IBM Data Studio

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Information Management
Abstract

A significant part of IBM Data Studio is the set of administration functions that are used by application and system DBAs. These functions include query/workload tuning, automating routine data maintenance, proactive monitoring, and mapping of problem applications - all the way back to the line number of the application that generated the database request. Learn how the cost of database administration can be significantly reduced by this tool set that integrates the life cycle of the data. This presentation will introduce current capabilities as well as discuss future directions.
Data Lifecycle Management

- Database logic
- Stored Procedures
- Performance
- Availability
- Maintenance
- Physical Change
- Management

- Data Definitions and Relationships
- Logical Data Models
- Synchronize & Collaborate
- Database Servers
- Eclipse
- Java
- .NET
- Application Developer
- Object Models and Applications
- Database Developer
- Data Architect
- Security Administrator
- Compliance
- Database Administrator
- Application Developer
- Object Models and Applications
- Database Developer
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IBM Data Studio Vision

An integrated, modular, data management framework 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.

*It enables organizations to more efficiently and effectively*

- Respond to emergent, data-intensive business opportunities
- Meet business growth demands while driving down total cost of ownership
- Meet service level agreements for data-driven applications
- Comply with data privacy and data retention regulations
- Secure database access in alignment with corporate policies
Addressing the Data Lifespan
... from Requirements to Retirement

- Model
- Relate
- Refine

- Plan
- Monitor
- Maintain
- Optimize

- Code
- Debug
- Test
- Tune

- Design
- Develop
- Govern
- Manage
- Deploy

- Secure
- Retain
- Retire
- Audit

- Install
- Configure
- Alter
- Change-control
Enabling Collaboration and Alignment Across Roles

**Rational Software Delivery Platform**
- **Business Analyst**
- **Enterprise Architect**

**Data Modeling**
- Logical Modeling
- Physical Modeling
- Integration Modeling

**Application Development**
- Data Access:
  - Java objects
  - Web services
  - Web 2.0

**Database Development**
- Stored Procedures
- SQL
- XQuery
- User Defined Functions

**Database Administration**
- Configuration Management
- Performance Management
- Change Management
- Availability Management

**Tivoli Service Management Platform**
- Systems Administrator
- Network Administrator
- Compliance Administrator

**Data Governance**
- Security and Privacy Management
- Archive and Retention Management
- Auditing

**Database Administrator**
Today

Powerful Life Cycle Tools, Emerging Integration

- **Data Modeling**
  - Rational Data Architect

- **Application Development**
  - Data Studio Developer
  - Optim Test Data Management
  - Optim Data Privacy Solution

- **Database Development**
  - Data Studio Developer
  - Data Studio Change Manager
  - Optim Test Data Management
  - Optim Data Privacy Solution

- **Database Administration**
  - Data Studio (Console)
  - DB2 Change Management Expert
  - DB2 Perf Expert
  - OMEGAMON Perf Expert

- **Data Governance**
  - Data Studio (Console)
  - Optim Data Privacy Solution
  - Optim Data Growth Solution
  - Audit Mgmt Expert
  - Database Encryption

---

**Design**  **Develop**  **Deploy**  **Manage**  **Govern**
<table>
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<th>IBM DB2 Developer Workbench V9.1</th>
<th>IBM Data Studio V1.1.1 for Windows and Linux</th>
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<td>SQL Routine Debugger</td>
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<td>Project Management</td>
<td>Project Management</td>
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**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, v9
- DB2 for i5/OS v5r2, v5r3, v5r4
- 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
- pureQuery for Java*
- Administration Console (DSAC) V1.1.2 for DB2 for LUW 9.5
Data Studio: Data Modeling / Application Dev / Database Dev
A Consistent and Productive work environment
IBM Data Studio

Project Explorer

Teaming options to share projects
Data Modeling / Application Dev / Database Dev
ER Diagramming

Easily create, view and share ER diagrams
Integrated Query Editor

- Express yourself with optimal queries
- Content assistance for database objects
- Rapid interactive end-user feedback
- Extensible templates
- Multiple SQL statement testing
- SQL assistance and XQuery assistance

**SQL and XQuery together using an integrated editor**
Data Modeling / Application Dev / Database Dev

XML Editors

- Easily perform your XML tasks
  - Create XML documents and schemas
  - Import and export XML documents and schemas
  - Insert XML documents into XML columns
  - Generate XML Schema registration scripts
  - Register XML Schema

Extensive XML support and capabilities
Quickly build and test SQL graphically using the SQL Builder
Stored Procedure Support
SQL Debugger

Integrated editor and debugger for SQL PL
Stored Procedure Support

Java Debugger

Integrated editor and debugger for JDBC and SQLJ
Create, Alter, Drop, Browse and Filter database objects
Data Management
Edit, Load, Extract, Browse, Update Statistics
Data Management
Data Distribution Editor

View data distribution skews with the Data Distribution Viewer
Security Access Controls

Data Object Editors

Manage Roles

Privileges By User

Manage Roles and Users – Grant and Revoke Privileges

Privileges By Object
Data Web Services

- Web Services without programming
  - Generate Web services from
    - SQL statements
      - SELECT, INSERT, UPDATE, DELETE
    - XQuery
    - Stored procedures
  - Simplified creation of Web services interfaces to your data server
  - Customizable data format
  - Assembles a “ready-to-deploy” solution
  - Integrated deploy and test tools
  - Support for SOAP and REST bindings
  - Support for all DB2 platforms and IDS

An integrated set of web services and data access tools
Data Web Services

1. Create and Test Queries or Stored Procedures
2. Create Service
3. Drag ‘n Drop Resources
4. Deploy Service
5. Test and Deliver

Data Web Services without programming
Data Studio Complimentary Base and Data Studio Developer

IBM Data Studio

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Download it today!
pureQuery is a high-performance Java data access platform focused on simplifying the tasks of developing and managing applications that access data.

**Optimizing Java database development and deployment**

- Productive set of integrated tools, APIs, and runtime for Java applications
- Unified programming interface to query databases and Java objects
- Unleash the power of SQL within Java applications
- Provides infrastructure to greatly improve monitoring and problem determination for Java applications that access DB2
pureQuery supports two programming styles

1. **Inline style – SQL in application**
   - Simplified direct data access via SQL

2. **Method Style – Encapsulate SQL in Java interfaces**
   - Annotated Method Style
     - Define SQL as Java annotations
   - Named query style – extension of Annotated Method Style
     - Define SQL in XML files
pureQuery - “Inline Style”

- SQL statements coded directly in application
- SQL can be fully declared and embedded, or constructed at execution time
- All standard SQL supported including queries, updates, DDL, CALL statements

```java
import com.acme.Customer;
Connection con = DriverManager.getConnection(...);
Data db = DataFactory.getData(con);
Customer c;
int region = 123;
Iterator<Customer> customers =
    db.queryIterator("SELECT custId, name FROM Customer WHERE region=\?1",
                    Customer.class, region);
while (customers.hasNext()){
    c = customers.next();
    System.out.println(c.custId+" "+c.name);
}
((ResultIterator) customers).close(); // best practice
```
Java Persistence Technologies with pureQuery

- **JDBC**
- **SQLJ**
- **JPA API**
- **pureQuery API**
- **iBatis**
- **Spring**

**JPA Runtime**

**pureQuery Runtime**

**High Speed API**

**JDBC w/pureQuery**

**pureQuery runtime provides**
- SQL profiling
- Ability to statically bind SQL statements (with pureQuery Runtime product)
Toughest issue for Web applications – Problem diagnosis and resolution
Customer Job Roles – A Barrier to a “Holistic View”
Typical Customer Pain Points:

- DBA can’t see which app issued a given SQL query
- App developer and DBA can’t track SQL to JPA Query Language transitions
- DBA has no control or visibility into how the WebSphere connection pool is configured
Simplifying Problem Determination Scenario

**Application Developer**
- Available for each db access
  - SQL text generated
  - Access path
  - Cost estimates
  - Estimated response time
  - Elapsed & CPU time
  - Data transfer (getpages)
  - Tuning advice

**Database Administrator**
- Available for each SQL
  - Application name
  - Java class name
  - Java method name
  - Java object name
  - Source code line number
  - Source code context
  - J-LinQ transaction name
  - Last compile timestamp

**Java Profiling**
- pureQuery

**DRDA Extensions**
pureQuery with IBM Runtime/Tooling

Compile-time application details:
- Java class/line number for SQL
- Original query syntax
- Final SQL query syntax

Performance data by application:
- CPU and elapsed time
- Getpages, locks, etc.

App   CPU
A1   2.1
A4   8.3
A5   22.0
Data Studio Administrative Tooling

- Web-based Administration Console (DSAC), part of the complimentary base that products will plug into
- Data Studio Administrator
  - For DB2 LUW (announced today, July 8th, 2008)
- A performance manager
- A query tuner
- A high performance unload
- A recovery manager
Web-based Administration Console (DSAC), part of the complimentary base that products will plug into

- **What is it?**
  - An integral set of features and functions within Data Studio
  - A web based interface to perform operational database management tasks
  - Immediate access to critical data server information and functions from anywhere, anytime
  - Quick analysis and resolution capabilities to identified data server conditions and scenarios

- **What’s available today?**
  - *V1.1.2 for DB2 for LUW*
  - Health and availability monitoring
    - DB2 for LUW V9.5 Fixpack 1
      - Problem determination and recommendations
      - 72 hours of history
      - Ability to monitor up to 100 databases
  - Replication -- monitor Q replication and event publishing, generate replication health reports, and perform basic replication operations

- **What will be available in the future?**
  - Support for all IBM data servers – IDS and DB2 on all platforms (DB2 for z/OS in June 2008)
  - The future home for commonly performed operational database management functions
    - Performance Management, Workload Analysis
    - Query Tuning, Utility Management
    - Configuration Management, Storage Management, …
Administration Console
Health Monitoring

Heatchart – Overall Health Status
Where are the most important hotspots that need my attention?

Dashboard – Adhoc Investigation
Something doesn't seem quite right. I wonder what's happening?

Alert List – Historical Investigation
What happened when I was out for lunch? ... Away for weekend?

Recommendations – Root Cause Analysis
Guide me to the root cause and help me fix it properly; I need to know all the relevant info to make the best decision.
## Administration Console

### Health Monitoring

#### Overall Health Status

<table>
<thead>
<tr>
<th>Category</th>
<th>Issues</th>
</tr>
</thead>
</table>
| Locking           | - Application causing lock escalation  
                    - Table space inaccessible due to quiesced state  
                    - Application waiting indefinitely for lock held by indoubt transaction |
| Database Storage  | - Table space inaccessible because it is offline  
                    - Running out of database storage  
                    - Storage I/O problem |
| Recovery          | - Database inaccessible because recovery is incomplete or failed  
                    - Table space cannot be updated because it is in backup pending state  
                    - Table space inaccessible because it is in drop pending state |
| System            | - Bad response times due to high CPU usage  
                    - Bad response times due to high memory usage |
| Logging           | - Long running app is using too much log space  
                    - Transaction log access problems  
                    - Full log held by indoubt transaction  
                    - Reduced application performance due to logging problems |
| Monitor Status    | - Monitor agent offline  
                    - Monitoring turned off by user |
| Data Server Status| - Data server not responding |
### Administration Console

#### Health Monitoring

### Adhoc Investigation

<table>
<thead>
<tr>
<th>Category</th>
<th>Metrics</th>
</tr>
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<tbody>
<tr>
<td>Locking</td>
<td>- Number of locks held</td>
</tr>
<tr>
<td></td>
<td>- Deadlock rate</td>
</tr>
<tr>
<td></td>
<td>- Lock escalation rate</td>
</tr>
<tr>
<td></td>
<td>- Number of lock waits</td>
</tr>
<tr>
<td>Transaction Activity</td>
<td>- Transaction rate</td>
</tr>
<tr>
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<td>- Failed transaction rate</td>
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<tr>
<td></td>
<td>- Number of in doubt transactions</td>
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<tr>
<td>I/O Activity</td>
<td>- Data Volume</td>
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<tr>
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<td>- I/O Volume</td>
</tr>
<tr>
<td>Connections</td>
<td>- Number of connections</td>
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<td></td>
<td>- High-water-mark of connection</td>
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<tr>
<td>System</td>
<td>- CPU load %</td>
</tr>
<tr>
<td></td>
<td>- Used / Free real memory</td>
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<tr>
<td></td>
<td>- Used / Free virtual memory</td>
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<td></td>
<td>- Used / Free swap memory</td>
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<tr>
<td>Logging</td>
<td>- Logging volume</td>
</tr>
<tr>
<td>Recovery</td>
<td>- Days since last backup</td>
</tr>
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<td>Status</td>
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Administration Console
Health Monitoring
Recommendations
Root Cause Analysis

Table space TS1 is offline

Database is offline
- Table space container is missing
  - A table space container file for TS1 was renamed or moved
  - The physical disk is offline
  - The file system is unmounted
  - The physical disk is corrupted
  - A table space container file for TS1 was deleted
- Table space container is damaged
  - The disk sector is damaged
  - The container file is tampered

Table space TS1 in the TA database is off-line
At the time of the alert, the TS1 tablespace is offline, and as a result, is inaccessible.

Symptoms
The TS1 tablespace is inaccessible.

Causes
A table space is in this state if there is a problem preventing access to one or more of its containers. This is often caused by media problems that are either permanent (for instance, a bad disk) or temporary (for instance, an offline disk or unmounted file system). After the problem has been remedied and the containers are all accessible, the table space can be brought back online.

Diagnosing the problem

Table space container is missing
If one or more containers of a table space cannot be found by the database management system, the table space will be taken offline and put in an inaccessible state.

Table space container is damaged
If one or more containers of a table space are found to be damaged by the data manager, the table space will be taken offline and put in an inaccessible state.
Administration Console
Q Replication Dashboard
Show a health summary for all important objects
**Data Studio Complimentary Base includes health and availability monitoring on the Administration Console**

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To properly configure your download, please review the information below. Select the appropriate offering. When you are done, press the "Continue" button at the bottom.

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| IBM Data Studio Administration Console for Linux (RHEL 4, RHEL 5, SLES 9, SLES 10) | Linux | download |
| Version 1.1.2                                                                 |      |          |
| Languages:                                                                    |      |          |
| English                                                                       |      |          |

| IBM Data Studio Administration Console for Windows | Windows Server 2003 | Windows XP | download |
| Version 1.1.2                                                                 |      |            |          |
| Languages:                                                                    |      |            |          |
| English                                                                       |      |            |          |
Data Studio Administrator

- Object management functions
- Configuration management
- Change management functions
  - Compare, Sync and Alter
  - DDL roundtrip support (undo changes made)
  - Extended Alter
  - Impact Analysis
  - Change model
  - Physical modeling,
  - Unified Change Project
  - Advanced Data Movement (HPU)
  - Scheduling & Enhanced Advanced Deployment
- Task-oriented management
  - Automated maintenance / integrated calendaring
  - Profile setting
  - Exception-based maintenance
Data Studio Administrator

Eclipse UI
- Config
- Change Mgt
- Object Mgt
- Schedule & Plan
- Utils & Commands
- Automation Dev

Web UI
- Monitoring
- Health
- Performance
- Autonomic Function
- Automation Mgt
- Workflow
- Battle Plan
- Schedule & Calendar
- Reporting

Operations Oriented Administration
- "DBA/management"

Object and Command Centric Administration
- "DBA/DEV/Arch"

Object and Command Centric Administration

"DBA/DEV/Arch"
A performance manager

- Problem determination and analysis for all aspects of accessing database
  - Application Monitoring
  - Engine Monitoring
- Integrated OS monitoring
  - Path to Tivoli System Monitoring Agent
- SQL Heavy hitter identification
- SQL tracing
- End-to-end performance monitoring with WebSphere access to DB2 metrics
- Top-n metrics to help DBA focus on the heavy-hitters
- Web-based user interface, integrated with health and availability monitoring (DSAC)
A query tuner

- Query Annotation and transformation
- Access plan graph / Visual Explain
- Query Reports
- Visual plan hint and lockdown
- Query Advisor
- Index Advisor
- Statistics Advisor
- Access path Advisor
Predicate that should be considered for re-write to get better performance

Re-write advice and details

The following predicate on column O_ORDERKEY in table SYSADM.ORDER has better selectivity than other predicates in this query. Consider rewriting it so that it is either an indestructible or a stage-1 predicate:

1. SYSADM.ORDER.O_ORDERKEY + 3 = (SYSADM.LINEITEM.L_LINEITEM + 4)

To filter out unnecessary rows earlier. Check the explanation for more details about possible impact and examples.

The specified SQL statement might perform faster if you rewrite the stage 2 predicate as an indestructible predicate or as a stage 1 predicate. Stage 1 predicates are better than stage 2 predicates because they disallow rows earlier and reduce the amount of processing that DB2 needs to perform during later stages of evaluation. Also, because processing of stage 2 predicates can take many CPU cycles, these predicates are generally slower than stage 1 predicates. Indestructible predicates, which are predicates that match existing index keys, are all stage 1 predicates.

Stage 2 predicates are sometimes called residual predicates, and stage 1 predicates are sometimes called sargable predicates.

For more information about what makes a predicate stage 1 or stage 2, search for information on predicate properties in the Information Management Software for z/OS Solutions Information Center at http://publib.boulder.ibm.com/infocenter/imcین. Generally, the predicate type depends on the structure of the predicate (for example, a range predicate, an INList predicate, a subquery predicate, and so on).
Query Annotation

Transformed shows how the query has been rewritten by the optimizer's query transformation component.

Formatted Query

Query Annotation (Catalog stats, cost estimation)
Annotation showed missing stats
Stats Advisor tells what stats to collect
Run the commands or
Save them for later
Recommendations

DDL to create the new index statement

CREATE INDEX "DB2/0E":LINEITEM_VIRT_IDX_1180338653263" ON "SYSADM":"LINEITEM"("PARTKEY" ASC, "SUPPKEY" ASC, "COMMENT" ASC) FREEPAGE 0 PCTFREE 10;
Access Plan Graph
A query tuner

- Query Annotation and transformation
- Access plan graph / Visual Explain
- Query Reports
- Visual plan hint and lockdown
- Query Advisor
- Index Advisor
- Statistics Advisor
- Access path Advisor
A high performance unload

- High speed extract of data

```sql
SELECT * FROM table_name1
```

HPU will access tables directly

HPU (not the DBMS) will translate the SQL.
Data Studio Recovery Manager

- Wizard driven
  - Object selection (Database, Table space, Table,…… Multiple objects supported)
  - Point in time selection (Time, Quiesce point, Backup point, Log point)
  - Recovery Paths / alternate recovery resources

- Analyzes all possible recovery paths for a version and attaches a relative cost to each

- Recommends the least cost recovery path while allowing other paths to be chosen

- Recovery paths include
  - Traditional restore and log apply (forward recovery)
  - Generating undo operations (backward recovery)

- Recommend set of objects to recover
  - Prompts the user to show related objects (next slide)
  - Assists in including these objects in the recovery process

- Manage recovery via policies: Recovery Policy – Insure that I can recover an application (set of DBMS objects) within twenty minutes to any point in time in the last week. {Supersedes the need for a backup policy}
Data Studio Administrative Tooling -- What’s avail now?

- Web-based Administration Console (DSAC), part of the complimentary base that products will plug into
  - DSAC 1.1.2 for DB2 for LUW (DSAC 1.2 for DB2 for z/OS in June 2008)
- Data Studio Administrator
  - Data Studio Administrator for DB2 LUW
  - DB2 Administration Tool and DB2 Object Comparison Tool
- A performance manager
  - OMEGAMON for DB2 (and DB2 PE for MP)
- A query tuner
  - DB2 Optimization Expert for z/OS
- A high performance unload
  - DB2 High Performance Unload
- A recovery manager
  - DB2 Recovery Expert
IBM Data Studio Vision

An integrated, modular, data management framework 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

*It enables organizations to more efficiently and effectively*

- Respond to emergent, data-intensive business opportunities
- Meet business growth demands while driving down total cost of ownership
- Meet service level agreements for data-driven applications
- Comply with data privacy and data retention regulations
- Secure database access in alignment with corporate policies
IBM Data Studio

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    - IBM Data Studio Administration Console
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    - forums
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