DB2 10 for z/OS
A Smarter Database for a
Smarter Planet

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The Information Management Specialists

Topics

- Introduction
- DB2 10 for z/OS Highlights
- Migrating to DB2 10
- Summary / Questions

Thanks to Roger Miller for providing much of the performance
information in this presentation

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Introduction

- Director and Principal Consultant at Triton Consulting

- 23 years DB2 experience, 18 as a consultant working with customers in UK, Europe and the US

- IBM Gold Consultant since 1999

- IBM Information Champion

- Former IDUG (International DB2 User Group) President

- Author of IBM Redbooks, white papers and more recently "flashbooks"

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DB2 10 for z/OS Highlights

Savings … right out of the box

IBM DB2 10 for z/OS delivers faster queries and reduced cost with optimized technology

Proven

Secure

Simple

Cuts costs

Innovative

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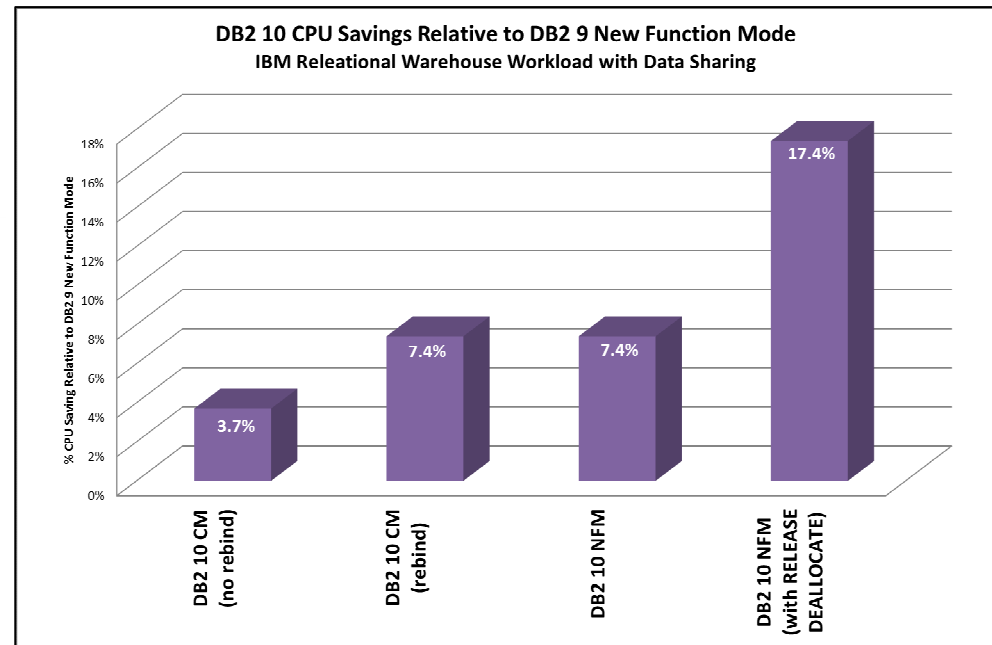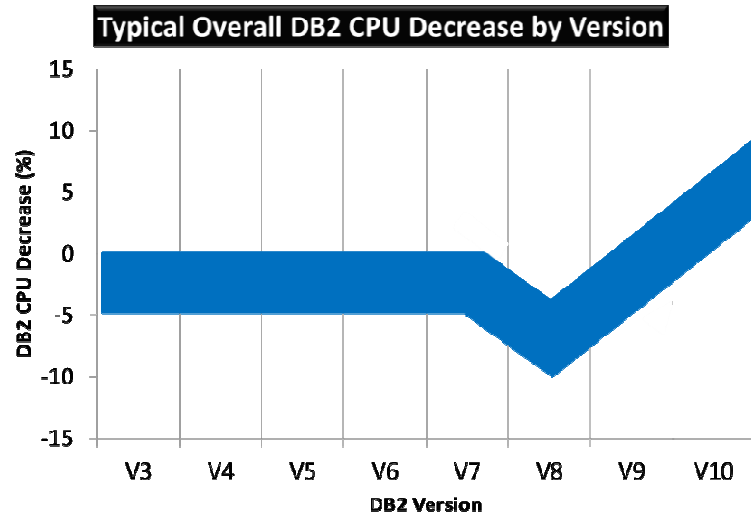
DB2 10 for z/OS

- Extensive beta program running throughout 2009/10, with customers from all around the world

- Generally available since October 2010

- First customers now running DB2 10 in production

- Many customers are planning their DB2 10 upgrades to begin in the next 12-24 months

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Top New Features

- CPU/Performance Improvements
- Virtual Storage Enhancements
- Security Extensions
- Improved Catalog Concurrency
- Temporal Data
- Access Path Management
- pureXML enhancements
- Currently Committed semantics
- Automated statistics
- Dynamic schema change enhancements
- In-memory object support

- Optimiser enhancements
- MEMBER CLUSTER for UTS
- Backup and recovery enhancements
- Enhanced audit
- Include additional index columns
- Enhanced SQL OLAP functions
- Skip Migration (see later)

- And many more….

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CPU/Performance Improvements

Typical Overall DB2 CPU Decrease by Version

DB2 CPU Decrease (%)

DB2 Version: V3, V4, V5, V6, V7, V8, V9, V10

DB2 10 CPU Savings Relative to DB2 9 New Function Mode
IBM Releational Warehouse Workload with Data Sharing

% CPU Saving Relative to DB2 9 New Function Mode

DB2 10 CM (no rebind)	3.7%
DB2 10 CM (rebind)	7.4%
DB2 10 NFM	7.4%
DB2 10 NFM (with RELEASE DEALLOCATE)	17.4%

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CPU/Performance Improvements

- CPU improvements were one of the major design goals for DB2 10
  - Many savings available ""Out of the box" with no application or database changes
  - Even more available with some DBA / developer effort
- CPU reductions for transactions, queries, and batch
  - CPU reductions of 5-10% for traditional workloads
  - Up to additional 10% CPU savings using new functions
  - CPU reductions of up to 20% for new workloads
  - For static SQL, REBIND typically required

Your mileage may vary!

IBM Premier Business Partner

Performance enhancements requiring few changes (CM)

- SQL runtime improved efficiency
- Address space, memory changes to 64 bit, some REBINDs
- Faster single row retrievals via open / fetch / close chaining
- Distributed thread reuse High Performance DBATs
- DB2 9 utility enhancements in CM8
- Parallel index update at insert
- Workfile in-memory enhancements
- Index list prefetch
- Solid State Disk use
- Buffer pool enhancements
  - Utilize 1MB page size on z10
  - "Fully in memory" option (ALTER BUFFERPOOL)

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Performance enhancements requiring REBIND (CM)

- Most access path enhancements
- Further SQL runtime improvements
- SQL paging performance enhancements
  - Single index access for complex OR predicates:
- IN list performance
  - Optimized Stage1 processing (single or multiple IN lists)
  - Matching index scan on multiple IN lists

- Use of RELEASE(DEALLOCATE)
- Safe query optimization
- Query parallelism improvements
- More stage 2 predicates can be pushed down to stage 1
- More aggressive merge of views and table expressions
  - Avoid materialization of views
- If migrating from V8, get new RUNSTATS before mass rebind
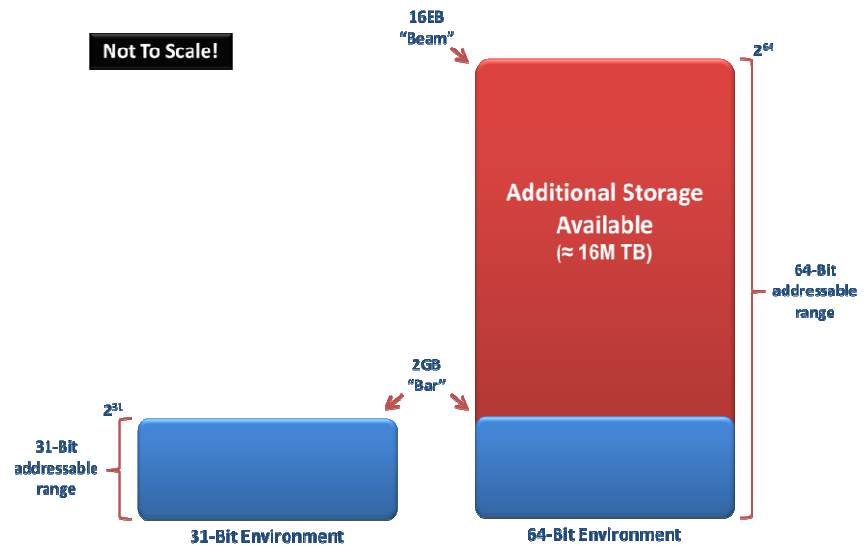
Performance enhancements requiring NFM

- DB2 catalog concurrency and productivity
- Compress on insert
- Most utility enhancements
- LOB streaming between DDF and rest of DB2
- Faster fetch and insert, lower virtual storage consumption
- SQL Procedure Language performance improvements
- Workfile spanned records, partition by growth
- Access to currently committed data
- Insert improvement for universal table spaces
- Locking improvement for multirow insert
- Efficient caching of dynamic SQL statements with literals

Performance enhancements which need NFM + DBA work

- Hash access path

- Index include columns

- Inline LOBs

- DEFINE NO for LOB and XML columns

- MEMBER CLUSTER for universal table space

- Alter to universal table space, page size, data set size, segment size

- Online reorg for all catalog and directory table spaces

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Virtual Storage Enhancements

- V8 began a major project to transform DB2 into a 64-bit RDBMS
  - Laid the groundwork and provided some scalability improvements but a lot of DBM1 objects remained below the 2GB bar
- DB2 9 improved things a little, but only by another 10-15% for most customers
  - Practical limit of 300-500 threads per DB2 subsystem
- DB2 10 moves 80-90% of the remaining objects above the bar, resulting in 5-10x improvement in threads per subsystem

16EB "Beam" 2^{64}

Additional Storage Available (≈ 16M TB)

64-Bit addressable range

2GB "Bar"

2^{31}

31-Bit addressable range

31-Bit Environment

64-Bit Environment

Not To Scale!

- Less DB2 subsystems
  - Lower data sharing overhead
  - Less systems to manage / maintain
- More space for critical storage objects such as dynamic statement cache

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Security Extensions

- New authorities introduced to separate data administration and data access
  - Security Administrator (SECADM)
  - System DBA (SYSTEM DBADM)
  - Data Administrator (DATAACCESS)
  - Performance Specialist (SQLADM)
- New row and column data access policy controls
  - Fully integrated into database engine
  - Applies to SELECT, INSERT, UPDATE and DELETE

Security Extensions

Base Table – with sensitive data

Employee_No	Dept	Title	First Name	Last Name	Salary	Commission
868763	A01	Mr	John	Doe	$50,500	$10,000
748939	A01	Miss	Jayne	Keele	$55,000	$4,300
...		...	...	...	...	...

Row / Column Level Access Policy

```
SELECT LAST_NAME,
       SALARY
FROM T1
WHERE ...
```

```
SELECT *
FROM T1
WHERE ...
```

```
SELECT LAST_NAME,
       SALARY
FROM T1
WHERE ...
```

```
SELECT *
FROM T1
WHERE ...
```

Error – column SALARY doesn't exist

Last Name	Salary
Doe	$50,500
Keele	$55,000
...	...

Employee_No	Dept	Title	First Name	Last Name
868763	A01	Mr	John	Doe
748939	A01	Miss	Jayne	Keele
...		...	...	...

Employee_No	Dept	Title	First Name	Last Name	Salary	Commission
868763	A01	Mr	John	Doe	$50,500	$10,000
748939	A01	Miss	Jayne	Keele	$55,000	$4,300
...		...	...	...	...	...

Normal User

Manager

Security Extensions

Base Table – with sensitive data

First Name	Last Name	CCN
John	Doe	1234-5678-1234-5678
Jayne	Keele	8765-4321-8765-4321
...	...	...

Row / Column Level Access Policy

```
SELECT LAST_NAME,
       CCN
FROM T1
WHERE ...
```

```
SELECT LAST_NAME,
       CCN
FROM T1
WHERE ...
```

Last Name	CCN
Doe	XXXX-XXXX-XXXX-5678
Keele	XXXX-XXXX-XXXX-4321
...	...

Last Name	CCN
Doe	1234-5678-1234-5678
Keele	8765-4321-8765-4321
...	...

Normal User

Authorised User

Temporal Data

- Most IT systems need to keep historical as well as current information
- Requires lots of effort by DBA and developer to design, test and implement – lots of "reinventing the wheel"
- DB2 10 provides this functionality as part of the database engine, making DBAs and developers more productive
  - DBA indicates which tables/columns need temporal support at CREATE/ALTER time
  - DB2 automatically maintains history table whenever row in main table is changed via INSERT/DELETE/UPDATE
  - Elegant extensions to SELECT allow historical perspective to ben seen via standard SQL

Temporal Data

Business Event

Policy 102 created

Change of address

DB2 Event

INSERT

UPDATE

Time

T1   T2   T3

Main Table

Policy #	Address	Sys_Start	Sys_End
101	A2	T0	31-12-9999
102	A3	T1	31-12-9999

Policy #	Address	Sys_Start	Sys_End
101	A2	T0	31-12-9999
102	A4	T3	31-12-9999

History Table

Policy #	Address	Sys_Start	Sys_End

Policy #	Address	Sys_Start	Sys_End
102	A3	T1	T3
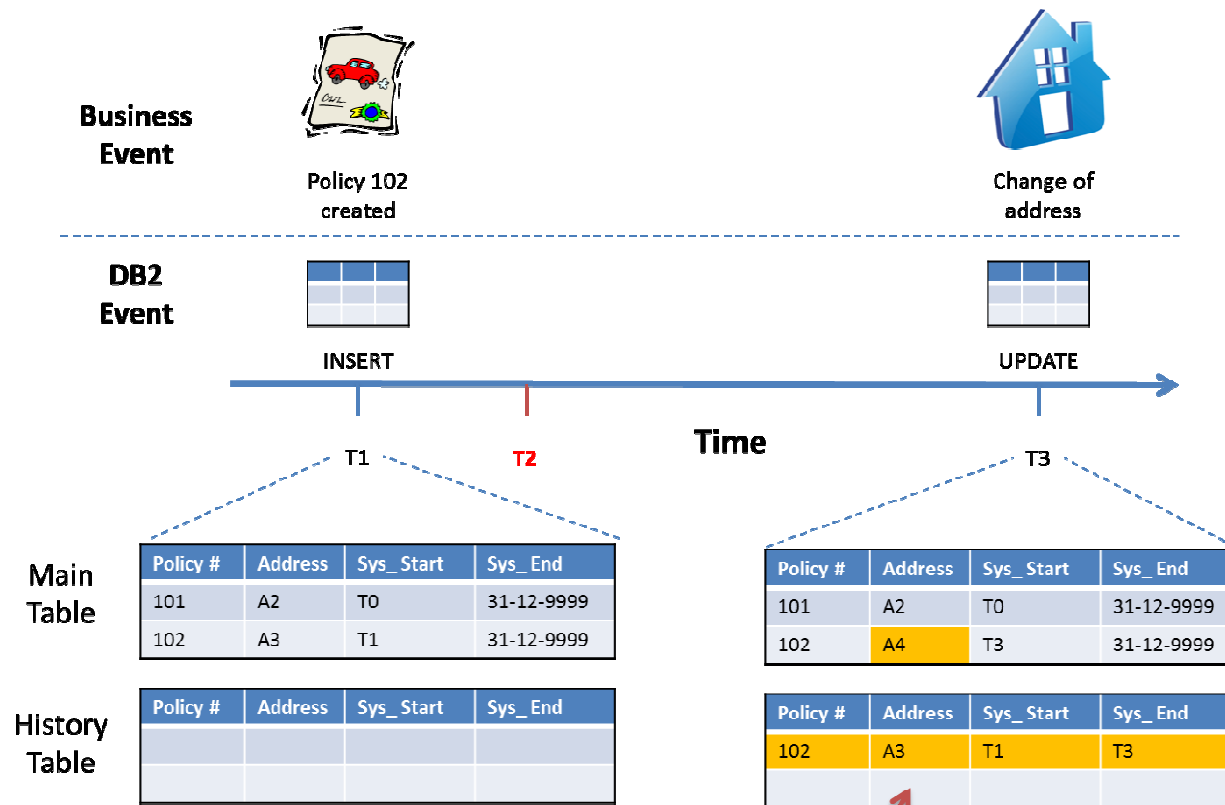
SELECT ADDRESS
FROM TABLE1
AS OF T2
WHERE POLICY=102

= **A3**

…and if you're going direct from V8…

- pureXML

- Universal tablespaces (PBG/PBR)

- Native SQL stored procedures

- Index on expression

- Reordered row format

- Utility CPU enhancements

- LOB enhancements

- Network trusted contexts and Roles

- Instead-of triggers

- Clone tables

- Automatic object creation

- Dynamic schema change enhancements

- SQL MERGE

- TRUNCATE TABLE

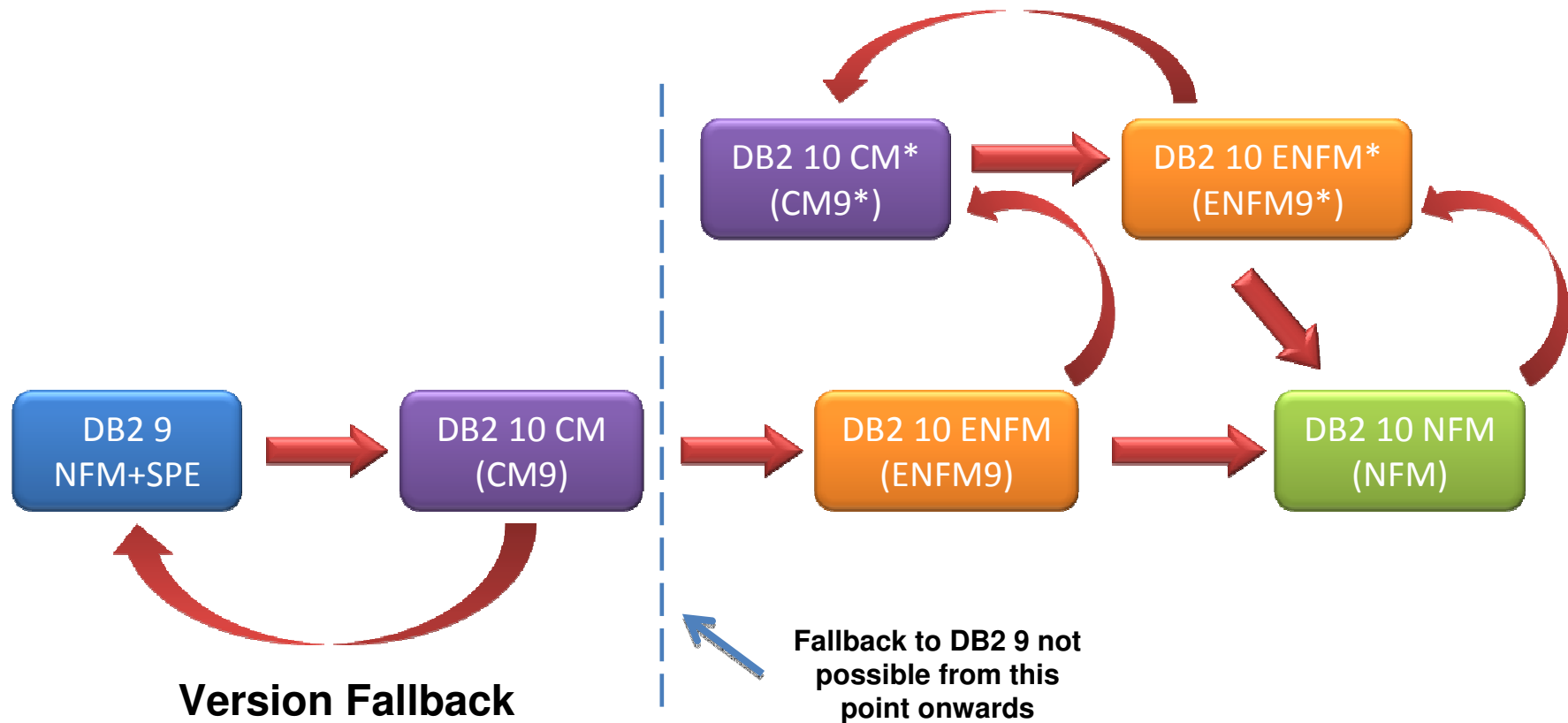- ..and many others

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DB2 10 Major Technical Pre-Reqs

- z/OS 1.10 or later
- At DB2 V8 or DB2 9 in NFM with migration/fallback SPE applied
- REBINDs for packages bound at V5 or lower
- Replace DBRMs bound directly in plans with packages
- Remove all use of private protocol
- Prepare for SMS-managed catalog objects
- New PLAN_TABLE formats
- DB2 client and DB2 Connect 9
  - 9.7 FP3a for function & performance
- Convert DB2-managed stored procedures (if migrating from DB2 V8)
- … and many more minor ones – check the Install Guide for a full list

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"Normal" Upgrade from DB2 9

- Follows same overall process as DB2 V8 to DB2 9 upgrade
  - Must be in DB2 9 NFM with all DB2 10 technical pre-reqs met
  - Move to DB2 10 CM (Conversion Mode)
  - Move to DB2 10 NFM via ENFM
- Support for "rolling upgrade" in data sharing group
  - All members must have pre-migration SPE applied before CM is attempted
  - All members must be at DB2 10 CM before ENFM is attempted
- Plan stability feature (PK52523) will be a major advantage for those who have previously suffered from "Rebindaphobia"

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DB2 9 to DB2 10 Upgrade

DB2 10 CM* (CM9*)

DB2 10 ENFM* (ENFM9*)

DB2 9 NFM+SPE

DB2 10 CM (CM9)

DB2 10 ENFM (ENFM9)

DB2 10 NFM (NFM)

Version Fallback

Fallback to DB2 9 not possible from this point onwards

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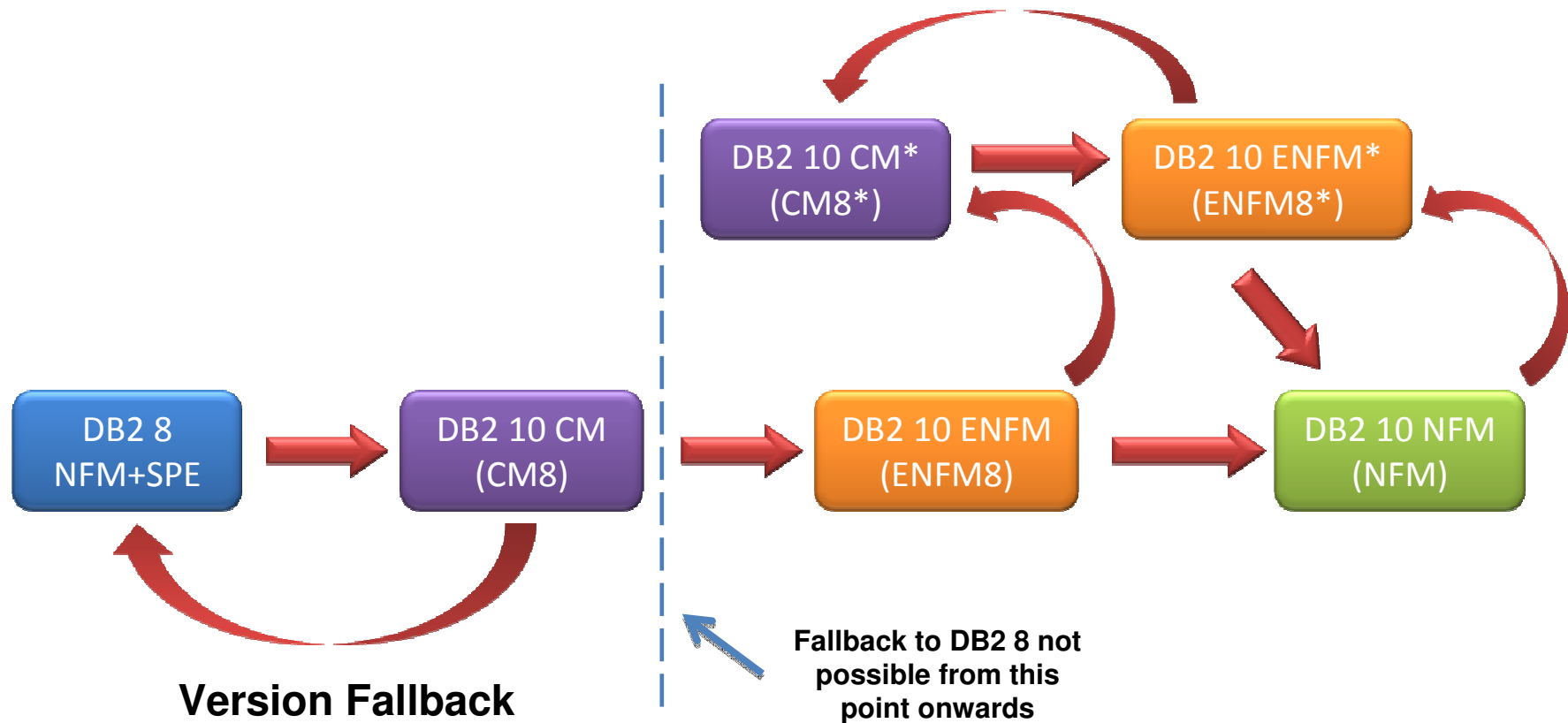
"Skip Migration" Upgrade from V8

- DB2 10 is the first release since V7 to support "skip migration" from a previous release
  - Tested by customers as part of the DB2 10 beta program
  - First customer to go with DB2 10 in production used skip migration
  - Rare opportunity for back-level customers to catch up with DB2 release schedule
- Risks and benefits must be carefully weighed
  - Must meet prereqs for DB2 9 as well as the new ones for DB2 10
  - Robust, mature regression test environment is strongly recommended
  - Timing is important, and best practice for applying maintenance is essential
  - Elapsed time and effort for the upgrade project will probably be greater than for a "normal" migration, but less than two separate upgrades
  - Lots of new function to assimilate once upgrade is complete!

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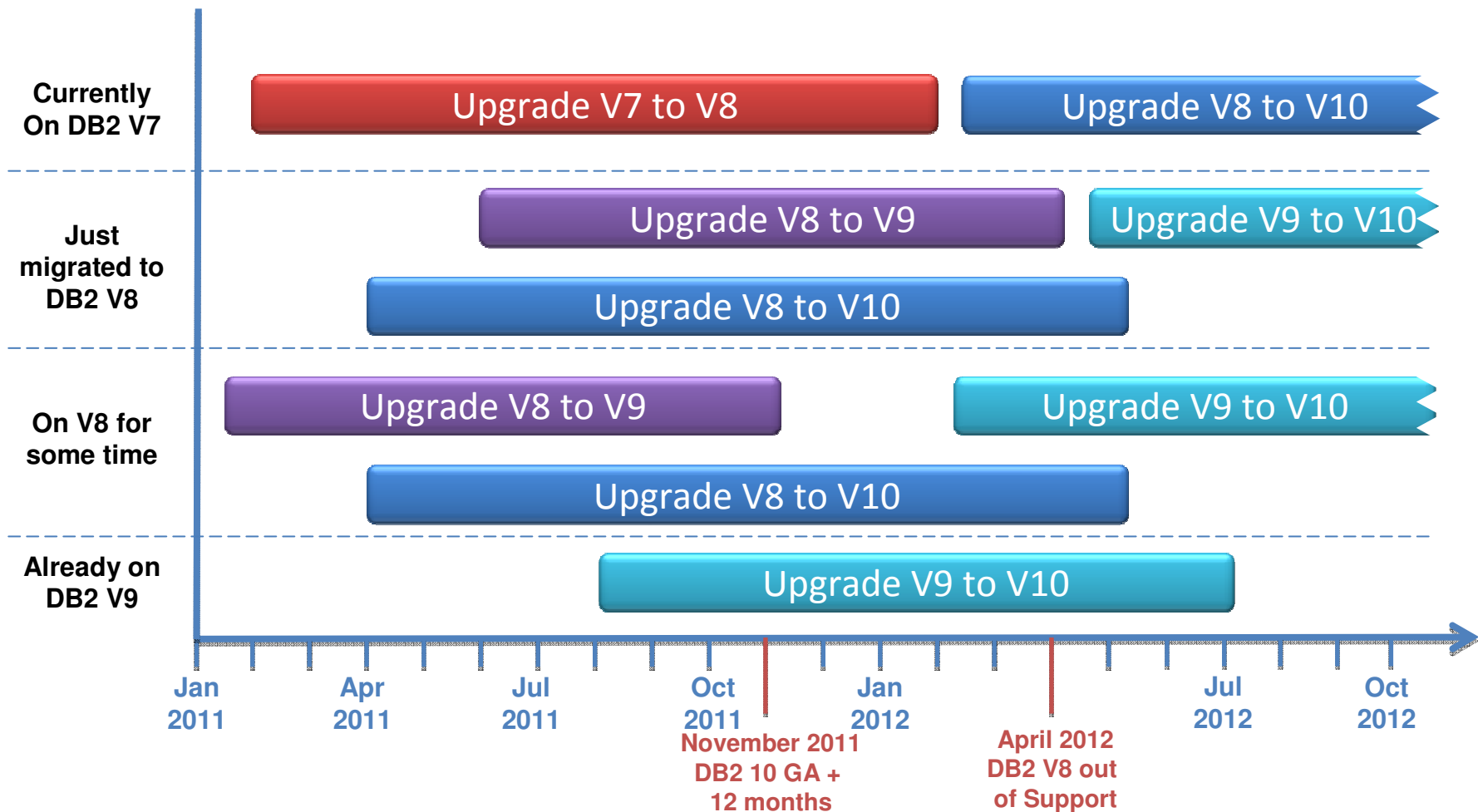# "Skip Migration" Upgrade from V8

- No plan stability features available until DB2 9, so use the old techniques to manage access paths when rebinding on V8
  - Original package for package stability can be V8
- Follows same overall process as DB2 V8 to DB2 9 upgrade
  - Must be in DB2 8 NFM with all DB2 9 and 10 technical pre-reqs met
  - Move to DB2 10 CM (Conversion Mode)
  - Move to DB2 10 NFM via ENFM
- Support for "rolling upgrade" in data sharing group
  - All members must have pre-migration SPE applied before CM is attempted
  - All members must be at DB2 10 CM before ENFM is attempted

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DB2 8 to DB2 10 Upgrade

DB2 10 CM*
(CM8*)

DB2 10 ENFM*
(ENFM8*)

DB2 8
NFM+SPE

DB2 10 CM
(CM8)

DB2 10 ENFM
(ENFM8)

DB2 10 NFM
(NFM)

Version Fallback

Fallback to DB2 8 not possible from this point onwards

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Possible DB2 10 Upgrade Strategies

DB2 10 Migration Resources

- Information APARs
    - II14474: DB2 V8 MIGRATION/FALLBACK INFOAPAR TO/FROM DB2 10
    - II14477: DB2 9 MIGRATION/FALLBACK INFOAPAR TO/FROM DB2 10
- DSNTIJPM pre-migration checker job
    - http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp?topic=/com.ibm.db29.doc.inst/db2z_dsntijpa.htm
- Free migration planning workshops from IBM
    - ftp://ftp.software.ibm.com/software/data/db2/zos/presentations/migration/db2-10-migration-planning-workshop-trifold.pdf
- IDUG DB2 10 Migration Experiences Forum
    - http://www.linkedin.com/groups?mostPopular=&gid=3797589
- IBM DB2 for z/OS Best Practices Web Page
    - www.ibm.com/developerworks/data/bestpractices/db2zos/
- IDUG, IOD, DB2-L, etc

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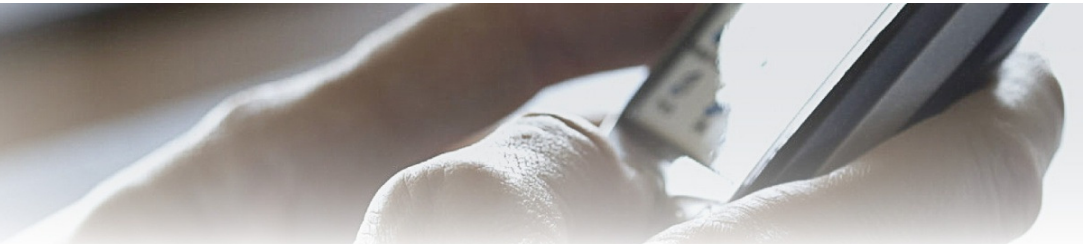
Further Reading

- IBM White Paper

  - DB2 10 for z/OS: A Smarter Database for a Smarter Planet
    https://www14.software.ibm.com/webapp/iwm/web/sign
    up.do?lang=en_US&source=sw-infomgt&S_PKG=wp-z-
    db2-smarter

- DB2 10 Performance Topics Redbook on the way

Feedback / Questions

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