

Resources for DB2 family consistency

- ❑ SQL Reference for Cross Platform Development
- ❑ Porting to DB2 web site
 - Process details, steps and guidance
 - Migration Toolkit
- ❑ Papers, presentations on the web
 - Architecture
 - Porting experiences
- ❑ DB2 Connect

Notes on Resources for migration from DB2 to DB2:

The details of SQL across the DB2 family are provided in the 934 page book, in the SQL References for each version and platform and on the web pages. This presentation has a quick overview, showing how much SQL has become similar, but not the same. So one of the key choices is generally having the target DB2 be as current as possible.

There are a number of presentations showing the architecture, terminology and some porting experiences.

For DB2 Connect, see this information

<http://www.ibm.com/software/data/db2/db2connect/>

Some resources may come from groups who port, or perhaps from vendors and consultants.

DB2 Family SQL Reference

**Cross-platform
SQL Reference
V3 March 2008
V3.1 March 2009**

IBM DB2

SQL Reference for Cross-Platform Development

z/OS i AIX HP-UX Solaris Linux Windows

SQL Reference for DB2 family

<http://www.ibm.com/developerworks/db2/library/techarticle/0206sqlref/0206sqlref.html>

Version 3.1 DB2 9.5 for Linux, UNIX, & Windows
DB2 9 for z/OS
DB2 for i V6R1

2

This is the web page for the SQL Reference for Cross-Platform Development. It has four versions of the cross-platform SQL Reference and pointers to the base product SQL Reference books as well. If you want to write programs that work well across the DB2 family, then this is the book to download and use.

These books publish frequently, so you need to choose the one for the proper combination of DB2 platforms and versions. The latest book is Version 3.1 for platforms DB2 9 for z/OS, DB2 for I V6.1, and DB2 9.5 for Linux, UNIX and Windows. The addition of newer versions of the DB2 products means the following great SQL features are now included:

- DECFLOAT data type Additional timestamp format
- ROW CHANGE expressions New built-in functions
- order-by-clause and fetch-first-clause in a subselect
- SELECT FROM INSERT Full outer join
- IMPLICITLY HIDDEN columns row-change-timestamp columns
- RESTRICT on DROP of functions and procedures
- CURRENT DECFLOAT ROUNDING MODE special register & SET statement
- ALTER FUNCTION Other portability enhancements

Other books are for DB2 for z/OS Version 7 and Version 8.

<http://www.ibm.com/developerworks/db2/library/techarticle/0206sqlref/0206sqlref.html>

ftp://ftp.software.ibm.com/ps/products/db2/info/xplatsql/pdf/en_US/cpsqlrv31.pdf

ftp://ftp.software.ibm.com/ps/products/db2/info/xplatsql/pdf/en_US/cpsqlrv3.pdf

http://www.ibm.com/developerworks/data/library/techarticle/db2common/?S_TACT=105AGX11&S_CMP=LP



The best web site for application developers who work with DB2 is DeveloperWorks.

There is extensive help for porting to DB2 UDB on the web, with suggestions for the process and many resources, including a migration toolkit. The dramatically improved DB2 family compatibility in DB2 for z/OS V7 and V8 makes porting to DB2 UDB for z/OS from Unix or Windows platforms much easier.

<http://www.ibm.com/developerworks/db2/zones/porting/>

Here is the URL for the main DeveloperWorks page

<http://www.ibm.com/developerworks/db2/>

There is also a DeveloperWorks page about DB2 for z/OS.

<http://www.ibm.com/developerworks/db2/products/db2zos/>

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Home Products Services & industry solutions Support & downloads My IBM

developerWorks > Information Management >

Porting to DB2 for Linux, UNIX, and Windows

Technical resources and roadmap

Overview Porting steps Resources

This IBM® DB2® for Linux®, UNIX®, and Windows® porting Web site will help you find the information you need to port an application and its data from other database management systems to DB2. The porting and migration steps, which appear in the order that they are commonly performed, are briefly described on this page. More detail about each step can be found on the [Porting steps](#) tab above, or by selecting a step from below.

In addition to the technical information in this site, **IBM customers** and **IBM Business partners** should check out the [Information for IBM customers](#) and [Information for IBM partners](#) links (respectively) in the right-hand column of each page. Here you will find additional links and information about finding assistance and resources for your port.

Porting steps

- 1. Assessment**
Your first task is to determine what needs to be done and how long it will take. This is best performed by a systematic analysis of each of the following tasks that are needed, and by estimating how long each task will take.
- 2. Planning the project**
After you understand the scope of the work, there is great value in planning out each step with the aid of a project plan. There are a variety of tools (see the [Project Planning Tools section](#)) that can be used for planning a porting projects This section will provide you with a description of how to approach the detailed tasks, dependencies, and other information you need to plan out the work.
- 3. Education and Training**
Before porting work can be begun in earnest, the staff that will perform the port will require training in the use of DB2, and potentially, also in new tools and operating environments. This section will show you where to find the necessary materials, courses, and other resources needed to bring the staff up-to-speed.

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The questions at the bottom of the web page are crucial to communicating and understanding the customer objectives. With the key questions answered, many of the uncertainties are avoided. These

- Primary reason for porting to DB2
- Primary function of the application, Workload type (OLTP, OLAP/DSS, both)
- DBMS, platform, version that will be ported from and to
- Languages, APIs & web technologies (EJB, ASP, JSP, etc.)
- Availability & performance requirements
- Application SQL characteristics, know differences
- Database structure characteristics
- Time frame, People and resources available, experience

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<http://www.ibm.com/software/data/db2/migration/mtk/>

IBM Migration Toolkit - IBM Information Management - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Home Products **Services & solutions** Support & downloads My account

Software > IBM Information Management > DB2 Product Family DB2 Information Management Software

DB2 Migrate NOW! **Migrate Now!**

Library
Success stories
News
Trials and betas
Events
Training and certification

IBM Migration Toolkit

You need to be able to access all of your information wherever it resides. IBM Information Management Software protects your current database investment and delivers information on demand to ensure your information is integrated, comprehensive, uniform, analyzable and accessible all the time across all platforms. See how you can migrate your data from a wide variety of source databases to either DB2 or Informix Dynamic Server, regardless of platform.

The IBM Migration Toolkits help you migrate from Oracle, Sybase ASE, Sybase SQL Anywhere, Microsoft SQL Server, Informix IDS and XPS, and MySQL to DB2 UDB on Windows, UNIX and Linux, DB2 on iSeries, DB2 on z/OS, as well as Informix Dynamic Server. The IBM Migration Toolkits are available in English on a variety of platforms including Windows, AIX, Linux, HP/UX and Solaris. Select the correct Migration Toolkit version for your source and target.com from the table below:

		Source DBMS					
		Oracle versions 9i, 9s, & 10g	Sybase Adaptive Server Enterprise (ASE) versions 11, 12, & 12.5	Microsoft SQL Server versions 7 & 2000	Sybase SQL Anywhere version 9	Informix Dynamic Server versions 7.3 & 9 and XPS versions 8.3, 8.4 & 8.5	MySQL versions 3.23.48 and higher
Target DBMS	DB2 UDB on Linux, Unix, & Windows - Versions 8.1 & 8.2	MTK 1.4	MTK 1.4	MTK 1.4	MTK 1.4	MTK 1.4	MySQL to DB2 Toolkit
	DB2 UDB for iSeries VSR3	MTK 1.3	MTK 1.3	MTK 1.3		MTK 1.3	
	DB2 UDB for z/OS Version 8	MTK 1.4					
	Informix Dynamic Server Version 10	MTK 1.4			MTK 1.4		

Related software
IBM Software Catalog
Application Development using DB2
WebSphere
Web Services for DB2 Universal Database
WebSphere Information Integrator

Related solutions
Middleware Industry Solutions
Strategic Alliances

Related hardware
IBM **server**

Related services
Consulting
Warranty info

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This is the migration toolkit page, which includes a capability to migrate from many other DBMS to DB2 with the 1.4 Migration Tool Kit (MTK). This is not generally needed for migration from DB2 to DB2. Here is an article on using the MTK.

<http://www.ibm.com/developerworks/db2/library/techarticle/0209jarzebowicz/0209jarzebowicz.html>

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DB2 SQL

z z/OS V7
common
luw Linux, Unix & Windows V8.2



z { Range partitioning

c
o
m
m { Inner and Outer Joins, Table Expressions, Subqueries, GROUP BY, Complex Correlation, Global Temporary Tables, CASE, 100+ Built-in Functions, Limited Fetch, Insensitive Scroll Cursors, UNION Everywhere, MIN/MAX Single Index Support, Self Referencing Updates with Subqueries, Sort Avoidance for ORDER BY, and Row Expressions, Call from trigger, statement isolation

n { Updateable UNION in Views, ORDER BY/FETCH FIRST in subselects & table expressions, GROUPING SETS, ROLLUP, CUBE, INSTEAD OF TRIGGER, EXCEPT, INTERSECT, 16 Built-in Functions, MERGE, Native SQL Procedure Language, SET CURRENT ISOLATION, BIGINT data type, file reference variables, SELECT FROM INSERT, UPDATE, or DELETE, multi-site join, 2M Statement Length, GROUP BY Expression, Sequences, Scalar Fullselect, Materialized Query Tables, Common Table Expressions, Recursive SQL, CURRENT PACKAGE PATH, VOLATILE Tables, Star Join Sparse Index, Qualified Column names, Multiple DISTINCT clauses, ON COMMIT DROP, Transparent ROWID Column, FOR READ ONLY KEEP UPDATE LOCKS, SET CURRENT SCHEMA, Client special registers, long SQL object names, SELECT from INSERT

l
u
w

6


This text just shows the relationship of DB2 for Linux, Unix & Windows with DB2 for z/OS and OS/390 Version 7, comparing a March 2001 z/OS version with an October 2004 LUW version. V7 has almost no unique function, there is a small set of common function, and a larger set of SQL unique to LUW.

The next step in the process is DB2 for z/OS Version 8. There are three sets of SQL noted above, with none that is unique to DB2 for z/OS in the first group, SQL that is common across DB2 for Linux, Unix, Windows and z/OS in the large group in the middle, then SQL that is unique to DB2 for Linux, Unix and Windows in the bottom group.

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DB2 SQL

z z/OS V8
common
luw Linux, Unix & Windows V8.2



z	{	Multi-row INSERT, FETCH & multi-row cursor UPDATE, Dynamic Scrollable Cursors, GET DIAGNOSTICS, Enhanced UNICODE for SQL, join across encoding schemes, IS NOT DISTINCT FROM, session variables, range partitioning
c	{	Inner and Outer Joins, Table Expressions, Subqueries, GROUP BY, Complex Correlation, Global Temporary Tables, CASE, 100+ Built-in Functions including SQL/XML, Limited Fetch, Insensitive Scroll Cursors, UNION Everywhere, MIN/MAX Single Index Support, Self Referencing Updates with Subqueries, Sort Avoidance for ORDER BY, and Row Expressions, 2M Statement Length, GROUP BY Expression, Sequences, Scalar Fullselect, Materialized Query Tables, Common Table Expressions, Recursive SQL, CURRENT PACKAGE PATH, VOLATILE Tables, Star Join Sparse Index, Qualified Column names, Multiple DISTINCT clauses, ON COMMIT DROP, Transparent ROWID Column, Call from trigger, statement isolation, FOR READ ONLY KEEP UPDATE LOCKS, SET CURRENT SCHEMA, Client special registers, long SQL object names, SELECT from INSERT
o	{	
m	{	
n	{	
l	{	Updateable UNION in Views, ORDER BY/FETCH FIRST in subselects & table expressions, GROUPING SETS, ROLLUP, CUBE, INSTEAD OF TRIGGER, EXCEPT, INTERSECT, 16 Built-in Functions, MERGE, Native SQL Procedure Language, SET CURRENT ISOLATION, BIGINT data type, file reference variables, SELECT FROM UPDATE or DELETE, multi-site join, MDC
u	{	
w	{	

7

This chart shows the relationship of SQL in the DB2 family comparing DB2 for Linux, Unix & Windows with DB2 for z/OS for key language constructs. This chart compares the z/OS Version 8 from March 2004 with the LUW version from October 2004.

There are three sets of SQL noted above, with some that is unique to DB2 for z/OS in the first group, SQL that is common across DB2 for Linux, Unix, Windows and z/OS in the large group in the middle, then SQL that is unique to DB2 for Linux, Unix and Windows in the bottom group. Sheryl Larsen provided the base for this information, but the mistakes are mine.

If you want to improve DB2 family consistency, then DB2 for z/OS Version 8 is a big step, changing the game from one of catch up to one of leapfrog.

If you want to have a book for SQL across platforms, see the 2004 Cross-Platform SQL Reference.


● Cross-Platform Development,

<http://www.ibm.com/developerworks/db2/library/techarticle/0206sqlref/0206sqlref.html>

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DB2 SQL cross-platform SQL book V3

z z/OS 9
common
luw Linux, Unix & Windows 9



z { Multi-row INSERT, FETCH & multi-row cursor UPDATE, Dynamic Scrollable Cursors, GET DIAGNOSTICS, Enhanced UNICODE for SQL, join across encoding schemes, IS NOT DISTINCT FROM, session variables, **TRUNCATE, DECIMAL FLOAT, VARBINARY, optimistic locking, FETCH CONTINUE, ROLE, MERGE, SELECT from MERGE**

c { Inner and Outer Joins, Table Expressions, Subqueries, GROUP BY, Complex Correlation, Global Temporary Tables, CASE, 100+ Built-in Functions including SQL/XML, Limited Fetch, Insensitive Scroll Cursors, UNION Everywhere, MIN/MAX Single Index Support, Self Referencing Updates with Subqueries, Sort Avoidance for ORDER BY, and Row Expressions, 2M Statement Length, GROUP BY Expression, Sequences, Scalar Fullselect, Materialized Query Tables, Common Table Expressions, Recursive SQL, CURRENT PACKAGE PATH, VOLATILE Tables, Star Join Sparse Index, Qualified Column names, Multiple DISTINCT clauses, ON COMMIT DROP, Transparent ROWID Column, Call from trigger, statement isolation, FOR READ ONLY KEEP UPDATE LOCKS, SET CURRENT SCHEMA, Client special registers, long SQL object names, SELECT from INSERT, **UPDATE or DELETE, INSTEAD OF TRIGGER, Native SQL Procedure Language, BIGINT, file reference variables, XML, FETCH FIRST & ORDER BY in subselect and fullselect, caseless comparisons, INTERSECT, EXCEPT, not logged tables, OmniFind, Spatial, range partitioning, compression**

l { Updateable UNION in Views, GROUPING SETS, ROLLUP, CUBE, 16 Built-in Functions, SET CURRENT ISOLATION, multi-site join, MERGE, MDC, **XQuery**

w

8

This chart shows the 2007 relationship of DB2 for Linux, Unix & Windows with DB2 for z/OS. This step in the process is DB2 9 for z/OS and DB2 9 for LUW. DB2 9 moves about half of the LUW unique items into the common set and adds a little more that is unique to the z platform. We are able to move more from the z list to the common list with Viper. There are three sets of SQL noted above, with some that is unique to DB2 for z/OS in the first group, SQL that is common across DB2 for Linux, Unix, Windows and z/OS in the large group in the middle, then SQL that is unique to DB2 for Linux, Unix and Windows in the bottom group.

The Cross-Platform SQL Reference Version 3 documents this combination, with DB2 for i5/OS V5R4.

Cross-Platform Development Version 3,

<http://www.ibm.com/developerworks/db2/library/techarticle/0206sqlref/0206sqlref.html>

ftp://ftp.software.ibm.com/ps/products/db2/info/xplatsql/pdf/en_US/cpsqlrv3.pdf


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DB2 SQL cross-platform SQL book V3.1

z z/OS 9

common

luw Linux, Unix & Windows 9.5



z	{	Multi-row INSERT, FETCH & multi-row cursor UPDATE, Dynamic Scrollable Cursors, GET DIAGNOSTICS, Enhanced UNICODE for SQL, join across encoding schemes, IS NOT DISTINCT FROM, TRUNCATE, VARBINARY, FETCH CONTINUE, MERGE, SELECT from MERGE, index compression
c	{	Inner and Outer Joins, Table Expressions, Subqueries, GROUP BY, Complex Correlation, Global Temporary Tables, CASE, 100+ Built-in Functions including SQL/XML, Limited Fetch, Insensitive Scroll Cursors, UNION Everywhere, MIN/MAX Single Index, Self Referencing Updates with Subqueries, Sort Avoidance for ORDER BY, and Row Expressions, 2M Statement Length, GROUP BY Expression, Sequences, Scalar Fullselect, Materialized Query Tables, Common
o	{	Table Expressions, Recursive SQL, CURRENT PACKAGE PATH, VOLATILE Tables, Star Join Sparse Index, Qualified Column names, Multiple DISTINCT clauses, ON COMMIT DROP, Transparent ROWID Column, Call from trigger, statement isolation, FOR READ ONLY KEEP
n	{	UPDATE LOCKS, SET CURRENT SCHEMA, Client special registers, long SQL object names, SELECT from INSERT, UPDATE or DELETE, INSTEAD OF TRIGGER, Native SQL Procedure Language, BIGINT, file reference variables, XML, FETCH FIRST & ORDER BY in subselect & fullselect, caseless comparisons, INTERSECT, EXCEPT, not logged tables, OmniFind, spatial, range partitions, data compression, session variables, DECIMAL FLOAT, optimistic locking, ROLE
l	{	Updateable UNION in Views, GROUPING SETS, ROLLUP, CUBE, more Built-in Functions, SET CURRENT ISOLATION, multi-site join, MERGE, MDC, XQuery, XML enhancements, array data type, global variables, more vendor syntax
u	{	
w	}	

9

This chart shows the 2008 relationship of DB2 for Linux, Unix & Windows with DB2 for z/OS. This step in the process is DB2 9 for z/OS, (DB2 9). DB2 9 moved about half of the LUW unique items into the common set and adds a little more that is unique to the z platform. DB2 9.5 for LUW, delivered in 2008. We are able to move more from the unique z list to the common list with DB2 9.5 for LUW.

There are three sets of SQL noted above, with some that is unique to DB2 for z/OS in the first group, SQL that is common across DB2 for Linux, Unix, Windows and z/OS in the large group in the middle, then SQL that is unique to DB2 for Linux, Unix and Windows in the bottom group. The changes in a specific version are not consistent. As we introduce new function, sometimes it will be on one platform first, but movement from unique lists into the common list continues to be the strongest trend.

The Cross-Platform SQL Reference Version 3.1 documents this combination, with DB2 for i V6R1.

Cross-Platform Development Version 3.1,

<http://www.ibm.com/developerworks/db2/library/techarticle/0206sqlref/0206sqlref.html>

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DB2 SQL projected

z z/OS X

common

luw Linux, Unix & Windows Y

z { Multi-row INSERT, FETCH & multi-row cursor UPDATE, Dynamic Scrollable Cursors, GET DIAGNOSTICS, Enhanced UNICODE for SQL, join across encoding schemes, IS NOT DISTINCT FROM, VARBINARY, FETCH CONTINUE, MERGE, SELECT from MERGE, **data versioning, access controls**

c { Inner and Outer Joins, Table Expressions, Subqueries, GROUP BY, Complex Correlation, Global Temporary Tables, CASE, 100+ Built-in Functions including SQL/XML, Limited Fetch, Insensitive Scroll Cursors, UNION Everywhere, MIN/MAX Single Index, Self Referencing Updates with Subqueries, Sort Avoidance for ORDER BY, and Row Expressions, 2M Statement Length, GROUP BY Expression, Sequences, Scalar Fullselect, Materialized Query Tables, Common Table Expressions, Recursive SQL, CURRENT PACKAGE PATH, VOLATILE Tables, Star Join Sparse Index, Qualified Column names, Multiple DISTINCT clauses, ON COMMIT DROP, Transparent ROWID Column, Call from trigger, statement isolation, FOR READ ONLY KEEP

o { UPDATE LOCKS, SET CURRENT SCHEMA, Client special registers, long SQL object names, SELECT from INSERT, UPDATE or DELETE, INSTEAD OF TRIGGER, Native SQL Procedure Language, BIGINT, file reference variables, XML, FETCH FIRST & ORDER BY in subselect and fullselect, caseless comparisons, INTERSECT, EXCEPT, not logged tables, range partitioning, data compression, Session variables, DECIMAL FLOAT, optimistic locking, ROLE, OmniFind, spatial, **index compression, XQuery, global variables, TRUNCATE, more granular security, last committed, created temps, ...**

m

n

i { Updateable UNION in Views, GROUPING SETS, ROLLUP, CUBE, more Built-in Functions, SET CURRENT ISOLATION, multi-site join, MERGE, MDC, XML & XQuery enhancements, array data type, **more vendor syntax, parameterized cursors, CREATE MODULE**

u

w



10


This text just shows the projected relationship of DB2 for Linux, Unix & Windows with DB2 for z/OS. The key at the top has the shorthand, the platform and the level. This step in the process is DB2 X for z/OS and DB2 for luw Y. The projected DB2 X for z/OS and DB2 for luw code named Y are being developed, not announced or generally available for some time. We expect to be able to move more from the z and the luw list to the common list with these changes to DB2.

Three sets of SQL are noted above, with some that is unique to DB2 for z/OS in the first group, SQL that is common across DB2 for Linux, Unix, Windows and z/OS in the large group in the middle, then SQL that is unique to DB2 for Linux, Unix and Windows in the bottom group. The changes for a specific version are not consistent. As we introduce new function, often one platform will be first, but movement from unique lists into the common list continues to be the strongest trend.

DB2 family consistency and productivity for those who use SQL have improved a lot in the past few versions. We use the Cross-platform SQL Reference to compare DB2 across the Linux, UNIX, Windows, i5/OS and z/OS platforms. See the 900+ page SQL Reference for Cross-Platform Development, Version 3,


<http://www.ibm.com/developerworks/db2/library/techarticle/0206sqlref/0206sqlref.html>
ftp://ftp.software.ibm.com/ps/products/db2/info/xplatsql/pdf/en_US/cpsqlrv3.pdf

Watch for a new version of this book to show new SQL being delivered.

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Leverage Existing Application Development Skills

- Use new converged SQL & DB2 Workbench
- Key Database Technologies
 - SQL, SQL Procedures
 - XML
 - SOA, Web Services
- Developer communities
 - COBOL, PL/I, C, C++, assembler
 - REXX, APL2, Fortran
 - Java (JDBC / SQLJ)
 - .NET (C#, VB .NET)
 - Open Source
 - PHP
 - Perl
 - Python
 - Ruby on Rails
 - TOAD for DB2



11

DB2 for z/OS handles many more languages than most people think. There are many different interfaces used for the languages to fit the style appropriate to the language. The languages on this chart are not all of those which are supported by or to DB2 for z/OS.

The DB2 for z/OS precompiler works with assembler, C, C++, COBOL, PL/I and Fortran. The DB2 for z/OS coprocessor works with C, C++, COBOL, and PL/I. ODBC or CLI APIs are provided for C and C++. Java has JDBC and SQLJ, with JLINQ on the way. REXX and APL2 interfaces are provided. Other languages and application generators connect to DB2 using call attach or RRS attach for local connections, DRDA or private protocols for remote connections. Other languages use these of APIs or those implemented in DB2 Connect and other client deliveries. Some examples include WebSphere Developer for z, Enterprise Generation Language. Both Microsoft .NET and open source languages use this variety of connections.

Database Application Development Technologies

- **Key Database Technologies**

- SQL / SQL Procedures
- XML
- SOA / Web Services



WebSphere. software

Rational. software



Microsoft
Visual Studio .NET

- **Developer communities**

- C/C++
- Java (JDBC / SQLJ)
- .NET (C#, VB .NET)
- Open Source
 - PHP
 - Perl
 - Python

PYTHON

Zend Core™
for IBM

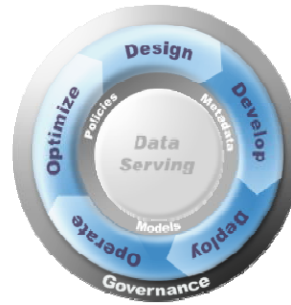


Application programming is using a wider range of tools, environments and languages. The Eclipse framework is growing strongly. We need to connect the new languages and environments to the scale and value of the existing infrastructure. The Rational and WebSphere product lines provide part of the connection, with products like Rational Data Architect and WebSphere Information Integration. DB2 clients provide more support for new environments and new languages.

Integrated Data Management Core Values

An integrated, modular, data management environment designed to increase organizational productivity and effectiveness while improving the quality of service, cost of ownership, and governance of diverse data, databases, and data-driven applications

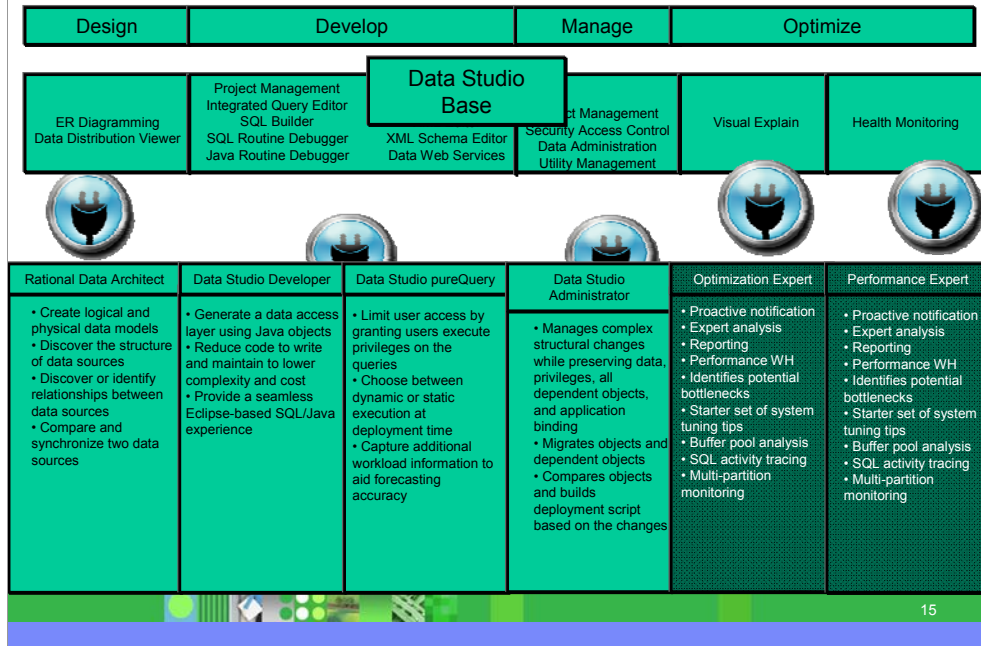
- Providing end-to-end data lifecycle management
- Facilitating cross-organizational collaboration for business alignment
- Flexibility to provide the ease of use small businesses require with the scalability to manage the large enterprises



Core Users of the IBM Data Studio



Data Studio Packaging



DB2 Developer Workbench vs. Data Studio

before

now

IBM DB2 Developer Workbench V9.1

- SQL Query Editor
- SQLJ Editor
- SQL Builder
- XQuery Builder
- SQL Routine Debugger
- Java Routine Debugger
- XML Editor
- XML Schema Editor
- Data Management
- Visual Explain
- Project Management

IBM Data Studio

- Integrated Query Editor – SQL + XQuery
- SQLJ Editor
- SQL Builder
- XQuery Builder
- SQL Routine Debugger
- Java Routine Debugger
- XML Editor
- XML Schema Editor
- Data Management
- Visual Explain
- Project Management

**Data Studio is a full replacement of
DB2 Developer Workbench
plus much more**

- **DB2 for Linux, Unix, Windows v8.x, v9.1.x, v9.5**
- **DB2 for z/OS v7, v8, 9**
- **DB2 for i v5r2, v5r3, v5r4, v6**
- **Informix Dynamic Server (IDS) v9.x, v10.x, v11**

- ER Diagramming
- Data Distribution Viewer
- Object Management
- Browse & Update Statistics
- Security Access Control
- Connection Management integration with Kerberos and LDAP
- Data Web Services
- IDS Server Support
- Health Monitoring DB2 for LUW 9.5 and DB2 z/OS v9

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IBM Integrated Data Management Software

Managing the value of your data throughout its lifetime
Data Studio Offerings

DB2 Optimization Expert
Detect and tune poorly written SQL proactively before the business is affected.
** Not yet integrated into Data Studio*

DB2 Performance Expert
Reduce downtime and quickly resolve performance issues with this comprehensive DB2 monitor.
** Not yet integrated into Data Studio*

Data Studio Administrator
Increase productivity and reduce application outages by automating and simplifying complex DB2 structural changes.

Rational Data Architect
Enterprise data modeling and integration design tool.

Data Studio Developer
An Integrated Development Environment for creating and testing database and pureQuery applications

Data Studio pureQuery Runtime
A high-performance Java data access platform -- improves security and manageability of Java application connections to databases.

High Performance Unload
Unloads data quickly and easily to help meet service level agreements and application upgrade requirements.

** Not yet integrated into Data Studio* 17

Recent and upcoming Integrated Data Management Innovations include:

Java Database Connectivity

- Transaction affinity routing in a Shared Queue environment**
This feature gives IMS users more control over where a transaction or group of transactions should be processed. The end result is that IMS users have direct control over shared message queue workload balance and can better manage availability.

Integration between dashboard and threshold processing
Users can set threshold values based on dashboard definitions. Threshold exceptions are logged in history database for after the fact viewing.

More status data for RM structure entries
Users can make more informed decisions about when it is safe to delete entries. Multiple delete capability is added for mass removal of structure entries.

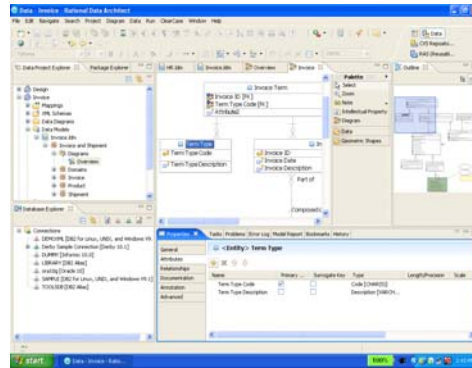
- DB2 Accessories Suite for z/OS 1.3**
Data Studio Administration Console (DSAC)
The Data Studio Administration Console (DSAC) is a component of Data Studio available for Web-download only, that provides:
A rich Web interface for

 - Database health monitoring and troubleshooting
 - Q replication and event publishing monitoring and management
 - Support for DB2 on z/OS, Linux, UNIX and Windows

Rational Data Architect

Rational Data Architect is a collaborative, data design solution to discover, model, relate, and standardize diverse data assets.

- Increase Data Quality and Integrity
 - Discover, explore, and visualize the structure of data sources
 - Analyze and enforce compliance to enterprise standards
 - Support business and IT collaboration via a common business glossary
 - Use with IBM Industry Models for industry-specific best practices
 - Facilitate model-driven development via seamless integration with Rational Software Delivery Platform
 - Automate transformations between the application model and the data model



IBM Data Studio Developer and pureQuery Runtime

IBM Data Studio Developer is an integrated database development environment that speeds application design, development, and deployment while increasing data access performance and manageability.

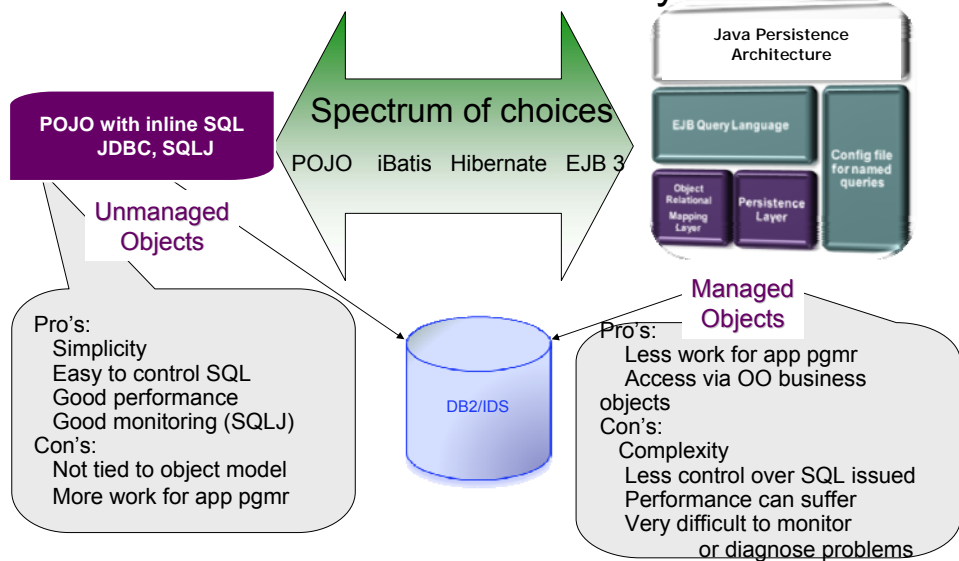
- Ease JAVA coding
 - pureQuery code assistance
- Improve predictability and manageability with static SQL
 - Switch dynamic to static SQL without changing a line of code
- Visualization of JAVA request to SQL code
 - SQL Outline correlates SQL to JAVA code



```
Employee2.java EmployeeData.java EmployeeDataTest.java
import java.util.Iterator;
import java.sql.Date;
import java.math.BigDecimal;
import com.ibm.pdq.annotation.Select;
import com.ibm.pdq.annotation.Update;

public interface Employee2Data {
    // Select all EMPLOYEE2s
    @Select(sql = "select E, FIRSTNAME, MIDDLEINIT, LASTNAME, WORKDEPT, PHONENO, HIREDATE, J
    Iterator<Employee2> get;
    Iterator<Employee2> get; end-with end-with function
    @Select(sql = "select E
    Iterator<Employee2> get; EMPNO-CHAR(6)
    Iterator<Employee2> get; EMP_ACT
    String middleinit; EMP_PHOTO
    Date hiredate; EMP_RESUME
    BigDecimal sala; EMPACT
    EMPLOYEE
```

Java Data Access – many forms





pureQuery Outline

Speed up problem isolation for developers – even when using frameworks

- Capture application-SQL-data object correlation (with or without the source code)
- Trace SQL statements to using code for faster problem isolation
- Enhance impact analysis identifying application code impacted due to database changes
- Answer “Where used” questions like “Where is this column used within the application?”
- Use with modern Java frameworks e.g. Hibernate, Spring, iBatis, OpenJPA

```
private void deleteEntities() {
    String firstName = "John";
    em.getTransaction().begin();

    // single JPQL query delete all persisted entities whose first name is 'firstName'
    Query deleteQuery = em.createQuery("DELETE FROM MyEntity AS e WHERE e.firstName = ?");
    deleteQuery.setParameter(1, firstName);

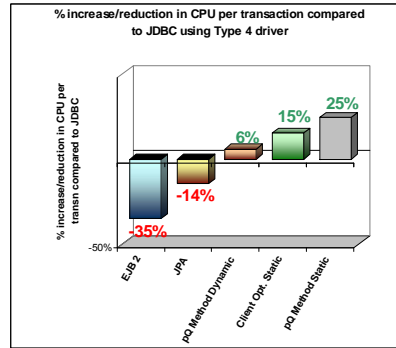
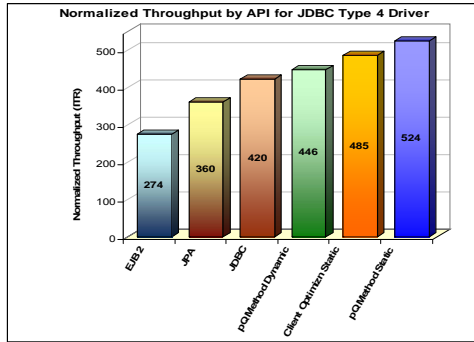
    List deleted_entities = deleteQuery.executeUpdate();

    System.out.println("Deleted " + deleted_entities + " instance(s) of " + firstName);
    em.getTransaction().commit();
}

pureQuery Outline - Properties Data Output Console
Java Packages
  org.apache.spepca.jdbc.kernel
  org.apache.spepca.jdbc.xd
  org.apache.spepca.xd
  org.apache.spepca.lib.rsp
  org.apache.spepca.lib.jdbc
  org.apache.spepca.kernel
  com.ibm.test
  org.apache.spepca.java
    Line#10: UPDATE DBUSER.LOPENPA_SEQUENCE_TABLE SET SEQUENCE_VALUE = ? WHERE ID = ? AND SEQUENCE_VALUE = ?
    Line#79: SELECT SEQUENCE_VALUE FROM DBUSER.LOPENPA_SEQUENCE_TABLE WHERE ID = ? FOR READ ONLY WITH RS USE AND KEEP UPDATE LOG
    Line#133: DELETE FROM DBUSER.LIDENTITY WHERE ID = ?
    Line#130: UPDATE DBUSER.LIDENTITY SET FIRSTN = ?, LASTN = ? WHERE ID = ?
    Line#131: SELECT SEQUENCE_VALUE FROM DBUSER.LOPENPA_SEQUENCE_TABLE WHERE ID = ? FOR READ ONLY WITH RS USE AND KEEP UPDATE LOG
    Line#132: UPDATE DBUSER.LIDENTITY SET FIRSTN = ?, LASTN = ? WHERE ID = ?
    Line#130: DELETE FROM DBUSER.LIDENTITY WHERE ID = ?
    DBUSER
      IDENTIFY
        Line#79: UPDATE DBUSER.LOPENPA_SEQUENCE_TABLE SET SEQUENCE_VALUE = ?
        Line#133: SELECT ID, ID, FIRSTN, IS_LASTN FROM DBUSER.LIDENTITY
        Line#130: INSERT INTO DBUSER.LIDENTITY (ID, FIRSTN, LASTN, HALL)
        Line#79: TRUNCATE INTO IN (DBUSER.LIDENTITY (ID, FIRSTN, LASTN, HALL))
      Show in Source
      Run SQL
      Show in SQL Editor...
      Export SQL to File...
      Launch Visual Explorer
      Generate pureQuery code...
```

Data Studio pureQuery Runtime for z/OS

- In-house testing shows double-digit reduction in CPU costs over dynamic JDBC

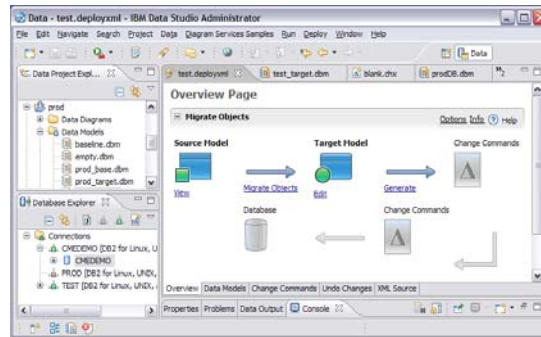


- IRWW – an OLTP workload, **Type 4 driver**
- Cache hit ratio between 70 and 85%
- 15% - 25% reduction on CPU per transaction over dynamic JDBC**

IBM Data Studio Administrator

IBM Data Studio Administrator improves DBA productivity and reduces application outages by automating and simplifying complex DB2 structural changes.

- Manages changes while preserving data, privileges, all dependent objects, and application binding
- Synchronizes, copies, clones, or merges database schema definitions from the source to the target
 - Change in place and object migration
- Documents changes for collaboration and audit
- Integrates with Rational V7 software for easy collaboration



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Differentiated features:

- We can customize changes and migrate in a single change
- We have the most flexible data preservation options
- We can incorporate RDA physical data models

Other Resources for migration from DB2 to DB2

□ Papers, presentations on the web

▪ Architecture

DB2 UDB for Linux, UNIX, Windows for a z/OS DBA
Examining Architectural Differences of DB2
Breaking the DB2 Platform Barrier

▪ Porting experiences

Getting Started with DB2 for z/OS™ and OS/390®
Version 7 for DB2 Distributed Platform Users

▪ Moving Data Across the DB2 Family

- DB2 UDB for Linux, UNIX, Windows for a z/OS DBA: Chris Eaton, IDUG Berlin 2005
 - Examining Architectural Differences of DB2 on OS/390 vs. UNIX/NT, Jim Wankowski, Quest
 - Breaking the DB2 Platform Barrier, Jim Wankowski, Quest
 - Getting Started with DB2 for z/OS™ and OS/390® Version 7 for DB2 Distributed Platform Users, Raul Chong
<http://www.ibm.com/developerworks/db2/library/techarticle/0207chong/0207chong2.html>
<http://www.ibm.com/developerworks/db2/library/techarticle/0207chong/0207chong.html>
 - A colorful introduction to DB2 UDB, Version 8 for UNIX, Linux, and Windows: Visualize fundamental DB2 concepts, Raul Chong
<http://www.ibm.com/developerworks/db2/library/techarticle/0301chong/0301chong.html>
- Moving Data Across the DB2 Family redbook, SG24-6905
<http://www.redbooks.ibm.com/abstracts/SG246905.html?Open>
<http://www.redbooks.ibm.com/redbooks/pdfs/sg246905.pdf>

DB2 Cross-Platform SQL Reference

updated March 2009

ibm.com/developerworks/db2/library/techarticle/0206sqlref/0206sqlref.html

V3.1 DB2 for LUW 9.5
DB2 for i V6.1
DB2 9 for z/OS



New SQL features now included

- DECFLOAT data type Additional timestamp format
- ROW CHANGE expressions New built-in functions
- order-by-clause and fetch-first-clause in a subselect
- SELECT FROM INSERT Full outer join
- IMPLICITLY HIDDEN columns row-change-timestamp columns
- RESTRICT on DROP of functions and procedures
- CURRENT DECFLOAT ROUNDING MODE special register & SET
- ALTER FUNCTION Other portability enhancements

25

This is the web page for the SQL Reference for Cross-Platform Development. It has four versions of the cross-platform SQL Reference and pointers to the base product SQL Reference books as well. If you want to write programs that work well across the DB2 family, then this is the book to download and use.

These books publish frequently, so you need to choose the one for the proper combination of DB2 platforms and versions. The latest book is Version 3.1 for platforms DB2 9 for z/OS, DB2 for I V6.1, and DB2 9.5 for Linux, UNIX and Windows. The addition of newer versions of the DB2 products means the following great SQL features are now included:

- DECFLOAT data type Additional timestamp format
- ROW CHANGE expressions New built-in functions
- order-by-clause and fetch-first-clause in a subselect
- SELECT FROM INSERT Full outer join
- IMPLICITLY HIDDEN columns row-change-timestamp columns
- RESTRICT on DROP of functions and procedures
- CURRENT DECFLOAT ROUNDING MODE special register & SET statement
- ALTER FUNCTION Other portability enhancements


Other books are for DB2 for z/OS Version 7 and Version 8.

<http://www.ibm.com/developerworks/db2/library/techarticle/0206sqlref/0206sqlref.html>

ftp://ftp.software.ibm.com/ps/products/db2/info/xplatsql/pdf/en_US/cpsqlrv31.pdf

ftp://ftp.software.ibm.com/ps/products/db2/info/xplatsql/pdf/en_US/cpsqlrv3.pdf

http://www.ibm.com/developerworks/data/library/techarticle/db2common/?S_TACT=105AGX11&S_CMP=LP

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DB2 Cross-Platform SQL Reference V3

updated March 2008

<http://www.ibm.com/developerworks/db2/library/techarticle/0206sqlref/0206sqlref.html>

The SQL Reference for Cross-Platform Development

Level: Introductory
 Staff, IBM, Staff, IBM

01 Jun 2002
 Updated 28 Mar 2008


Great news for people who want to write portable applications! This reference makes it easy for you to develop applications using SQL that is portable across the [DB2 database family](#), including [DB2 for z/OS®](#) Version 9, [DB2 for iSeries™](#) Version 5 Release 4, and [DB2 for Linux, UNIX®, and Windows®](#) Version 9.

Introduction

The *SQL Reference for Cross-Platform Development* uses the familiar format of the product SQL Reference manuals and includes the following topics:

- Database concepts
- Built-in functions
- Statements and queries
- SQL procedural language control statements
- Limits
- Programming in C, Java™, COBOL, REXX, and external routines in general
- SQL return codes (SQLSTATES)
- CCSIDs

New in Version 3!

 26

This is the web page for the SQL Reference for Cross-Platform Development. It has three versions of the cross-platform SQL Reference and pointers to the base product SQL Reference books as well. If you want to write programs that work well across the DB2 family, then this is the book to download and use.

These books publish frequently, so you need to choose the one for the proper combination of DB2 platforms and versions. The current book is Version 3 for platforms Version 9 of DB2 for z/OS, Version 5 Release 4 of DB2 for i5/OS, and Version 9 of DB2 for the Linux, UNIX and Windows. The addition of newer versions of the DB2 products means the following great SQL features are now included:

- BIGINT data type
 - New built-in functions
 - Recursive common table expressions
 - Additional common features for ALTER COLUMN on ALTER TABLE
 - Table partitions
 - SQL PL extensions including the FOR statement and support for nested ATOMIC compound statements
 - Other portability enhancements
- OLAP specifications
 - INTERSECT and EXCEPT
 - INSTEAD OF triggers

Other books are for DB2 for z/OS Version 7 and Version 8.

<http://www.ibm.com/developerworks/db2/library/techarticle/0206sqlref/0206sqlref.html>

ftp://ftp.software.ibm.com/ps/products/db2/info/xplatsql/pdf/en_US/cpsqlrv3.pdf

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- ✓ Program Directories
- ✓ Installation Guide
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- Application Programming Guide & Reference for JAVA™
- RACF Access Control Module Guide
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- ✓ Messages
- ✓ Codes
- ✓ Administration Guide
- ✓ Performance Guide
- ✓ Utility Guide and Reference
- ✓ Internationalization Guide (Unicode)



For installation, you need many books. Some are optional, for example the data sharing book is not needed if you don't use data sharing. If you use data sharing, then part of the install process is in that book. Part of the Java install process is in the Java book. Part of the ODBC install process is in the ODBC book. If you use RACF access control, then you need the RACF Access Control Module Guide. You can get most of the books from the DB2 Library web page. The books were updated in December 2007 and February, March, June, and August 2008, with some coming later, so get the latest ones. Some of the Redbooks may be helpful. You may need books from the z/OS Library as well.

<http://www.ibm.com/support/docview.wss?rs=64&uid=swg27011656>

<http://www.ibm.com/support/docview.wss?rs=64&uid=swg27011658>

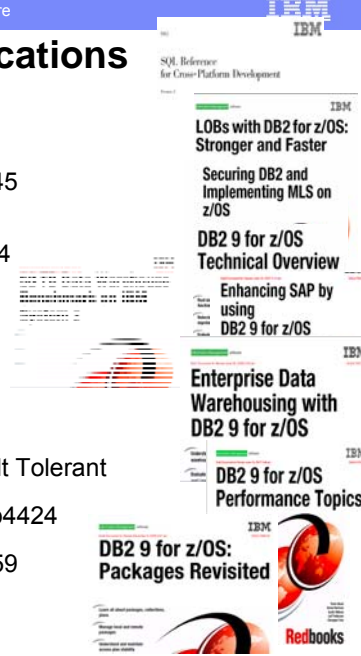
<http://www.ibm.com/systems/z/os/zos/bkserv/r9pdf/>

Be sure to use the latest information to save time and problems. Some of the IBM Redbooks publications have always been updated and added lately (next page).

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DB2 9 in IBM Redbooks Publications

1. DB2 9 Technical Overview SG24-7330
2. DB2 9 Performance Topics SG24-7473
3. DB2 9 Stored Procedures SG24-7604
4. Index Compression with DB2 9 for z/OS redp4345
5. SQL Reference for Cross-Platform Development
6. Enterprise Database Warehouse, SG24-7637
7. 50 TB Data Warehouse on System z, SG24-7674
8. DB2 9 Optimization Service Center SG24-7421
9. LOBs with DB2 for z/OS SG24-7270
10. Deploying SOA Solutions SG24-7663
11. Enhancing SAP - DB2 9 SG24-7239
12. SAP Application on Linux z SG24-6847
13. Best practices SAP BI - DB2 9 SG24-6489-01
14. Data Sharing in a Nutshell, SG24-7322
15. Securing DB2 & MLS z/OS SG24-6480-01
16. Data Sharing: Distributed Load Balancing & Fault Tolerant Configuration redp4449
17. Considerations on Small & Large Packages redp4424
18. Backup and Recovery Considerations redp4452
19. Powering SOA with IBM Data Servers SG24-7259
20. Packages Revisited, SG24-7688
21. Data Studio V2.1 Web Services redp4510



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DB2 library more information <http://www.ibm.com/software/data/db2/zos/library.html>

Many IBM Redbooks publications, Redpapers and one cross-platform book on DB2 9 are published, in addition to the standard library, with more in the works. Check for updates.

1. DB2 9 Technical Overview, SG24-7330 <http://www.redbooks.ibm.com/abstracts/SG247330.html>
2. DB2 9 Performance Topics, SG24-7473, <http://www.redbooks.ibm.com/abstracts/SG247473.html>
3. DB2 9 Stored Procedures, SG24-7604, <http://www.redbooks.ibm.com/abstracts/SG247604.html>
4. Index Compression DB2 9, REDP4345, <http://www.redbooks.ibm.com/abstracts/redp4345.html>
5. Deploying SOA Solutions SG24-7663, <http://www.redbooks.ibm.com/abstracts/SG247259.html>
6. Cross-Platform Development Version 3, <http://www.ibm.com/developerworks/db2/library/techarticle/0206sqlref/0206sqlref.html>
ftp://ftp.software.ibm.com/ps/products/db2/info/xplatsql/pdf/en_US/cpsqlrv3.pdf
7. Enterprise Data Warehousing, SG24-7637, <http://www.redbooks.ibm.com/abstracts/sg247637.html>
8. LOBs: Stronger & Faster SG24-7270, <http://www.redbooks.ibm.com/abstracts/SG247270.html>
9. Securing DB2 & MLS z/OS, SG24-6480-01, <http://www.redbooks.ibm.com/abstracts/sg246480.html>
10. Enhancing SAP, SG24-7239, <http://www.redbooks.ibm.com/abstracts/SG247239.html>
11. Best practices SAP BI, SG24-6489-01, <http://www.redbooks.ibm.com/abstracts/sg246489.html>
12. Optimization Service Center, SG24-7421, <http://www.redbooks.ibm.com/abstracts/sg247421.html>
13. Data Sharing in a Nutshell, SG24-7322, <http://www.redbooks.ibm.com/abstracts/sg247421.html>
14. DB2 9 for z/OS Data Sharing: Distributed Load Balancing and Fault Tolerant Configuration <http://www.redbooks.ibm.com/abstracts/redp4449.html>
15. DB2 for z/OS: Considerations on Small and Large Packages redp4424 <http://www.redbooks.ibm.com/abstracts/redp4424.html>
16. DB2 9 for z/OS: Backup and Recovery Considerations redp4452 <http://www.redbooks.ibm.com/abstracts/redp4452.html>
17. Powering SOA IBM Data Servers, SG24-7259 <http://www.redbooks.ibm.com/abstracts/SG247259.html>
18. DB2 9 for z/OS Packages Revisited, SG24-7688 <http://www.redbooks.ibm.com/abstracts/SG247688.html>
19. 50 TB Data Warehouse Benchmark on IBM System z <http://www.redbooks.ibm.com/redpieces/abstracts/sg247674.html>
20. SAP on DB2 9 for z/OS: Implementing Application Servers on Linux for System z <http://www.redbooks.ibm.com/redpieces/abstracts/sg246847.html>
21. IBM Data Studio V2.1: Getting Started with Web Services on DB2 for z/OS <http://www.redbooks.ibm.com/redpieces/abstracts/redp4510.html>
22. Parallel Sysplex Operational Scenarios <http://www.redbooks.ibm.com/redpieces/abstracts/sg242079.html>
23. Watch for titles on DB2 distributed; serialization & concurrency; utilities

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Data Studio

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IBM Data Studio

Features and benefits

System requirements

Technical resources

Trials and demos

Related links

- DB2 9
- Informix
- U2
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IBM Data Studio

The comprehensive data management solution to design, develop, deploy, and manage data-driven applications.


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IBM Data Studio Developer: An Integrated Development Environment for creating and testing database and pureQuery applications.

IBM Data Studio pureQuery Runtime: A high-performance Java data access platform -- improves security and manageability of Java application connections to databases.

<http://www.ibm.com/software/data/studio/>

ftp://ftp.software.ibm.com/software/data/db2zos/IOD1298_ADadminTrendsDirections_CotnerOct2007.pdf

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DB2 Connect

<http://www.ibm.com/software/data/db2/db2connect/>

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Related links

→ What's new in DB2 Connect V9

→ Blog: An Expert's Guide to DB2 Technology

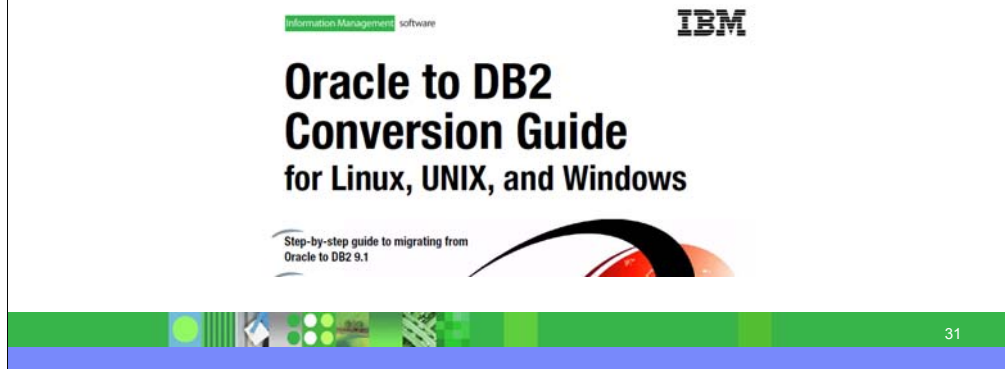
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<http://www.ibm.com/software/data/db2/db2connect/>

More Notes

- See the detailed notes below for other resources and web pointers.
- <http://www.redbooks.ibm.com/abstracts/sg247048.html>
- <http://www.redbooks.ibm.com/abstracts/tips0674.html>



In general, if you are looking for the best portability, then you should be using the one year old DB2 9, rather than the four year old DB2 V8. Here are some additional resources:

Presentation on porting:

SQL Reference for Cross-Platform

ftp://ftp.software.ibm.com/ps/products/db2/info/xplatsql/pdf/en_US/cpsqlrv2.pdf

Porting web sites:

<http://www.ibm.com/developerworks/db2/zones/porting/index.html>

<http://www.ibm.com/developerworks/db2/products/db2zos/index.html>

Key DB2 for z/OS platform differences <http://publib.boulder.ibm.com/epubs/pdf/dsnitk11.pdf>

DeveloperWorks papers:

<http://www.ibm.com/developerworks/db2/library/techarticle/0207chong/0207chong2.html>

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