DB2 for z/OS Leadership in the Era of Cloud, Analytics, and Mobile

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Updated since …

Insight 2015
Lead in the Insight Economy
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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.
Agenda

• Introduction
• DB2 11 update
• DB2 12 ESP
• SQL as a service via RESTful APIs
• Cloud style provisioning
• Apache Spark and Hadoop integration
• Recent analytics advancements
• DB2 12 quick preview
Introduction
What does the next generation database look like?

✓ Advanced in-memory technology
✓ Super fast for transactional and analytic workloads
✓ Scalable performance
✓ Available, reliable, resilient, secure
✓ Simple, intelligent and agile
✓ Easy to deploy, cloud ready

DB2 for z/OS!
Extend the unique value of System z

Scalable  Reliable  Efficient

Secure  Highly Available

Empower the next wave of applications

Cloud
Self provisioning, Multi-tenancy, Self managing, guaranteed SLAs

Analytics
Real time analytics integrated with OLTP

Mobile
Agile development, RESTful APIs, Enterprise mobile scale
DB2 11 Update
Affordable for every workload with out-of-the-box savings

- Up to 10% for complex OLTP
- Up to 15% for update intensive batch
- Up to 40% for queries

Business critical analytics

- Expanded SQL, XML and analytics capabilities
- Hadoop integration, NoSQL/JSON support
- In-transaction real-time scoring
- Advanced QMF analytic capabilities with mobile support

Enhanced Resiliency and Continuous Availability

- Fewer planned outages, fewer REORGs, faster recovery
- Transparent archiving, access warm/cold data in single query

Simpler, faster upgrades for faster ROI

- 16x faster catalog migration
- No application changes required for DB2 upgrade
- Product quality and stability – raised the bar
DB2 11 Out-of-the-box stability

- 41% fewer APARs than DB2 10 at the same point post-GA
- 58% fewer PMRs

V9 vs V10 vs V11 APARs (quarters)

V9 vs V10 vs V11 PMRs (quarters)
DB2 11: Impressive Performance for Queries and Analytics

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<th>Query</th>
<th>% CPU Improvement</th>
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<td>TPC-H queries</td>
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<td>Customer queries 3</td>
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<td>TPC-H executed in IDAA</td>
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<td>TSO Batches non-SHR</td>
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<td>High Insert Seq</td>
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DB2 12 ESP
Announcement
Cypress ESP to start in March, 2016

ESP announced Oct. 6, 2015
Scale and speed for the next era of mobile applications
Over 1 Million Inserts per second measured, will scale higher
256 trillion rows in a single table, with agile partition technology

In Memory database
23% CPU reduction for lookups with advanced in-memory techniques

Next Gen application support
360 million transactions per hour through RESTful web API

Deliver analytical insights faster
Up to 2x speedup for query workloads, 100x for targeted queries
SQL as a service via RESTful APIs
New Era Application Characteristics

• Applications evolve rapidly as the needs for mobile and Web presence try to keep pace with internet user needs

• Application developers are increasingly looking for solutions that allow nearly continuous integration of application changes

• RESTful APIs and JSON based protocols are appealing to these developers
DB2 for z/OS, adapting to modern Application Development paradigms

- Many modern application developers work with REST services and JSON data formats
- **DB2 Adaptor for z/OS Connect** provides the means to do this
- Available via DB2 Accessories Suite
- DB2 10 and 11 as well as DB2 12
- Data Studio enhancements for developing z/OS Connect services

```
```

```
{"customer":
  {"ID": "32537",
  "Name": "Bob Rady Enterprises"}
}
```

![Diagram showing RESTful connection to DB2 with JSON data format](diagram.png)
DB2 Adapter for z/OS Connect Overview

Getting REST and JSON into your mainframe environment in a way that enables you to best take advantage of the assets that exist there:

- **WebSphere Liberty Profile for z/OS** - WLP is a faster lightweight version of WebSphere.
- **z/OS Connect** – z/OS Connect is a special Java Servlet in WLP to handle connectivity to z/OS services, HTTPS request and reply, REST/JSON message formatting and transformation, forward message to registered service providers, configure services, discovery service, security, auditing for enterprise data.
- **REST** – Representational State Transfer … Stateless client-server protocol, typically using HTTP URLs that map to a ‘service’, such as ‘query account’ or ‘update data’
- **JSON** – JavaScript Object Notation … a standard of representing data as a set of name/value pairs. This is passed back and forth along with REST request/responses
- **DB2 Adapter for z/OS Connect Service** – Maps to a single SQL statement (eg. INSERT, SELECT, CALL) execution.
DevOps: Continuous delivery for the mainframe
New capabilities speed delivery of interdependent, multi-platform applications

IBM UrbanCode Deploy for z/OS

- Download build output from artifact repository on z/OS
- Deploy to z/OS or RD&T to test application changes

NEW! DB2 Plugin, available

- Unified solution for continuous delivery of heterogeneous enterprise applications
- Accelerate delivery and reduces cycle time to develop/test multi-tier applications across heterogeneous environments and platforms
- Reduce costs and eliminate delays for delivering mainframe applications
- Minimize risk and improve productivity across disparate teams with cross-platform release planning
DB2 for z/OS: Online changes and 24x7 support fits the needs of the modern world

- DB2 data sharing and z/OS Parallel Sysplex: the most advanced DBMS clustering architecture in the industry
  - Rolling maintenance keeps DB2 available 24x7
    - Entire stack: hardware, OS, CFs, DB2
  - Rolling upgrades & DB2 co-existence provide 24x7 for DB2 release migrations (as well as fallback, if needed!)
  - Removal of single points of failure
  - Special-purpose hardware for unmatched performance and availability

- DB2 online schema change support, including DB2 11 improvements:
  - BIND / DDL break-in for persistent threads
  - Online change of partition limit keys, dropping columns

- Online database REORGs, including DB2 11 improvement
Cloud-style provisioning
New z/OS Cloud Open Beta – Turn z clients into Service Providers

- Bluemix
- ISV written Consumer Portal
- IBM written Service Manager
- Chef Scripts
- Open Stack HEAT Template
- Urban Code Deploy w/ Patterns

Driving to on-demand:
- Self-service end-user experience
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured service and chargeback

Sign up at: http://www-03.ibm.com/systems/z/solutions/hybrid-cloud/
IBM z/OS Management Facility (z/OSMF) delivers on the IBM’s strategy for mainframe simplification and modernization

Is a free feature of z/OS

Provides a modern browser based interface for managing the z/OS system

Helps to automate management tasks to

- Reduce the learning curve and improve productivity
- Helps guide users easily through tasks with embedded user assistance (such as wizards)
- Helps accelerate productivity, making navigation and task steps more seamless
- Makes administration more intuitive

Extend to simplify management of z/OS subsystems like DB2
DB2 Fast Provisioning

• z/OSMF support for automated DB2 install/migration workflows
  ▪ Sysprog productivity
  ▪ Cloud-style DBaaS
  ▪ Sub system lifecycle support

• DB2 Services
  ▪ DB2 plans to provide customizable templates to define zOSMF workflows for automatic provisioning of DB2 resources at various granularities:
    • DB2 install/migrate
    • Schema provisioning
  ▪ DB2 will also provide RESTful APIs to call these provisioning services from a variety of tools
    • IBM Bluemix, IBM Data Server Manager (DSM), or other service catalogs/portal
Prerequisite for automated migration with z/OSMF

- DB2 11 for z/OS
  - APAR PI38553, PTF available in Feb.

- z/OS V2R1
  - SPE 3
    - PI32148 / UI90019
    - PI32157 / UI90020
    - PI32158 / UI90021
    - PI32163 / UI90022
IBM RITz

Built on:
- RD&T
- Bluemix DevOps Services
- Application Delivery Intelligence

With Extensions:
- z/OS Editor: COBOL, JCL
- z/OS Shells: TSO, USS, CICS
- SaaS: Pay as You Go Tools

On-Premises Integration:
- Push Application from on-prem
- Push tests & data from on-prem
- Treated like another test LPAR

Introductory video: https://www.youtube.com/watch?v=aJeROJGKiPg
Recent Analytics Advancements
Hybrid transaction/Analytical processing

The hybrid computing platform on z Systems supports transaction processing and analytics workloads concurrently, efficiently and cost-effectively. Delivers industry leading performance for mixed workloads.

The unique heterogeneous scale-out platform in the industry.

Superior availability, reliability and security.

DB2 Analytics Accelerator and DB2 for z/OS

A self-managing, hybrid workload-optimized database management system that runs every query workload in the most efficient way, so that each query is executed in its optimal environment for greatest performance and cost efficiency.
Enable real-time analytic solutions on a single, integrated system combining transactional data, historical data and predictive analytics

- In-database transformation and multi-step processing
  - Enables faster and more sophisticated reporting, allowing for deep application integration
  - Accelerator-only tables store intermediate or final results of data transformation or reporting processes

- In-database analytics
  - Accelerate predictive analytics applications
  - Enables SPSS / Netezza Analytics(INZA) data mining and in-database modeling to be processed within the Accelerator

- Incremental Update
  - Load and continuous operation improvements

- Data Encryption
  - Extend advanced security with encryption of data at rest and in motion while taking advantage of the renowned built-in security of System z

- Call Home Capability
  - Enhance systems management capabilities and improve serviceability
IBM DB2 Analytics Accelerator Loader for z/OS

Use Cases
- Load DB2 data and Non-DB2 data directly to IDAA
- Easy consolidation of enterprise data on secure z platform
- Exploit Accelerator to join DB2 and non-DB2 data
- New analytic workload on DB2 for z/OS
- Data Validation, In accelerator transformations (ELT)
- Analytics of SMF data, DB2/IMS performance data, etc.

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Apache Spark and Hadoop Integration
z/OS Data is important for Hadoop / Spark Analytics

Transaction and Log Data are consistently PART OF the analysis.

Evidence of the value of combining traditional data with Hadoop / Spark analytics.

Moving Hadoop / Spark processing closer to the data on z Systems can be advantageous.

Spark and z Systems

- Spark processing of z data
  - Access to z data
    - JDBC access to DB2 z/OS, IMS ✔
    - Rocket Mainframe Data Service for Apache Spark ✔
  - Spark running on z Systems
    - z/OS ✔
    - Linux on z Systems ✔
    - Accelerator, i.e., IDAA – future direction

[IBM Packages for Apache Spark](https://www.ibm.com/developerworks/java/jdk/spark/)
InfoSphere z Systems Connector for Hadoop

- Two significant needs to integrate Big Data Analytics with DB2 for z/OS:
  - Merge this data with trusted OLTP and analytics data from z Systems data sources
  - Integrate this data so that insights from Big Data sources can drive business actions
- Connectors to allow BigInsights to easily & efficiently access DB2 data
- DB2 11 provides the connectors & the DB capability to allow DB2 apps to easily and efficiently access Hadoop data sources

• Relational projection of IMS model

IBM BigInsights

- New user-defined functions and generic table UDF capability

Lead in the Insight Economy
DB2 as Spark Data Source
Apache Spark z/OS
Available since Year End 2015 via Open Source

Securely Integrate OLTP and Business Critical Data
Integrate:
• DB2 for z/OS, IMS, VSAM, PDSE, Syslog, SMF, ...
• Remote (non-z) data on distributed servers, Hadoop, Oracle, ...

NEW!
Partnership with Rocket Software supporting Apache Spark z/OS
DB2 12 Quick Preview

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DB2 12 Outlook: Taking DB2 to a New Level

Extending the core

• Expanded in-memory processing
• CPU reductions expected for most workloads
• Faster insert and easier insert performance mgmt
• Streamlined and less disruptive migrations

Empowering the future

• DevOps and Agile development: More schema and partition flexibility
• Stay ahead of mobile, internet-of-things: Extreme scale tables
• Easier to use, more self-optimizing system
• Cloud-style as-a-Service provisioning
• SQL enhancements for improved analytics, application porting, and developer productivity
DB2 12 Performance Enhancements

- In-memory contiguous buffer pools
  - Direct row access in-memory, avoid GetPage overhead
- In-memory index for fast traversal
- More granular Global Commit LSN
  - Potential huge improvement in lock avoidance (data sharing)
  - Also will help space reuse for insert
- Faster INSERT performance
  - 3x faster, 20% less CPU
  - Non-clustered, journal table pattern (common)
- >4G active logs
- BP size limit raised to 16 TB
DB2 12 Query Performance Enhancements

- Up to 25% CPU improvement for traditional query workloads
- 2X improvement for modern SQL applications
  - Performance improvements for next gen SAP applications
  - Real-time analytics, complex OLTP workloads
- 100% zIIP eligibility for parallel query child tasks

NOTE: Modern applications contain more complex SQL patterns (targeted in DB2 12), and more sorting, joins, stage 2 predicates etc.
  - These complex patterns are less common in traditional OLTP/batch
DB2 12 Significant CPU Reduction In DB2 Queries
(work still in progress)
DB2 12: Simplicity and RAS

- Dynamic SQL Plan Stability
  - Stabilize performance of repeating dynamic SQL statements
- RUNSTATS automation
  - Optimizer automatically update profile with RUNSTATS recommendations
- RLF control for static packages
- LOB compression
  - Using zEDC hardware
- DRDA Fast Load
  - Callable command for fast load of data into DB2 directly from files on distributed client
DB2 12: application enablement

- Several SQLPL Improvements
  - SQLPL in triggers, including versioning and debug support
  - SQLPL obfuscation
  - Support for constants
  - Dynamic SQL in SQLPL UDFs and stored procedures
- ARRAY and LOB global variables
- Full MERGE support
- New SQL Pagination syntax
- Piece-wise modification of data (DELELTE)
- XMLModify multiple update support
- Bi-temporal improvements
  - Inclusive/inclusive support
  - Temporal RI
  - Logical transaction for system time
DBA Productivity – DB2 12 Goals

• Relief for table scalability limits
• Simplify large table management
• Improve availability
• Agile schemas (more online schema changes)
• Security and compliance improvements
• Streamline migration process
• Utility performance, availability, usability
Migration & Catalog

- Single phase migration process
  - No ENFM phase
  - New function activated through new command
    - -ACTIVATE NEW FUNCTION
  - APPLCOMPAT rules, fallback rules continue to apply
- BSDS conversion to support 10 byte log RBA is pre-requisite
- BRF is deprecated
  - BRF pagesets still supported, but zparm & REORG options are removed
- Temporal RTS tables
  - Defined in catalog, enablement is optional
Beyond DB2 Cypress

- **Extend Reach**
  - Add AD community and Architects

- **Focus**
  - New workloads/workload growth
  - Continuous delivery, even more agile
  - Quality

- **Themes**
  - Modern Application Development
  - Analytics
  - DB2 in a Cloud
  - Core Technology
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