



Migrating to DB2® UDB for z/OS Version 8

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| September 2004

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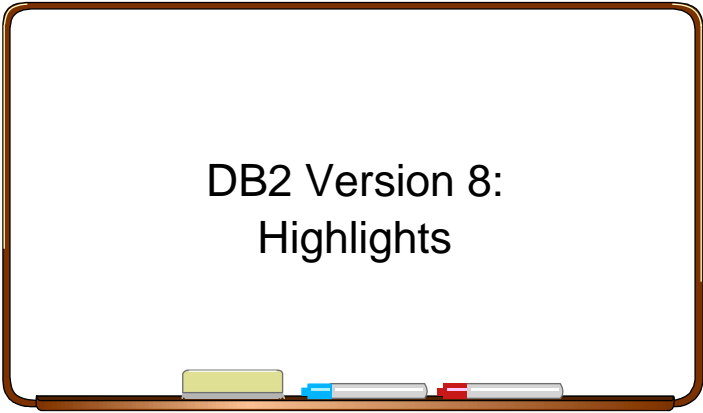


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Agenda

- DB2 Version 8 highlights
- Migration Considerations
- Summary and sources for additional information



DB2 Version 8: Highlights

DB2 UDB for z/OS Version 8 is

- ✓ **SQL OLTP Leadership:** Multi-row Fetch & Insert, Select within Insert, Dynamic Scrollable Cursors, ...
- ✓ **Breaking through limitations:** storage, name lengths, SQL statements, partitions, logging
- ✓ **Performance Enhancements:** MQTs, index use
- ✓ **Database changes without an outage:** add partition, rotate partitions, alter cluster
- ✓ **Integration:** applications, middleware, platform



Reengineered for e-business

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Limits: DB2 for z/OS



Image of Earth from Moon,
Source: NASA (Public Domain)

Breaking through limitations

- Virtual Storage 2 GB 2^{31} to 2^{64}
- Table name sizes 18 to 128
- VIEW & ALIAS names 18 to 128
- Column name sizes 18 to 30
- Partitions 254 to 4096
- SQL statement length 32K to 2 MB
- Index key size 255 to 2000
- Character Literals 255 to 32704
- Hex literal digits 255 to 32704
- Predicates 255 to 32704

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Limits: DB2 for z/OS



Image of Earth from Moon,
Source: NASA (Public Domain)

Breaking through limitations ...

- Tables in a join 15 to 225
- Active logs 31 to 93
- Archive logs 1000 to 10,000
- Maximum table size 16 TB to 128 TB
(partitioned, 32K page)
- Current optimization 8 to 128
- CURRENT PACKAGESET 18 to 128
- CURRENT PATH 254 to 2048
- SCHEMA 8 to 128

SQL and DB2 Family



- Multi-row INSERT, FETCH & UPDATE
- GET DIAGNOSTICS
- INSERT within SELECT
- IDENTITY Column enhancements
- SEQUENCES
- CURRENT PACKAGE PATH
- Dynamic Scrollable Cursors
- Common Table Expressions
- Scalar Fullselect
- Materialized Query Tables
- UNICODE SQL, Multiple CCSIDs
- XML Publishing
- ...

Performance Enhancements



- Ability to use indexes more often
 - More matching in predicates
 - Index backward scan
 - Index varying length
 - Distribution statistics on non-index columns
- Materialized Query Tables
- Multi-row fetch & insert
- Data Sharing improvements

Continuous Availability



- Schema Evolution: database changes
ALTER instead of DROP / CREATE
- Data Partitioned Secondary Indexes (DPSI)
- System-Level Point in Time Recovery
- Improved LPL Recovery
- Additional online zparms

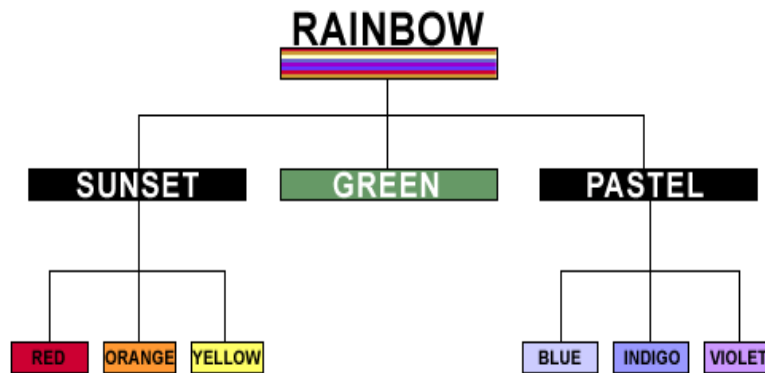
System Level Point In Time Recovery

- Easier, more flexible, less disruptive, faster recovery
- Handle large numbers of table spaces & indexes
- Two new utilities are introduced
 - ▶ BACKUP SYSTEM: Fast volume-level backups
 - DB2 databases and logs
 - Data sharing group scope
 - z/OS V1R5 required
 - ▶ RESTORE SYSTEM
 - To an arbitrary point-in-time
 - Handles creates, drops, LOG NO events

Multilevel Security by Row

	DB2_SECURITY_LABEL_EXT	COL1	COL2	COL2
Sally SECLABEL='RAINBOW'	RAINBOW	56	7	76
	RAINBOW	24	56	65
	RAINBOW	42	6	45
	BLUE	3	456	7
Joe SECLABEL='PASTEL'	INDIGO	113	456	56
	VIOLET	3	456	4
	BLUE	4	4556	7
Sam SECLABEL='SUNSET'	RED	4	76	567
	ORANGE	33	7	567
	RED	5455	76	567
	YELLOW	999	65	45

Multilevel Security by Row ...



DB2 Version 8: Getting Ready Part 1

Prerequisites

- Hardware prerequisites
- Coupling facility prerequisites for data sharing
 - ▶ CFLEVEL=7 with service level 1.06
 - ▶ CFLEVEL=8 with service level 1.03
 - ▶ Higher CFLEVELs do not currently have additional service requirements
- Software prerequisites
 - ▶ z/OS 1.3 or above (in 64-bit mode)
 - ▶ z/OS Unicode Conversion Services
 - ▶ Migration is from DB2 for OS/390 and z/OS V7 only
- ISV tools and applications

Getting ready for V8



- Migrate to DB2 for z/OS V7
- Migrate to z/OS V1R3 or later
 - ▶ Requires WLM goal mode
 - ▶ Some functions need z/OS V1R4, V1R5
- zSeries, z/Architecture 64 bit mode
- Migrate to IBM COBOL V2 or V3
 - ▶ No OS/VS COBOL or VS COBOL II
 - ▶ Run Old COBOL modules under LE
- IMS V7, CICS TS V1.3, V2.2

Synergy: zSeries, z/OS & ESS

DB2 Version 8 requires:

zSeries, z/OS V1R3, 64 bit architecture

DB2 Version 8 also has new uses

z/OS V1R4 & CFLEVEL 12 Parallel Sysplex,

z/OS V1R5 DFSMS, multilevel security,

WLM, Cryptography, Unicode, ...

**DB2 also delivers synergy with instruction set,
Compression, FICON, Disk storage, ...**



Version 7 Performance Topics, Chapter 10

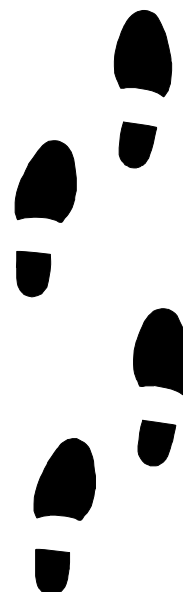


Typical migration process - V7 and earlier releases

- **Process built up over years of DB2 migration experience**
- **Test installation of new subsystem and/or migration of test system**
- **Rollout across strategic development environments**
- **Finally migrate production to the new release**
- **Use no new function during migration timeframe**
- **Verify compatibility of old function on new release**
- **When satisfied with new release, begin to use new function**

Four step process for Migration to V8

- Test with New Install & Migrate
- Apply the Fallback SPE to all members
 - ▶ Start all members at SPE level
- Migrate to new release without new function (**COMPAT Mode**)
- **Enable New Function Mode**
 - ▶ Then in **New Function Mode**



Tighter Migration Customer Value

- **More robust migration process**
 - Fewer migration & fallback errors
 - All customers apply the Fallback SPE
- **Customer control for migration process & timing for using new function**
- **Reduced risk of problems in Fallback SPE**
 - Reduced number of modules, fewer changes
- **Improved ability to deliver new function, while still having fallback & coexistence**

Formalize Customary Procedure

- **Test Install, Migration, Fallback on Test System**
- **Install Fallback SPE on all members (required)**
 - UQ81009
- **Migrate to V8 - Compatibility Mode**
 - Normal CATMAINT - no long names
 - No new external functions available (almost)
- **When satisfied with V8 supporting production,**
- **Run job to Enable New Function**
 - Fallback and Coexistence with V7 no longer possible
 - A series of ALTERs and Online Reorgs (RO) of Catalog and Directory table spaces
- **New Function Mode**
 - All new functions available

Migration Modes



Compatibility Mode (CM)

- Can last as long as necessary
- No new function available
- Run tests to ensure that no regression is taking place
- V7 and V8 Data Sharing coexistence supported
- Fallback to V7 is allowed



Enable New Function Mode (ENFM)

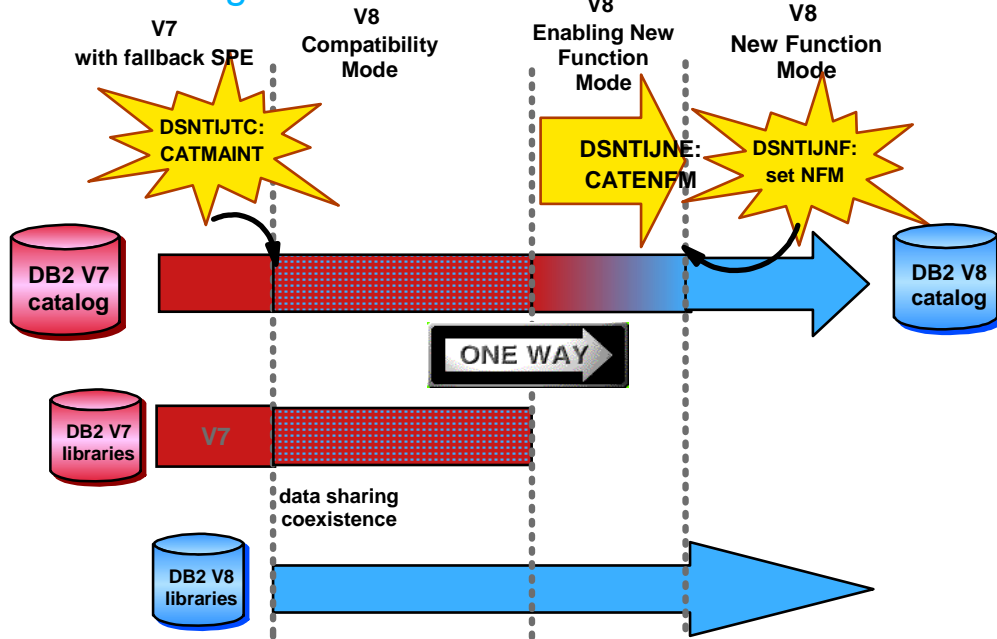
- Convert DB2 so that it is ready to support new functions
 - Series of ALTERS and ONLINE REORGS of the Catalog and Directory
 - Process can be halted and restarted
 - This is a group wide event - no V7 allowed even if ENFM not running
 - However, no fallback to DB2 V7 is allowed once this job is started



New Function Mode (NFM)

- Administrator runs a job that triggers the ability to use new features of V8
- No Fallback allowed to V7
- No Returning to CM
- DSNTIJEN to return to ENFM
 - No change to the catalog data or structure

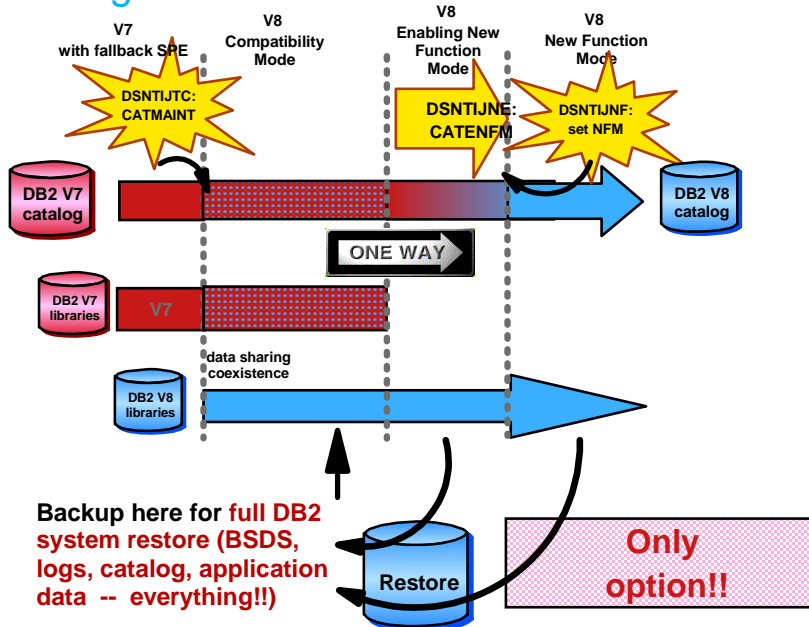
Overview of migration



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Overview of migration

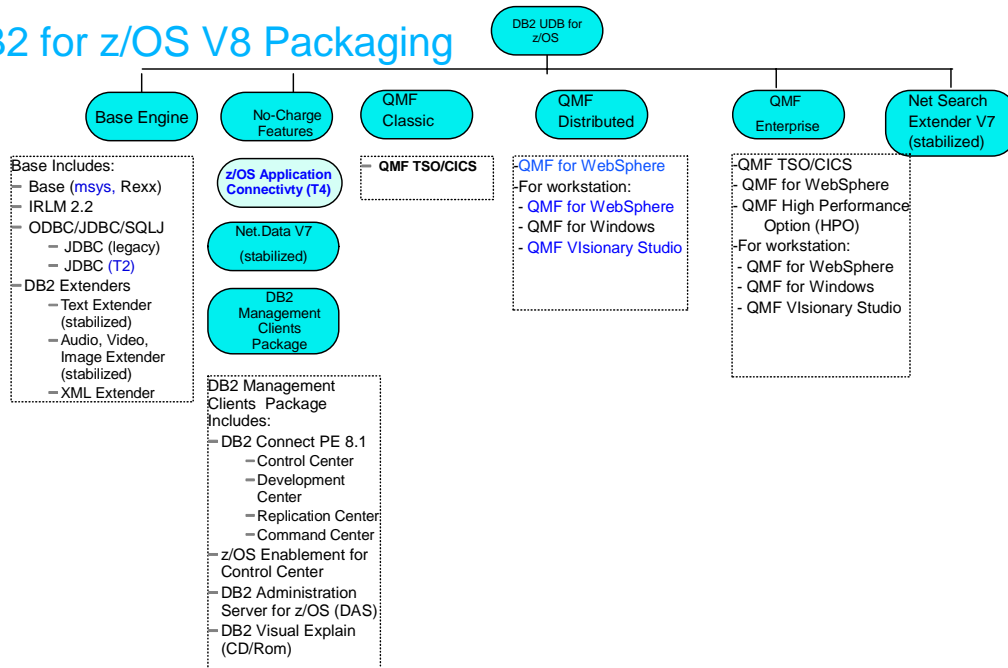


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DB2 Version 8: Getting Ready Part 2

DB2 for z/OS V8 Packaging



Before Migrating Checklist

- Fall Back SPE on DB2 V7 - SPE PQ48486
 - Installed and started on all DB2 V7 members
- CCSIDs and Unicode
 - Specify a valid CCSID
 - Identify code character set supported by your I/O device
 - CCSIDs for EBCDIC, ASCII and Unicode (even if application data is not stored in one of these encoding schemes)
 - Define and customize Unicode Conversion Services
 - z/OS V1R3.0 Support for Unicode Using Conversion Services
- Define User DSNHDECP Module
 - DB2 no longer creates a default
 - Run DSNTIJUZ to define it
- Ensure BP8K0, BP16K0, and BP32K Buffer Pools are Defined
 - If missed, DB2 will create with defaults during ENFM processing

Before Migrating Checklist (continued)

- Install IRLM 2.2
 - Delivered with DB2 as FMID HIR220
 - Both 31-bit and 64-bit versions - size of libraries double
 - IMS V8 still uses the 31-bit version
- Use CI size > 4KB
 - Specifies whether you want DB2 managed data sets to have variable VSAM CI size
 - Possibly better availability and performance
 - Only available after migration
- New Utility for Converting BSDSs
 - Support 93 active logs (372GB) and 10,000 archive logs (40TB)
 - Run when in ENFM or NFM

Other Sizes to Consider

- Increase External Sort Size
 - New Default in CM for SORTDATA and SORTKEYS for LOAD and REORG
 - Increases Parallelism
 - More concurrent active tasks and more sort work definitions
- SYSSTATS Table Space
 - SYSCOLDISTSTATS and SYSCOLDIST contain more data in V8
- Increase Size of Catalog Table and Index Spaces
 - Long Names, Unicode
 - When is the last time you REORG'd your catalog?
- Increase / Decrease EDM Pool Size?
 - More partitions = larger database descriptors
 - DBDs and Dynamic Statement Cache moved to their own area above the bar

Changes to Subsystem Defaults

Panel	Field	Parameter	Version 7 default value	Version 8 default value
DSNTIP7	USER LOB VALUE STORAGE	LOBVALA	2048	10240
DSNTIPE	MAX USERS	CTHREAD	70	200
	MAX REMOTE ACTIVE	MAXOBAT	64	200
	MAX REMOTE CONNECTED	CONOBAT	64	10000
	MAX TSO CONNECT	IDFORE	40	50
	MAX BATCH CONNECT	IDBACK	20	50
DSNTIPN	DDFRRSAF ACCUM	ACCUMACC	NO	10
DSNTIPB	CACHE DYNAMIC SQL	CACHEDYN	NO	YES
DSNTIPP	PLAN AUTH CACHE	AUTHCACH	1004	3072
DSNTIPL	LOG APPLY STORAGE	LOGAPSTG	0	100
	CHECKPOINT FREQ	CHKPFREQ	\$0000	\$00000
DSNTIPA	BLOCK SIZE	BLKSIZE	30672	24576
DSNTIPP	DDF THREADS	CMTSTAT	ACTIVE	INACTIVE
	IDLE THREAD TIMEOUT	IDTHTOIN	0	120
	EXTENDED SECURITY	EKTSEC	NO	YES
DSNTIPS	TCPIP KEEPALIVE	TCIPKALV	ENABLE	120
DSNTIPC	MAXIMUM OPEN DATA SETS	DSMAX	3000	10000
	EDMPOOL STORAGE SIZE	EDMPOOL	7012	32768 ¹

Note:

¹ The installation CLIST calculates the default value for the EDMPOOL parameter.

Language Considerations

- LANGUAGE COMPJAVA Not Supported for Stored Procedures
- Type 2 JDBC/SQLJ Driver will not be enhanced
 - Use Java Common Client (aka DB2 Application Connectivity for z/OS)
- No New DB2SPAS Stored Procedures
 - Existing will continue to run, but should migrate them
- COBOL: Migrate to IBM COBOL V2 or V3
 - No OS/VS COBOL or VS COBOL II
 - Can run old COBOL load modules under LE
- 64-bit compilers are not currently supported by DB2 for z/OS V8

Run DSNTIJPM(8)

- Shipped as V7 APAR PQ84421
- Checks for:
 - Type 1 Indexes
 - Catalog tables with DATACAPTURE
 - Partitioned TS with selective partition locking and/or truncated limit key
 - Stored Procedures with COMPJAVA and/or use DB2SPAS
 - Use of DSNWZPR by DSNWZP
 - Existence of V7 Sample Database
 - Evidence of Multiple CCSIDs
 - Beware of 500

Release Incompatibilities

- Trace applications that use statement length fields
 - May need to change to use 4 byte statement length fields
- Built in functions
 - There are several new built in functions. Make sure existing built in functions are called fully qualified to avoid inadvertent calling of new functions
 - Could also move SYSIBM to later in the SQL path
- Utilities default behavior is changed
 - SORTKEYS is default for REORG, LOAD, and REBUILD
 - SORTDATA is default for REORG
- DISPLAY LOCATION command
 - Requires a parameter in V8. Error will be DSN9010I
- The TRANSLATE function operates differently
 - May need to change the translate table for characters that are now double-byte in Unicode
- DISPLAY GROUPBUFFERPOOL command
 - Displays both operational coupling facility level as well as the actual level

Release Incompatibilities (continued)

- BLOB, CLOB, and DBCLOB function lower limit
 - Lower limit is now 1 (not 0) for consistency with VARCHAR & VARGRAPHIC functions
 - Defaults to 1 with empty input string
 - With input string, an error is returned if not specified
- Input for GRAPHIC, VARGRAPHIC, and DBCLOB
 - Cannot be BIT data. EBCDIC BIT data will return an error
- CHAR function
 - Strings > 255 bytes are truncated and return a warning (for non-blank truncation)
 - V7 issued an error
- SQLDA may contain truncated data
 - SQLDA is not changed for long names to be compatible with prior releases
- LOCKPART is deprecated
 - Still supported in V8 for compatibility
 - Default is changed to lock individual parts when accessed

Release Incompatibilities (continued)

- Subsystem parameter UTLRSTRT is no longer supported
 - DB2 V8 attempts restart of online-restartable utilities regardless of RESTART keyword
- Subsystem parameter PKGLDTOL is no longer supported
 - DB2 V8 requires that a plan/package be bound at an application requester
 - This parm was provided as a temporary fix for V7
- DB2 Private Protocol
 - This is still support in V8, but SQL is limited to pre-V8
- SQL Reserved Words
 - See the DB2 SQL Reference Guide for new reserved words
- Return Code change for DSNU185 (VSAM DATASET DOES NOT EXIST FOR...)
 - Was RC=8, and is now RC=0
- Parameter markers of prepared statements are always nullable
 - Prior to V8 this could be set in the SQLDA

Release Incompatibilities (continued)

- Savepoint names cannot begin with 'SYS'
 - This will issue an error
- ALTER TABLESPACE..ALTER PARTITION must specify the partition
- ALTER INDEX..ALTER PARTITION
 - Now issues a warning if no options specified
- Invalidation of Plan / Packages
 - Plans / Packages that have SQL referencing the catalog may be invalidated
 - Use DSNTESQ to check for this in advance
- SYSIBM.SYSDUMMY1 is recreated during migration
 - DSNTIJNE drops and recreates this table - invalidating plans / packages
 - These will Auto-rebind
- Some system catalog table columns cannot be updated
 - SELECT...FOR UPDATE OF statements may fail.

Release Incompatibilities (continued)

- SELECT...FOR UPDATE OF statement cannot have:
 - Nested table expressions, nor
 - Table UDFs
- Improved validation of host variables may require application changes
 - Like, a host variable that is smaller than the actual data
- CREATE PROCEDURE...PARAMETER STYLE keyword now required
 - This optional V7 keywords now return an error

Planning for Unicode

- DB2 V7 had Unicode. CCSIDs must now be defined. See PQ56697 (March, 2003)
- Check existing CCSIDs in V7 by running queries in job DSNTIJP8, supplied in PQ84421
- If not already done, consider running V7 Unicode IVPs to test z/OS Unicode Conversion Services setup
- DB2 V8 requires z/OS Unicode Conversion Services in all modes. Defaults: OA04069
- Check CCSIDs for terminal emulators and workstations
- Check for affect of Unicode on your applications which
 - ▶ Access the DB2 catalog
 - ▶ Access DB2 trace records



UNICODE Catalog

- In Compatibility Mode, all table spaces are EBCDIC
- In Enabling New Function Mode, some are EBCDIC, some are Unicode
 - -DISPLAY GROUP DETAIL
 - SYSTABLES - ENCODING_SCHEME
 - SYSTABLESPACE - ENCODING_SCHEME
- In New Function Mode
 - 20 are Unicode
 - 2 are EBCDIC (SYSCOPY & SYSEBCDC)

Installation Verification Procedure (IVP)

- **Important** - You cannot run the Version 8 IVP jobs until DB2 is running in Version 8 new-function mode
- Run the Version 7 IVP jobs to verify a successful migration to Version 8 compatibility mode
- If migrating, the recommendation is to run portions of the sample applications from Version 7
 - Verifies the migration
 - Ensures that the old jobs work with Version 8 in new-function mode
- The Version 8 IVP jobs are created by the installation CLIST as part of Version 8 enabling-new-function mode

Strategy for migration

- **Get education!**
- **Read!**
 - ▶ **DB2 V8 What's New**
 - ▶ **Presentations from the web**
 - ▶ **DB2 V8 Installation Guide**
 - ▶ **Program Directories**
 - ▶ **Preventive Service Planning bucket**
 - ▶ **...**
- **Plan!**

DB2 web pointers

- **DB2 for z/OS** ibm.com/software/db2zos
 - <http://www.ibm.com/software/data/db2/os390/presentations.html>
- **Online Support**
 - ibm.com/software/db2zos/support.html
 - ibm.com/software/db2zos/osupport.html
- **IBM iSource** ibm.com/isource
- **Education** ibm.com/services/learning
- **Redbooks** ibm.com/redbooks
- **DB2 Magazine** www.db2mag.com
- **DB2 Users Groups**
 - www.idug.org
 - www.share.org
- **DeveloperWorks** ibm.com/developer
 - www7b.software.ibm.com/dmdd/
- **zSeries, z/OS**
 - ibm.com/servers/eserver/zseries
 - ibm.com/servers/eserver/zseries/zos
 - ibm.com/servers/eserver/zseries/library

Latest DB2 Redbooks

- **DB2 UDB for z/OS V8 Everything you ever wanted to know, ...and more, SG24-6079 (May 2004)**
- **DB2 UDB for z/OS Version 8 Technical Preview, SG24-6871**
- **DB2 UDB for z/OS V8: Through the Looking Glass & What SAP Found There, SG24-7088**
- **DB2 for z/OS and OS/390: Ready for Java, SG24-6435**
- **Distributed Functions of DB2 for z/OS and OS/390, SG24-6952**
- **Moving Data Across the DB2 Family, SG24-6905**
- **Implementing PeopleSoft 8.4 on zSeries, SG24-6549**
- **Siebel 7 with DB2 for z/OS: Database Implementation & Administration, SG24-6868**
- **SAP on DB2 for z/OS: Multiple Components in One Database, SG24-6914**
- **SAP on DB2 for z/OS: High Availability Using System Automation, SG24-6836**
- **Squeezing the Most Out of Dynamic SQL, SG24-6418**
- **Large Objects with DB2 for z/OS and OS/390, SG24-6571**



Next Latest DB2 Redbooks

- **DB2 for z/OS V7 Selected Performance Topics, SG24-6894**
- **DB2 for z/OS Application Programming Topics, SG24-6300**
- **DB2 for z/OS and OS/390 Version 7 Using the Utilities Suite, SG24-6289**
- **DB2 for z/OS and OS/390 V7 Performance Topics, SG24-6129**
- **DB2 UDB for z/OS and OS/390 Version 7 Presentation Guide, SG24-6121**
- **Cross-Platform DB2 Stored Procedures: Build & Debug, SG24-5485-01**
- **A Practical Guide to DB2 UDB Data Replication V8, SG24-6828**
- **New Tools for DB2 for OS/390 and z/OS Presentation Guide, SG24-6139**
- **SAP R/3 on DB2 for OS/390: Database Availability, SG24-5690**
- **DB2 for z/OS and OS/390 e-business Solutions, SG24-6257**
- **SAP R/3 on DB2 for OS/390: DB2 Features for SAP (redpaper)**
- **e-Business Intelligence Front-End Tool OS/390 Data Warehouse, SG24-5688**



Next Next Latest DB2 Redbooks

- **Migrating to the IBM Replication Solution, SG24-6140**
- **DB2 for OS/390 V6 Technical Update, SG24-6108**
- **DB2 for OS/390 V6 Management Tools Package, SG24-5759**
- **DB2 Version 6 Performance Topics, SG24-5351**
- **Storage Management with DB2 for OS/390, SG24-5462**
- **Getting Started with DB2 OLAP Server OS/390, SG24-5665**
- **DB2 Enterprise Query – QMF for Windows, SG24-5746**
- **Converting from Oracle AIX to DB2 for OS/390, SG24-5478**
- **DB2 for OS/390 Continuous Availability SG24-5486**
- **DB2 Java Stored Procedures, Learning by Example, SG24-5945**
- **SAP on OS/390: Information Warehouse, SG24-5681**



Are Your DB2 Tools Ready?

- **Status of IBM DB2 Tools can be found at:**
 - http://www-1.ibm.com/support/docview.wss?rs=434&context=SSZJXP&uid=swg21162152&loc=en_US&cs=utf-8&lang=en+en
- **Contact other vendors to determine proper maintenance levels**



DB2 Tools Product Portfolio

Database Administration

Tools today...

- DB2 Administration Tool
- DB2 Object Comparison Tool
- Data Encryption for DB2 and IMS
- DB2 Batch Thread Cancel

Recovery

Tools today...

- Application Recovery Tool for IMS and DB2 Databases
- DB2 Archive Log Accelerator
- DB2 Change Accumulation Tool
- DB2 Log Analysis Tool
- DB2 Object Restore Tool
- DB2 Recovery Expert**

Available on zSeries

Available on zSeries and multiplatforms



Utilities Management

Tools today...

- DB2 Utilities Suite
- DB2 Automation Tool
- DB2 HP Unload**
- DB2 Utilities Migration Toolkit**

Performance Management

Tools today...

- DB2 Performance Expert**
- DB2 Performance Monitor
- DB2 Buffer Pool Analyzer
- DB2 Query Monitor
- DB2 SQL Performance Analyzer

Replication

Tools today...

- DB2 DataPropagator
- Replidata

Application Management

Tools today...

- DB2 Bind Manager
- DB2 II ClassicFederation for z/OS
- DB2 Test Database Generator
- DB2 Data Archive Expert
- DB2 Path Checker
- DB2 Table Editor**
- DB2 Web Query Tool**

Currently only available on multiplatforms PRPQ

V8 Migration Assistance is Available

- Contact your IBM Team. Your DB2 for OS/390 & z/OS Specialist can provide:
 - DB2 for z/OS V8 Migration Project Planning Assistance
 - DB2 UDB for z/OS V8 Readiness Assessment
 - DB2 Solutions Assurance Review
- IBM Services (billable)
 - DB2 V7 Health Check
 - Migration / Implementation Services



