



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

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Updated since ...

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# 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

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# What does the next generation database look like?



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- ✓ 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



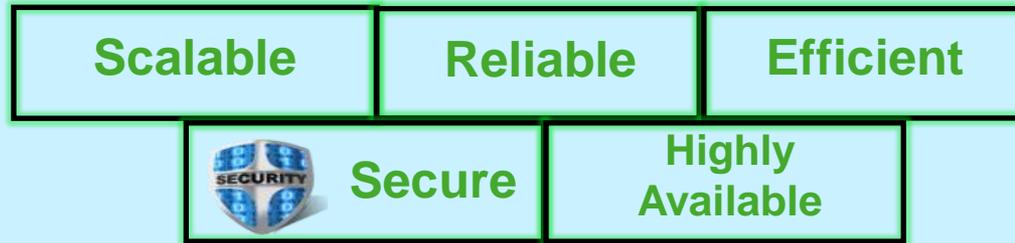
## DB2 for z/OS!



## Extend the core

reliability:availability:scalability:security

Extend the unique value of System z



## Empower the future

analytics:autonomics:cloud:mobile

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

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## ***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***

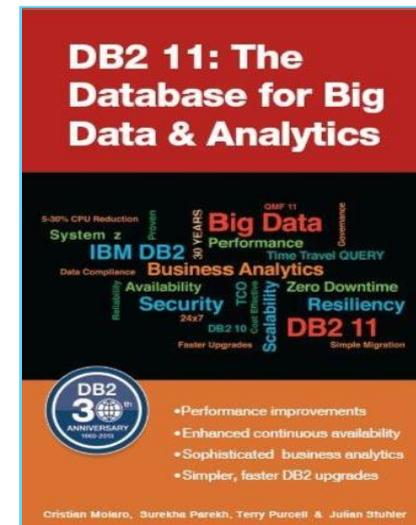
- Expanded SQL, XML and analytics capabilities
- Hadoop integration, NoSQL/JSON support
- In-transaction real-time scoring
- Advanced QMF analytic capabilities with mobile support

## ***Enhanced Resiliency and Continuous Availability***

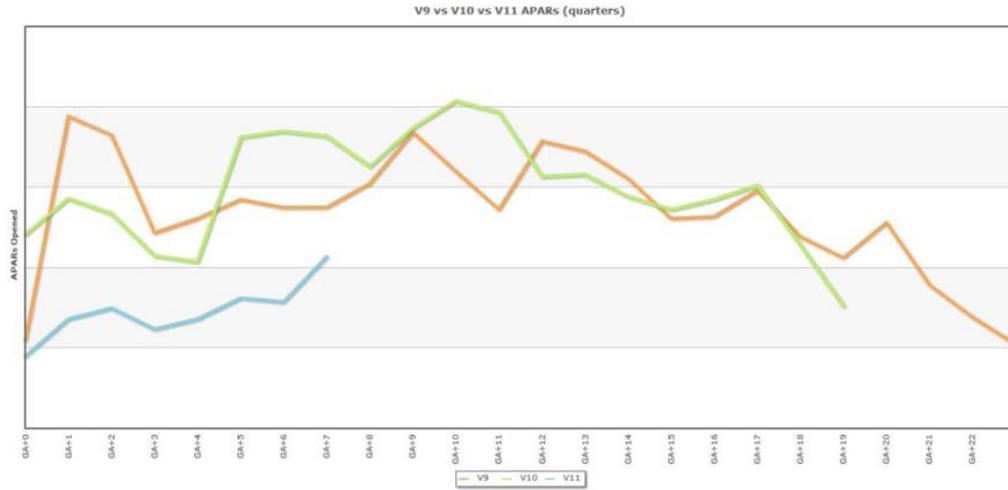
- Fewer planned outages, fewer REORGs, faster recovery
- Transparent archiving, access warm/cold data in single query

## ***Simpler, faster upgrades for faster ROI***

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



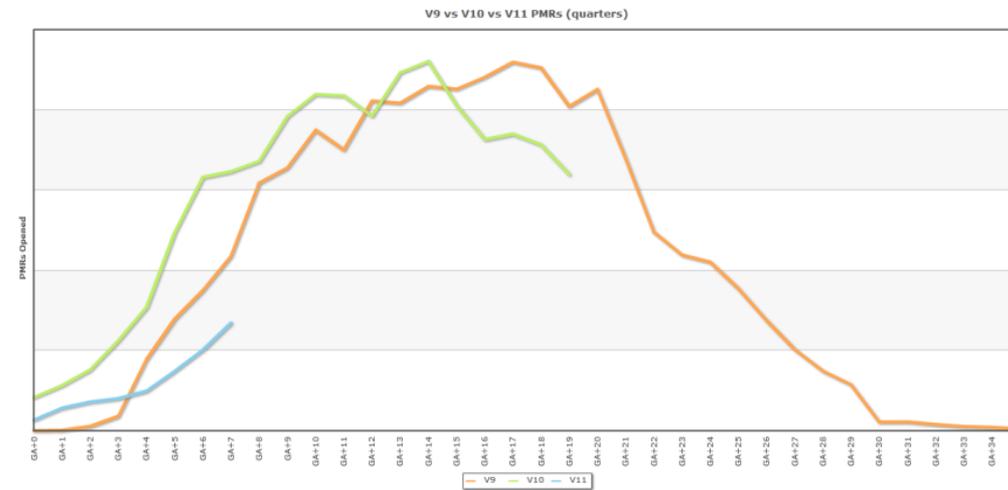
# DB2 11 Out-of-the-box stability



**41% fewer APARs**



Than DB2 10 at the same point post-GA



**58% fewer PMRs**

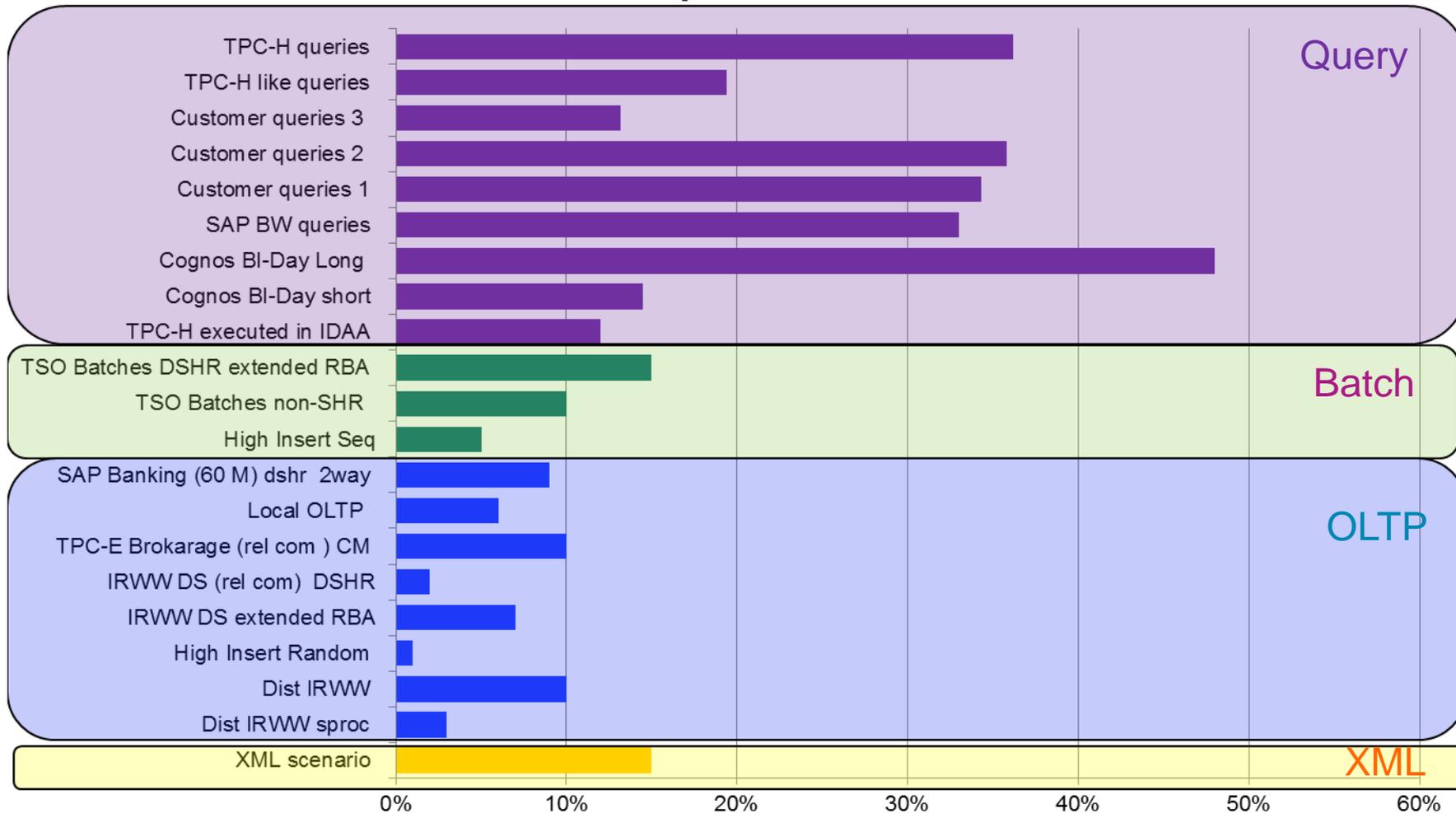


# DB2 11: Impressive Performance for Queries and Analytics



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## DB2 11 % CPU Improvement From DB2 10





# DB2 12 ESP Announcement

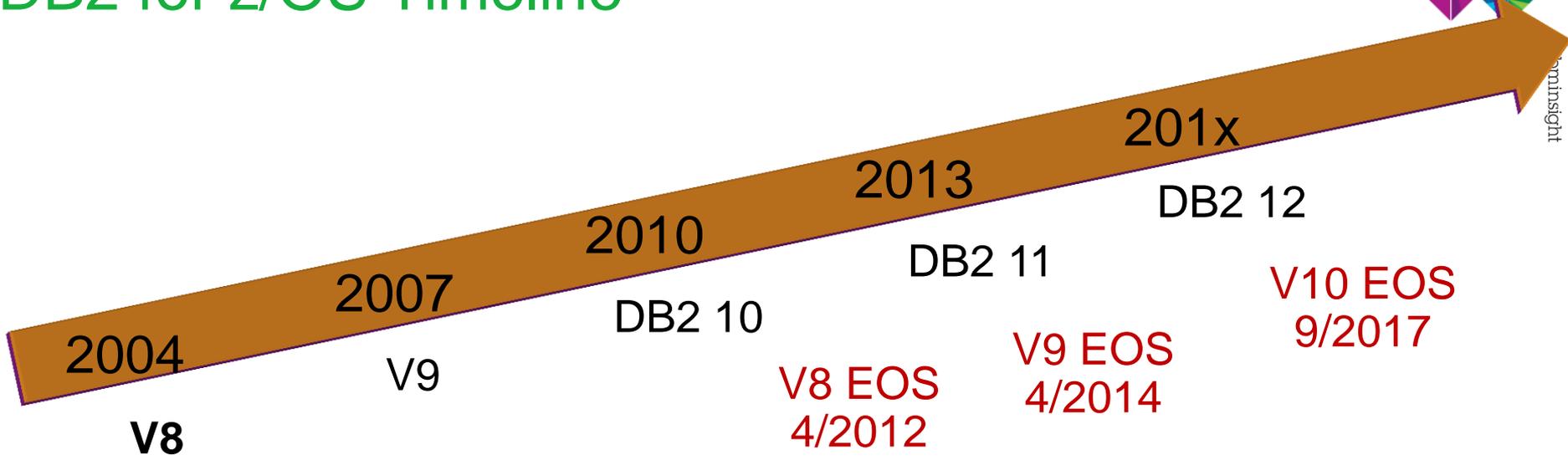
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# DB2 for z/OS Timeline



Version	GA
V7	3/2001
V8	3/2004
V9	3/2007
V10	10/2010
V11	10/2013

Cypress ESP to start in March, 2016

ESP announced Oct. 6, 2015

# DB2 12 for z/OS:

Redefining enterprise IT for digital business  
and the mobile app economy

An early look

## 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

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# New Era Application Characteristics

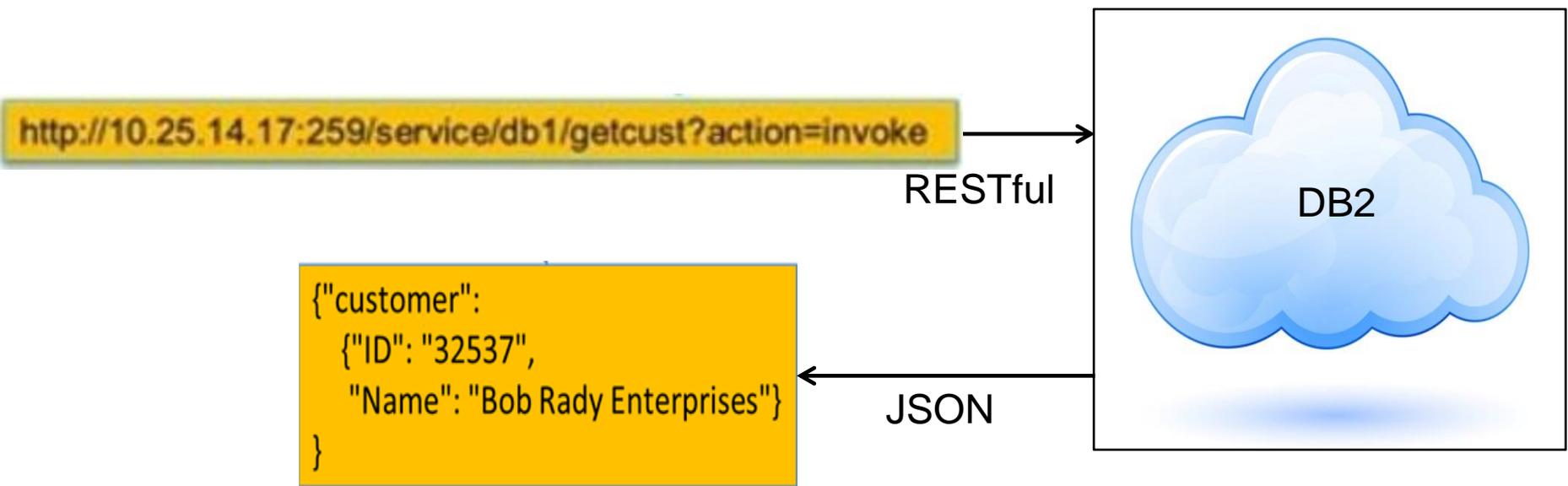
- Applications evolve rapidly as the needs for mobile and Web presence try to keep pace with internet user needs
- Application developers are increasingly looking for solutions that allow nearly continuous integration of application changes
- RESTful APIs and JSON based protocols are appealing to these developers



# DB2 for z/OS, adapting to modern Application Development paradigms



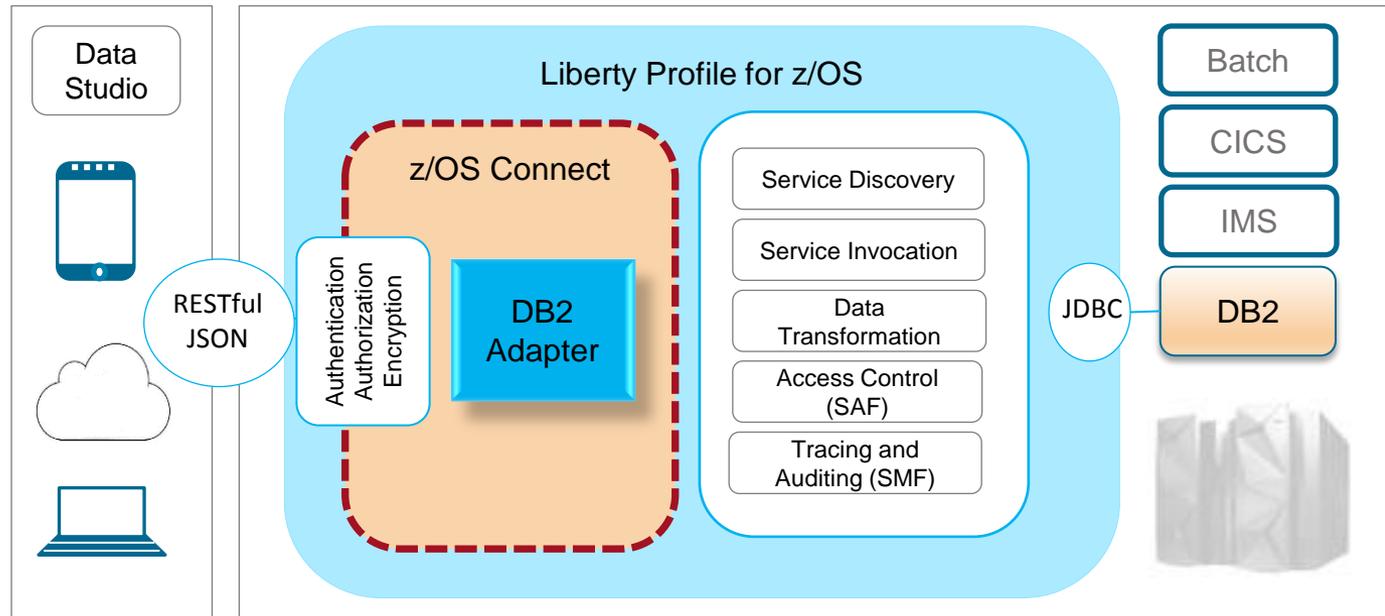
- Many modern application developers work with REST services and JSON data formats
- **DB2 Adaptor for z/OS Connect** provides the means to do this
- Available via DB2 Accessories Suite
- DB2 10 and 11 as well as DB2 12
- Data Studio enhancements for developing z/OS Connect services



# DB2 Adapter for z/OS Connect Overview



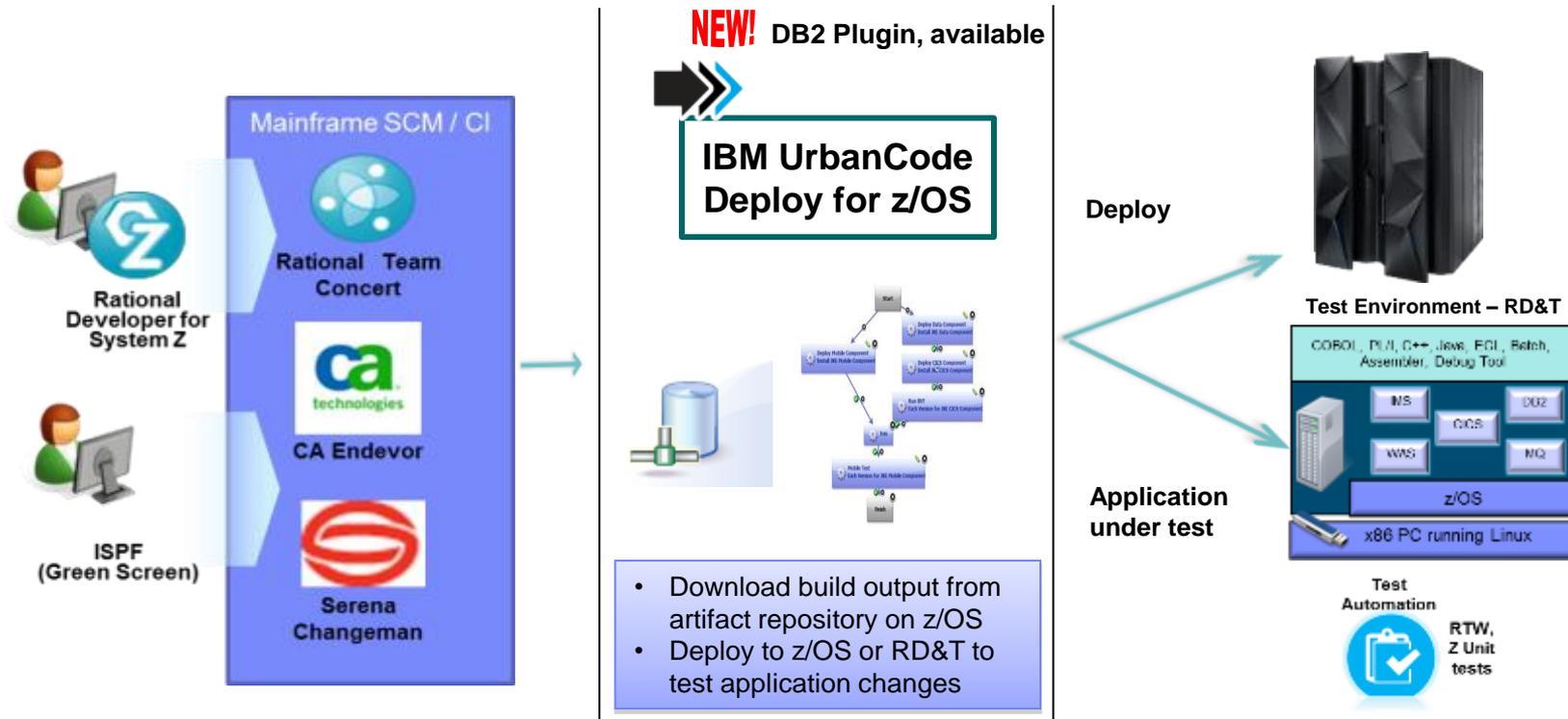
Getting REST and JSON into your mainframe environment in a way that enables you to best take advantage of the assets that exist there:



- **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



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- **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



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- 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

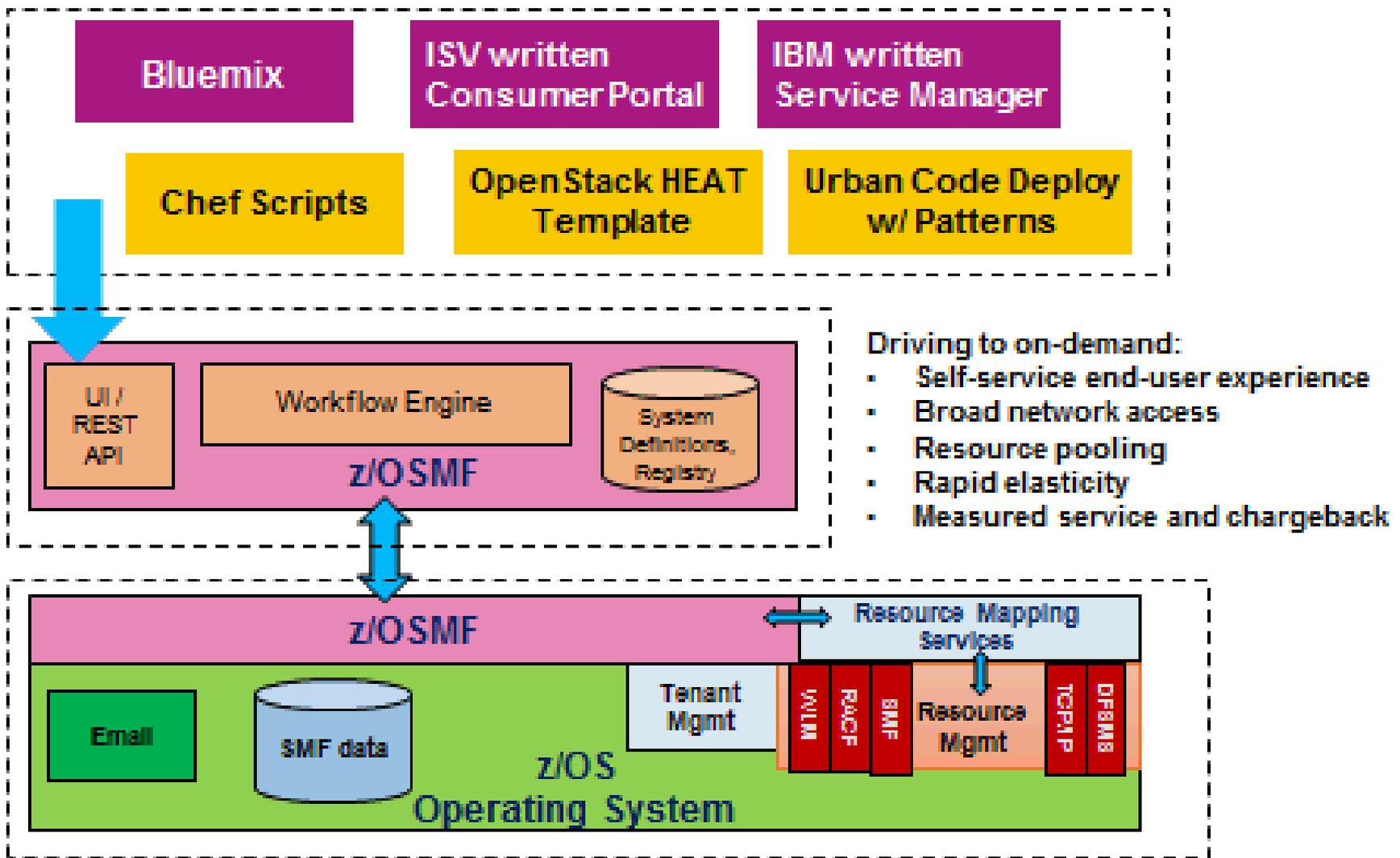
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# New z/OS Cloud Open Beta – Turn z clients into Service Providers



Sign up at: <http://www-03.ibm.com/systems/z/solutions/hybrid-cloud/>

# z/OS Management Facility



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- 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



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- 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



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- DB2 11 for z/OS
  - APAR PI38553, PTF available in Feb.
- z/OS V2R1
  - SPE 3
    - PI32148 / UI90019
    - PI32157 / UI90020
    - PI32158 / UI90021
    - PI32163 / UI90022



# z/OS aaS in IBM-managed Public Cloud

## Hybrid cloud testing solution



### IBM RITz

#### Built on:

- RD&T
- Bluemix DevOps Services
- Application Delivery Intelligence

#### With Extensions:

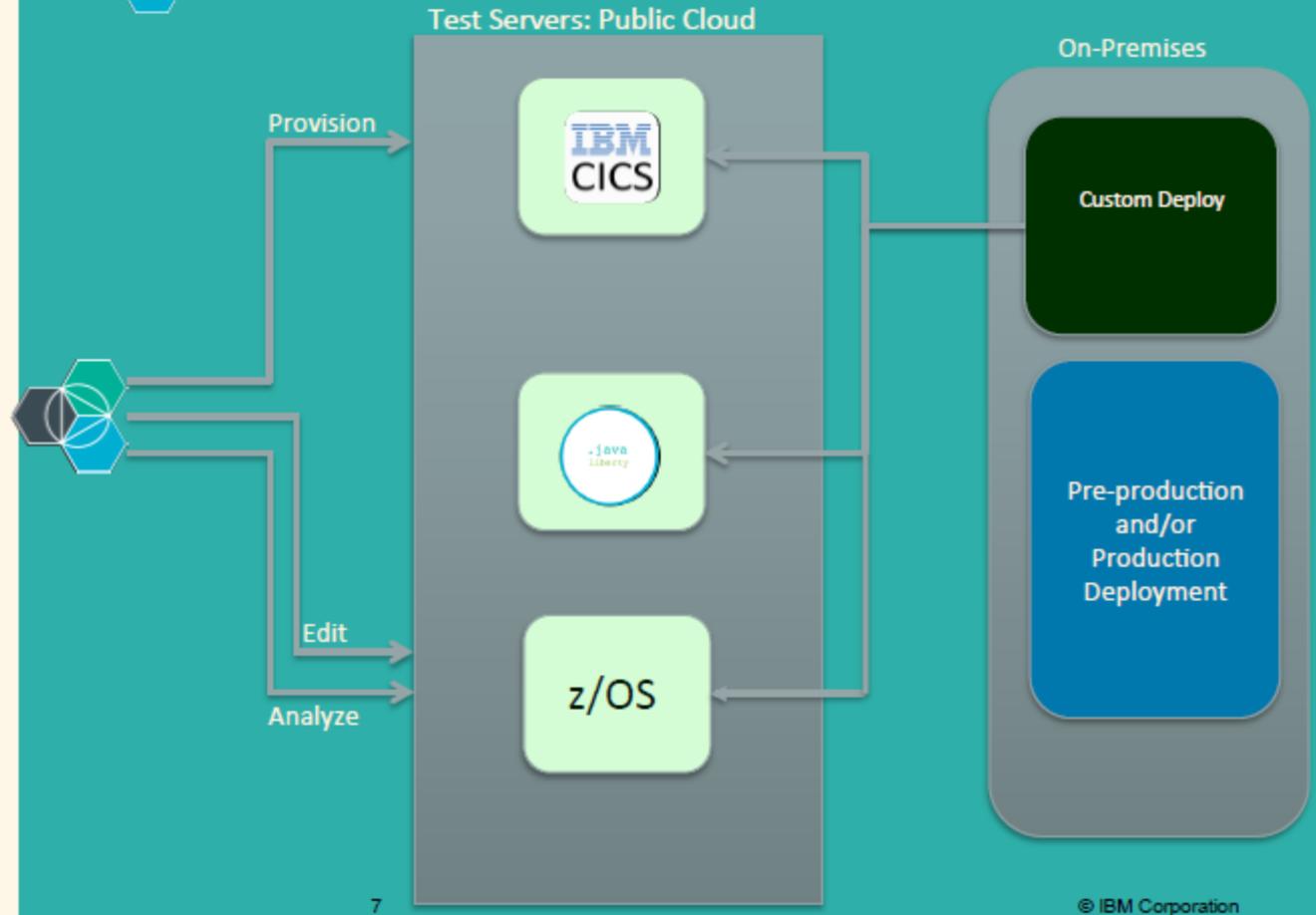
- z/OS Editor: COBOL, JCL
- z/OS Shells: TSO, USS, CICS
- SaaS: Pay as You Go Tools

#### On-Premises Integration:

- Push Application from on-prem
- Push tests & data from on-prem
- Treated like another test LPAR



### IBM RITz Rapid Intelligent Testing for z Systems



Introductory video: <https://www.youtube.com/watch?v=aJeROJGKiPg>



# Recent Analytics Advancements

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# Hybrid transaction/Analytical processing



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Transaction Processing

Analytics Workload



## 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



# IBM DB2 Analytics Accelerator Version 5.1 – Highlights (Announced Oct. 6, 2015)



## Speed

Dramatically improve query response--up to 2000X faster to support time-sensitive decisions. Right-time. Trusted. Accurate.

## Savings

Minimize data proliferation. Lower the cost of storing and managing historical data. Free up compute resources

## Simplicity

Non-disruptive installation. Simplify infrastructure, reduce ETL and data movement off-platform

## Security

Safeguard valuable data under the control and security of DB2 for z/OS. Protected. Secured. Governed.

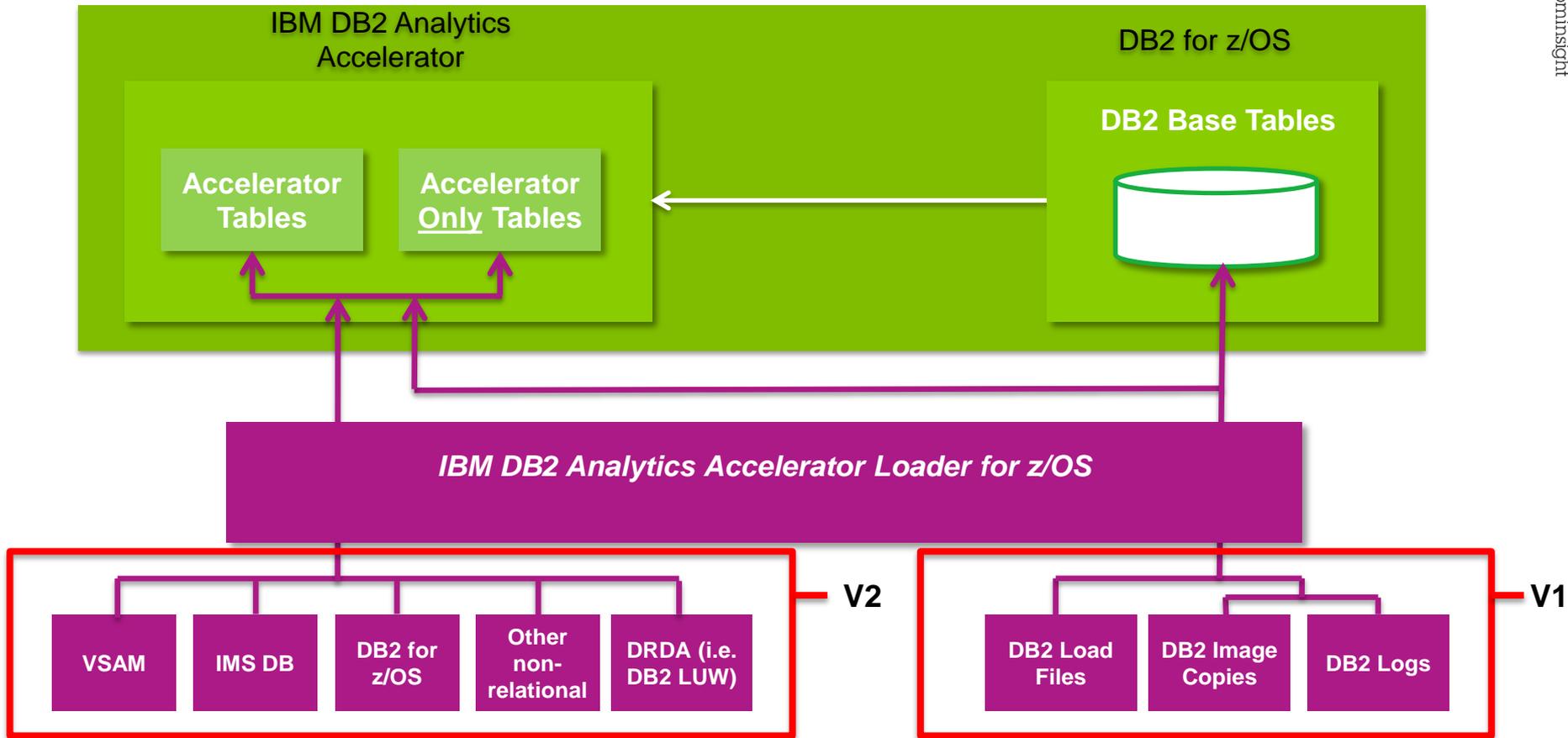
***Enable real-time analytic solutions on a single, integrated system combining transactional data, historical data and predictive analytics***

- **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.





# Apache Spark and Hadoop Integration

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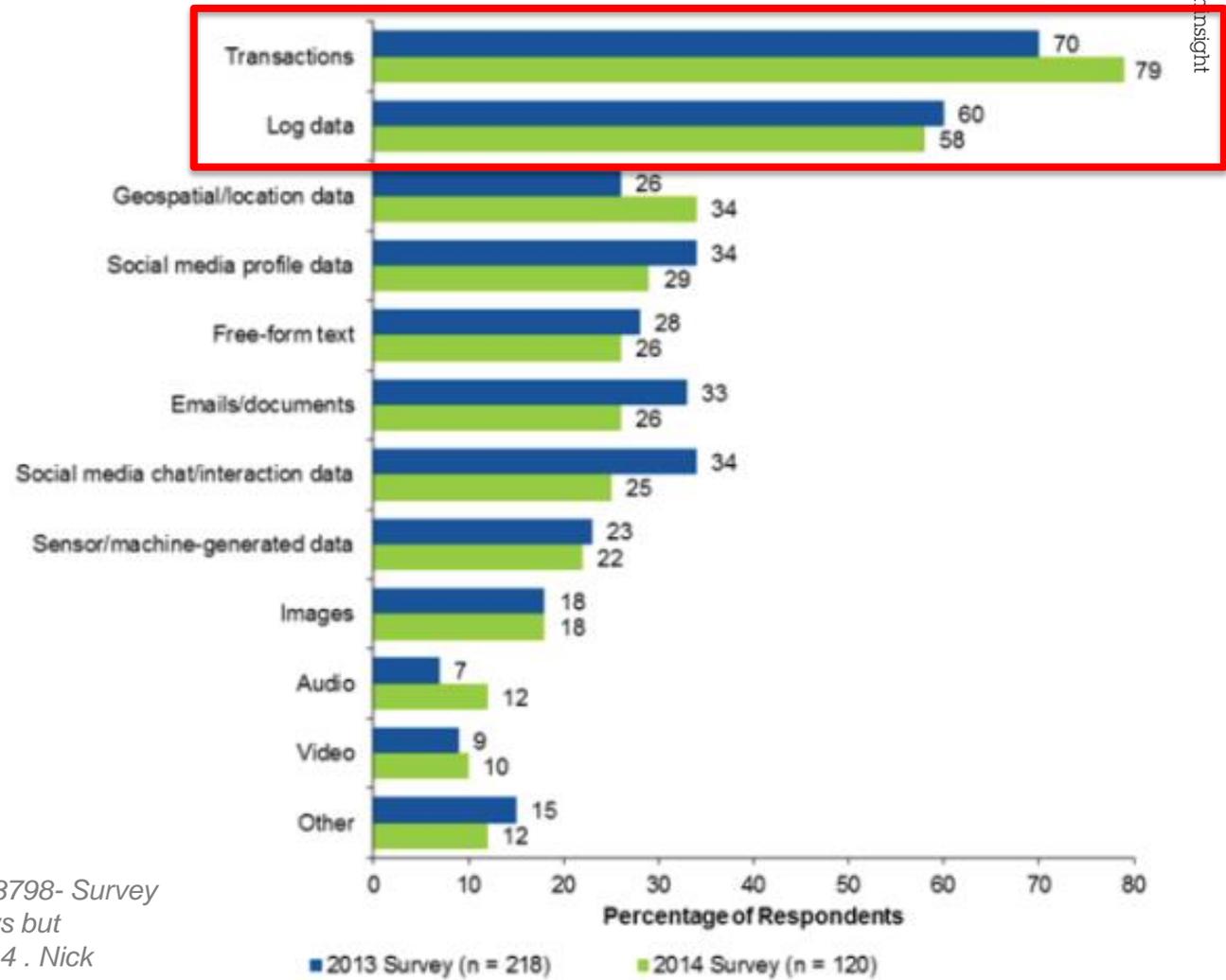
# z/OS Data is important for Hadoop / Spark Analytics



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



#1 on insight

Source : Gartner Inc, Research Note G00263798- Survey Analysis: Big Data Investment Grows but Deployments Remain Scarce in 2014 . Nick Heudecker, Lisa Kart, Published 09/09/2014

Base: Respondents invested in big data technology  
Multiple responses allowed

Source: Gartner (September 2014)



# 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

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## IBM Packages for Apache Spark

Exploit the big data analytics capabilities of Apache Spark with this new package for IBM platforms.

### Downloads

These are the available downloads of the IBM Packages for Apache Spark:

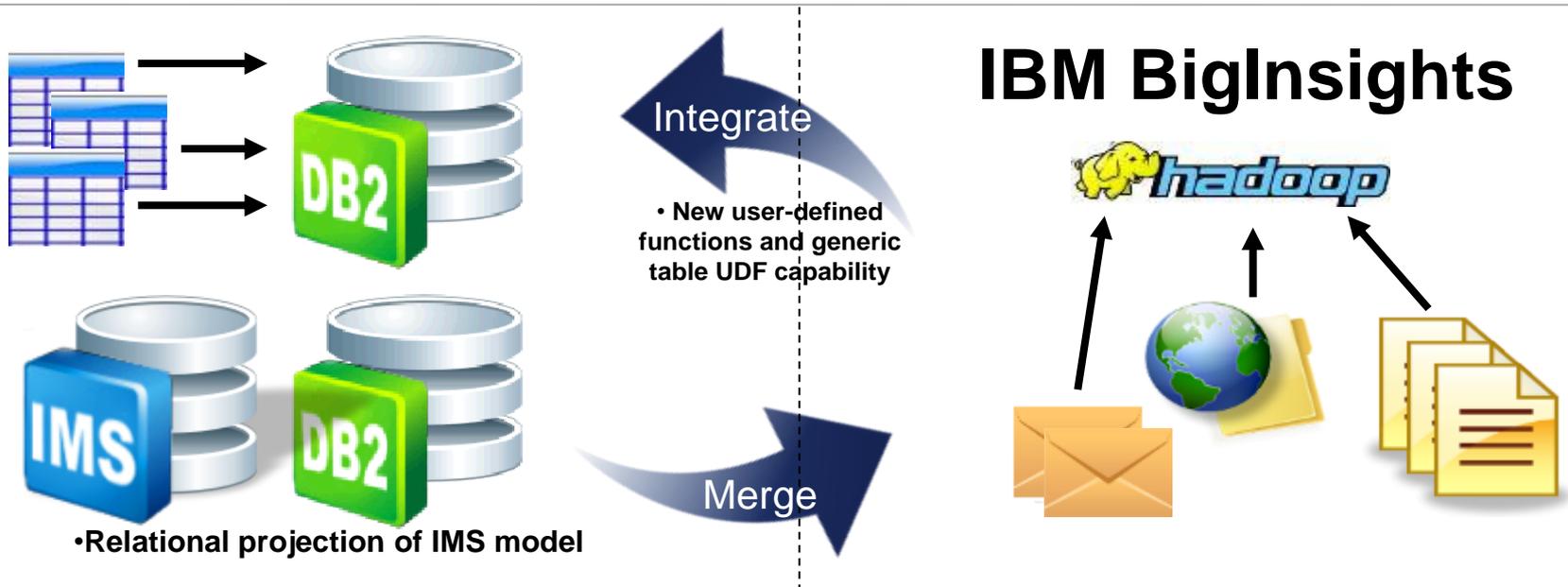
- ⬇ Linux on Power Systems
- ⬇ Linux on System x
- ⬇ Linux on z Systems
- ⬇ z/OS





# InfoSphere z Systems Connector for Hadoop

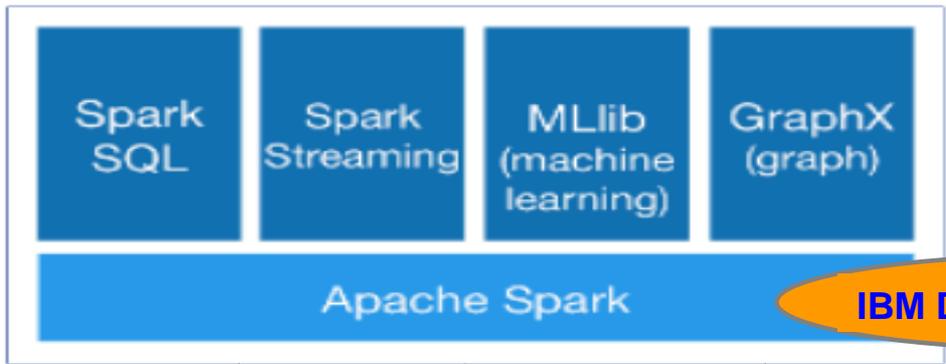
- Two significant needs to integrate Big Data Analytics with DB2 for z/OS :
  - Merge this data with trusted OLTP and analytics data from z Systems data sources
  - Integrate this data so that insights from Big Data sources can drive business actions
- Connectors to allow BigInsights to easily & efficiently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





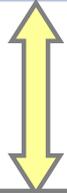
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# DB2 as Spark Data Source



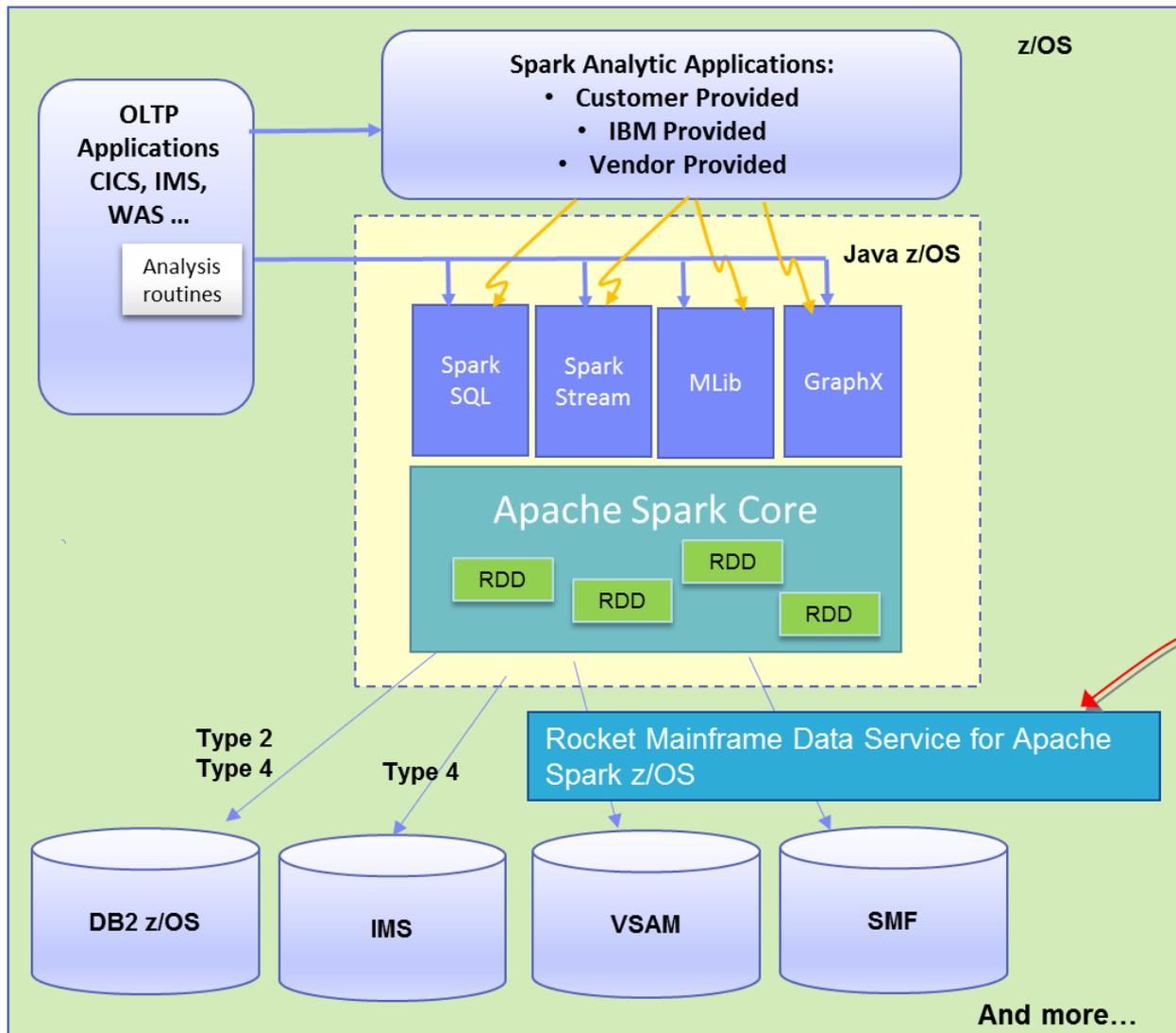
**NEW**

**IBM Data Server Dialect**



# 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



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- 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

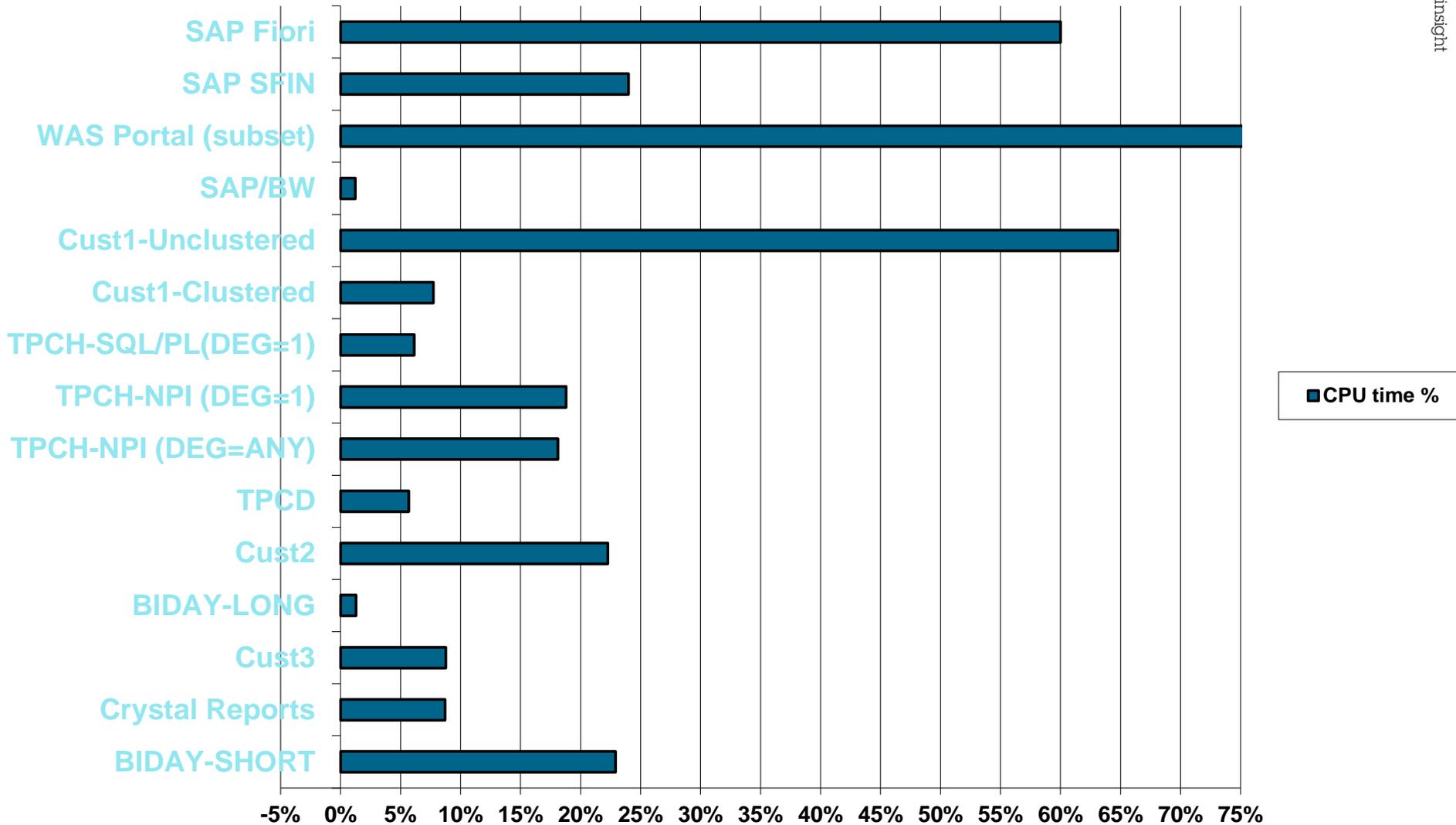


# DB2 12 Significant CPU Reduction In DB2 Queries

(work still in progress)



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# DB2 12: Simplicity and RAS



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- 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



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- 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

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- **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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