

Solution Brief: Oracle ZFS Storage Appliance for Oracle Database Online Transaction Processing 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 online transaction processing (OLTP) workloads, Oracle offers solutions using Oracle ZFS Storage Appliance that provide compelling performance and availability benefits. In addition, unique Oracle hardware and software coengineering delivers enhanced performance, efficiency, and management automation benefits that are not available with storage from any other vendor. Using Oracle storage with Oracle Database empowers database administrators (DBAs) to efficiently manage and optimize the entire database stack.

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

The Correct Tools for the Job

Oracle Exadata is the ultimate platform for Oracle Database, delivering the highest performance, scalability, and availability. However, if you have requirements to run OLTP as part of a dynamic cloud environment, support heterogeneous database servers, or meet stringent cost constraints, a solution built using Oracle ZFS Storage Appliance and taking advantage of its unique coengineered Oracle Database integrations can simplify management, increase operational efficiencies, and reduce risk.

Superior OLTP Performance

OLTP storage workloads are generally characterized by small-block-size random reads and writes in response to transactional commands. From a performance perspective, the key requirement is high transactional frequency for which low latency and high rates of I/Os per second are more important than maximum throughput bandwidth. Oracle ZFS Storage Appliance combines a scalable DRAM centric storage architecture, and intelligent caching of critical workloads identified by unique co-engineering with Oracle database with option of configuring all-flash storage to deliver extreme performance for just this type of workload. And, Oracle ZFS Storage Appliance delivers this high performance at a lower cost—enabling better price/performance compared to competitive systems. For large and growing OLTP workloads, this price/performance advantage is critical.

With its Hybrid Storage Pool architecture and all-flash storage, Oracle ZFS Storage Appliance is able to make the most of standard enterprise hardware and create massive performance efficiency benefits ideal for OLTP workloads. The Adaptive Replacement Cache (ARC) is made up of up to 3 TB of dynamic random access memory (DRAM) and serves reads at DRAM speed, which is up to 1,000 times faster than flash storage. In addition, the ZFS Intent Log (ZIL) is an optimized flash cache that is used to minimize latency of writes to both all-flash and disk-based storage pools while ensuring data integrity and consistency in the event of an outage. Please see the [“Architectural Overview of the Oracle ZFS Storage Appliance”](#) white paper for further details.



High Availability and Data Protection

In addition to high performance, high availability also is required in OLTP environments so that transactions can continue to be served in the event of component failures. Oracle ZFS Storage Appliance offers high availability through its dual-controller architecture with controller failover mechanisms, 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 Active Data Guard and 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 to ensure that database hosts do not time out and applications continue running with zero data loss and minimal disruption time.

Simplified Management

Oracle ZFS Storage Appliance offers multiprotocol support for Oracle Database, so databases can be accessed via either file or block protocols. When Oracle ZFS Storage Appliance is used in conjunction with Oracle Database 11g and higher releases, the preferred protocol is Oracle Direct NFS Client—a high-performance NFS client built into the database. Oracle Direct NFS avoids inefficiencies inherent in many OS kernel NFS implementations and achieves Fibre Channel-like performance but with the simplified high availability and costs of an enterprise-wide Ethernet environment. For more about Oracle Direct NFS, please see the [“Implementing Direct NFS Client and Oracle Intelligent Storage Protocol”](#) white paper. With Oracle Database 19c, Oracle Direct NFS share tuning can be automated by using Oracle Intelligent Storage Protocol, a unique protocol that is a feature of Oracle ZFS Storage Oracle Intelligent Storage Protocol automatically and dynamically adjusts share settings like record size and logbias on the storage, eliminating guesswork and simplifying tuning. Oracle Intelligent Storage Protocol sends hints from Oracle Database 19c and higher databases to the Oracle ZFS Storage Appliance and implements capabilities like fair share scheduling and negative cache hints that automatically optimize critical storage resources to ensure that latency-sensitive I/Os complete first, decreasing their completion time and increasing OLTP throughput—all without manual tuning by DBAs or storage administrators. Additionally, extended analytics available through Oracle Intelligent Storage Protocol at the pluggable database level allow DBAs and storage administrators to identify problems more precisely and resolve them more quickly with the help of AWR-like statistics now available on an appliance. See the [“Oracle Intelligent Storage Protocol”](#) data sheet for more information.

Oracle Direct NFS provides also extremely low latency over 25, 40, or 100GbE Ethernet connections to Oracle ZFS Storage Appliance systems, High-speed Ethernet is often used to connect to Oracle Exadata, PCA, and other Oracle engineered systems.

ORACLE INTELLIGENT STORAGE PROTOCOL PROVIDES UNIQUE INTEGRATION BETWEEN ORACLE DATABASE AND ORACLE ZFS STORAGE APPLIANCE, SIMPLIFYING AND AUTOMATING TUNING, ELIMINATING GUESSWORK, AND REDUCING RISK.

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

- High availability
- High performance in both transactional and throughput workloads
- Reduced management complexity costs and a lower upfront cost
- Unprecedented integration with Oracle Database, such as Oracle Intelligent Storage Protocol and Oracle Hybrid Columnar Compression
- Rich capabilities available with Oracle Intelligent Storage Protocol such as fair share scheduling, negative cache hints and extended analytics optimize database storage and make troubleshooting of performance issues faster and more effective.

Ease of provisioning additional environments

One of the main benefits of using Oracle ZFS Storage Appliance for primary storage use cases is to leverage thin cloning capabilities of the underlying OS to deploy clones rapidly to meet development, test, or QA storage needs with virtually no use of additional storage capacity. Also, with built-in remote replication plus best practices for Oracle Recovery Manager (Oracle RMAN) and Oracle Active Data Guard, Oracle ZFS Storage Appliance offers a number of options for OLTP environments to be integrated with development and test, data protection, and disaster recovery on the same or remote storage system. Best practices for Oracle ZFS Storage Appliance are available for all of the following secondary workloads:

- » Backing up Oracle Databases using Oracle RMAN
- » Performing Disaster recovery using Oracle Active Data Guard
- » Provisioning development and test workloads from production, backup, or DR databases
- » Using the Snap Management Utility for Oracle Database feature of Oracle ZFS Storage Appliance to automatically provision dev/test/QA environments on Oracle ZFS Storage Appliance from the database management console (see the [data sheet](#) for more information)
- » Integrating all of the above along with production database storage
- » Using Oracle Enterprise Manager 13c for a single pane of glass into multiple workloads across multiple systems, complete with database as a service Snap Clone (a feature of Oracle Cloud Management Pack for Oracle Database) integration

Public Cloud Integration

A critical consideration for OLTP environments is how to provide offsite data protection and archiving of critical business data. In addition to Oracle Database-centric solutions for business continuity, Oracle RMAN backups also can be replicated to the cloud with Oracle ZFS Cloud using built-in ZFS replication. With its unique cloud-converged storage design, Oracle ZFS Storage Appliance systems provide seamless integration with Oracle Storage Cloud Service so you can easily protect data and create archives in an enterprise cloud simply by creating local replicas and letting Oracle ZFS storage appliance store the data as objects in the cloud.

Conclusion

As an Oracle engineered storage, Oracle ZFS Storage Appliance accelerates OLTP workloads, makes storage for them more efficient, and streamlines management using unique integrations with Oracle Database. Furthermore, Oracle ZFS Storage Appliance's unique combination of a scalable storage operating system, high-performance system design, and intelligent caching delivers the performance and availability characteristics needed for demanding mixed workload and OLTP 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 ["Oracle ZFS Storage Appliance and Oracle IT: Use Cases and Benefits" white paper](#) for more information.

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

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