IBM DB2: Your bridge to the cloud

Transformative database software for the Cognitive Era

Highlights

- High-performance database with in-memory technology designed for mission-critical transactional and analytics workloads
- Petabyte-level scalability with industry-leading compression capabilities
- Application-transparent database scalability beyond 100 nodes[1]
- Excellent availability: failover can be achieved in seconds between two nodes[2]

In this era of digital transformation, business and IT leaders across all industries are looking for ways to easily and cost-effectively unlock the value of enterprise data and use it to deliver new customer experiences while fueling business growth. The digital economy is changing the way organizations gather information, gain insights, reinvent their businesses and innovate both quickly and iteratively.

No longer is it enough to just manage data volumes. Organizations need to become cognitive businesses, combining information and experience to unlock a deeper understanding of customers, processes and strategies. Hybrid cloud is the new norm, accelerating the transformation to a digital enterprise through business innovation and enhanced cloud-enabled solutions designed to maximize customer engagement. In fact, 70 percent of IT decision-makers say they expect to always have a hybrid blend of traditional IT and cloud, according to a 2016 IBM Center for Applied Insights Survey.[3]

A hybrid cloud environment combining traditional IT systems and public cloud enables companies to extend business processes beyond enterprise walls. For example, many organizations use public cloud as a collaborative development environment to create innovative applications that can be ported to an on-premises or hybrid production environment. As organizations develop these apps, they are using cognitive computing

approaches ushered in by IBM Watson™ technology. Cognitive applications can learn and react to customer preferences, and then use that information to support capabilities such as confidence-weighted outcomes with data transparency, systematic learning and natural language processing.

To make the most of these applications, organizations need a next-generation database that can handle a massive volume of data while delivering high performance to support real-time analytics. At the same time, it must provide data availability for demanding applications, scalability for growth and flexibility for responding to changes.

IBM® DB2® for Linux, UNIX and Windows is a multi-workload database management solution built with these challenges in mind. Providing new, innovative capabilities and advanced features to meet demanding data processing requirements on ground or on cloud. DB2 is designed to help ensure your data systems are fast, always available, scalable, secure and flexible.

Here are some of the ways DB2 helps organizations tackle the challenges presented by the Cognitive Era:

- **Leverage all data sources:** With the flexibility and simplicity of DB2, clients can deploy the software on premises or on the cloud to leverage data from next-generation applications, born-on-the-cloud applications, sensors, and mobile and web-based applications.
- **Capture the value of data through right-time actionable insights:** IBM BLU Acceleration® enhances response time by deploying over a massively parallel processing (MPP)-based cluster architecture to provide insight from real-time operational and historical data. DB2 can support in-memory speed and simplicity on existing infrastructures along with improvements for deeper in-database analytics. It is optimized for SAP applications, transactional and analytics workloads, and features an average of 98 percent Oracle Database application compatibility.[4]
- **Provide insights everywhere for new users, new buyers and new ways of working:** DB2 provides highly available business data to keep your business up and running. IBM DB2 pureScale® clustering technology is designed to avoid both planned and unplanned outages with Geographically Dispersed DB2 pureScale Clusters (GDPCs). It helps support disaster recovery over multiple sites that are far enough apart to be on separate power grids. This means virtually no costly downtime, even with maintenance. Together, DB2 and pureScale provide agile database software for the always-on business.
- **Protect resources with industry-strength security and compliance:** DB2 provides important encryption capabilities that allow clients to safely protect their data while online or in backups, helping to support compliance with data governance requirements. DB2 adds support for Key Management Interoperability Protocol 1.1 (KMIP 1.1) to provide centralized key management for many databases and file systems across the enterprise.
- **Adapt your infrastructure to your business:** Businesses must adapt their processes to changing consumer behaviors and help their developers innovate quickly to stay ahead of the competition. Whether deployed on premises or on the cloud, DB2 provides the same experience and features so developers can leverage existing skills and streamline transitions between ground and cloud.

Transformative, powerful database software for today's business challenges

The effectiveness and speed of data analytics are often hindered by infrastructures that are unable to keep pace with the rate of data growth and change. DB2 with BLU Acceleration offers a huge step forward in analytic workload processing by combining proven dynamic in-memory and columnar data store capabilities, MPP, advanced compression and hardware exploitation techniques. The result: reliably faster analytic query processing

for a variety of online analytical workloads without the limitations of in-memory-only systems, thus providing timely answers to business questions and helping users take action quickly.

Developed by IBM Research and Development Labs, DB2 with BLU Acceleration represents a new generation of in-memory-based data management. Innovations include:

- **Next-generation in-memory computing** that dynamically optimizes movement of data from storage to system memory to CPU memory
- **Actionable compression** to preserve order so the data can be used for analytics without decompression
- **CPU acceleration techniques** such as multi-core processing, MPP and Single Instruction Multiple Data (SIMD) processing
- **Native columnar parallel data sort** for compressed data, including columnar-encoded data
- **Data skipping** to get to the relevant data and bypass unnecessary data processing
- **Column-based DB2 Shadow Tables** to perform analytics on operational data directly within a transactional environment without compromising transactional performance

BLU Acceleration utilizes an extra storage engine and integrated run time directly into the core DB2 system to support the storage and analysis of column-organized tables. This processing runs parallel to traditional row-based table processing, enabling DB2 to process both row-based and column-based tables in the same system (Figure 1). Such an architecture allows you to maintain investments in your existing enterprise resource planning (ERP) environments and skills to avoid disrupting your business. The potential results include significantly improved performance, massive storage savings, and ease of implementation and management for both transactional and analytic data workloads.

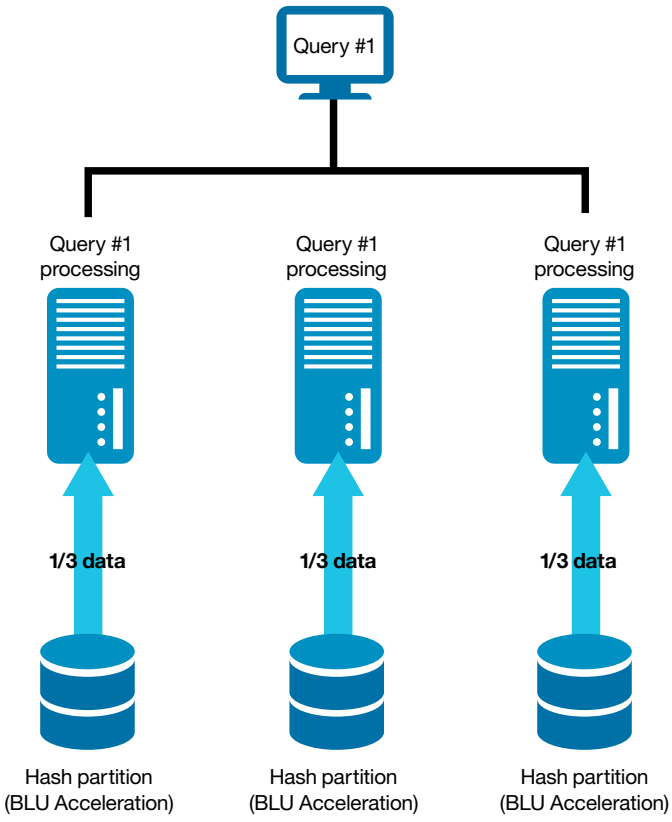

Figure 1. DB2 with BLU Acceleration MPP scale-out capabilities can significantly improve performance.

Encryption and enterprise key management

DB2 V11.1 enhances its native encryption capabilities by introducing KMIP 1.1 support to allow integration with centralized enterprise key managers such as IBM Security Key Lifecycle Manager and any other products that support this industry-standard protocol.

Backup and log compression acceleration

The newest version of DB2 enables you to offload compression to hardware on IBM POWER7+™ and IBM POWER8® and use Active Memory Expansion compression in those systems. Such an approach can significantly reduce CPU consumption and elapsed time while maintaining most compression storage benefits.

Simplified pureScale installation and deployment

DB2 V11.1 introduces the ability to deploy pureScale and be up and running in a matter of hours with the simplicity of a "push-button" installation for pureScale clusters. According to IBM internal testing, the streamlined setup can improve the install process by at least 40 percent (sockets) or 25 percent (RDMA); plus, it reduces the number of steps from 30 to 4 for a native IBM General Parallel File System (IBM GPFS™) replication setup process. It also introduces smarter defaults with intuitive options and quick pre-deployment validation across hosts, and can increase resiliency for aborted and partial installations with clean rollback for re-execution. DB2 V11.1 now supports all sync modes (SYNC, NEARSYNC, ASYNC, SASYNC) between the clusters for high availability/disaster recovery (HADR).

Very large database (VLDB) enhancements

DB2 V11.1 brings big data to the online transaction processing (OLTP) system—previously a domain of warehousing only. With the increasing number of data sources and the extreme growth of data volumes in today's organizations, the OLTP system may contain hundreds of terabytes of data. Some of the enhancements aimed at very large database sizes and user population include:

- Concurrency and scalability for recently and commonly referenced pages
- Features for higher throughput
- The ability to perform online table reorganization tasks at the partition level

Deliver the full value of DB2 with updated database management solutions

A comprehensive set of database management solutions offers a complete range of capabilities for the enterprise, enabling developers, architects and database administrators to design, develop, manage and deploy both transactional and warehouse databases with greater efficiency, scalability, performance and availability. To help you accelerate adoption and enhance the value of key DB2 features, all tools have been updated to support BLU Acceleration, compression and pureScale capabilities.

For more information about IBM database management solutions for DB2, visit: http://ibm.biz/DSMTools

Cloud agility

DB2 on Cloud offers the same functionality as its on-premises equivalent—along with rapid self-service cloud deployment and pay-as-you-go licensing that make it especially useful in the following scenarios:

- **Cloud strategy adherence:** DB2 on Cloud helps you comply with mandates to deploy new projects on the cloud to reduce capital IT expenditures and conserve on-premises data center resources.
- **Short-term database projects:** DB2 on Cloud is great for proofs-of-concept and other short-term development or analytics projects, because you have to pay only for as long as you use it.
- **Disaster recovery:** On-premises DB2 instances can replicate data to DB2 on Cloud, which can be your fail-safe in the event of a primary data center disaster.
- **Geographic reach and regulatory compliance:** Deploy DB2 on Cloud to IBM SoftLayer® data centers around the world to help meet requirements for hosting data in specific regions or countries.

Streamlined packaging and hassle-free upgrades

You can upgrade directly from DB2 V9.7 to DB2 V11.1, eliminating the need for an offline backup and reinitialization of HADR standby databases. This should facilitate a faster database upgrade process.

DB2 offers a simple packaging structure with seven editions and optional DB2 Advanced Recovery and DB2 Performance Management offerings. All editions contain NoSQL, Oracle compatibility and varying degrees of HADR support. Select DB2 V11.1 editions now share a common install image with previous editions of DB2, so moves between editions can be as simple as a license key update. The simplified packaging means you have fewer editions to deploy and administer, straightforward entitlement tracking and greater utilization of DB2 functionality.

DB2 Advanced Enterprise Server Edition offers the functionality and database management solutions needed for large, global enterprise environments. It is ideal for transactional, analytic and operational analytic workloads. It includes BLU Acceleration, data compression, DB2 pureScale, DB2 Workload Management, IBM DB2 Database Partitioning Feature (DPF) and other advanced capabilities such as change queue-based replication, change data capture (CDC) replication along with IBM Data Server Manager and a rich set of tools. It can be deployed on servers of any size, from one processor to hundreds of processors, and on both physical and virtual servers.

DB2 Advanced Workgroup Server Edition is ideal for medium-sized businesses and departmental deployments. It includes most of the same functionality and database management solutions as DB2 Advanced Enterprise Server Edition, and can handle transactional, analytic and operational analytic workloads. This edition does have processor core, socket, memory and terabyte restrictions, and only supports federation between DB2 and IBM Informix® data sources.

DB2 Enterprise Server Edition is designed to meet the needs of medium-to-large businesses and is ideal for transactional and operational analytic workloads. It has no memory, terabyte, socket or core limits and can be deployed on physical and virtual servers. It does not include BLU Acceleration, DB2 pureScale or DPF deployment modes, but does include some advanced database capabilities such as the connection concentrator, materialized query tables (MQTs), multidimensional clustering (MDC), multi-temperature data management, query parallelism, scan sharing and table partitioning.

DB2 Workgroup Server Edition is for transactional database workloads in a departmental, workgroup or medium-sized business environment. This edition shares significant functionality with DB2 Enterprise Server Edition, but has processor core and memory restrictions. There is no limit on the cores or memory available to the physical server if the restrictions are observed by the virtual servers running DB2. Therefore, this edition is ideal for consolidating multiple workloads onto a large physical server running DB2 Workgroup Server Edition on multiple virtual servers.

Note that DB2 Workgroup Server Edition no longer contains the DB2 pureScale capability. Existing customers can upgrade their entitlements to restricted DB2 Advanced Workgroup Server entitlements so they may continue to use DB2 pureScale functionality.

DB2 Direct Advanced Edition provides the same DB2 functionality as DB2 Advanced Enterprise Server Edition for digital delivery and deployment either on premises or on the cloud. It can be deployed on Linux, UNIX or Windows servers of any size, from one processor to hundreds of processors, and on both physical and virtual servers.

DB2 Direct Standard Edition provides the same functionality as DB2 Workgroup Server Edition for digital delivery and deployment either on premises or on the cloud. It is restricted to 16 virtual processor cores and 128 GB of instance memory. These restrictions are per physical or virtual server except in a pureScale or DPF cluster where the restrictions apply to the entire cluster. Under all charge metrics, you are restricted to 15 TB of user data per database.

DB2 Developer Edition is a comprehensive package that includes all of the DB2 capabilities for a single application developer to design, build, test and prototype applications for deployment on any of the DB2 client or server platforms. It requires a separate license for each developer and cannot be used in production systems.

DB2 Advanced Recovery Solution is a software bundle that includes IBM DB2 Merge Backup for Linux, UNIX and Windows V3.1; IBM DB2 Recovery Expert for Linux, UNIX and Windows V5.1; and IBM InfoSphere® Optim™ High Performance Unload for DB2 for Linux, UNIX and Windows V6. It helps improve data availability, mitigate risks and accelerate crucial administrative tasks. DB2 Advanced Recovery is available as a separate purchase and can be used with all DB2 Editions mentioned above.

IBM DB2 Performance Management Offering helps organizations manage their DB2 databases across the enterprise through tooling that has a common integrated console, improved performance and scalability, and simplified workflow with actionable recommendations. Organizations can:

- Streamline database administration and reduce errors by using the integrated web console to view and monitor the health of databases across the enterprise
- Identify, diagnose, prevent and solve performance problems through a more predictable database server execution environment
- Track and manage client/server and database environments efficiently with centralized management
- Optimize database performance with expert recommendations on query design, unique indexes and statistics quality

In the past, these performance management tools were primarily available with DB2 Advanced Editions. DB2 Performance Management Offering gives organizations access to these tools for DB2 Enterprise Edition and DB2 Workgroup Server Edition.

Advanced DB2 V11.1 capabilities

Feature	Description/Function
BLU Acceleration	Delivers the breakthrough performance of in-memory columnar processing without the cost or limitations of in-memory-only systems, dramatically simplifying and speeding the delivery of business insight from data.
Compression	Helps reduce storage needs and increase performance using multiple techniques, including table and index compression with page-level compression and DB2 with BLU Acceleration with advanced encoding, to maximize compression of columnar tables.
Continuous data ingest	Loads data continuously from multiple sources throughout the organization to support faster decision-making.
IBM Database Partitioning Feature (DPF)	Enables massively parallel processing by transparently splitting the database across multiple partitions and using the power of multiple servers to satisfy requests for large amounts of information.
DB2 pureScale	Transparently delivers high availability and exceptional scalability to applications, freeing them from the complexities of the underlying database architecture. Utilizes a shared-disk, cluster architecture that allows you to efficiently scale the database across several servers.
DB2 Workload Management	Enables fine-grain resource allocation, monitoring and management of workloads based on service classes, workload characteristics, elapsed time, time of day and more.
Federation Server	Supports federation between DB2 for Linux, UNIX and Windows and other databases: • Advanced Enterprise Server Edition includes federation between DB2 and Oracle Database and Microsoft SQL Server for staged migration or long-term coexistence strategies. • Advanced Workgroup Server Edition supports federation only with DB2 for Linux, UNIX and Windows plus Informix data sources.
Materialized query tables (MQTs)	Improves the performance of complex queries with the pre-computed results of the whole or parts of queries.
MQ replication/CDC	Replicates large volumes of data at very low levels of latency.
Multi-temperature data management	Helps maximize performance and reduce overall media costs with storage tiering and the ability to transfer data in real time between different types of storage media.
Column store	Improves performance and reduces consumption of processor, memory and I/O resources for analytics workloads by directing scans to values in a particular column or columns, avoiding the need to process all data in a table.
Data skipping	Reduces processor, memory and I/O resource consumption by automatically avoiding the processing of data that is not needed for a query.
Shadow tables	Provides the performance benefits of BLU Acceleration to analytic queries that must be executed in OLTP environments. Shadow tables are column-organized copies of row-organized tables implemented as MQTs that are maintained by replication.

Why IBM DB2?

DB2 is transformative database software for businesses that are moving into the Cognitive Era. By combining always-on transactional processing with actionable insight analytics, it simplifies the IT landscape to help deliver better performance with fewer resources. It is designed for extremely fast time to value and operational simplicity, and can be deployed on premises or on the cloud for maximum flexibility.

DB2 offers continuous data availability and massive scalability of high-throughput transactional workloads. It allows you to allocate more resources for performance or growth at will, and to free applications from the complexities of the underlying database architecture.

DB2 with BLU Acceleration also represents a huge step forward in analytic workload processing by combining proven in-memory and columnar data store capabilities with advanced compression and hardware exploitation techniques. The result: reliably faster response times for a variety of online analytical workloads—without the limitations of in-memory-only systems.

For more information

To learn more about the capabilities of each DB2 V11.1 for Linux, UNIX and Windows edition, contact your IBM representative or IBM Business Partner, or visit: **ibm.com**/db2/luw/

Additionally, IBM Global Financing provides numerous payment options to help you acquire the technology you need to grow your business. We provide full lifecycle management of IT products and services, from acquisition to disposition. For more information, visit: **ibm.com**/financing

[1] Available with DB2 Advanced Enterprise Server Edition.

[2] Based on IBM design for normal operation under typical workload using HADR and pureScale clusters. Individual results will vary depending on individual workloads, configurations and conditions, network availability and bandwidth.

[3] "Growing up hybrid: Accelerating digital transformation." IBM Center for Applied Insights. February 2016. http://www.ibm.com/smarterplanet/us/en/centerforappliedinsights/article/globalcloud.html

[4] Based on internal tests and reported client experience from 28 September 2011 to 07 March 2012.

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