IBM FlashSystem all-flash storage and Oracle Database 12*c*

Increasing Oracle Database performance, efficiency, and value

Nearly a decade long, proven track record of accelerating Oracle Database performance

Microsecond-scale storage latency delivered by IBM FlashSystem arrays benefit the Oracle Database in many ways, improving redo log performance, complex sorts, and other processes

Rich set of data management capabilities and storage services provided by IBM FlashSystem V9000 complement Oracle ASM and Oracle RAC features

Lower cost of Oracle Database data storage through increased data agility, dynamic data management, and optimized efficiency

Building business value through innovation

Today, IT infrastructure is fully entwined with basic business operations, which means that crucial business questions become information technology questions. What is it worth to stay ahead of the competition? What is a better online customer experience worth to the bottom line? What advantages are gained by making faster, more informed business decisions? Can we afford not to have the best possible fraud protection and data security? When you answer these business-critical questions in terms of IT infrastructure, and recognize the crucial role storage plays in the right answers, then the value of IBM FlashSystem® becomes very clear.

IBM FlashSystem storage

The IBM FlashSystem family of all-flash storage arrays brings a long and successful history of accelerating Oracle Databases. The extreme performance, IBM MicroLatency®, macro-efficiency, and enterprise-grade reliability offered by IBM FlashSystem arrays make an excellent fit with the current and future storage needs of Oracle Database applications. In addition to platforms that focus exclusively on providing the lowest possible latency with excellent cost-efficiency, IBM FlashSystem storage provides a wide range of enterprise-grade management

and feature-rich storage services. IBM FlashSystem platforms and configurations have been exhaustively tested and benchmarked against the full spectrum of Oracle Database versions, including years of successful deployment with Oracle Automatic Storage Management (Oracle ASM) and Oracle Real Application Clusters (Oracle RAC). IBM FlashSystem solutions provide multiple options for Oracle Database users seeking to address high velocity application requirements, increase system efficiency, and lower IT costs.

The IBM FlashSystem family includes IBM FlashSystem 900 and IBM FlashSystem V9000 arrays. Powered by IBM FlashCore™ technology, IBM FlashSystem 900 delivers the extreme performance, enterprise reliability, and operational efficiencies required to gain competitive advantage in today's dynamic marketplace.

Adding to these capabilities, FlashSystem V9000 offers the advantages of software defined storage at the speed of flash. These all-flash storage systems deliver the full capabilities of FlashCore technology's hardware accelerated architecture, MicroLatency modules, and advanced flash management. Those capabilities are coupled with a rich set of features found in only the most advanced enterprise storage solutions, including IBM Real-time Compression™, external storage virtualization, dynamic tiering, thin provisioning, snapshots, cloning, replication, data copy services, and high-availability configurations.

The IBM and Oracle alliance

Since 1986, Oracle and IBM have been providing customers with compelling joint solutions, combining Oracle's technology and application software with IBM's complementary hardware, software and services solutions. More than 100,000 joint customers benefit from the strength and stability of the Oracle and IBM alliance, which offers technology, applications, services, and hardware solutions that mitigate risk, boost efficiency, and lower total cost of ownership.

IBM is a Diamond Partner in the Oracle Partner Network, delivering the proven combination of industry insight, extensive real-world Oracle applications experience, deep technical skills and high performance servers and storage to create a complete business solution with a defined return on investment. From application selection, purchase and implementation to upgrade and maintenance, we help organizations reduce the total cost of ownership and the complexity of managing their current and future applications environment while building a solid base for business growth.

Oracle Database 12*c*

Oracle Database 12*c*, the latest generation of Oracle Database, has a major focus on cloud and enables customers to make more efficient use of their IT resources. This latest generation Oracle Database has a new multitenant architecture, and includes several enhancements and new features for:
- Consolidating multiple databases into multitenant containers
- Automatically optimizing data storage
- Providing continuous access with high availability features
- Securing enterprise data with a comprehensive defense-in-depth strategy
- Simplifying in-database analysis of Big Data

Multitenant architecture

Oracle Multitenant delivers an architecture that simplifies consolidation and delivers the high density of schema based consolidation, without requiring changes to existing applications. It's an option of Oracle Database 12c that offers the benefits of managing many databases as one, yet retains the isolation and resource control of separate databases. In this architecture, a single multitenant container database can host many 'pluggable' databases. Each database consolidated or 'plugged in' to a multitenant container looks and feels to applications exactly the same as a standalone non-container Oracle Database. Administrators can control the prioritization of available resources between consolidated databases thereby enabling dynamic policy based resource management.

Database In-Memory

Oracle Database In-Memory uses a new dual-format in-memory architecture that allows simultaneous row and column format representations of data available at all times. Using the dual-format architecture, Oracle Database In-Memory accelerates both Data Warehouses and mixed workload OLTP databases. Any existing applications compatible with Oracle Database 12c can easily start utilizing Oracle Database In-Memory without requiring any changes.

Automatic Data Optimization

The pattern of usage of rows stored in database tables and partitions changes over time. In addition to the age of data, its level of activity is also important. It's common for rows to be continuously updated over time; therefore a combination of age and activity is required to determine the usage pattern of table rows. New Automatic Data Optimization features in Oracle Database 12c can be used to implement an automated Information Lifecycle Management strategy using a Heat Map and server managed storage policies that enable smart compression and storage tiering.

High availability

Basic high availability architectures using redundant resources can prove costly and fall short of availability service level expectations due to technological limitations, complex integration requirements, and an inability to provide availability through planned maintenance. Oracle Database 12c goes beyond the limitations of basic high availability and in conjunction with hardware features such as provided by IBM storage devices and servers, offers customers a set of best practice blueprints that can be deployed at minimal cost and address the common causes of unforeseen and planned downtime.

Reducing planned downtime

Planned downtime for essential maintenance such as hardware upgrades, software upgrades and patching are part and parcel of every IT operation. Oracle Database 12*c* offers a number of solutions to help customers reduce the amount of planned downtime required for maintenance activities, including:

- Hardware Maintenance and Migration Operations to Oracle Database 12*c* infrastructure can be performed without taking users offline.
- Online Patching of database software can be applied to server nodes in a 'rolling' manner using Oracle RAC. Users are simply migrated from one server to another; the server is quiesced from the cluster, patched, and then put back online.
- Rolling Database Upgrades using Oracle Active Data Guard enables upgrading of a standby database, testing of the upgraded environment and then switching users to the new environment, without any downtime.
- Online Redefinition can reduce maintenance downtime by allowing changes to a table structure while continuing to support an online production system.
- Edition Based Redefinition enables online application upgrades. With edition-based redefinition, changes to program code can be made in the privacy of a new edition within the database, separated from the current production edition.
- Data Guard Far Sync provides zero data loss protection for a production database by maintaining a synchronized standby database located at any distance from the primary location.
- Global Data Services provides inter-region and intra-region load balancing across Active Data Guard and Golden Gate replicated databases. It effectively provides Real Application Cluster failover and load balancing capabilities to Active Data Guard and Golden Gate distributed databases.

Simplifying analysis of Big Data

Oracle Database 12*c* fully supports a wide range of Business Intelligence tools that take advantage of optimizations including; advanced indexing operations, Oracle OLAP aggregations, automatic star query transformations, partitioning pruning and parallelized database operations.

By providing a comprehensive set of integration tools, customers can use their existing Oracle resources and skills to bring together big data sources into their data warehouse. With this, customers can add to the existing Oracle Database 12*c* features, the ability to better analyze data throughout the enterprise.

The power of preferred reads

One of the most compelling use cases for IBM FlashSystem all-flash storage is to speed up an Oracle Database via the preferred read process. The concept of the preferred read is not a new idea, but it's very easily implemented leveraging Oracle ASM volume management. The concept is to do all reads from the fastest storage while mirroring writes between a fast device and a slow device. Initially, the preferred read concept was designed for global mirroring or site-specific storage in order to avoid higher-latency site connections. By restricting data reads to the local storage, databases would be able to service requests at nominal read speeds while writes were the only communication needed to traverse the long haul site link.

This concept of preferred reads can be adapted for use with local storage with differing performance characteristics. Because the concept of preferred reads is to read from a lower latency mirror, the strategy of preferring the reads from IBM FlashSystem storage mirrored to an existing disk array can be employed—with great read performance benefits to applications and the enterprises depending on them. This allows IBM FlashSystem arrays to be deployed with additional redundancy by mirroring to an existing disk array, which may avoid the cost of deploying multiple IBM FlashSystem units. Many shops have a large investment in hardware, software, and procedures for backup and disaster recovery. Expecting these shops to do a rip and replace to implement IBM FlashSystem technology is not realistic.
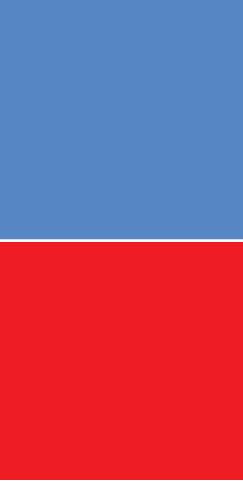
The combination of Oracle ASM preferred reads and IBM FlashSystem storage offers significantly greater customer value across multiple dimensions than traditional storage architectures. More database transactions with lower latency and higher overall throughput result from the use of preferred reads with IBM FlashSystem storage and existing disk-based storage systems. With higher database performance driven by FlashSystem storage, fundamental costs per database transaction are reduced. It all adds up to a win for enterprises looking to gain competitive advantage while at the same time lowering overall IT costs.

IBM FlashSystem V9000

IBM FlashSystem V9000 is designed to accelerate all types of applications and infrastructures, but it is most often deployed to support high-performance database applications such as those based on Oracle Database, and to replace existing Tier 1 storage constrained by slow disk drives. By accelerating multiple workloads—both physical and virtual—IBM FlashSystem V9000 can help organizations reduce costs, increase revenue, and improve customer satisfaction.

IBM FlashSystem V9000 can function as a feature-rich, software-defined storage layer that virtualizes and extends the functionality of all managed storage. In this capacity, it acts as the virtualization layer between the host and other external storage systems, providing flexibility and extending functionality to the virtualized external storage capacity. Up to 32 PB of external storage can be managed by a single IBM FlashSystem V9000 array, and because the storage is virtualized, volumes can be non-disruptively moved between external and internal storage capacity. This functionality enables very agile integration into existing storage environments with seamless data migration between FlashSystem V9000 and legacy storage systems.

FlashSystem V9000 can take the place of multiple racks of hard disk drives—lowering power, space, and cooling costs. Plus, it can increase server efficiency, which can further cut power and cooling costs and reduce software licensing expenses. When using Real-time Compression for active data sets, V9000 can increase the effective capacity of your flash storage up to five times.

To make your entire storage environment easier to manage while preserving your investments in legacy storage, FlashSystem V9000 offers:

- **Storage virtualization technology:** Helps you manage other IBM or third-party storage arrays. IBM FlashSystem V9000 software-defined storage capabilities slow storage growth and lower infrastructure costs through powerful features such as end-to-end storage virtualization, real-time data compression, and application aware snapshots.
- **Scalable performance:** Allows flash capacity to be added (scaled up) to support multiple applications, the virtualized system to be expanded (scaled out) to support higher IOPS and bandwidth, or the solution to be simultaneously scaled up and out to improve capacity, IOPS, and bandwidth while maintaining MicroLatency.
- **Agile integration:** Enables enterprises to tailor storage deployment architectures to specific workloads, including data access that bypasses the storage virtualization layer for low latency data access, data compression using Real-time Compression, and data replication to disaster recovery sites.

IBM FlashSystem 900

Easy to deploy and manage, IBM FlashSystem 900 is designed to accelerate the applications that drive business – like those using an Oracle Database. Advanced flash management features include Variable Stripe RAID technology, IBM-engineered error correction codes, overprovisioning capabilities, ultra-fast write buffers, and hardware-based data offloads. Features also include proprietary garbage collection, relocation, and block-picking algorithms that not only increase flash endurance, but also increase performance and decrease latency.

In addition, IBM FlashSystem 900 is composed of up to 12 MicroLatency modules that provide extremely high storage capacities. In fact, IBM FlashSystem 900 can scale usable capacity from as low as 2 TB to as much as 57 TB in a single system. The MicroLatency modules also support an offload AES-256 encryption engine, high-speed internal interfaces, and full hot-swap and storage capacity scale-out capabilities, enabling organizations to achieve lower cost per capacity with the same enterprise reliability.

Sizing and capacity planning Oracle Database with IBM FlashSystem technology

Working together, IBM and Oracle have developed a capacity-estimation capability to aid in designing optimal configurations, including using IBM FlashSystem storage for each specific Oracle Database customer environment. A detailed sizing estimate customized for your environment should be obtained from the IBM Techline ISV Solutions Sizing Team, accessible through your IBM or IBM Business Partner representative. You can download a questionnaire to start the sizing process from:

ibm.com/partnerworld/wps/servlet/ContentHandler/techline/FAQ00000750

For more information

To explore other joint solutions from IBM and Oracle, please contact an IBM sales representative at 1-866-426-9989, or visit us at:

ibm.com/solutions/oracle

ibmandoracle.com

For more information about IBM FlashSystem storage, visit:

ibm.com/systems/storage/flash

For more information about IBM FlashSystem and Oracle Database performance, access the documents posted at:

ibm.com/common/ssi/cgi-bin/ssialias?infotype=SA&subtype=WH&htmlfid=TSW03285USEN&attachment=TSW03285USEN.PDF&appname=STGE_TS_ZU_MYEN_WHCR

ibm.com/systems/es/resources/TSW03191USEN.pdf

For more information about Oracle Database 12*c*, visit:

www.oracle.com/us/products/database/overview/index.html