Latest from the lab: Db2 11.1.4.4 and Db2 11.5 Core Engine Enhancements

Keri Romanufa

IBM

Session code: TRIDEX
06/13/2019 12:45
Please note:

- IBM’s statements regarding its plans, directions, and intent are subject to change or withdrawal without notice and at IBM’s sole discretion.
- Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision.
- The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code or functionality. Information about potential future products may not be incorporated into any contract.
- The development, release, and timing of any future features or functionality described for our products remains at our sole discretion.
- Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon many factors, including considerations such as the amount of multiprogramming in the user’s job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve results similar to those stated here.
Notices and disclaimers

© 2019 International Business Machines Corporation. No part of this document may be reproduced or transmitted in any form without written permission from IBM.

U.S. Government Users Restricted Rights — use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM.

Information in these presentations (including information relating to products that have not yet been announced by IBM) has been reviewed for accuracy as of the date of initial publication and could include unintentional technical or typographical errors. IBM shall have no responsibility to update this information. This document is distributed “as is” without any warranty, either express or implied. In no event, shall IBM be liable for any damage arising from the use of this information, including but not limited to, loss of data, business interruption, loss of profit or loss of opportunity.

IBM products and services are warranted per the terms and conditions of the agreements under which they are provided.

IBM products are manufactured from new parts or new and used parts. In some cases, a product may not be new and may have been previously installed. Regardless, our warranty terms apply.”

Any statements regarding IBM’s future direction, intent or product plans are subject to change or withdrawal without notice.

Performance data contained herein was generally obtained in a controlled, isolated environments. Customer examples are presented as illustrations of how those customers have used IBM products and the results they may have achieved. Actual performance, cost, savings or other results in other operating environments may vary.

References in this document to IBM products, programs, or services does not imply that IBM intends to make such products, programs or services available in all countries in which IBM operates or does business.

Workshops, sessions and associated materials may have been prepared by independent session speakers, and do not necessarily reflect the views of IBM. All materials and discussions are provided for informational purposes only, and are neither intended to, nor shall constitute legal or other guidance or advice to any individual participant or their specific situation.

It is the customer’s responsibility to insure its own compliance with legal requirements and to obtain advice of competent legal counsel as to the identification and interpretation of any relevant laws and regulatory requirements that may affect the customer’s business and any actions the customer may need to take to comply with such laws. IBM does not provide legal advice or represent or warrant that its services or products will ensure that the customer follows any law.
Agenda

Data and AI. Meet The Family

Db2 Strategy And Roadmap

Version 11.1
  • Review: Continuous Delivery and Mod 4!

Version 11.5
  • Goals: Convergence! Convergence! Convergence!
  • Platform Support
  • Planned GA Content
  • Looking Forward
Our family of Hybrid Data Management solutions built on the **Db2** common SQL engine

**Write your SQL once deploy against any form factor run anywhere**

<table>
<thead>
<tr>
<th><strong>Db2 Warehouse on Cloud</strong></th>
<th><strong>Db2 on Cloud</strong></th>
<th><strong>Db2 Hosted</strong></th>
<th><strong>Hosted Analytics with Hortonworks</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully-managed, cloud data warehouse</td>
<td>Fully-managed, cloud transactional data store</td>
<td>Not managed - we install Db2 and hand the keys over to you</td>
<td>Hosted Hadoop deployment with Big SQL and Data Science Experience</td>
</tr>
</tbody>
</table>

**Db2 SQL Engine**

<table>
<thead>
<tr>
<th><strong>Integratetd Analytics System</strong> &amp; <strong>Db2 Warehouse</strong></th>
<th><strong>Db2 Big SQL</strong></th>
<th><strong>Db2 Event Store</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated analytics appliance</td>
<td>Open source Hadoop with Hortonworks</td>
<td>Event-driven data processing and real-time analytics</td>
</tr>
</tbody>
</table>
Agenda

Data and AI. Meet The Family

Db2 Strategy And Roadmap

Version 11.1
• Review: Continuous Delivery and Mod 4!

Version 11.5
• Goals: Convergence! Convergence! Convergence!
• Platform Support
• Planned GA Content
• Looking Forward
Db2 Strategy ...in 60 seconds or less....

• Core Database Capabilities, Resiliency, Security
  • Compatibility and gap closing, Simplicity, and other features
  • Resiliency, Availability and pureScale enhancements
  • Performance, performance, performance
  • Security Enhancements
  • Hardware support & exploitation

• Developer Focus
  • Ease of deployment, new languages, preferred IDEs
  • Samples and other getting started materials

• Cognitive Capabilities (aka AI)
Want to know more detail?

• Stick around for the next 70 minutes!

• But... things can (and do) change. So to keep up-to-date:
  • We revisit development priorities frequently (e.g. every quarter) in response to customer and market demand/feedback
  • Public roadmap:
    • http://ibm.biz/AnalyticsRoadmaps

• We want to hear from you!
  • http://ibm.biz/IBMAnalyticsIdeasPortal
Agenda

Data and AI. Meet The Family

Db2 Strategy And Roadmap

Version 11.1
- Review: Continuous Delivery and Mod 4!

Version 11.5
- Goals: Convergence! Convergence! Convergence!
- Platform Support
- Planned GA Content
- Looking Forward
Db2 11.1: Was a new beginning

• With Db2 11.1, Db2 changed to a “continuous delivery” model
  • Explicit plan to deliver function throughout the active development lifetime of a version
  • New versions will still happen occasionally for various reasons. At which point the new version becomes the target for new deliveries

• What does this mean to you?
  • Introduction of Modification levels to the product signature
  • Function delivered continuously during a version’s lifecycle
  • No more “big gulps”, just a series of “little bites”
The Db2 11.1 lifecycle

Regular fix/mod pack deliveries (every 6-12 months)

- With overriding focus on stability for immediate production deployment
- Modifications will contain select functional enhancements (often off by default)
- Spacing likely to start spreading out a bit more as we move to fixes only
What about getting critical fixes in between official updates?

• To ensure that critical fixes are made available as soon as possible, we have introduced the concept of an interim fix (aka “iFix”)

• An iFix is an update based on the last shipped update + a select set of critical updates (Hiper, Security, and “high impact” APARs)
  • Cumulative (i.e. Db2 11.1.2.2 iFix002 contains Db2 11.1.2.2 iFix001)
  • Reset after each new official update (i.e. the first iFix after Db2 11.1.3.3 was Db2 11.1.3.3 iFix001)

• To be released every 2-3 months until the next update occurs
  • Again, spacing likely to increase as we move to fixes only.
GA, FP1, FP2, FP3 Highlights: Mission Critical Workloads

Comprehensive Enterprise Security

**Enterprise Encryption**
- Centralized Key Managers (KMIP)
- PKCS#11 HSM support
- SSL Encryption for non-pS HADR (Linux x86, ALL platforms)

Mainframe Class Availability

**pureScale “for the Masses”**
- Up and running in hours
- Zero data loss DR with HADR
- Multi-switch GDPC (no SPOF)
- Seamless HADR pureScale upgrades
- Restore REBUILD
- Online Index Create
- Add/Drop CF

**Faster MCR by default**
- Improved sockets performance
- Multiple hosts in maintenance mode
- Recover HADR Standby w/ tbsp restore (now for pS)
- Improved XA performance

**HADR ease of use:**
- Export HADR TSAMP configuration to XML file

**Even Greater Availability**
- Online Crash Recovery
- Faster Rollback of Multiple and Large Txn
- ADMIN_MOVE_TABLE advances
- Better tablespace state and replay window monitoring with HADR
- Per partition OLR
- Avoid Lock Escalation
- Timeout support for vendor Archive

Significant Core Database Advances

**Increased Serviceability**
- 16x increase in active log space capability
- Enhanced monitoring for lock and logging events

**Additional Core Function**
- Workload Manager (WLM) multi-tenancy extensions
- Federation simplification and integration

**Simpler, Faster, More Online Upgrades**
- Faster, no need for offline backup
- Streamlined HADR upgrade
- DB2 Version 9.7 direct to 11.1

**Very Large Database Performance**
- Higher user throughput
GA, FP1, FP2, FP3 Highlights: SQL & Warehousing Workloads

**SQL and Compatibility**

**PDF manuals for DB2 LUW v11**
- Multi-Lingual SQL Advances
  - BINaRY, EXTENDED ROWSIZE
  - CHAR(255)

**BLU Restriction Removal**
- Automatic Dictionary Creation improvements
- ALTER VARCHAR/VARGRAPHIC length support
- Codepage 819

**Richer and Even More Compatible SQL**
- JSON support
- BOOLEAN data type
- Common table expression (Db2 for z/OS compatibility)
- WITH and SELECT INTO support
- Alias for XML

**Massive Scale Warehousing at In-Memory Performance**

**MPP BLU Scalability**
- PB scale in-memory warehousing

**Next Gen In-Memory Performance, Function and Workloads**

- Faster ELT/ETL performance
- More Query Workloads Optimised
- More Function supported
  - Generated Columns
  - RCAC
  - User maintained temporal tables

**Continued Performance Improvements**
- Synopsis table enhancements
- Additional SIMD exploitation
- Aggregation enhancements, sort elimination
- INSERT from sub-select – multi-core parallelism improvements
- BLU Secondary Index
Db2 11.1.4.4

**Continuous Delivery – 4Q18 New Capabilities**

- Extent reclaim support for Db2 pureScale
- ALTER TABLESPACE ... REDUCE
- HADR Read on Standby (RoS) enhancements
- ISO JSON SQL functions – Part 1
- Following public standards SQL:2016
- Preview: Support for storage devices using 4K sector size
Extent reclaim support for pureScale

- When table objects are dropped, the storage may not be immediately available to be released from the tablespace
  - Only space above the tablespace high water mark (HWM) can be released

- The ALTER TABLESPACE ... REDUCE statement attempts to reduce the high water mark for the table space by moving live extents to unused ones lower in the tablespace
  - Supported with reclaimable storage DMS table spaces (created in Db2 9.7 or newer)
Extent reclaim

Internal table space metadata extents
- Table 1
- Table 2
- Table 3
- Extent that is allocated to a table space, but not to a table

DROP TABLE 2
DROP TABLE 3

ALTER TABLESPACE ...
REDUCE MAX
A brief history of Db2 & JSON (Part 1)

- Db2 10.5 FP1 introduced JSON NoSQL support
  - Focused on allowing Db2 to participate in the NoSQL paradigm

- This support used undocumented, proprietary JSON SQL functions in Db2 server
  - aka “SYSTOOLS” JSON SQL functions
Enhancements to JSON NoSQL support in Db2 11.1.4.4

- Db2 NoSQL JSON wire listener is enhanced to support latest mongo db client (3.6.3)

- Added support for Kerberos Authentication to wire listener

- Enhanced wire listener script to enable jcc and nosql trace using command line options.
A brief history of Db2 & JSON (Part 2)

Our customers also asked for native SQL support for JSON in Db2

As a tactical response, we revealed our proprietary “SYSTOOLS” JSON SQL functions in DB2 11.1
First wave of new built-in JSON SQL functions!

- New implementations of JSON SQL functions based on recent ISO report on SQL support for JavaScript Object Notation (JSON)

  - The (proprietary) SYSTOOLS functions will be de-emphasized but will continue to be supported

<table>
<thead>
<tr>
<th>Schema</th>
<th>Name</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSIBM</td>
<td>BSON_TO_JSON</td>
<td>Convert BSON formatted document into JSON strings</td>
</tr>
<tr>
<td>SYSIBM</td>
<td>JSON_TO_BSON</td>
<td>Convert JSON strings into a BSON document format</td>
</tr>
<tr>
<td>SYSIBM</td>
<td>JSON_ARRAY</td>
<td>Creates JSON array from input key value pairs</td>
</tr>
<tr>
<td>SYSIBM</td>
<td>JSON_OBJECT</td>
<td>Creates JSON object from input key value pairs</td>
</tr>
<tr>
<td>SYSIBM</td>
<td>JSON_VALUE</td>
<td>Extract an SQL scalar value from a JSON object</td>
</tr>
<tr>
<td>SYSIBM</td>
<td>JSON_QUERY</td>
<td>Extract a JSON object from a JSON object</td>
</tr>
<tr>
<td>SYSIBM</td>
<td>JSON_TABLE</td>
<td>Creates relational output from a JSON object</td>
</tr>
<tr>
<td>SYSIBM</td>
<td>JSON_EXISTS</td>
<td>Determine whether a JSON object contains the desired JSON value</td>
</tr>
</tbody>
</table>
What makes these JSON SQL functions different/better?

- Following a public “standard” (ISO technical report)

- Easier to use
  - No need to qualify or add SYSTOOLS to function path
  - No need to grant EXECUTE privilege

- Simpler and more flexible storage options
  - You choose the stored format: JSON or BSON
  - You choose the table organization: row or column
  - You choose the column data type
    - BLOB, CHAR, CLOB, VARBINARY, VARCHAR
  - Normal Db2 mechanisms can be used to load JSON (or BSON) data into tables (e.g. INSERT, Load, etc.)
  - Conversion functions are now complimentary not mandatory
HADR Read on Standby (RoS) in Mod3 and earlier...

- CREATE TABLE T1
- CREATE INDEX ON T1
- RUNSTATS ON T1
- Etc.
HADR Read on Standby (RoS) in 11.1 Mod 4!

- CREATE TABLE T1
- CREATE INDEX ON T1
- RUNSTATS ON T1
- Etc.

Primary server

Standby server

HADR log flow
Preview: Support for storage devices using 4K sector size

- This support can be enabled by setting the DB2_4KDEVICE_SUPPORT registry variable to ON

- This feature is not supported for production use at this time
  ➢ Try it out and let us know!

- Restrictions and limitations:
  - Single node and DPF only
  - The use of DMS Raw containers is not supported
  - Backup and load copy files will be slightly larger
  - There may be a performance penalty accessing:
    - LOB data stored on 512-byte sector storage
    - Backup or load copy files created prior to the enablement of 4K device support
GoLang for Db2

- Now available @ https://github.com/ibmdb/go_ibm_db

### How to run sample program

**example1.go:**

```go
package main

import (  
  _ "github.com/ibmdb/go_ibm_db"
  "database/sql"
  "fmt"
)

func main(){
  con:="HOSTNAME=host;DATABASE=name;PORT=number;UID=username;PWD=password"
  db, err:=sql.Open("go_ibm_db", con)
```
Agenda

Data and AI.  Meet The Family

Db2 Strategy And Roadmap

Version 11.1
• Review: Continuous Delivery and Mod 4!

Version 11.5
• Goals: Convergence! Convergence! Convergence!
• Platform Support
• Planned GA Content
• Looking Forward
Db2 11.5
Agenda

Data and AI. Meet The Family

Db2 Strategy And Roadmap

Version 11.5

- Goals: Convergence! Convergence! Convergence!
- Platform Support
- Planned GA Content
  - Core Database Capabilities, Resiliency, Security
  - Developer Focus
  - Cognitive Capabilities (aka AI)
- Looking Forward
Convergence

Move all Db2 family members to the same version of the Db2 Common SQL Engine with continuous delivery model
  • Consistent experience
  • Reduced latency in feature availability

Wider availability of existing Db2 Common SQL Engine capabilities across Db2 family
  • Consistent experience

Individual family members pick up updates at different intervals
  • E.g. Db2 offers modification updates every 6-12 months while IIAS, Cloud, and docker-based environments (can) move to a new level every 1-2 months
  • Monthly Early Access Program (EAP) updates
**Db2 11.5**

We plan to release a new version of Db2 in 1H 2019

- This will get all our Db2 and Db2 Warehouse offerings on the same level of the Db2 common SQL engine
- Db2 11.1 will be 3 years old in 2019!!

We will continue to follow the “continuous delivery” paradigm started with Db2 11.1

- GA will include any enhancement that is “ready to go” for on-premise environments plus a number of tech previews
- Steady release of function through subsequent modification updates
- Note: Db2 11.1 shipped 4 modification updates since GAing in 2016, and going forward is planned to be fix packs only
Agenda

Data and AI. Meet The Family

Db2 Strategy And Roadmap

Version 11.5

• Goals: Convergence! Convergence! Convergence!
• Platform Support
• Planned GA Content
  • Core Database Capabilities, Resiliency, Security
  • Developer Focus
  • Cognitive Capabilities (aka AI )
• Looking Forward
Platform Server Support -- non-pureScale

Linux:
RHEL 7.(5), SLES 12 SP(3), Ubuntu 16.(4) LTS:
    Intel x86-64, System Z, Power 8,9 (compat-mode only) LE
Potential futures → RHEL 8.0, SLES 15, Ubuntu 18.4 LTS

AIX:
AIX 7.1 TL(5) SP(3): Power 7 and 8
AIX 7.2 TL(3) SP(2): Power 7, 8, and 9

(x) = “and up” at this level.
e.g. 7.(5) would include 7.6 but not 8.*
Platform Server Support -- non-pureScale

Windows Server 2012, 2012R2, 2016: x86-64
   Potential future → Windows 2019

Windows Desktop 8, 8.1 and 10: x86-64
Platform Support -- non-pureScale

Solaris – Dropped

CentOS – Dropped
Platform Server Support -- pureScale

Linux:

RHEL 7.(5) : Intel x86-64, Power 8,9 (compat mode only) LE
SLES 12 SP(3) : Intel x86-64

*** Also added: CX-4 RoCE & IB adapter support on Intel.

Potential futures → RHEL 8.0, SLES 15

AIX:

AIX 7.1 TL5 SP(3): Power 7 and 8
AIX 7.2 TL3 SP(2): Power 7, 8, and 9

(x) = “and up” at this level.
e.g. 7.(5) would include 7.6 but not 8.*
Agenda

Data and AI. Meet The Family

Db2 Strategy And Roadmap

Version 11.5

• Goals: Convergence! Convergence! Convergence!
• Platform Support
• Planned GA Content
  • Core Database Capabilities, Resiliency, Security
  • Developer Focus
  • Cognitive Capabilities (aka AI)
• Looking Forward
*Developer: Programming IDE*

- Bridging the gap between developers and Db2 application development
- Install Visual Studio Code and install Db2 Extension (link: ibm.co/2wvxcGs)
- Connect with Db2 and test your application
Support for storage devices using 4K sector size

This support can be enabled by setting the `DB2_4KDEVICE_SUPPORT` registry variable to ON.

Allows Db2 databases to be created on devices that only allow 4k IOs.

Restrictions and limitations:
- The use of DMS Raw containers is not supported
- Backup and load copy files will be slightly larger
- There may be a small performance penalty accessing:
  - Small non-inlined LOBs
  - Backup or load copy files created prior to the enablement of 4K device support
• One setting and DONE
  • In Db2 11.5, users can specify a port range for which will be used for all Db2 activities, from before install throughout deployment and during production.

• Configurable options
  • `db2set DB2_FIREWALL_PORT_RANGE=<StartPort>-<EndPort>`
Security - pureScale Support for host-based firewalls
Simplicity - pS cluster wide free space management

Reuse free space regardless of mix of deleting and inserting members.
Free space indicator has been moved to the CF
  • All the members can check for new free space efficiently and reliably

This is the new default behavior starting in Db2 v11.5 GA.

The following registry variable can be set to revert back to old behavior of free space searching:

    db2set DB2_SD_DISABLE_GLOBAL_SPACE_SEARCH=TRUE
Simplicity - Advanced Log Space Management (Tech Preview)

As part of a focus on simplifying log management, the first delivery will result from a focus on avoiding “log full” scenarios caused by long running, low volume transactions hold up log space.

E.g. transactions that span multiple log files with little content in the intermediate files.
Simplicity - ALSM (Tech Preview)

Solution is to extract log records for long running active transactions to a separate file and allow intermediate log files to be closed, archived, and reused.

Log records from long running transaction

Available log files
S0000000.LOG
S0000001.LOG
S0000002.LOG

Active log files
S0000003.LOG

TXID_EXTRACT.LOG
Performance - Columnar Insert/Update/Delete

• Db2 11.5 greatly expands core-friendly parallelism for SQL-based IUD operations on columnar tables
  • KIWI: Kill It With Iron  (Slide stolen from Chris D! Only fruit acronym I have!)
  • Maximize CPU cache, cache-line efficiency

• Critical to maximize ETL/ELT batch performance

• Many general improvements, but primary focus on bulk operations
Performance - Vectorized Insert/Update

Pre-v11.5 approach

1. Form row
   - 1
   - 2
   - 3
   - ...

2. Insert row
   - 1
   - 100
   - abc
   - 1.1
   - 10

3. Indexes
   - 1
   - abc

4. Synopsis
   - 1
   - 100
   - abc
   - 1.1
   - 10

5. Repeat

v11.5 approach

1. Insert column, 2. Repeat, 3. Indexes, 4. Insert Synopsis + gen. Synopsis (vectorized too!)

- 1
- 2
- 3
- ...

- 100
- 110
- abc
- 1.1
- 10

- 2
- 110
- def
- 2.2
- 55

- 3
- 55
- g
- 3.3
- 34

- ...
- ...
- ...
- ...

- 55
- 110
- ...
- ...

- 40
- 99
- ...
- ...

- 1023
- 1024
- ...
- ...

- 1024-2047
- ...
- ...

- 55
- 110
- ...
- ...

- 40
- 99
- ...
- ...

- 1
- abc
- def
- 1.1
- 10
Performance - ETL Performance Example

- Data ingest rate
  - 1 TB/hour before enhancements
  - **Now ~5 TB/hour (IIAS)**
- >10 TB data
- Table remains online
- Combined features (in Db2 W today)
  - GA - ET load
  - future - Columnar Reduced Logging
  - GA - Columnar Parallel insert
  - GA - Columnar Vectorized insert
  - GA - Columnar Optimized bulk insert codepath
Performance- 2x faster pureScale LOAD for range-partitioned tables

LOAD requires the buffer pool to be flushed/purged of the target table data before it starts.

In pureScale v11.1 and earlier, the flush/purges were done individually for each partition X each data part; requiring multiple RPCs to each member.

Improvements:
• Grouped flush/purge for partitions, indexes and LOB columns
Storage Reduction - Grooming for columnar tables

When Automatic Dictionary Creation (ADC) or Vectorized-ADC is used, some portion of the data will be inserted before the dictionary is created

- Grooming is focused on these uncompressed first portions of the data
- NOTE: amount of data inserted before creating a dictionary has been increased.

Grooming simply applies the compression dictionary to the first portion of the data that was uncompressed initially.
Gap Closing - Large Objects in Columnar Tables

Datatypes supported CLOB, BLOB, DBCLOB, NCLOB

Columnar database engine consumers can now avoid storing Large objects in row store tables

Descriptor and in-lined data placed in Columnar data page
  • Larger Objects stored in same buddy space as row tables
Gap Closing - Db2 pureScale Cross-member
Currently Committed

In pureScale environments, the Currently Committed isolation will avoid lock wait when:

- Concurrent access allows a member to use a older (but still valid) version of a page that does not yet show a IUD operation

- The application performing the row read, and the application performing the row UPDATE or DELETE, reside on the same member

- The application performing the row read, and the application performing row INSERTs, reside on any member
In current pureScale environments, the Currently Committed isolation method can still result in a wait if:

- A row-reader finds the row is being updated or deleted (locked) by an application on a different member

This feature brings completeness to Currently Committed behaviour in pureScale environments, by allowing a row-reader to go out to the another member to return the currently committed data from the other members logs.
SQL Compatibility - External Tables

A simple mechanism that lets you access external “files” within an SQL statement just like a table

• Can also be used to load from or unload to external files
• Can be used to define a permanent external table or directly within a SQL statement

Currently supports CSV/delimited files and local/remote sources

Example:

```sql
create external table ext_orders(order_num INT, order_dt TIMESTAMP)
    USING(dataobject('/tmp/order.tbl') DELIMITER '|');
```

```sql
insert into orders (select * from ext_orders);
```

Example:

```sql
insert into orders (select * from external '/tmp/orders.txt' using(REMOUTESOURCE GZIP delimiter ',');
```
SQL Compatibility - DROP/CREATE TABLE [IF EXISTS]

DROP TABLE IF EXISTS FOO

• IF EXISTS clause can be added to suppress SQL0204N errors
• 0 success returned if table exist or not

CREATE TABLE FOO (C1 int) IF NOT EXISTS

• IF NOT EXISTS clause add to suppress SQL0601N error
  • Warning “SQL4136W Table or view "SPRINGGA"."FOO" already exists.” returned if table does exist
• No impact if table exists
• Table created as normal if not exists
Developer - Use Db2 SQL to query Blockchain (Tech Preview)

1. A Db2 federation wrapper that provides:
   - Connectivity to Blockchain Transactions via Hyperledger Rest API
   - Rewriting SQL queries into equivalent Hyperledger API calls to query data.

2. Using Zeppelin (can use any JDBC supported tool) as end user tool to connect to Big SQL (Db2).

3. Query Blockchain via Zeppelin using SQL.

Honors the security measures in place at Blockchain level and Db2 level for end users.
AI - Db2, the only database w/ ML Optimizer in addition to Cost-based Optimizer

- Number of rows flowing through the various operations impacts performance for most common issues and is calculated via cardinality estimates
- Basic tuning to improve cardinality estimation is high impact
- **Phase 1 – Cardinality Estimation**
  - Initial phase – Support equality & range local operators with no expressions
  - Future phases – Cardinality support for expressions, predicates & BLU, support for join enumerations,
Conversational analytics is the future…

• Data scientists often face the challenge of exploring data sets that are not familiar to them
  • Time consuming, Not sure what to look for
  • Need understanding of what is in the data set

• Need an intuitive data exploration tool
  • Alexa, Google Home, etc. prove trend
  • Natural extension of conversation to data
  • Provide multiple views of the data with minimal touch

  • Currently in Beta
  • Seamlessly plugs and plays with Db2
Availability: Replication of Columnar Tables (tech preview)
IBM Data Replication for Db2 Continuous Availability Feature (Rep4CA)

Built for Hybrid Cloud

- Deploys with common container
- Designed for on-premises, private and public Cloud
- Docker-based container with REST APIs
- Integrated User console for setup, management and monitoring
- Built-in 90 Day Trial Demo

✓ Pre-configured & customized for replicating Columnar Analytics workloads
Agenda

Data and AI. Meet The Family

Db2 Strategy And Roadmap

Version 11.5

- Goals: Convergence! Convergence! Convergence!
- Platform Support
- Planned GA Content
- Looking Forward
  - Core Database Capabilities, Resiliency, Security
  - Developer Focus
  - Cognitive Capabilities (aka AI)
Security - Schema level authorization

Administration = DBADM
Security = SECADM, ACCESSCTRL
Access = DATAACCESS
Load = LOAD

Administration = SCHEMAADM
Security = ACCESSCTRL
Access = DATAACCESS, SELECTIN, INSERTIN, UPDATEIN, DELETEIN
Load = LOAD

Administration = Owner/CONTROL
Security = Owner/CONTROL
Access = SELECT, INSERT, UPDATE, DELETE
Load = LOAD
Performance – (HTAP) Trickle Columnar Insert

| 1  | 100 | abc  | 1.1 | 10 |

Post-v11.5 approach

Extents

Row-like format

Columnar format

Potential Future
Performance - Improved Compression of String Datatypes

- Frequency-based compression difficult for some string datasets
- String data dominates storage cost
- Add another level of pattern-based page compression
Performance - Reduced logging for Columnar

• An enhanced version of “Not Logged Initially” (NLI)
  • Table contents will be preserved during rollback, crash recovery, and rollforward recovery to END of online backup

• Very large INSERTs possible without running out of log space
  • Up to 95% less data logged!

• Unlike NLI, reduced logging is not a universal table property. Instead, it is only relevant to operations driving a large amount of insert work against a table
  • E.g. Insert from subselect via External Table, Create Table As, Update statements, INGEST, MERGE, Insert statements, etc
  • Reduced logging takes effect after a certain amount of insert work has already occurred

• This is the default (and only behaviour in Db2 Warehouse on the Cloud (Db2WoC))
Simplicity - Adaptive WLM

• Objective is to deliver automatic workload management within Db2 that ensures system stability and responsiveness with zero tuning
  • Don’t overcommit the system yet ensure it’s well utilized
  • Schedule jobs appropriately to ensure fairness and appropriate responsiveness

• Basic premise:
  • Incoming work guided to different “lanes” based on expected resource consumption and duration
    • Each “lane” gets a defined resource allotment to maximize predictability
    • Resources considered: Sort memory & CPU
  • Scheduling of work in each “lane” based on dynamic view of resource availability
    • Admission of new work is on the fit of the work to the available resources in that class and latency
    • Includes historical feedback based on past executions
The introduction of Adaptive WLM

- Currently being used by default in Db2 Warehouse family
  - New default workload configuration

- Will introduce as new, optional behaviour for default configuration in Db2 VNext in an early update
  - Need to validate further with more row-centric workloads

- User defined capabilities to be rolled out in later updates
Bringing AWLM to Db2...

• AWLM will have a staged delivery to Db2
  • Stage 1: AWLM available for use by analytics (BLU) customers
    • Available to customers who set DB2_WORKLOAD = ANALYTICS
  • Stage 2: AWLM available for use by all Db2 customers

• Moving to AWLM will require an outage to allow the implementation of a new default system configuration
  • A new “opt-in” procedure will be provided
Developer – Additional JSON support

Objective:
Complete implementation of the current set of defined ISO JSON SQL functions.

This includes:

<table>
<thead>
<tr>
<th>Schema</th>
<th>Name</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSIBM</td>
<td>IS JSON</td>
<td>Validates format of JSON</td>
</tr>
<tr>
<td>SYSIBM</td>
<td>JSON_ARRAYAGG</td>
<td>Creates JSON array from input key value pairs</td>
</tr>
<tr>
<td>SYSIBM</td>
<td>JSON_OBJECTAGG</td>
<td>Creates JSON object from input key value pairs</td>
</tr>
<tr>
<td>SYSIBM</td>
<td>JSON_TABLE</td>
<td>Creates relational output from a JSON object (full ISO JSON specification)</td>
</tr>
</tbody>
</table>
Up to 10x better query performance powered by an ML-Optimizer

Enriched and faster data exploration by using NLQ and Db2 ADE

No data movement & a single view on all data delivered by Data Virtualization

IBM Db2 the AI database

Confidence-based query results leveraging ML-SQL

Model Complex Relationships by using Db2 Graph & SQL

Build AI based applications by using Python, GO, JSON and Jupyter notebooks