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Oracle Intelligent Storage Protocol

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Introduction

Oracle Intelligent Storage Protocol provides an unprecedented and unique level of integration between Oracle Database 12*c* and the Oracle ZFS Storage Appliance family of products. This integration enables faster database performance while saving valuable IT resources by automatically optimizing over 70 percent of the administration required for storage setup and tuning. It also provides detailed visibility into database-storage interactions down to the pluggable database level to improve troubleshooting and collaboration.
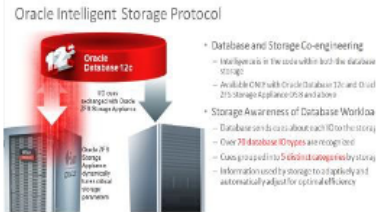
Table 1. Key features and benefits of Oracle Intelligent Storage Protocol

Key Features	Key Benefits
• Hints about key database processes passed from Oracle Database 12*c* to Oracle ZFS Storage Appliance systems. • Oracle ZFS Storage Appliance systems perform automatic and dynamic tuning of critical parameters based on database hints • Per-database (or per-pluggable-database) drill-downs are available • Fair share scheduling aligns resources with I/O criticality • Negative cache hints allow important data blocks to remain cached in dynamic random access memory (DRAM). • Robust insights are provided, including matching report statistics from the Automatic Workload Repository feature of Oracle Enterprise Manager 12*c* with storage analytics 	• Reduces manual intervention and guesswork • Simplifies setup and tuning • Reduces risk and operational costs • Delivers more-consistent database performance • Empowers DBAs with management and provisioning via their preferred tools, including Automatic Workload Repository reports provided by Oracle Database • Improves system efficiency • Enables rapid identification of individual database (or pluggable database) operations for rapid resolution of issues in a multitenant database environment

Engineered Storage

Oracle engineers hardware and software to work together in a way that goes far beyond what any third-party hardware vendor can offer. This unique integration enables features that can dramatically improve performance, efficiencies, and IT economics. With database workloads, storage is often one of the most complicated, yet one of the most important, components of the environment to properly configure and tune. To simplify these tasks for database administrators, Oracle is leading the innovation of coengineered features such as Oracle Intelligent Storage Protocol. Oracle Intelligent Storage Protocol is a unique file storage protocol for Oracle Database 12*c* and Oracle ZFS Storage Appliance systems that, for the first time, allows storage to have database awareness. Oracle Intelligent Storage Protocol enables continuous communication between databases and storage, automatically and dynamically

optimizing critical tuning parameters in real time. The result is easier management, better visibility, less manual intervention and guesswork, and better more-predictable performance.

The Ultimate Storage Integration for Oracle Database

Oracle Intelligent Storage Protocol is available exclusively with the combination of Oracle Database 12*c* and Oracle ZFS Storage Appliance systems because it requires intelligence on both the database host side and the storage side to pass and interpret database hints. With Oracle Intelligent Storage Protocol, Oracle Database can send over 70 different cues, which Oracle ZFS Storage Appliance systems categorize into five different groups. The protocol dynamically and automatically adjusts share parameter settings to tune a storage system for optimal database performance.

Traditionally, multiple shares would have to be set up for different database file types, each with its own settings all tuned manually by an administrator. However, with Oracle Intelligent Storage Protocol and Oracle ZFS Storage Appliance systems, the entire process is automated. Only two shares need to be created, and Oracle ZFS Storage Appliance systems exclusively can understand the database hints and manage settings on a file-by-file basis automatically and in real time.

Figure 1. Setup and tuning is simplified with Oracle Intelligent Storage Protocol
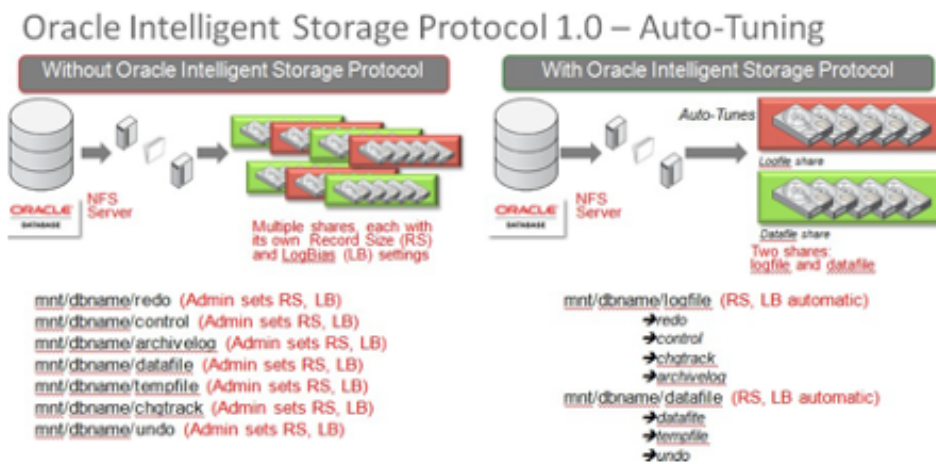
Oracle Intelligent Storage Protocol takes the guesswork out of database storage tuning and helps to automate the process. This can result in reduced risk and operating expense savings and enhances the ability of database administrators to quickly and easily provision their own databases on Oracle ZFS Storage Appliance systems.

Oracle Intelligent Storage Protocol 2.0, available with Oracle ZFS Storage Appliance software release OS8.7, provides features such as fair share scheduling, negative, cache hints, and extended analytics to provide additional optimization for database operations. Fair share scheduling allows the database to send priority hints with each I/O request, which ensures that more-critical database operations receive higher priority for resources from the appliance and results in more-consistent database performance. Negative cache hints prevent data blocks associated with high bandwidth operations— such as backups performed by the Oracle Recovery Manager (Oracle RMAN) feature of Oracle Database—from taking up critical space in DRAM, which frees that resource for data blocks associated with more-important database operations such as an online transaction processing (OLTP) workload.

Another benefit of Oracle Intelligent Storage Protocol is the detailed, granular visibility it provides into database workloads—including insight at the pluggable database level— and how those insights impact the underlying storage. These valuable insights into the nature of database operations lead to faster and more-effective troubleshooting efforts, especially in complex multitenant Oracle Database 12*c* environments. These insights— paired with Oracle Enterprise Manager Plug-in for Oracle ZFS Storage Appliance, which includes provisioning—are part of a highly efficient set of management tools that enables rapid application-to-database-to-storage issue resolution in large-scale, multitenant environments.

In Oracle Intelligent Storage Protocol 2.0, extended analytics further enable IT administrators to see Oracle Intelligent Storage Protocol operations by database name, database function, and database file types and do deep drill-downs on the I/O operations. This data is aligned with Automatic Workload Repository reports so DBAs and storage administrators can easily work together to identify and resolve storage-related performance issues.

Figure 2. Database analytics displayed in the Oracle ZFS Storage Appliance browser user interface (BUI)
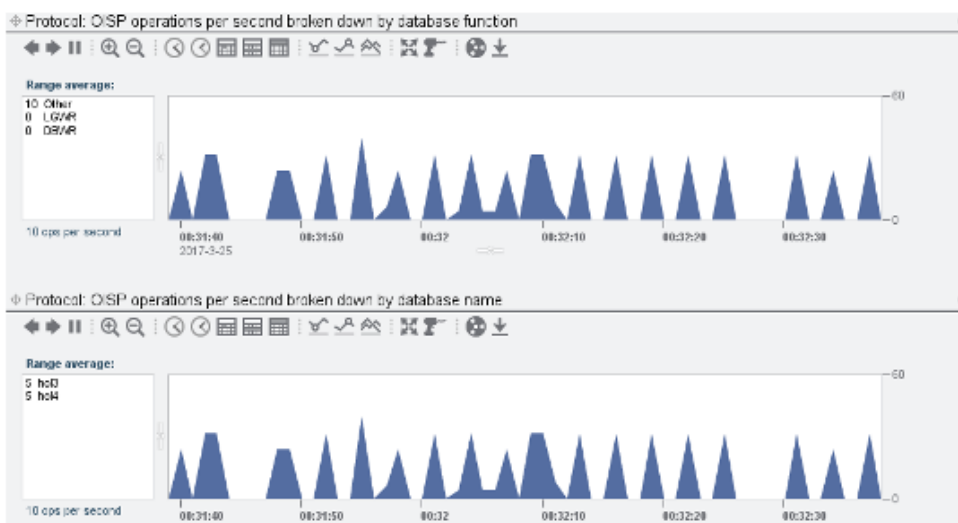
Direct NFS Client: High-Performance Oracle Database Storage Simplified

Oracle Intelligent Storage Protocol is built upon a proven technology, the Direct NFS Client feature that was first released in Oracle Database 11*g*. Direct NFS Client is a highly efficient NFS client built into Oracle Database that was designed specifically for high-performance database workloads. Unlike traditional operating system kernel NFS clients, Direct NFS Client optimizes NFS client settings for the database workload and provides dedicated, parallel TCP connections for each of the major database processes. This enables Fibre Channel–like (or better) performance but with reduced capital and operational costs due to the simplified administration benefits of Ethernet-based, file protocol storage. With Direct NFS Client, organizations can choose to have DBAs manage their own storage by simply provisioning shares themselves rather than having to wait for storage administrators to provision and manage LUNs—as would be the case in traditional Fibre Channel SAN environments. Oracle ZFS Storage Appliance systems are the ultimate platform for Direct NFS Client database storage, given their extreme NAS performance and availability characteristics, plus their optional 40 Gb InfiniBand connectivity.

Figure 3. Direct NFS Client architecture for log write (LGWR), database write (DBWR), parallel query (PQ) slave, and Oracle RMAN I/O operations
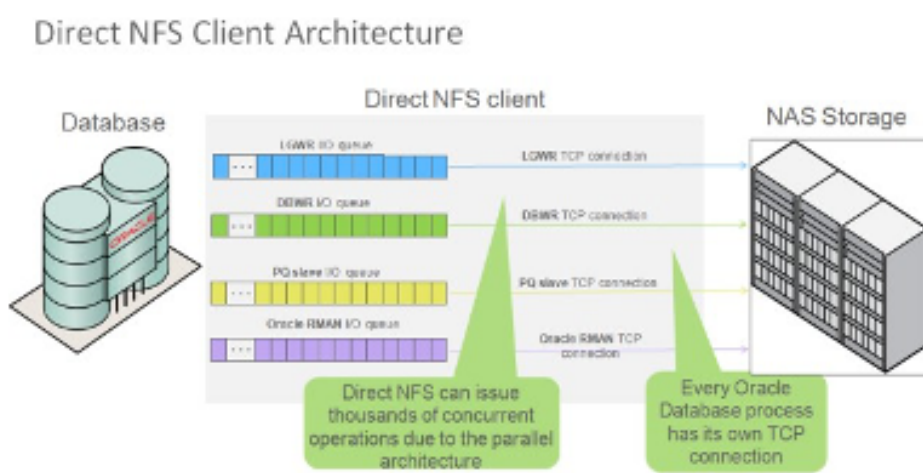

Table 2. Key Enhancements and Required Product Versions

	Product Version	Product Version	Product Version
Oracle Intelligent Storage Protocol version	1.0	1.1	2.0
Oracle ZFS Storage Appliance software release minimum version*	OS8.0	OS8.3	OS8.7
Oracle Database minimum version**	12.1.0.2	12.1.0.2	12.2.0.1

Key Enhancements			
	Storage auto-tuning	Per-database analytics	Fair share scheduling, negative cache hints, and extended analytics

* See My Oracle Support document 1943618.1 at support.oracle.com for further information and setup details.

** Oracle Database, Enterprise Edition is required for these features.

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