



DB2 12 — The ultimate enterprise database for business-critical transactions and analytics

DB2 for z/OS: Continuous Delivery of New Features (part 1)

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Presented by Mark Rader

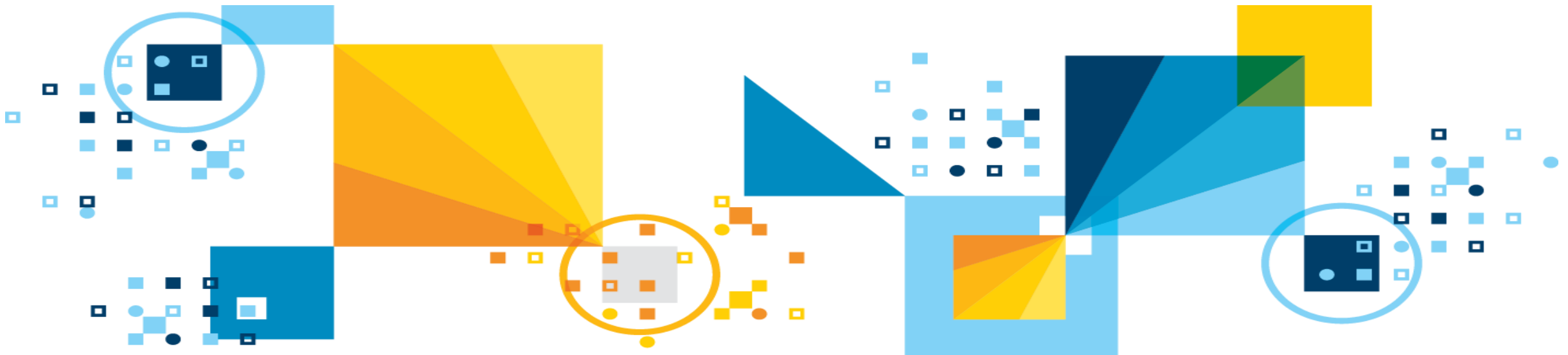
WSC: DB2 for z/OS



Agenda

- Why we are changing
- Migration from DB2 11 to DB2 12
- New Function Activation beyond base DB2 12
- Catalog Changes
- New Function Activation Scenarios
- Summary
- Appendix
 - Documentation Proposal
 - Vendor Support

Why we are changing



DB2 for z/OS Today

- We deliver most of our new function in a new release ~every 3 years
- DB2 is on 3 year cycle, but many of our customers are on 4 year cycles, hence the interest in skip release migrations
- We develop or retrofit a very limited number of new features in the service stream, but only if urgent and generally low risk
- Deployment of new releases is seen as a disruption by our customers
- Many of our customers want new features delivered much faster
- Industry and customer trend is to move away from monolithic code delivery towards continuous delivery model
- IBM is moving towards continuous delivery model
- Time for us in DB2 to change

Proposals Considered

- Faster release cycle -- DB2 vNext in 18 months
 - DB2 CAC customers gave this a thumbs down
 - Not able to take on such a fast migration due to the cost of any version/release migration
 - The migration effort would be just as large as moving to a new DB2 version
 - Even the promise of skip release migration couldn't save this proposal
- Continuous release cycles
 - DB2 V12.1, V12.2, V12.3, As you order V12, you get what is available
 - Considerable migration/coexistence challenges and high cost of forward fits
- A combination of Service only and Continuous Delivery streams
- Continuous delivery on one stream

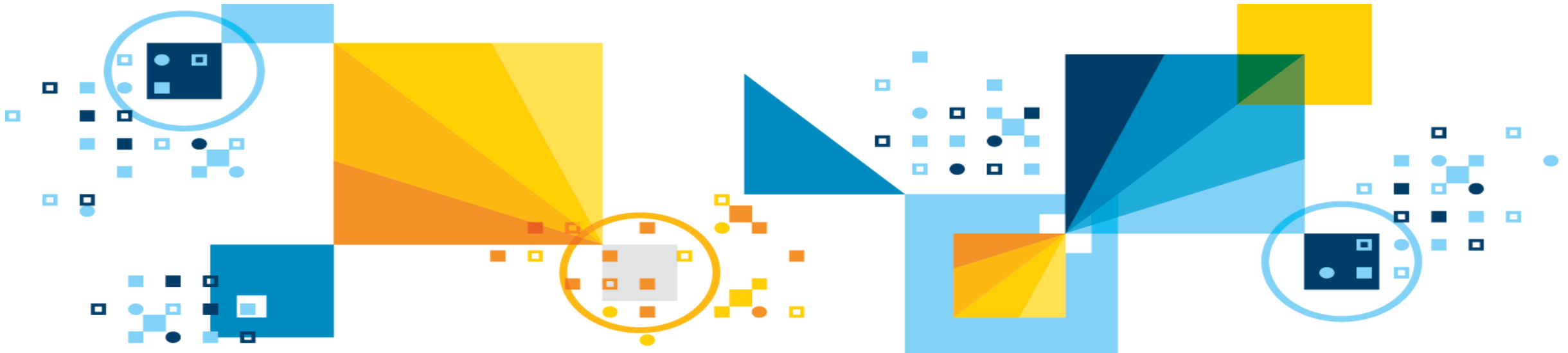
Strategy for DB2 for z/OS

- We are dedicating ourselves to going forward on a continuous delivery model
 - Radical internal changes are required within DB2 for z/OS Development to do this
- DB2 12 is the starting point after GA
 - There will be significantly higher volume of continuously delivered items
- Customers will see a single maintenance stream for DB2 12
 - New function delivered into that stream
 - New function will be designed to be easily consumable
- Point releases or versions will be a very rare exception
 - There are reasons why we might want to have a point release or new version. For instance:
 - To adopt a new compiler, extend control structures, or enable an architecture level set
- DB2 for z/OS Development will have relentless focus on maintaining continuous production level reliability for you in the service stream
- We will deliver new function when the quality is right, and not based on a date

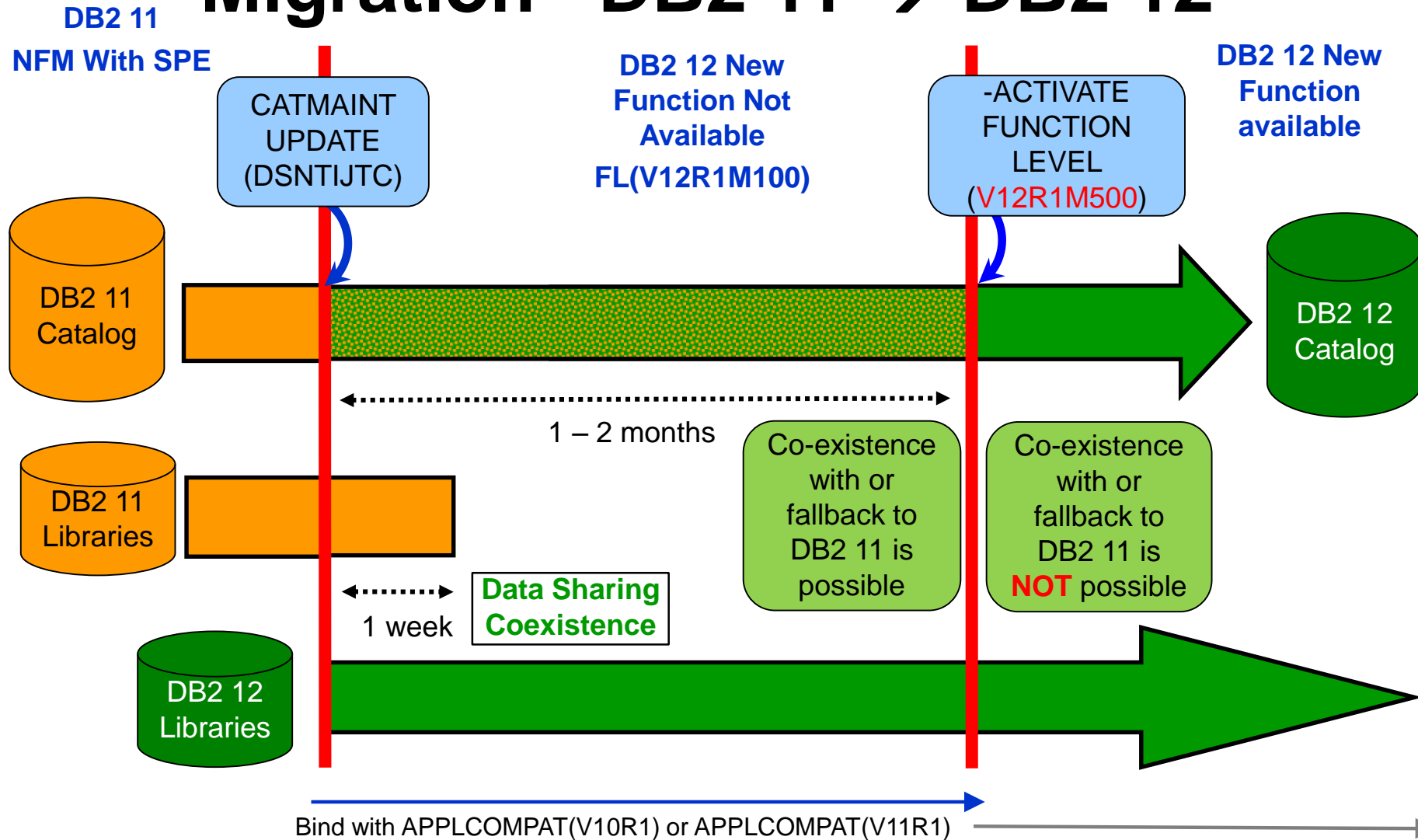
Using Design Thinking and Sponsor Users

- A key component of Design Thinking methodology
- Deliver items that customers will actually adopt and people believe in
 - If we cannot find sponsor users then we should not be doing it
- Customer input which will be more targeted than before with ESPs
- Strong focus on getting the design right up front

Migration from DB2 11 to DB2 12



Migration DB2 11 → DB2 12



-ACTIVATE FUNCTION LEVEL [Knowledge Center]

Important: On successful completion of the command, all function for the specified level, and any previous levels becomes available. For migration to DB2 12 from DB2 11, the level of V12R1M100 (new function not available) and V12R1M500 (new function available) are the base function levels. Once V12R1M500 is adopted, coexistence with and fallback to Version 11 are not possible. Version 11 cannot start. Use of this command requires that the data sharing group contains no active Version 11 members.

Abbreviation: -ACTIVATE FUNCTION LEVEL(*function-level*)

Environment: The command can be issued from a z/OS console, a DSN session under TSO, a DB2I panel (DB2 COMMANDS), an IMS or CICS terminal, or a program using the instrumentation facility interface (IFI).

Data sharing scope: Group

Authorization: To execute this command, you must use a privilege set of the process that includes install SYSADM.

```
>>-ACTIVATE-FUNCTION-LEVEL- (VxxRyMxxx) --+-----+--><
                                     | -TEST-- |
```

-ACTIVATE FUNCTION LEVEL

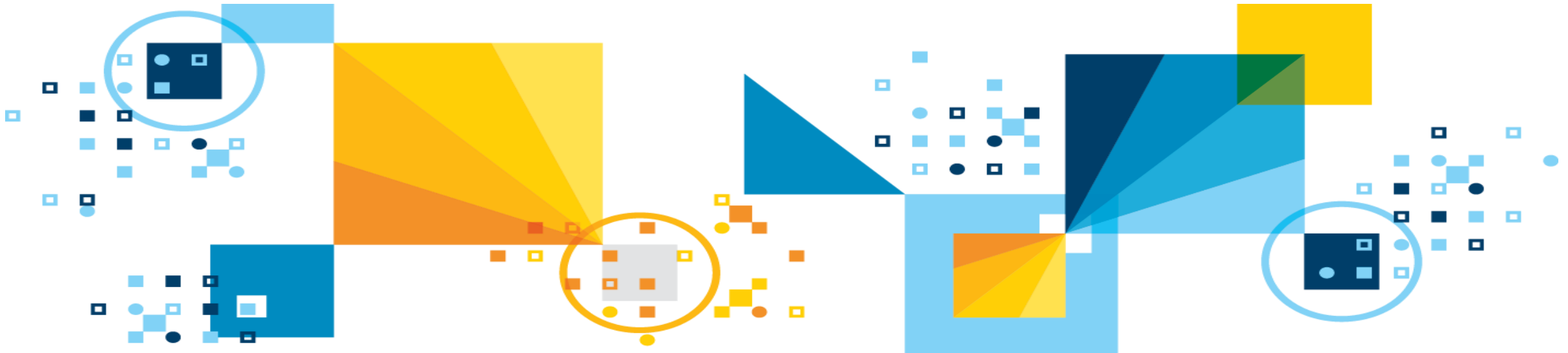
```
DSN7100I -DB1A DSN7GCMD
```

```
-DB2A ACTIVATE FUNCTION LEVEL (V12R1M500)
```

```
*** BEGIN ACTIVATE FUNCTION LEVEL (V12R1M500)  
      FUNCTION LEVEL (V12R1M500) SUCCESSFULLY ACTIVATED  
      CATALOG LEVEL (V12R1M500)  
      CURRENT FUNCTION LEVEL (V12R1M500)  
      HIGHEST ACTIVATED FUNCTION LEVEL (V12R1M500)  
      HIGHEST POSSIBLE FUNCTION LEVEL (V12R1M500)
```

```
DSN9022I -DB2A DSNZACMD '-ACTIVATE FUNC' NORMAL COMPLETION
```

New Function Activation beyond base DB2 12



Acronyms

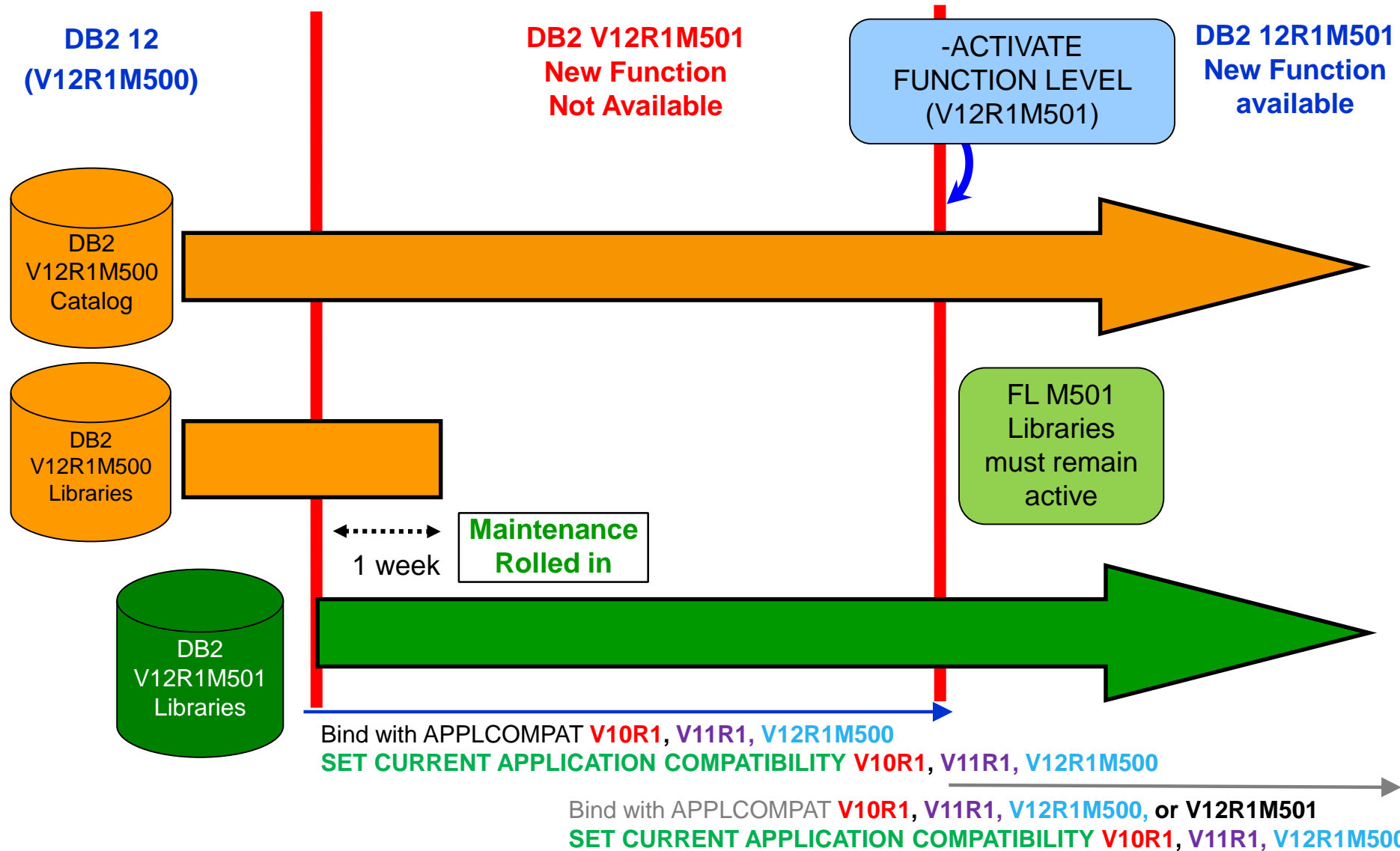
- Maintenance level (ML)
 - DB2LVL on –DIS GROUP output
 - Sometimes called ‘code level’

- Catalog level (CL)
 - Result of DSNTIJCT job, aka ‘catmaint’

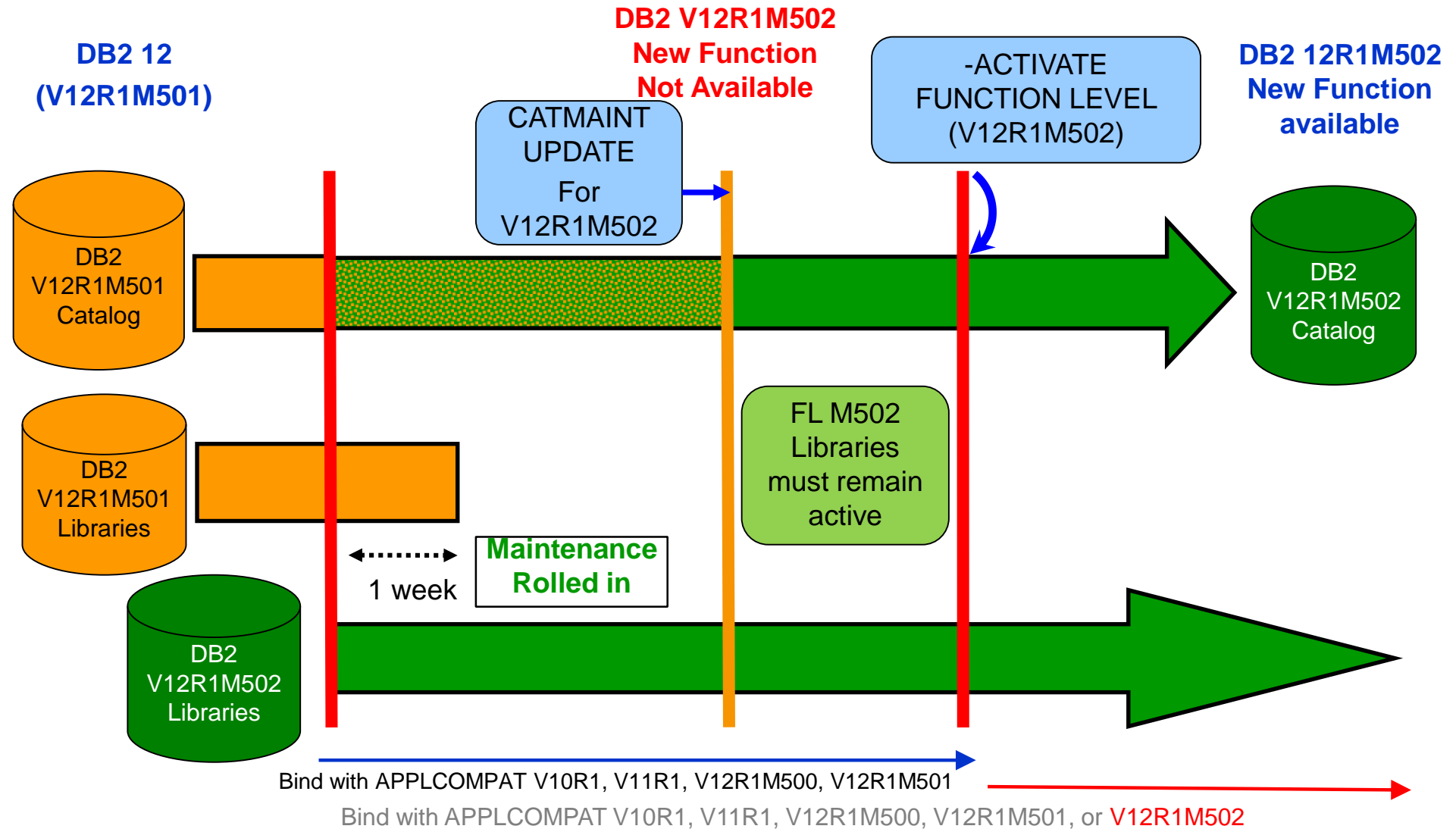
- Function level (FL)
 - Result of –ACTIVATE FUNCTION LEVEL command

- APPLCOMPAT level (APPLV)
 - Result of BIND, REBIND, or SET CURRENT APPLICATION COMPATIBILITY

New function activation no Catalog Change

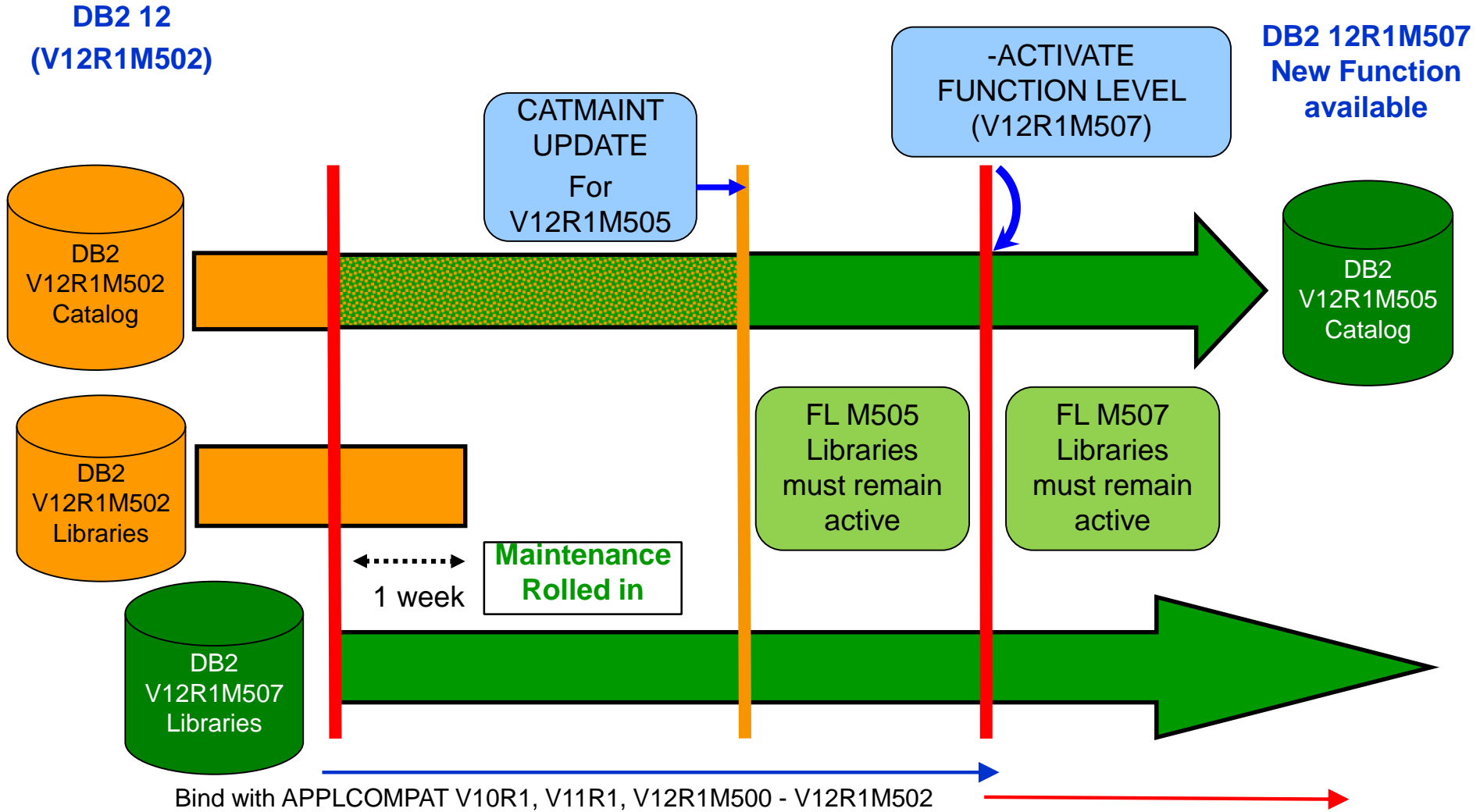


New function activation with Catalog Change

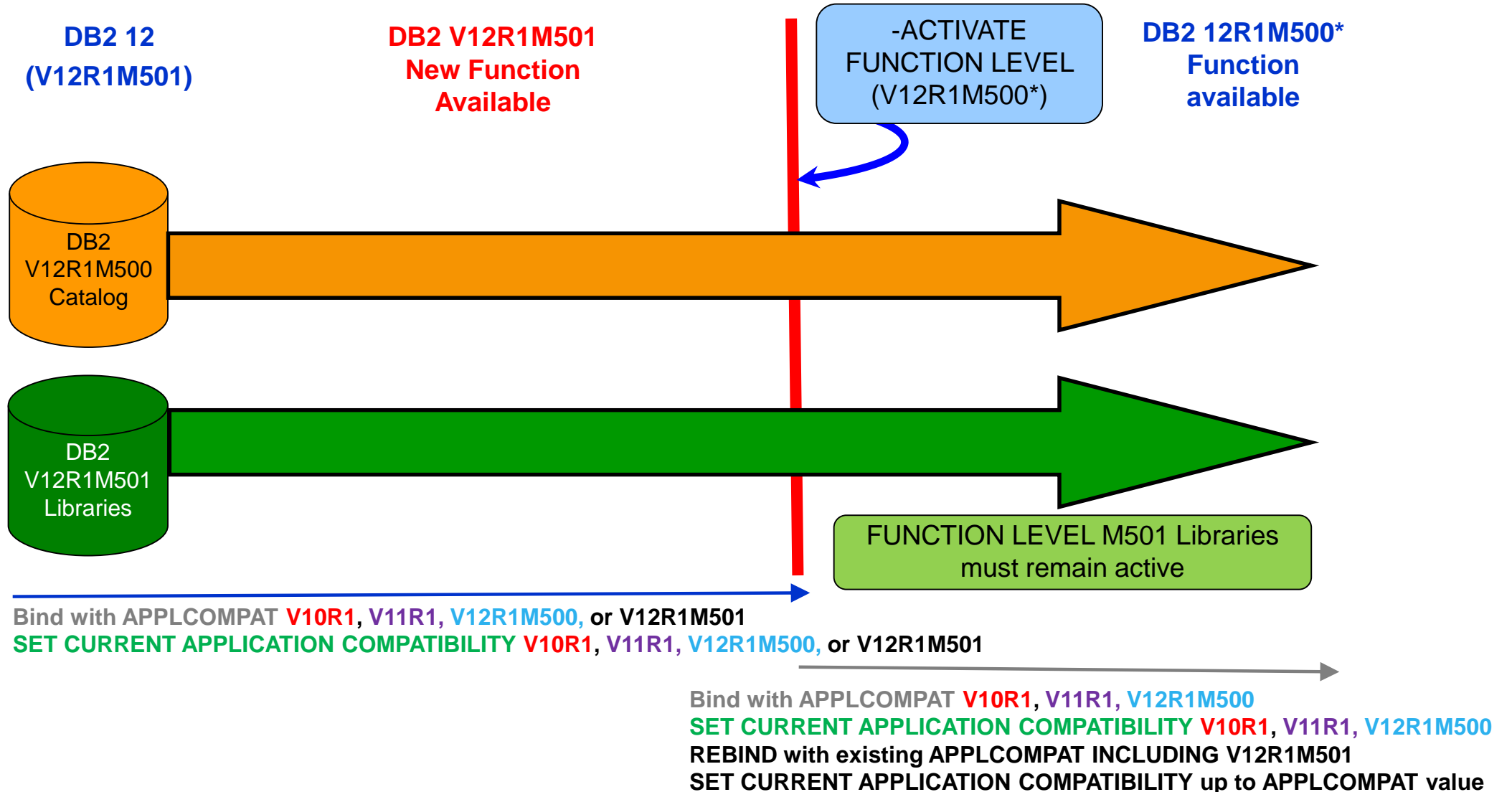


Note that once CATMAINT has been run, all members must started at a ML that supports ML502 or above

New function activation with Catalog Change – Skip FLs



Function activation of Previous Level (* Mode)



-ACTIVATE FUNCTION LEVEL (to a lower level)

DSN7100I -DB1A DSN7GCMD

-DB2A ACTIVATE FUNCTION LEVEL (V12R1M100)

```
*** BEGIN ACTIVATE FUNCTION LEVEL (V12R1M100)
      FUNCTION LEVEL (V12R1M100) SUCCESSFULLY ACTIVATED
      CATALOG LEVEL (V12R1M500)
      CURRENT FUNCTION LEVEL (V12R1M100*)
      HIGHEST ACTIVATED FUNCTION LEVEL (V12R1M500)
      HIGHEST POSSIBLE FUNCTION LEVEL (V12R1M500)
```

DSN9022I -DB2A DSNZACMD '-ACTIVATE FUNC' NORMAL COMPLETION

SELECT * FROM SYSIBM.SYSLEVELUPDATES

	FUNCTION_ LVL	PREV_FUNC TION_LV	HIGH_FUNC TION_LVL	CATALOG_ LVL	OPERA TION_ TYPE	EFFECTIVE_TIME
1_	V12R1M500	V12R1M100	V12R1M500	V12R1M500	M	2016-06-27 07:31:18
2_	V12R1M100	V12R1M500	V12R1M500	V12R1M500	F	2016-07-29 14:57:43
3_	V12R1M500	V12R1M100	V12R1M500	V12R1M500	F	2016-07-29 15:06:47

	EFFEC TIVE_ LRSN	OPERATION_TEXT	GROUP_ MEMBER
1_	...	CATMAINT PROCESSING - DB2DEV	
2_	...	-ACTIVATE FUNCTION LEVEL (V12R1M100)	
2_	...	-ACTIVATE FUNCTION LEVEL (V12R1M500)	

Relationship between Maintenance and Function Level

- The Function Level (FL) that a DB2 member is capable of running is directly related to the maintenance level (ML) of that member
 - The FL of a DB2 Member is associated with one or more PTFs
 - An RSU level (monthly or quarterly) may or may not contain PTFs for one or more Function Levels
- All members must be capable of supporting a FL before that FL can be activated
 - Each member has a FL capability – that is the code running on that member is capable of supporting a specific FL
 - Maintenance is member scope – members can run code capable of supporting different FLs
 - FL activation is group scope
 - Once a FL is active, then all members joining that group must be capable of supporting that FL
- It is possible to return to a previous FL
 - E.G. if you are a FL V12R1M506, you can return to V12R1M504* (wherever I came from). The * will indicate that the group has previously been at a higher FL
 - All existing usage of a feature of a FL will continue to be allowed, but new exploitation of the previous FL will be prevented
 - Returning to a previous FL will still require that all members joining a group must support the highest activated FL ever set for the group

Relationship between a Function Level and APPLCOMPAT

- The APPLCOMPAT Level (APPLV) of a package is directly related to the Function Level of the group.
 - You may not BIND (or set in any other way) an APPLV that is higher than the current FL of the group.
 - APPLCOMPAT controls DML (SQL and XML), DDL, and DCL (GRANT and REVOKE) capability in an application (Package). In order to use a function that requires a specific APPLV, the FL for the group must be at the specific APPLV or Higher – to allow the APPLV to be specified.
 - The default APPLCOMPAT level for new BINDs is controlled by the zPARM (BAU)
 - The default APPLCOMPAT level for REBIND is the value currently in the catalog, however it can be changed by explicitly specifying a specific value on the REBIND.
 - There is no (urgent) need to change an APPLCOMPAT value for an application that has already been deployed – there should be nothing that an application that has already been tested and deployed would need from an new APPLCOMPAT level.

The DB2 Catalog – new concept Catalog Level (CL)

- There is usually a direct relation between the DB2 catalog and the DB2 code
 - Traditionally catalog and code are tightly in sync
 - DB2 12 migration is an example of this
 - When you start DB2 12, you must run CATMAINT before doing anything else
- The introduction of the FL will soften this relationship
 - A catalog change will not be required until the FL that requires that change is activated
 - A catalog change may require a FL be active before the catalog change occurs
 - i.e. Preconditioning
 - A CL will require all members be at a level that supports the change – this is similar to FL activation.
 - This implementation will seem familiar to CM, ENFM and NFM in the sense that the concepts are similar
 - Running with new maintenance is like running in CM – you can back the maintenance off
 - Running CATMAINT prevents backing off any maintenance that is required by that CL – this is similar to ENFM in the past (you can't fall back)
 - -ACTIVATE FUNCTION LEVEL enables usage of new function (this is similar to NFM)

-DISPLAY GROUP (DB2 11)

DSN7100I -DB1A DSN7GCMD

*** BEGIN DISPLAY OF GROUP(.....) CATALOG LEVEL(111)

NEW FUNCTION(X) PROTOCOL LEVEL(2)

GROUP ATTACH NAME(.....)

```

-----
DB2                                DB2 SYSTEM      IRLM
MEMBER  ID  SUBSYS  CMDPREF  STATUS  LVL NAME      SUBSYS  IRLMPROC
-----  -  -  -  -  -  -  -  -  -
DB1A    1  DB1A   -DB1A   ACTIVE  111 MVSA       DJ1A   DB1AIRLM
DB1B    2  DB1B   -DB1B   ACTIVE  111 MVSB       DJ1B   DB1BIRLM
DB1C    3  DB1C   -DB1C   ACTIVE  111 MVSC       DJ1C   DB1CIRLM
DB1D    4  DB1D   -DB1D   QUIESCED 111 MVSD       DJ1D   DB1DIRLM
-----

```

SCA STRUCTURE SIZE: 1024 KB, STATUS= AC, SCA IN USE: 11 %

LOCK1 STRUCTURE SIZE: 1536 KB

NUMBER LOCK ENTRIES: 262144

NUMBER LIST ENTRIES: 7353, LIST ENTRIES IN USE: 0

*** END DISPLAY OF GROUP(DSNDB10)

DSN9022I -DB1A DSN7GCMD 'DISPLAY GROUP ' NORMAL COMPLETION

-DISPLAY GROUP (coexistence) – From DB2 12 member

DSN7100I -DB1A DSN7GCMD

```

*** BEGIN DISPLAY OF GROUP(.....) CATALOG LEVEL (V12R1M500)
CURRENT FUNCTION LEVEL (V11R1M500)
HIGHEST ACTIVATED FUNCTION LEVEL (V11R1M500)
HIGHEST POSSIBLE FUNCTION LEVEL (V11R1M500)
PROTOCOL LEVEL (2)
GROUP ATTACH NAME (.....)
    
```

Catalog level (CL)

Function level (FL)

DB2 MEMBER	ID	SUBSYS	CMDPREF	STATUS	DB2 LVL	SYSTEM NAME	IRLM SUBSYS	IRLMPROC
DB1A	1	DB1A	-DB1A	ACTIVE	121500	MVSA	DJ1A	DB1AIRLM
DB1B	2	DB1B	-DB1B	ACTIVE	121500	MVSB	DJ1B	DB1BIRLM
DB1C	3	DB1C	-DB1C	ACTIVE	121500	MVSC	DJ1C	DB1CIRLM
DB1D	4	DB1D	-DB1D	QUIESCED	111500	MVSD	DJ1D	DB1DIRLM

Maintenance level (ML)

```

SCA STRUCTURE SIZE:      1024 KB, STATUS= AC, SCA IN USE:      11 %
LOCK1 STRUCTURE SIZE:    1536 KB
NUMBER LOCK ENTRIES:     262144
NUMBER LIST ENTRIES:     7353, LIST ENTRIES IN USE:          0
*** END DISPLAY OF GROUP(DSNDB10 )
    
```

DSN9022I -DB1A DSN7GCMD 'DISPLAY GROUP ' NORMAL COMPLETION

-DISPLAY GROUP (new function not available)

DSN7100I -DB1A DSN7GCMD

```

*** BEGIN DISPLAY OF GROUP(.....) CATALOG LEVEL (V12R1M500)
CURRENT FUNCTION LEVEL (V12R1M100)
HIGHEST ACTIVATED FUNCTION LEVEL (V12R1M100)
HIGHEST POSSIBLE FUNCTION LEVEL (V12R1M500)
PROTOCOL LEVEL (2)
GROUP ATTACH NAME (.....)
    
```

Catalog level (CL)

Function level (FL)

DB2 MEMBER	ID	SUBSYS	CMDPREF	STATUS	DB2 LVL	SYSTEM NAME	IRLM SUBSYS	IRLMPROC
DB1A	1	DB1A	-DB1A	ACTIVE	121500	MVSA	DJ1A	DB1AIRLM
DB1B	2	DB1B	-DB1B	ACTIVE	121500	MVSB	DJ1B	DB1BIRLM
DB1C	3	DB1C	-DB1C	ACTIVE	121503	MVSC	DJ1C	DB1CIRLM
DB1D	6	DB1D	-DB1D	ACTIVE	121503	MVSD	DJ1D	DB1DIRLM

Maintenance level (ML)

```

SCA STRUCTURE SIZE:      1024 KB, STATUS= AC,   SCA IN USE:      11 %
LOCK1 STRUCTURE SIZE:   1536 KB
NUMBER LOCK ENTRIES:    262144
NUMBER LIST ENTRIES:    7353, LIST ENTRIES IN USE:      0
*** END DISPLAY OF GROUP(DSNDB10 )
    
```

DSN9022I -DB1A DSN7GCMD 'DISPLAY GROUP ' NORMAL COMPLETION

-DISPLAY GROUP (New Function Active – but backed off to M502)

DSN7100I -DB1A DSN7GCMD

```

*** BEGIN DISPLAY OF GROUP(.....) CATALOG LEVEL(V12R1M501)
      CURRENT FUNCTION LEVEL(V12R1M502*)
      HIGHEST ACTIVATED FUNCTION LEVEL(V12R1M503)
      HIGHEST POSSIBLE FUNCTION LEVEL(V12R1M505)
      PROTOCOL LEVEL(2)
      GROUP ATTACH NAME(.....)
    
```

```

-----
DB2          DB2      SYSTEM      IRLM
MEMBER      ID    SUBSYS  CMDPREF   STATUS    LVL      NAME      SUBSYS  IRLMPROC
-----
DB1A        1  DB1A    -DB1A    ACTIVE    121505  MVSA      DJ1A    DB1AIRLM
DB1B        2  DB1B    -DB1B    ACTIVE    121505  MVSB      DJ1B    DB1BIRLM
DB1C        3  DB1C    -DB1C    ACTIVE    121505  MVSC      DJ1C    DB1CIRLM
DB1D        4  DB1D    -DB1D    ACTIVE    121507  MVSD      DJ1D    DB1DIRLM
    
```

```

-----
SCA  STRUCTURE SIZE:      1024 KB, STATUS= AC,      SCA IN USE:      11 %
LOCK1 STRUCTURE SIZE:      1536 KB
NUMBER LOCK ENTRIES:      262144
NUMBER LIST ENTRIES:      7353, LIST ENTRIES IN USE:      0
*** END DISPLAY OF GROUP(DSNDB10 )
    
```

DSN9022I -DB1A DSN7GCMD 'DISPLAY GROUP ' NORMAL COMPLETION

-DISPLAY GROUP (after catmaint)

DSN7100I -DB1A DSN7GCMD

```

*** BEGIN DISPLAY OF GROUP(.....) CATALOG LEVEL(V12R1M506)
      CURRENT FUNCTION LEVEL(V12R1M502*)
      HIGHEST ACTIVATED FUNCTION LEVEL(V12R1M503)
      HIGHEST POSSIBLE FUNCTION LEVEL(V12R1M507)
      PROTOCOL LEVEL(2)
      GROUP ATTACH NAME(.....)
  
```

```

-----
DB2                DB2    SYSTEM    IRLM
MEMBER    ID    SUBSYS  CMDPREF  STATUS  LVL    NAME    SUBSYS  IRLMPROC
-----
DB1A      1    DB1A    -DB1A    ACTIVE  121507 MVSA    DJ1A    DB1AIRLM
DB1B      2    DB1B    -DB1B    ACTIVE  121507 MVSB    DJ1B    DB1BIRLM
DB1C      3    DB1C    -DB1C    ACTIVE  121507 MVSC    DJ1C    DB1CIRLM
DB1D      4    DB1D    -DB1D    ACTIVE  121507 MVSD    DJ1D    DB1DIRLM
  
```

```

-----
SCA    STRUCTURE SIZE:    1024 KB, STATUS= AC,    SCA IN USE:    11 %
LOCK1  STRUCTURE SIZE:    1536 KB
NUMBER LOCK ENTRIES:    262144
NUMBER LIST ENTRIES:    7353, LIST ENTRIES IN USE:    0
  
```

*** END DISPLAY OF GROUP(DSNDB10)

DSN9022I -DB1A DSN7GCMD 'DISPLAY GROUP ' NORMAL COMPLETION

Function Level Adoption – Best Practices

- PTFs (RSUs...) are applied that may increase the Code Level (CL) of a DB2 system
- After system is stable on maintenance, execute (if any) catmaint
 - After execution of catmaint, the system can only be started with a CL that supports the catalog
- Activate Function Level
 - Function not related to SQL, DML, DCL syntax is available
 - REBIND of packages with any APPLCOMPAT would pick up optimizer enhancements
 - Non-stabilized dynamic SQL would pick up optimizer / other non-APPLCOMPAT related enhancements

APPLCOMPAT Adoption – Best Practices

- After Function Level is considered stable - allow new application feature rollout.
 - REBIND DBA packages to allow new DDL to be utilized

 - REBIND application static packages with higher APPLCOMPAT to exploit DDL/DML new functions/behaviors

 - REBIND dynamic packages with higher APPLCOMPAT to allow new SQL functions to be used

 - REBIND distributed packages (**in separate collection) to allow new SQL functions to be used
 - Switch applications to use new distributed package collection

 - Leverage PLANMGMT extended
 - REBIND SWITCH (PREVIOUS) to restore static to prior runtime structures
 - REBIND SWITCH (PREVIOUS) for dynamic would restore prior APPLCOMPAT
 - ***switching to prior collid for distributed dynamic would restore APPLCOMPAT