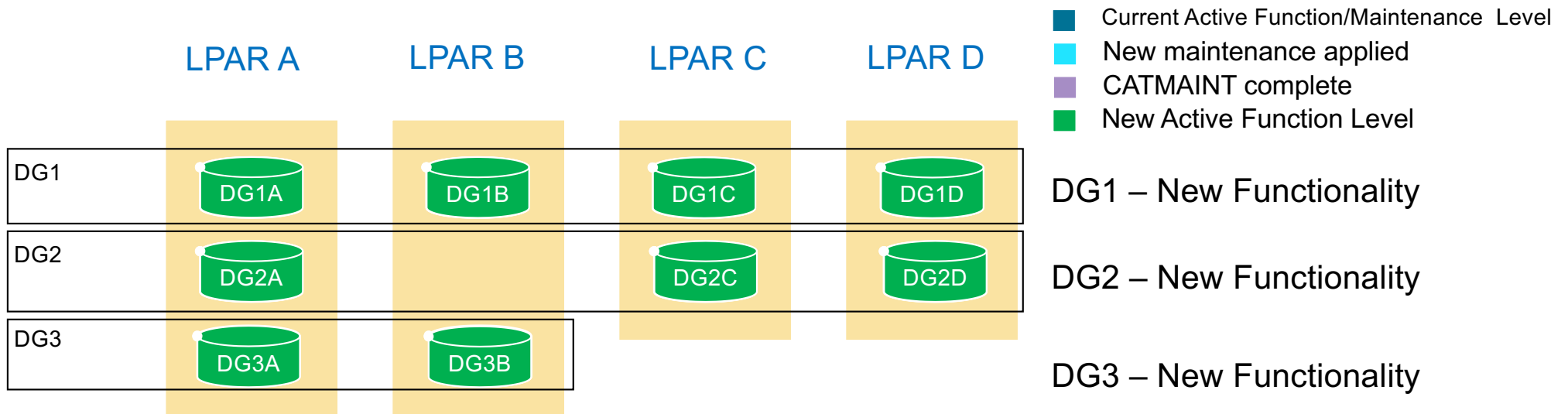
Four new levels:

- **Maintenance level (ML)** ← **Increases as maintenance is applied**
 - Also known as code level
 - Contains fixes & inactive new functions
- **Catalog level (CL)** ← **Reflects Catalog Version**
 - Db2 Catalog changes that are needed for FLs
- **Function level (FL)** ← **Controls non-SQL new Function**
 - Introduces new Db2 features and functionality
- **APPLCOMPAT level (AC)** ← **Controls Application Behavior**
 - Determines SQL level of applications
 - Activates new SQL syntax
 - Freezes SQL syntax even if FL is later moved back to earlier level

Assumptions:

- **New MLs & FLs expected every 3-4 months**
- **most of new function can be used without change of apps: optimizer, tools, utilities, security, new HW & OS features**
- **Occasional SQL changes (filtered out with APPLCOMPAT setting)**

LPAR Rollout of Db2 Function Levels



- Typical Best Practice is to
 - Install New Maintenance and stabilize
 - Activate FL
 - Activation is usually a FL that the previous ML supported (not something in New ML)
 - If a CATMAINT is required, it must be done prior to activation of the FL.
 - Activate APPLCOMPAT – if applicable – for packages that need new capability

Db2 Display Group

```
----- DB2 Command Processor -----
| -DISPLAY GROUP DETAIL |
***** TOP OF DATA *****
DSN7100I !DT32 DSN7GCMD
*** BEGIN DISPLAY OF GROUP(DSNDCJC ) CATALOG LEVEL(V12R1M500)
      CURRENT FUNCTION LEVEL(V12R1M500)
      HIGHEST ACTIVATED FUNCTION LEVEL(V12R1M500)
      HIGHEST POSSIBLE FUNCTION LEVEL(V12R1M501)
      PROTOCOL LEVEL(2)
      GROUP ATTACH NAME(DTGP)
-----
DB2          SUB          DB2    SYSTEM  IRLM
MEMBER  ID  SYS  CMDPREF  STATUS  LVL   NAME    SUBSYS  IRLMPROC
-----
CJC1      1  CJC1 !CJC1   ACTIVE  121509 CJC11   CJC1    CJC1IRLM
CJC2      2  CJC2 !CJC2   ACTIVE  121509 CJC12   CJC2    CJC2IRLM
CJC3      3  CJC3 !CJC3   ACTIVE  121509 CJC13   CJC3    CJC3IRLM
-----
SCA  STRUCTURE SIZE:    17408 KB, STATUS= AC,   SCA IN USE:    31 %
LOCK1 STRUCTURE SIZE:    46080 KB
NUMBER LOCK ENTRIES:    8388608
NUMBER LIST ENTRIES:    87329, LIST ENTRIES IN USE:    127
SPT01 INLINE LENGTH:    32138
*** END DISPLAY OF GROUP(DSNDCJC )
```

SYSIBM.SYSLEVELUPDATES – Keeps track of FL Changes

| FUNCTION_LVL | PREV_FUNCTION_LVL | HIGH_FUNCTION_LVL | CATALOG_LVL | OPERATION_TYPE | EFFECTIVE_TIME | EFFECTIVE_LRSN | OPERATION_TEXT | GROUP_MEMBER |
|--------------|-------------------|-------------------|-------------|----------------|----------------|----------------|-------------------------------------|--------------|
| V12R1M500 | V12R1M100 | V12R1M500 | V12R1M500 | F | 8/12/16 11:58 | 2 I | -ACTIVATE FUNCTION LEVEL(V12R1M500) | |
| V12R1M100 | V11R1M500 | V12R1M100 | V12R1M500 | C | 8/12/16 11:16 | ,öCİ | CATMAINT PROCESSING | |
| V12R1M501 | V12R1M500 | V12R1M501 | V12R1M500 | F | 12/4/17 10:30 | i I | -ACTIVATE FUNCTION LEVEL(V12R1M501) | |
| V12R1M501 | V12R1M500 | V12R1M501 | V12R1M502 | C | 12/9/19 11:12 | Wİ § | CATMAINT PROCESSING - V12R1M502 | |
| V12R1M501 | V12R1M500 | V12R1M501 | V12R1M503 | C | 12/9/19 11:12 | Wİ q | CATMAINT PROCESSING - V12R1M503 | |
| V12R1M501 | V12R1M500 | V12R1M501 | V12R1M505 | C | 12/9/19 11:12 | Wİ o* | CATMAINT PROCESSING - V12R1M505 | |
| V12R1M506 | V12R1M501 | V12R1M506 | V12R1M505 | F | 12/9/19 11:22 | Wİ ñ | -ACTIVATE FUNCTION LEVEL(V12R1M506) | |
| V12R1M506 | V12R1M501 | V12R1M506 | V12R1M507 | C | 2/2/21 14:34 | 8 e | CATMAINT PROCESSING - V12R1M507 | |
| V12R1M506 | V12R1M501 | V12R1M506 | V12R1M509 | C | 2/2/21 14:34 | 8 ñM | CATMAINT PROCESSING - V12R1M509 | |
| V12R1M509 | V12R1M506 | V12R1M509 | V12R1M509 | F | 2/2/21 14:37 | 8"iN | -ACTIVATE FUNCTION LEVEL(V12R1M509) | |
| V12R1M510 | V12R1M509 | V12R1M510 | V12R1M509 | F | 4/20/21 13:44 | α7fmμ | -ACTIVATE FUNCTION LEVEL(V12R1M510) | |

Can anyone spot something that is correct – but strange in this table?

Db2 12 Didn't GA until October 2016 – this system was installed during the ESP



How Vendors are Adapting

183.102

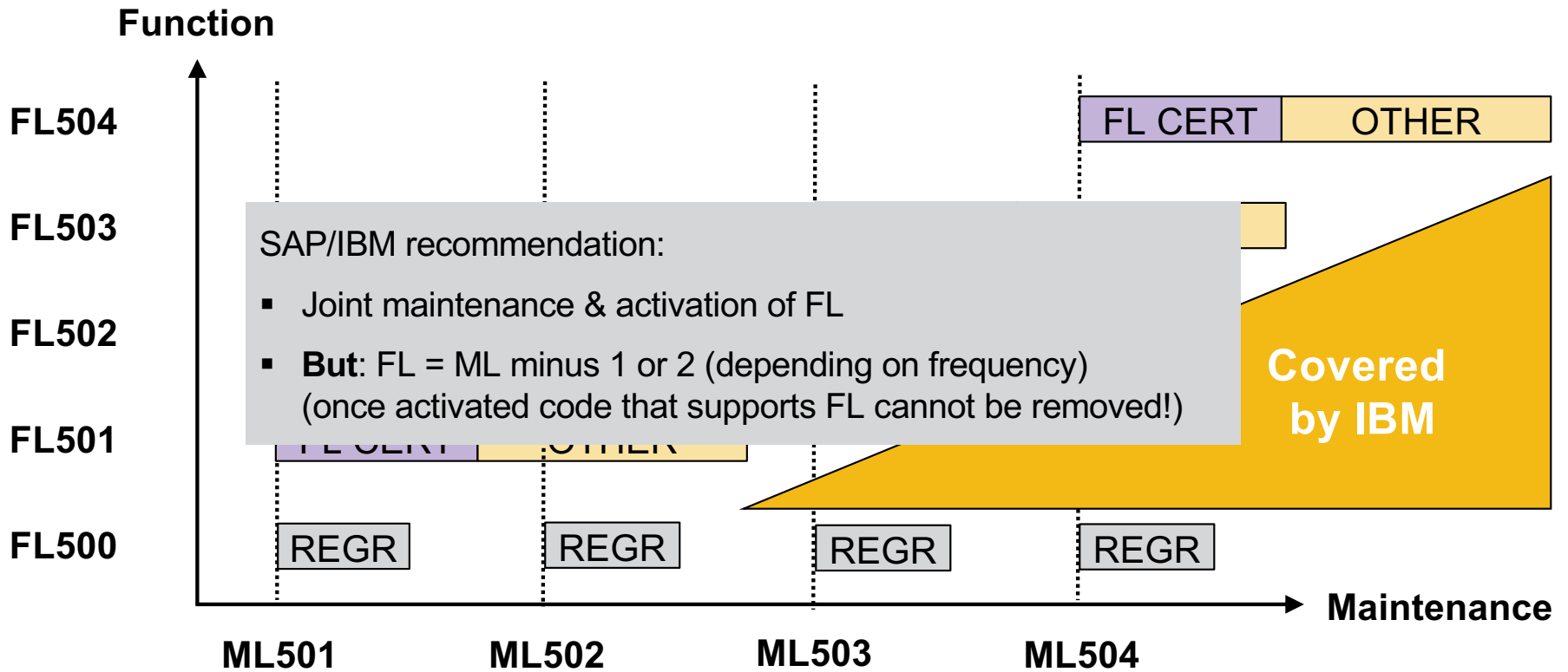
154.178

245.5

Db2 Continuous Delivery

SAP Certification over Time

- FL500 regression @ ISISC
- FL50x certification @ SAP & ISISC
- all other certifications @ SAP



Db2 12 for z/OS & SAP

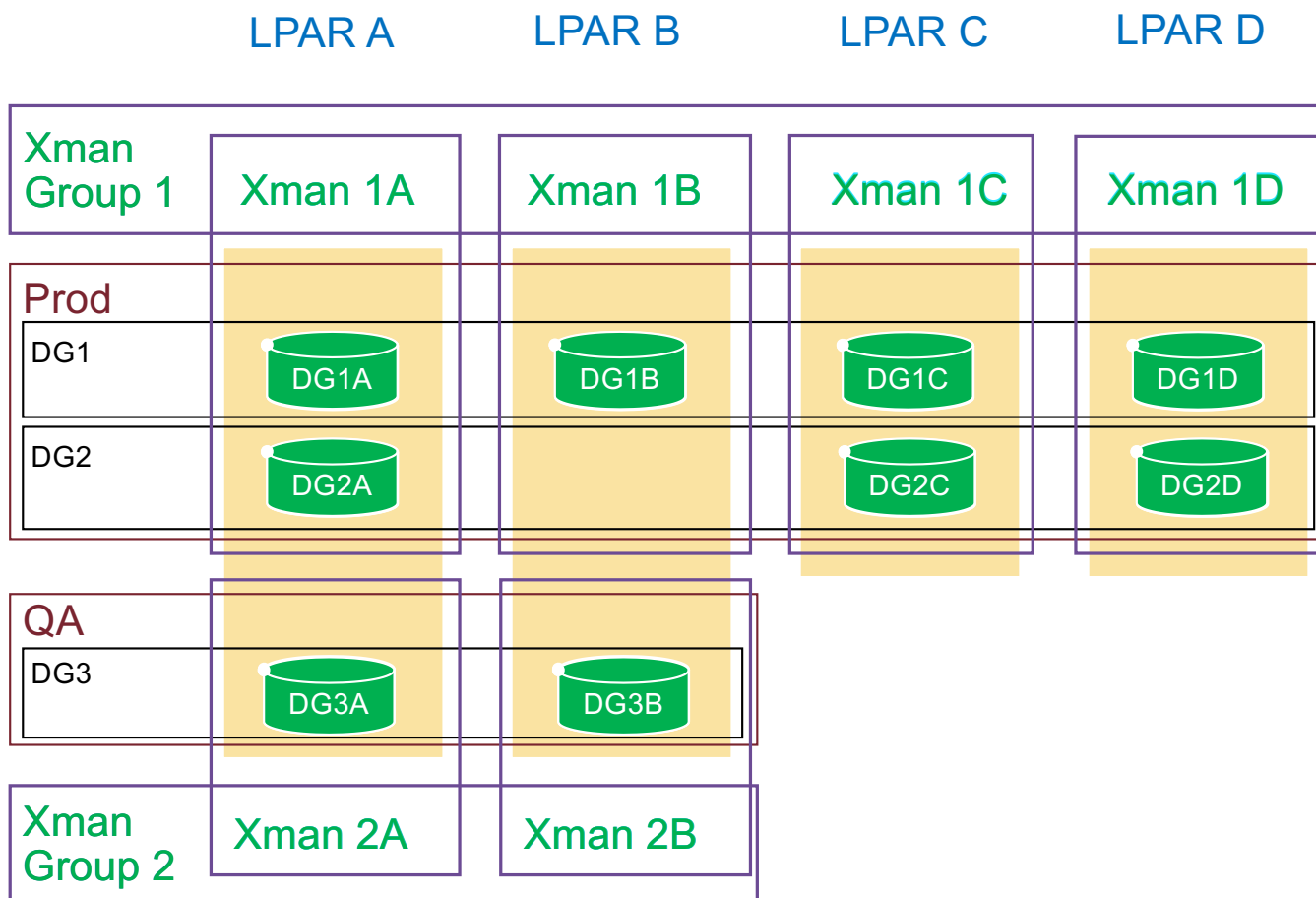
Function Levels

SAP Note [2302997](#) – Function Level Support.

SAP Note [2902423](#) – Support of APPLCOMPAT Levels

| Function Level | Content | APAR | IBM GA PTF closed | SAP GA | APPLCOMPAT level certified |
|----------------|--|---------|-------------------|-------------|----------------------------|
| v12 500 | <ul style="list-style-type: none"> Initial Release | | 21-Oct-2016 | 21-Oct-2016 | V12R1M500 |
| v12 501 | <ul style="list-style-type: none"> LISTAGG | PI70535 | 28-Mar-2017 | 18-Sep-2017 | V12R1M501 |
| v12 502 | <ul style="list-style-type: none"> CAST of numeric to a graphic string KEYLABEL mgmt. for z/OS DFSMS data set encryption | PI95511 | 26-Apr-2018 | 24-Sep-2018 | |
| v12 503 | <ul style="list-style-type: none"> Db2 AI for z/OS (Db2ZAI) ... | PH00506 | 11-Sep-2018 | 24-Jan-2019 | |
| v12 504 | <ul style="list-style-type: none"> Huffman compression | PH07672 | 25-Feb-2019 | 10-Jul-2019 | |
| v12 505 | <ul style="list-style-type: none"> HTAP performance, built-in en/decrypt data key functions | PH09191 | 26-Jun-2019 | 1-Oct-2019 | |
| v12 506 | <ul style="list-style-type: none"> Alternative function names Implicit drop of explicitly created objects | PH16829 | 1-Nov-2019 | 23-Jan2020 | V12R1M506 |
| V12 507 | <ul style="list-style-type: none"> functional code to support application granularity for locking limits | PH24371 | 15-Jun-2020 | 5-Oct-2020 | |
| V12 508 | <ul style="list-style-type: none"> Moving tables from multi-table table spaces to partition-by-growth table spaces | PH29392 | 1-Oct-2020 | 15-Feb-2021 | V12R1M508 |
| V12 509 | <ul style="list-style-type: none"> Specify compression algorithm at the table, table space, or partition level | PH33015 | 5-Feb-2021 | Est 3Q21 | |
| V12 510 | <ul style="list-style-type: none"> Steppingstone to Db2 vNext | PH33727 | 28-Apr2021 | Est 4Q21 | v12R1M510 |

Rollout of Broadcom Db2 Tools Maintenance w/ Level Set Activation



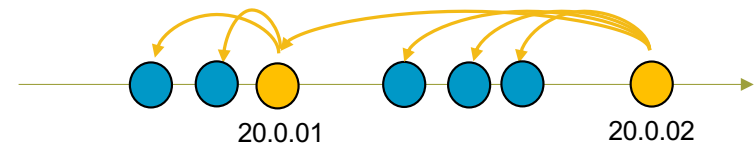
- Current Active Level Set
- New maintenance applied
- Compare/Binds complete
- New Active Level Set

Xman Group 1 – New Functionality

Xman Group 2 – New Functionality

Broadcom - Level Set PTFs - How Does Activation work?

- Level Set PTF ●
 - Introduced as part of Continuous Delivery
 - Prereqs all PTFs ● since previous Level Set PTF
 - Applying this PTF ensures that all maintenance is current to that point
 - Product version string expanded – 20.0.*mm*
- Post-Install Compare job execution
 - Makes sure that product Db2 objects are ready for new functionality
- Activate the new features
 - The maintenance Level Set of all Xmans in an Xman Group => *mm* in order to activate *mm*
 - Product features associated to Level Set *mm* require activation of Level Set *mm*



Broadcom - Xmanager Status

Generated by: GROUP=DEVGR20 LPAR=CA31 XMID=2001 SYSPLEX=PLEXC1

| Xmanager | | | | Level Set | | | |
|----------|------|------|------------|-----------|---------|----------------|---------------------------|
| Group | LPAR | XMID | Status | Maint | Active | Highest Active | Highest Possible Eligible |
| DEVGR20 | | | | | 20.0.01 | 20.0.02 | 20.0.01 |
| | CA11 | 2000 | Inactive | 20.0.00* | | | Ignored |
| | CA31 | 2001 | Active | 20.0.02 | | | Yes |
| | CA31 | 2002 | Incomplete | 20.0.02 | | | No |

*Last known Maintenance Level Set

Inactive Xmanagers require a minimum Maint Level Set of 20.0.02 to start

Incomplete Xmanagers each require an Xmanager Configuration File

Broadcom - New Xmanager Operator Commands

- F <ptxman>,SHOW LEVELSET
 - Level Set status will be written in the Xmanager Job Log
 - If the Xmanager was started with XSYS=Y, then all Xmanagers participating in the group are included
- F <ptxman>,TEST LEVELSET(vv.r.mm)
 - Check that all Xmanagers are at the needed Level Set or higher
- F <ptxman>. ACTIVATE LEVELSET(vv.r.mm)
 - Activate a new Level Set
 - A new Security Resource needs to be defined to perform the activation
 - Resource class: CADB2
 - Service: COMMAND
 - Function: LEVELSET.ACTIVATE.group.lpar.xmid
 - Activation of a Level Set requires all Xmanagers in the XMAN Group to be at the specified Level Set or higher
 - Activation to a lower Level Set is possible if an undesirable behavior is identified
 - After Activation of a Level Set an SMP/E Restore to remove the Level Set PTF is not supported

Broadcom - Support in version 20.0

- Version 20.0 supports Db2 12 continuous delivery
 - We participate in the IBM Vendor program
 - We **continuously** support new levels from IBM
 - See the documentation for the latest supported level, <http://techdocs.broadcom.com/content/broadcom/techdocs/us/en/ca-mainframe-software/database-management/ca-database-management-solutions-for-db2-for-z-os/20/release-notes/db2-version-support.html>
 - V12R1M510 as of July 2021 (LU01352)
- Transitioned from **Incremental releases** to **Continuous Delivery**
 - See <http://techdocs.broadcom.com/content/broadcom/techdocs/us/en/ca-mainframe-software/database-management/ca-database-management-solutions-for-db2-for-z-os/20/release-notes/transition-to-continuous-delivery.html>
 - IR8 was the last increment
 - Fixes and new features are no longer bundled together in 20.0



Db2 Continuous Delivery –



M501-M510

Terminology & Ground Rules

In the following slides

- Function Level 5xx implies a specific FL has been activated and any Catmaint (Catalog Level or CL) required by that FL has been applied (as required by Db2)
- APPLCOMPAT(V12R1M5xx) implies that any FL required for that APPLCOMPAT has been activated

I will cover all the changes for each FL and APPLCOMPAT Level – if something is left out it is **(probably)** intentional

- For Example – There were no changes associated with FL 501, so only the change associated with APPLCOMPAT is discussed

Catalog Levels are Not Discussed because in general, they are not usually impactful to operations

Db2 AI for z/OS specific changes are not discussed although new commands associated with it are

Packages for IBM Data Server Drivers (aka – the nullid packages)

APPLCOMPAT(V12R1M501) and above

- Two schools of thought – Good news, you can have either or both
 - I want it to work like it always has (the wild west)
 - <https://community.ibm.com/community/user/hybriddatamanagement/blogs/paul-mcwilliams1/2019/12/09/simplified-application-compatibility-for-ibm-data>
 - Enabled by PH08482 - <https://www.ibm.com/support/pages/apar/PH08482>
 - Reactive –vs- Proactive
 - I want to control what my applications are exposed to
 - <https://www.idug.org/blogs/chris-crone1/2020/11/04/db2-12-and-the-ibm-data-server-drivers-with-fl-501-and-above>
 - Proactive control of applications exposure to incompatible changes



LISTAGG – APPLCOMPAT(V12R1M501)

```
SELECT workdept, LISTAGG(ALL RTRIM(job),', ')  
WITHIN GROUP(ORDER BY RTRIM(job)) AS POSITION  
FROM emp  
GROUP BY workdept;
```



| WORKDEPT | POSITION |
|----------|---|
| A00 | CLERK, CLERK, PRES, SALESREP, SALESREP |
| B01 | MANAGER |
| C01 | ANALYST, ANALYST, ANALYST, MANAGER |
| D11 | DESIGNER, DESIGNER, DESIGNER, DESIGNER, DESIGNER, DESIGNER, DESIGNER, DESIGNER, DESIGNER, DESIGNER, MANAGER |
| D21 | CLERK, CLERK, CLERK, CLERK, CLERK, CLERK, MANAGER |
| E01 | MANAGER |
| E11 | MANAGER, OPERATOR, OPERATOR, OPERATOR, OPERATOR, OPERATOR, OPERATOR |
| E21 | FIELDREP, FIELDREP, FIELDREP, FIELDREP, FIELDREP, MANAGER |

LISTAGG (cont) – APPLCOMPAT(V12R1M501)

```
SELECT workdept, LISTAGG(DISTINCT RTRIM(job),'; ') WITHIN GROUP(
ORDER BY RTRIM(job)) AS POSITION
FROM emp
GROUP BY workdept;
```

| WORKDEPT | POSITION |
|----------|-----------------------|
| A00 | CLERK; PRES; SALESREP |
| B01 | MANAGER |
| C01 | ANALYST; MANAGER |
| D11 | DESIGNER; MANAGER |
| D21 | CLERK; MANAGER |
| E01 | MANAGER |
| E11 | MANAGER; OPERATOR |
| E21 | FIELDREP; MANAGER |



Explicit Casting to GRAPHIC/VARGRAPHIC – APPLCOMPAT(V12R1M502)

- Support Casting of Numeric to Unicode UTF-16 (GRAPHIC/VARGRAPHIC)

```
SELECT FIRSTNME, LASTNAME,  
       GRAPHIC(SALARY + BONUS + COMM) AS TOTAL_COMP  
FROM U_EMP WHERE LASTNAME = 'HAAS';
```

| FIRSTNME | LASTNAME | TOTAL_COMP |
|-----------|----------|------------|
| CHRISTINE | HAAS | 157970.00 |



Database Controlled Pervasive Encryption – APPLCOMPAT(V12R1M502)

- Follow on to DFSMS Pervasive Encryption
- KEYLABEL Column (Catalog Level V12R1M502) added to
 - SYSIBM.SYSINDEXES (Indexes inherit KEYLABEL from Table)
 - SYSIBM.SYSSTOGROUP
 - SYSIBM.SYSTABLESPACE (Tablespace inherits KEYLABEL from Table)
 - SYSIBM.SYSTABLES
- “KEY LABEL” added to CREATE/ALTER
 - STOGROUP
 - TABLE

Note: The application that issues CREATE/ALTER to STOGROUP or TABLE must be at APPLCOMPAT(V12R1M502), but applications that access the table or objects within an encrypted STOGROUP may be any supported APPLCOMPAT level (V10R1 and above).



Misc - FL 503

- Db2 AI for z/OS Support
 - -START ML (Db2)
 - -STOP ML (Db2)
 - -DISPLAY ML (Db2)
- New Console message for activation of FL
 - **DSNG014I**



Temporal Auditing – APPLCOMPAT(V12R1M503)

Temporal Auditing Changed Behavior

- The temporal query result change for system-period temporal tables defined with the ON DELETE ADD EXTRA ROW attribute that also contain a DATA CHANGE OPERATION column.
- Rows that contain null values in the history table column that corresponds to the DATA CHANGE OPERATION column will now be considered part of the intermediate result set for a system-period temporal query. However, rows that were added to a history table for the ON DELETE ADD EXTRA ROW attribute will still be excluded.
- Application behavior is tied to APPLCOMPAT(V12R1M503)

REPLICATION_OVERRIDE

- New Global Variable to enable replication of system-period temporal tables.
- Replication SW must be bound APPLCOMPAT(V12R1M503)



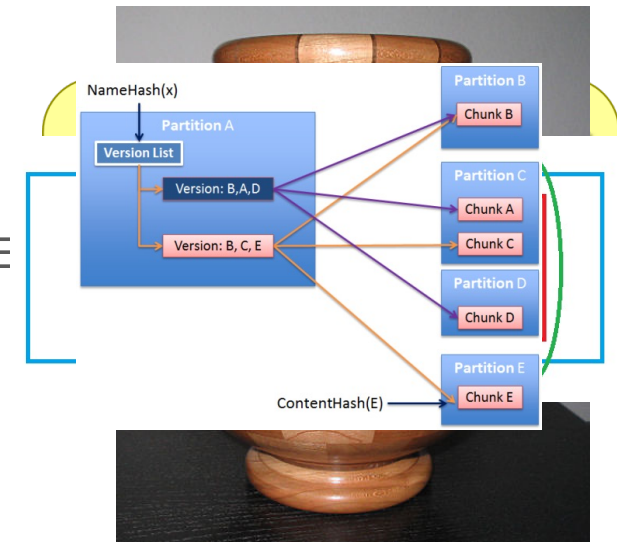
Z14 (and above) Huffman Compression – FL 504

- `TS_COMPRESSION_TYPE`
 - New zPARM to enable Huffman Compression
 - zPARM only “active” at FL 504 and above – install jobs with new zPARM shipped prior to FL 504
 - `FIXED_LENGTH` (default) – Existing (since Db2 V3) compression
 - `HUFFMAN` – Enables variable (entropy) compression as second stage compression



Prevent Creation of Deprecated Objects – APPLCOMPAT(V12R1M504)

- Packages bound with APPLCOMPAT(V12R1M504) cannot CREATE
 - SYNONYMS
 - SEGMENTED (non-UTS) tablespaces
 - Partitioned (non-UTS) tablespaces
 - Hash-Organized Tables
- This only affects the creation of new objects from packages bound APPLCOMPAT(V12R1M504) and above.
 - Use – “SET CURRENT APPLICATION COMPATIBILITY = ‘V12R1M503’” to allow creation of these objects, if necessary, on application/tooling bound at higher levels
 - Can be set in [“Profile Tables”](#)



IDAA BIF Passthrough – APPLCOMPAT(V12R1M504)

•Function level 504 introduces support for the following passthrough-only built-in functions, which are passed through from Db2 for z/OS to IBM Db2 Analytics Accelerator:

- [CUME_DIST](#)
- [CUME_DIST \(aggregate\)](#)
- [FIRST_VALUE](#)
- [LAG](#)
- [LAST_VALUE](#)
- [LEAD](#)
- [NTH_VALUE](#)
- [NTILE](#)
- [PERCENT_RANK](#)
- [PERCENT_RANK \(aggregate\)](#)
- [RATIO_TO_REPORT](#)
- [REGEXP_COUNT](#)
- [REGEXP INSTR](#)
- [REGEXP LIKE](#)
- [REGEXP REPLACE](#)
- [REGEXP SUBSTR](#)



New Syntax Alternative – APPLCOMPAT(V12R1M504)

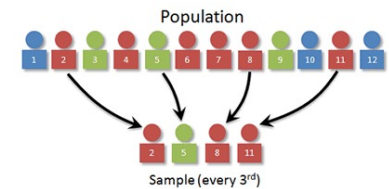


| Existing Syntax | New Syntax Alternatives |
|---------------------------------------|-------------------------|
| CURRENT CLIENT_ACCTNG | CLIENT ACCTNG |
| CURRENT CLIENT_APPLNAME | CLIENT APPLNAME |
| CURRENT CLIENT_USERID | CLIENT USERID |
| CURRENT CLIENT_WRKSTNNAME | CLIENT WRKSTNNAME |
| CURRENT SERVER | CURRENT_SERVER |
| CURRENT TIME_ZONE CURRENT TIMEZONE | CURRENT_TIMEZONE |
| IS NULL | ISNULL |
| IS NOT NULL | NOTNULL |

Misc – FL 505/APPLCOMPAT(V12R1M505)

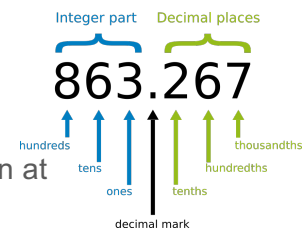
FL 505

- Improved Hybrid Transactional Analytical Processing
 - Ability to have true ISO(CS) CURRENT DATA(NO) query processing on IDAA
- Rebind Phase-in for packages being used for execution
- RUNSTATS automatic page sampling
 - Incompatible change if STATPGSAMP=DEFAULT (with activation of FL – essentially STATPGSAMP=YES)



APPLCOMPAT(V12R1M505)

- Index support for DECFLOAT
 - CREATE TABLE and ALTER TABLE – to specify primary and unique keys
 - CREATE INDEX and ALTER INDEX – support for DECFLOAT columns
 - Application/Tool used to CREATE or ALTER INDEX must be APPLCOMPAT(V12R1M505) or above, any application at any supported APPLCOMPAT (V10R1 and above) can use the index when rebound/PREPARED
- System-period temporal tables and archive-enabled tables can be referenced in WHEN clauses of both basic and advanced triggers
 - Regardless of the settings of the SYSTIMESENSITIVE and ARCHIVESENSITIVE bind options.
 - Time machine and transparent archive data retrieval are fully supported in the WHEN clause.



ENCRYPT_DATAKEY, DECRYPT_DATAKEY – APPLCOMPAT(V12R1M505)

```
CREATE TABLE T1  
(NAME CHAR(20), PHONE_NUMBER VARBINARY(95));
```

```
INSERT INTO T1 VALUES  
('Chris',ENCRYPT_DATAKEY('408-867-5309','MYKEYLABEL',AES256D));
```

```
SELECT  
NAME, DECRYPT_DATAKEY_VARCHAR(PHONE_NUMBER)  
FROM SAMPLE_TABLE;
```

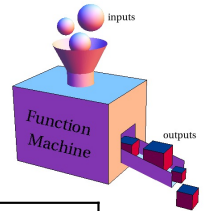
News from the Lab Blog on ENCRYPT_DATAKEY -
<https://ibm.co/39M55UW>



DROP – FL 506/APPLCOMPAT(V12R1M506)

- Consistent support for dropping implicitly and explicitly created tablespaces
 - If you drop a base table that resides in an explicitly created universal table space, Db2 implicitly drops the table space along with the table instead of returning an error in SQLCODE -669.
 - If you drop a system-period temporal table or an archive-enabled table, Db2 also drops the associated history table or archive table. If the history table or archive table resides in an explicitly created universal table space, Db2 implicitly drops the table space along with the table instead of returning an error in SQLCODE -669.
 - If you drop an auxiliary table that resides in an explicitly created LOB table space, Db2 implicitly drops the table space along with the table. Previously, the LOB table space remained as an empty table space. An auxiliary table is dropped when you take one of the following actions:
 - Issue the DROP TABLE statement on the auxiliary table
 - Drop the associated base table
 - Drop an associated LOB column
 - Remove an associated trailing empty partition when running the REORG utility on a partition-by-growth table space
- DROP Behavior is controlled by APPLCOMPAT(V12R1M506)
- REORG Behavior is controlled by FL V12R1M506

New Function Syntax Alternatives – APPLCOMPAT(V12R1M506)



| Newly supported alternative name | Existing equivalent function |
|----------------------------------|---|
| CHAR_LENGTH | CHARACTER_LENGTH, which returns the length of its argument in the number of string units that are specified |
| COVAR_POP | COVARIANCE or COVAR, which return the population covariance of a set of number pairs |
| HASH | HASH_MD5, HASH_SHA1, or HASH_SHA256, which return the result of applying a hash algorithm to an input argument, depending on the value specified for the second argument for the HASH function: |
| | 0 (default) |
| | HASH_MD5 |
| | HASH_SHA1 |
| | HASH_SHA256 |
| | The HASH function returns a varying length (VARBINARY) value, unlike the existing functions, which return fixed length (BINARY) values. |
| POW | POWER, which returns the value of one argument raised to the power of a second argument |
| RANDOM | RANDOM, which returns a double precision floating-point random number |
| STRLEFT | LEFT, which returns a string that consists of the specified number of leftmost bytes or the specified string units |
| STRPOS | POSSTR, which returns the position of the first occurrence of an argument within another argument |
| STRRIGHT | RIGHT, which returns a string that consists of the specified number of rightmost bytes or specified string units |
| TO_CLOB | CLOB, which returns a CLOB representation of the first argument |
| TO_TIMESTAMP | TIMESTAMP_FORMAT, which returns a timestamp for a character string expression, using a specified format to interpret the string |

Deletion of old statistics when using profiles – FL 507

- When you run the RUNSTATS, REORG, or LOAD with the USE PROFILE option
 - Db2 collects only those statistics that are included in the specified profile. Beginning in function level 507, Db2 now also deletes existing statistics that are not part of the profile. All frequency, key cardinality, and histogram statistics that are not included in the profile are deleted from the catalog for the target object. This new behavior provides a way for you to remove stale distribution statistics without impacting concurrently running dynamic SQL.

NUMLKUS and NUMLKTS Global Variables – APPLCOMPAT(V12R1M507)

New built-in global variables support granularity for locking limits:

- **SYSIBMADM.MAX_LOCKS_PER_TABLESPACE**
 - An integer value for the maximum number of page, row, or LOB locks that the application can hold simultaneously in a table space.
 - If the application exceeds the maximum number of locks in a single table space, lock escalation occurs.
 - Corresponds to the existing NUMLKTS subsystem parameter.
- **SYSIBMADM.MAX_LOCKS_PER_USER**
 - An integer value integer value that specifies the maximum number of page, row, or LOB locks that a single application can concurrently hold for all table spaces.
 - The limit applies to all table spaces that are defined with the LOCKSIZE PAGE, LOCKSIZE ROW, or LOCKSIZE ANY options. MAX_LOCKS_PER_USER.
 - Corresponds to the existing NUMLKUS subsystem parameter.

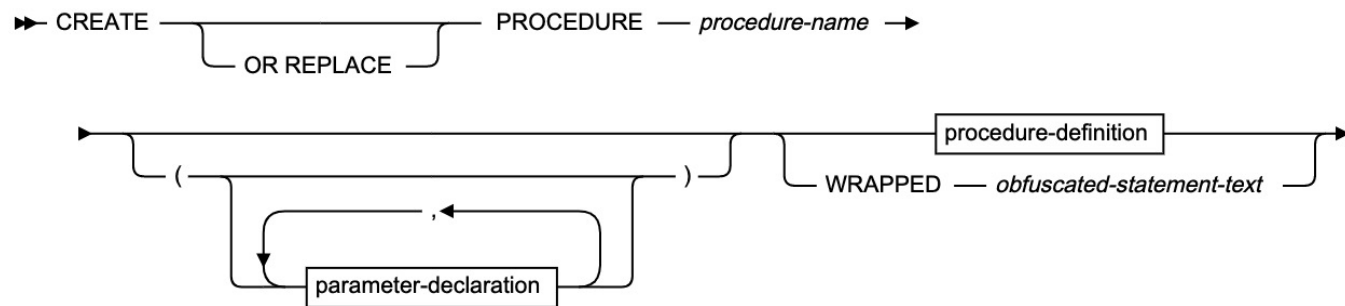


IDAA BIF Passthrough – APPLCOMPAT(V12R1M507)

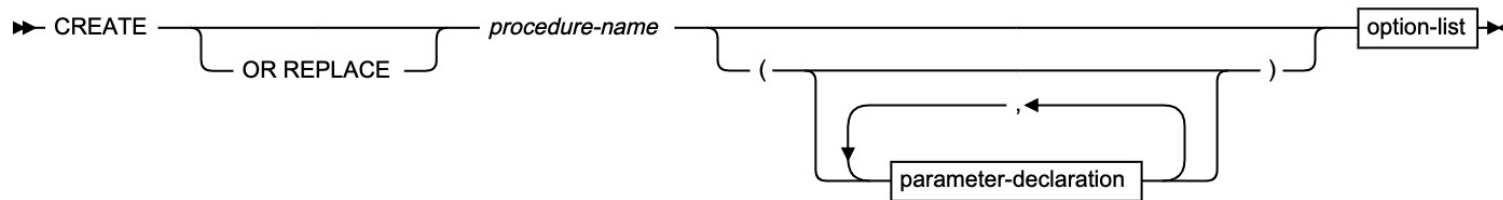
- The following built-in functions are now supported as passthrough-only expressions, which are passed through from Db2 for z/OS® to IBM Db2 Analytics Accelerator:
- [ADD DAYS](#)
- [BTRIM](#)
- [DAYS BETWEEN](#)
- [NEXT MONTH](#)
- [Regression Functions](#) (REGR_AVGX, REGR_AVGY, REGR_COUNT, ...)
- [ROUND TIMESTAMP](#) (if invoked with a date expression)

CREATE OR REPLACE for procedures - APPLCOMPAT(V12R1M507)

Syntax - Native SQL Procedures



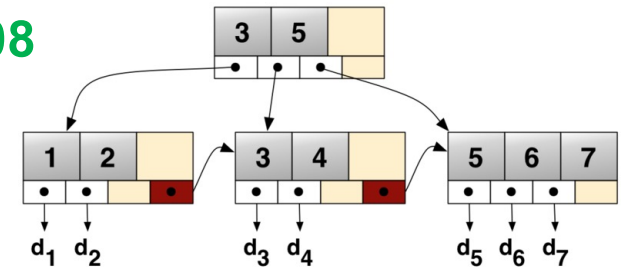
Syntax - External Procedures



FTB Support for Non-Unique Indexes – FL 508

Extends FTB support for Non-Unique indexes once FL 508 is active

- FTB_NON_UNIQUE_INDEX = YES/NO (NO is the default)
- INDEX_MEMORY_CONTROL = AUTO, DISABLE, *n*, (SELECTED,AUTO), or (SELECTED,*n*)
 - AUTO – Db2 controls FTBs
 - DISABLE – Selected Indexes only (see below)
 - *n* – Specifies size in megabytes
 - SELECTED,AUTO – Db2 calculates storage for specified indexes
 - SELECTED,*n* – Db2 use *n* megabytes for specified indexes
- SYSIBM.SYSINDEXCONTROL – rows control which indexes are selected
 - Example – to indicate SYSADM.IX1 gets priority for FTBs
INSERT INTO SYSIBM.SYSINDEXCONTROL (SSID, PARTITION, IXNAME, IXCREATOR, TYPE, ACTION, MONTH_WEEK, MONTH, DAY, FROM_TIME, TO_TIME) VALUES(NULL, NULL, 'IX1', 'SYSADM', 'F', 'F', 'W', NULL, NULL, NULL, NULL);



Multi-Table Segmented to PBG – FL 508/APPLCOMPAT(V12R1M508)

ALTER TABLESPACE

- New “move-table-clause”
- Application/Tooling must be APPLCOMPAT(V12R1M508) and above

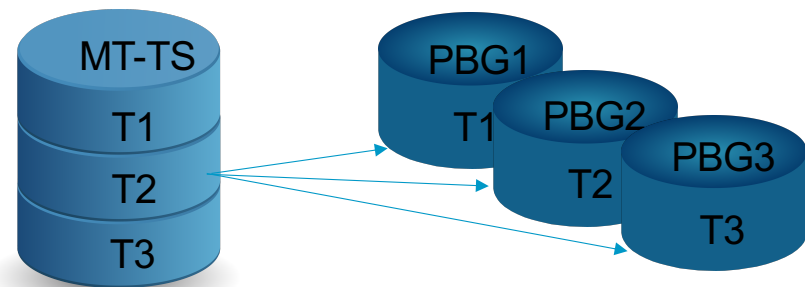
➔ ALTER TABLESPACE database-name. table-space-name ➔

move-table-clause:

➔ MOVE TABLE table-name TO TABLESPACE dbname. new-tsname ➔

REORG

- New Behavior to fan out tables available once FL 508 activated



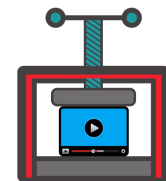
Misc – FL 509

FL 509

- Tamper Proof Audit Policies
 - By inserting an audit policy record into the SYSIBM.SYSAUDITPOLICIES catalog table with a DB2START value of 'T'. Any STOP TRACE commands on this record require additional ESM (RACF,TSS, ACF2) authorization in FL 509. UPDATE and DELETE statements on this record require additional ESM authorization in FL 509, regardless of the application compatibility level.
- High Availability Accelerator Tables
 - FL 509 enables definition of AOT tables in multiple IDAA instances
 - This enables Workload balancing as well

APPLCOMPAT(V12R1M509)

- Huffman Compression at Object Level
 - CREATE TABLE, CREATE TABLESPACE, ALTER TABLESPACE
- UPDATE and DELETE for Temporal RI
 - UPDATE with a FOR PORTION OF clause attempts to update the parent table in a temporal RI relationship, the update is allowed as long as the rules of temporal RI are not violated.
 - DELETE with a FOR PORTION OF clause attempts to delete from the parent table in a temporal RI relationship, the deletion is allowed, as long as the rules of temporal RI are not violated.

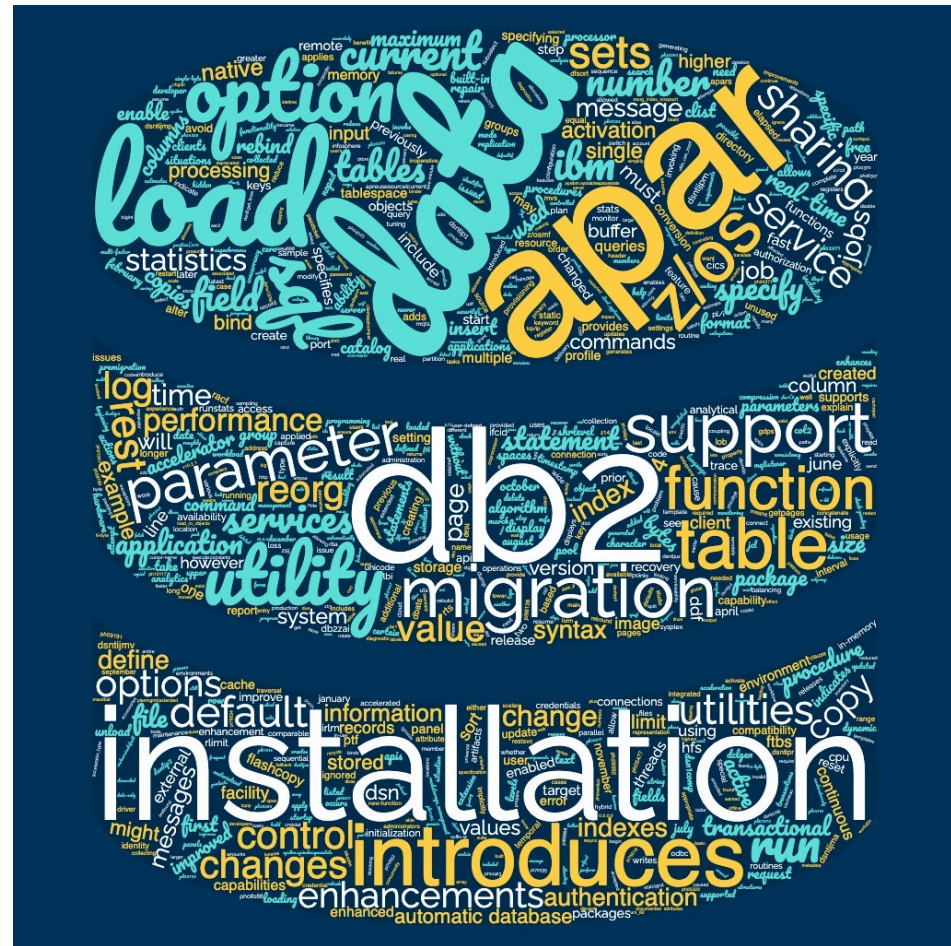


**THIS
CHANGES
EVERY
NOTHING**

FL 510

Activation of FL 510 activates all previous FLs and prepares the system for migration to Db2 Apollo

Enhancements not part of a Function Level





The background image shows a financial market data screen with various stock indices and a line chart. The text "Results" is overlaid in the center.

Results

| Index | Value | Change | Direction |
|--------|----------|-----------|-----------------|
| OMXC25 | 10916.69 | 10847.17 | ~ Buy |
| OMXRG1 | 984.13 | 0.27% | |
| INDEX | 57.2180 | 6025.9680 | 5993.7030 ~ Buy |
| OMX18 | 28289.06 | 27956.04 | ~ Buy |
| OMXIC8 | 6230.9 | 1632.51 | -0.30% ~ Sell |



RESULTS

- Db2 12 has, over the past 5 years, delivered more enhancements than have typically been delivered in the past
- Function Levels and APPLCOMPAT enable a degree of stability through this change
- Customer feedback continues to shape the content and timing of new capabilities



Chris Crone
cjc@broadcom.com

Please submit your session feedback!

- Do it online at <https://conferences.gse.org.uk/2021/feedback/4BI>

- This session is **4BI**



1. What is your conference registration number?

👉 This is the three digit number on the bottom of your delegate badge

2. Was the length of this presentation correct?

👉 1 to 4 = "Too Short" 5 = "OK" 6-9 = "Too Long"

1 2 3 4 5 6 7 8 9

3. Did this presentation meet your requirements?

👉 1 to 4 = "No" 5 = "OK" 6-9 = "Yes"

1 2 3 4 5 6 7 8 9

4. Was the session content what you expected?

👉 1 to 4 = "No" 5 = "OK" 6-9 = "Yes"

1 2 3 4 5 6 7 8 9



Become a member of GSE UK

- Company or individual membership available
- Benefits include:
 - GSE Annual Conference: Receive 5 free places + 2 free places for trainees
 - 20% discount on fees for IBM Technical Conferences
 - 20% on IBM Training Courses in Europe
 - 15% discount for IBM STG Technical Conferences in the USA
 - 20% discount on the fee for taking the Mainframe Technology Professional (MTP) exams
 - European events – via GSE HQ
- Contact membership@gse.org.uk for details

