Solution Brief: Oracle ZFS Storage Appliance for Oracle Database Business Intelligence/Data Warehousing Workloads

Oracle ZFS Storage Appliance is flexible multiprotocol enterprise storage that delivers high performance, unmatched efficiency, and superior manageability for many types of workloads. For Oracle Database business intelligence/data warehousing (BIDW) workloads, Oracle ZFS Storage Appliance provides compelling performance and availability benefits. In addition, unique Oracle hardware and software co-engineering delivers performance, manageability, and efficiency advantages unavailable from other third-party systems. Using Oracle storage with Oracle Database directly empowers database administrators (DBAs) to efficiently manage and optimize the entire stack. Furthermore, by being co-engineered with Oracle Public Cloud, Oracle ZFS Storage Appliance offers a built-in cloud gateway for on-demand access to seamlessly take advantage of cloud capacity and economics.

The Correct Tools for the Job

Oracle Exadata is the ultimate platform for Oracle Database from a performance and availability perspective. However, if you have consolidated workloads, heterogeneous vendors to support, flexible performance or availability requirements, or stringent cost constraints, an alternate solution is sometimes required. Oracle ZFS Storage Appliance, next-generation engineered storage, is just that solution due to its unique coengineering with Oracle software. This solution delivers special integrations that simplify management, reduce risk, and drive operational efficiencies.

Like Oracle Exadata, Oracle ZFS Storage Appliance supports Oracle Database's Hybrid Columnar Compression, a feature available only with Oracle Database 11*g* Release 2 and higher releases, when it is used exclusively in conjunction with Oracle storage systems. With multiple compression levels suitable for query and archival workload profiles, Hybrid Columnar Compression significantly enhances storage capacity utilization efficiency in many read-intensive Oracle Database data warehousing workloads. Because Hybrid Columnar Compression moves compressed data from the host to the storage, it actually uses bandwidth more efficiently and can result in higher throughput performance. In fact, customers accelerate critical BIDW queries an average of 8x. Additionally, Hybrid Columnar Compression can be used in conjunction with the Automatic Data Optimization feature of Oracle Database 12*c* to dynamically manage compression and storage tiering. This pairing helps you efficiently optimize partitioning for data footprint efficiency and query response performance

ORACLE OFFERS PROVEN SOLUTIONS FOR ORACLE DATABASE PRIMARY STORAGE USING THE ORACLE ZFS STORAGE APPLIANCE FOR BIDW WORKLOADS.

without manual intervention. This feature can be further enhanced by moving noncritical data to the cloud and taking advantage of on-demand capacities in the cloud. For more information, please see the "Automatic Data Optimization with Oracle Database 12c" white paper.

Superior BIDW Performance

BIDW storage workloads are generally characterized by large-block-size high-throughput reads in response to query commands. From a performance perspective, the key requirement is high bandwidth throughput as opposed to high transactional frequency (that is, MB/sec is a priority over IOPS). Oracle ZFS Storage Appliance combines a scalable storage operating system, high-throughput system design, and intelligent caching to deliver superior performance for just this type of workload. Plus, with all-flash and hybrid flash/disk configurations available, Oracle ZFS Storage Appliance delivers high performance at a lower cost—enabling better price/performance compared to competitive systems. For large and growing BIDW workloads, this price/performance advantage is critical. For further information, please see the "Realizing the Superior Value and Performance of Oracle ZFS Storage Appliance" white paper.

High Availability and Data Protection

Aside from performance, high availability is required in many BIDW environments so that queries can continue to be served in the event of component failures. Oracle ZFS Storage Appliance offers high availability through dual-controller configurations with controller failover mechanism, drive failure redundancy, and network redundancy features. Furthermore, the ZFS file system performs end-to-end checksumming and self-healing to ensure data integrity and prevent silent data corruption. Please see the "Architectural Overview of the Oracle ZFS Storage Appliance" white paper for further details. Additionally, when the Data Guard feature of Oracle Database, Enterprise Edition, is used in conjunction with Oracle ZFS Storage Appliance, a fully synchronous, duplicate instance of the database can be maintained on a redundant system. This offers you the ultimate in-system or site-level outage protection with far less performance impact than traditional storage-based synchronous replication solutions. Oracle has documented best practices for tuning Oracle ZFS Storage Appliance for optimal performance and for availability by ensuring that database hosts do not time out and applications continue running with zero data loss and minimal disruption time.

One of the compelling features of Oracle ZFS Storage Appliance is the ability to tune settings for optimal performance and efficiency in different workloads. While disk mirroring is available for high transactional performance, single-parity RAID can be employed in many throughput-oriented BIDW workloads for performance and space efficiency benefits. Also, share settings, including ZFS Intent Log (ZIL) behavior and block sizes, can be tuned for different workloads, and for different conditions. For example, a share that contains a data warehouse compressed by Hybrid Columnar Compression might optimally use a different record size than a share that contains an uncompressed data warehouse, and yet another record size would be used for other shares that are transactional in nature. Thus, unlike most storage systems from other
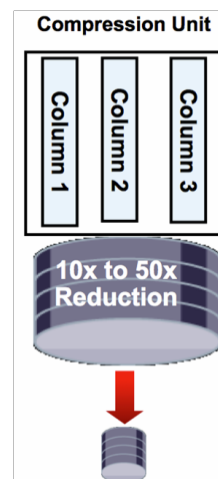
HYBRID COLUMNAR COMPRESSION, UNIQUELY AVAILABLE WITH THE COMBINATION OF ORACLE DATABASE AND ORACLE STORAGE, CAN PROVIDE UP TO 50X COMPRESSION IN DATA WAREHOUSING ENVIRONMENTS.

Oracle ZFS Storage Appliance offers compelling benefits in an Oracle Database primary storage environment:

- High availability
- High performance in both transactional and BIDW workloads
- Reduced management complexity costs at a lower upfront cost
- Unprecedented integration with Oracle Database, such as Oracle Intelligent Storage Protocol and Hybrid Columnar Compression
- Proven best practices used in Oracle IT's own data centers

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vendors, Oracle ZFS Storage Appliance can be optimally tuned for a variety of distinct Oracle Database workloads. To eliminate the tuning and guesswork required to optimize these share parameters, Oracle ZFS Storage Appliance has exclusive coengineering with Oracle Database 12c to dynamically automate this as a background process. This unique technology feature of Oracle ZFS Storage Appliance, Oracle Intelligent Storage Protocol, can reduce administrative steps to tune database storage by up to 65 percent. Oracle Intelligent Storage Protocol sends hints from Oracle 12c and higher databases to Oracle ZFS Storage Appliance to optimize critical storage resources without manual intervention, and it can actually prioritize I/O to further improve performance by reducing resource contention. This can enable consolidation of diverse database workloads on a single appliance by managing and optimizing based on the specific incoming database I/O. See the "Oracle Intelligent Storage Protocol" data sheet for more information. These database-aware technologies such as Hybrid Columnar Compression and Oracle Intelligent Storage Protocol result in much faster Oracle Database BIDW workload performance.

Simplified Management

Oracle ZFS Storage Appliance also offers integration with Oracle Enterprise Manager Cloud Control. In addition to having its own Oracle Enterprise Manager plug-in available for single-pane-of-glass visibility of multiple appliances, Oracle ZFS Storage Appliance provides Snap Clone (a feature of Oracle Cloud Management Pack for Oracle Database) integration with Oracle Enterprise Manager 12c and above to provide database-as-a-service (DBaaS) capabilities. This is useful because it allows administrators to make space-efficient thin copies of entire data warehouses through the Oracle Enterprise Manager interface. When they use snap cloning, the copy operation can occur much faster and occupy far less storage capacity than other copy options supported by most storage vendors. Snap Clone can be used in conjunction with the DBaaS schema provisioning functionality for rapid, low-storage provisioning of data marts for targeted analytical purposes.

Further information on DBaaS and Oracle ZFS Storage Appliance integration usage is available in the "Delivering Database as a Service (DBaaS) using Oracle Enterprise Manager 12c" white paper. Unique with Oracle ZFS Storage Appliance, this functionality also can be paired with Hybrid Columnar Compression to deliver a highly compact primary data warehouse footprint along with near-zero-initial-size data marts extracted from that small primary data warehouse. Such a setup can result in significant savings in terms of storage footprint as well as enhanced performance during provisioning.

In addition to integration with Oracle Enterprise Manager, it's also important to have granular insight into the storage itself in order to accurately tune and troubleshoot. Oracle ZFS Storage Appliance uniquely offers detailed drill-down, even to the pluggable database level, as a result of its co-engineering with the database. The extended statistics available with the unique Oracle Intelligent Storage Protocol technology allows DBAs and storage administrators to resolve problems quicker with visibility and correlations such as the help of AWR-like statistics made available on the appliance. Better visibility into the database-storage interaction replaces guesswork with knowledge and confidence.

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Oracle ZFS Storage Appliance offers multiprotocol support for Oracle Database. When Oracle ZFS Storage Appliance is used in conjunction with Oracle Database 11*g* and higher releases, the preferred protocol is Oracle's Direct NFS Client—a high-performance NFS client feature built into Oracle Database. Direct NFS Client avoids inefficiencies inherent in many OS kernel NFS implementations and achieves FC-like performance but with the simplified high availability and the infrastructure and management cost characteristics of an enterprise Ethernet environment. For more about Direct NFS Client, please see the "Oracle Database 11*g* Direct NFS Client" white pape.

While Direct NFS Client is typically implemented over a 10 Gb Ethernet network, 40 Gb InfiniBand is a connectivity option on Oracle ZFS Storage Appliance, making IPoIB with Direct NFS Client a high-performance connectivity option. In addition, block protocols including iSCSI and FC are fully supported and widely used in cases when customers have a management preference for LUNs.

Integration with Secondary Oracle Database Storage Workloads

One of the main benefits of using Oracle ZFS Storage Appliance for BIDW and other primary storage use cases is seamless integration with other Oracle Database storage workloads. With built- in low-footprint snapshot and cloning data services, the primary database can be quickly "copied" with little space and minimal overhead requirements to meet development, test, or QA storage needs. Also, with built-in remote replication plus best practices for Oracle Recovery Manager (Oracle RMAN) and Data Guard, Oracle ZFS Storage Appliance offers a number of options for both disaster recovery and for backups integrated with development and test use cases that are fully compatible with the primary database on Oracle ZFS Storage Appliance. Best practices for Oracle ZFS Storage Appliance are available for all of the following secondary workloads:

» Backup using Oracle Database and Oracle RMAN

» Disaster recovery using Data Guard

» Provisioning development and test workloads from production, backup, or DR databases, including via the Snap Management Utility for Oracle Database feature of Oracle ZFS Storage Appliance (see the data sheet for more information)

» Database consolidation

Conclusion

As engineered storage, Oracle ZFS Storage Appliance provides unique integrations with Oracle Database to streamline management, provide superior efficiency, and accelerate BIDW workloads in ways that are unobtainable by other vendors. Furthermore, Oracle ZFS Storage Appliance's unique combination of a scalable storage operating system, high-throughput system design, intelligent caching and flexible flash/disk/cloud configurations delivers the performance and availability characteristics needed for demanding mixed workload and BIDW environments. Oracle ZFS Storage Appliance is deployed by companies worldwide and proven in Oracle's own data centers, where Oracle ZFS Storage Appliance is used for a variety of database storage workloads. See the white paper, "Oracle ZFS Storage Appliance

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and Oracle IT: Use Cases and Benefits" for more information.

With compelling performance, unique Oracle co-engineering, attractive upfront pricing, and reduced operational costs due to simplified management, Oracle ZFS Storage Appliance is the ideal fit for your Oracle Database BIDW storage requirements.

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