ORACLE EXADATA STORAGE SERVER X2-2

KEY FEATURES AND BENEFITS

FEATURES

- 12 x 3.5 inch High Performance or High Capacity SAS disks
- 384 GB of Exadata Smart Flash Cache
- 12 CPU cores dedicated to SQL processing in storage
- 24 GB memory
- Dual InfiniBand ports
- Redundant power supplies
- Oracle Exadata Storage Server software
- Oracle Linux or Solaris based Database Machines

BENEFITS

- Uncompressed usable capacity of up to 3.25 TB per server when using High Performance SAS disks
- Uncompressed usable capacity of up to 16 TB per server when using High Capacity SAS disks
- Hybrid Columnar Compression delivers 10X-15X compression ratios
- Effective data bandwidth of up to 5.4 GB/second per server with Flash and uncompressed data
- Effective data bandwidth of up to 54 GB/second per server with Flash and compressed data
- Software pre-installed

The Oracle Exadata Storage Server X2-2 is the storage building block of the Oracle Exadata Database Machine, Oracle SPARC SuperCluster and Oracle Exadata Storage Expansion Rack. The Exadata Storage Server is highly optimized for use with the Oracle Database and employs a massively parallel architecture and Exadata Smart Flash Cache to dramatically accelerate Oracle Database processing and speed I/O operations. It may be attached to an Exadata Database Machine to build out the Database Machine and is ideal for Online Transaction Processing (OLTP), Data Warehousing (DW) and consolidation of mixed workloads. Simple to deploy and manage, the Oracle Exadata Storage Server provides linear I/O scalability and mission-critical reliability.

Oracle Exadata Storage Server

The Oracle Exadata Storage Server is a fast, reliable, high capacity, industry-standard storage server. Each server comes preconfigured with: 2 x six-core Intel® Xeon® L5640 Processors, 24 GB memory, 384 GB of Exadata Smart Flash Cache, 12 disks connected to a storage controller with 512MB battery-backed cache, and dual port InfiniBand connectivity. All software is preinstalled and comes complete with management interface for remote access, dual-redundant hot-swappable power supplies and takes up 2U in a 19-inch rack.

Intelligent Oracle Exadata Storage Server Software enables the Exadata Storage Server to quickly process database queries and return only the relevant rows and columns to the database server. By pushing SQL processing to the Exadata Storage Server all the disks can operate in parallel, reducing database server CPU consumption while using much less bandwidth to move data between storage and database servers. The Exadata Storage Server returns a query result set rather than entire tables, eliminates network bottlenecks, and frees up database server resources. This means users often see a performance increase of 10x when scanning and analyzing data.

RELATED PRODUCTS AND SERVICES

RELATED PRODUCTS

- Oracle Exadata Database Machine X2-2
- Oracle Exadata Database Machine X2-8
- Oracle Exadata Storage Expansion Rack
- Oracle SPARC SuperCluster
- Oracle Database 11g
- Real Application Clusters
- Partitioning
- Advanced Compression
- Advanced Security
- Active Data Guard
- Real Application Testing
- OLAP
- Advanced Analytics
- Business Intelligence
- Enterprise Manager
- Oracle Linux
- Oracle Solaris

RELATED SERVICES

The following services are available from Oracle:

- Advanced Customer Services
- Consulting Services
- Oracle University courses

The Oracle Exadata Storage Server comes with either twelve 600 GB 15,000 RPM High Performance Serial Attached SCSI (SAS) disks or twelve 3 TB 7,200 RPM High Capacity SAS disks. The High Performance SAS based Exadata Storage Servers provide up to 3.25 TB of uncompressed usable capacity, and up to 1.8 GB/second of raw data bandwidth. The High Capacity SAS based Exadata Storage Servers provide up to 16 TB of uncompressed usable capacity, and up to 1.3 GB/second of raw data bandwidth. When stored in compressed format, the amount of user data and the amount of data bandwidth delivered by each cell increases up to 10 times.

Each Exadata Storage Server includes 384 GB of Exadata Smart Flash Cache. This solid state storage delivers dramatic performance advantages with Exadata storage. The Exadata Smart Flash Cache holds frequently accessed data in very fast flash storage while most of the data is kept in very cost effective disk storage. This happens automatically without the user having to take any action. The Oracle Flash Cache is smart because it knows when to avoid trying to cache data that will never be reused or will not fit in the cache. The Oracle Database and Exadata storage allow the user to provide directives at the database table, index and segment level to ensure that specific data is retained in flash. Tables can be moved in and out of flash with a simple command, without the need to move the table to different tablespaces, files or LUNs like you would have to do with traditional storage with flash disks.

The Exadata Smart Flash Cache is also used to reduce the latency of log write I/O eliminating performance bottlenecks that might occur due to database logging. The time to commit user transactions is very sensitive to the latency of log writes. Also, many performance critical database algorithms such as space management and index splits are also very sensitive to log write latency. Today Exadata storage speeds up log writes using the battery backed DRAM cache in the disk controller. Writes to the disk controller cache are normally very fast, but they can become slower during periods of high disk IO. Smart Flash Logging takes advantage of the flash memory in Exadata storage to speed up log writes.

Flash memory has very good average write latency, but it has occasional slow outliers that can be one or two orders of magnitude slower than the average. The idea of the Exadata Smart Logging is to perform redo writes simultaneously to both flash memory and the disk controller cache, and complete the write when the first of the two completes. This literally gives Exadata the best of both worlds. The Smart Flash Logging both improves user transaction response time, and increases overall database throughput for IO intensive workloads by accelerating performance critical database algorithms.

Compressing data can provide dramatic reduction in the storage consumed for large databases. The Exadata Storage Server provides a very advanced compression capability called Hybrid Columnar Compression (HCC). Hybrid Columnar Compression enables the highest levels of data compression and provides enterprises with tremendous cost-savings and performance improvements due to reduced I/O. Typical storage savings can range from 10x to 15x.

In addition, Exadata Database Machine is the world's most secure database system.

Building on the high security capabilities in every Oracle Database, Exadata Database Machine provides the ability to query fully encrypted databases with near zero overhead at hundreds of gigabytes of user data per second. This is done by moving decryption processing from software into the Exadata Storage Server hardware.

Intelligent Scalable Storage Grid

Oracle Exadata Storage Servers is installed in to a customer supplied 19-inch rack and is connected to an Exadata Database Machine or SPARC SuperCluster via InfiniBand. Exadata Storage Servers have dual 40 Gigabit InfiniBand links that provide connectivity many times faster than traditional storage or server networks. Further, Oracle's interconnect protocol uses direct data placement to ensure very low CPU overhead by directly moving data from the wire to database buffers with no extra data copies.

Exadata Storage Servers are architected to scale-out easily. To achieve higher performance and greater storage capacity, additional Exadata Storage Servers can be connected to an Oracle Database Machine or SPARC SuperCluster. This, combined with faster InfiniBand interconnect, Exadata Smart Flash Cache and the reduction of data transferred due to offload processing and Hybrid Columnar Compression, yields very large performance improvements. A 10x improvement in query performance compared to traditional database storage architectures is common, with much greater improvement possible.

An alternative to the purchase of individual Exadata Storage Servers with the requisite rack, InfiniBand switches, cables and other infrastructure built and configured by the customer, is the Exadata Storage Expansion Rack. The Exadata Storage Expansion Rack enables you to easily grow the Exadata storage capacity and bandwidth of any X2-2 and X2-8 Exadata Database Machine or SPARC SuperCluster. It is designed for database deployments that require very large amounts of data including: historical or archive data; backups and archives of Exadata Database Machine data; documents, images, file and XML data, LOBs and other large unstructured data. Available in Full Rack, Half Rack and Quarter Rack versions it connects to the Exadata Database Machine or SPARC SuperCluster using the integrated InfiniBand fabric to easily scale the system to any capacity. The expansion rack is extremely simple to configure as there are no LUNs or mount points to configure. Storage is configured and added to a database with a few simple commands, completed in minutes. ASM dynamically and automatically balances the data across Exadata Storage Servers, online, evenly spreading the I/O load across the racks fully utilizing all the hardware and easily integrating the expansion rack into the configuration.

Enterprise Ready

The Oracle Exadata Storage Server has complete redundancy built in to support the demands of mission critical applications. Each Exadata Storage Server has dual port InfiniBand connections and dual-redundant, hot-swappable power supplies for high availability. Automatic Storage Management, a feature of Oracle Database 11g, provides disk mirroring. Hot swappable Exadata disks ensure the database can

tolerate disk drive failures. In addition, data is mirrored across storage servers to ensure that storage server failure will not cause loss of data, or inhibit data accessibility.

Oracle Enterprise Manager Cloud Control 12c uses a holistic approach to manage the Exadata product family and provides comprehensive lifecycle management from monitoring to management and ongoing maintenance for the entire engineered system. It provides a unified view of hardware and software where you can view hardware components such as compute nodes, Exadata cells, and InfiniBand switches and see the placement of software running on them along with their resource utilization. DBAs can also drilldown from the database to the storage layer of Exadata to identify and diagnose problems such as performance bottlenecks or hardware faults. Lights-out monitoring capability of Enterprise Manager is optimized for Exadata where metrics and thresholds are predefined so that administrators can get timely notifications when issues arise. In addition, hardware and software incidents are automatically detected and service requests logged to reduce problem resolution time. In addition, administrators can use Consolidation Planner in Oracle Enterprise Manager to determine optimal consolidation strategies for different Exadata configurations. In Oracle Exadata Database Machine, management is engineered together with hardware and software to provide not just high performance and availability but also ease of management and consolidation.

Software from Oracle, Hardware from Sun

The Exadata product builds upon years of Oracle and Sun jointly solving customers' business and technical challenges. Integrated hardware and software technology, and related hardware support services, are provided in a unified fashion by Oracle. By combining leading, industry-standard servers and storage hardware from Sun with the intelligence built into the Oracle software, the Oracle Database Machine and Oracle SPARC SuperCluster delivers the industry's highest levels of performance, scalability and reliability, and is backed by Oracle Support.

Oracle Exadata Storage Server X2-2 Hardware	
The Oracle Exadata Storage Server comes preconfigured with:	
Processors	2 x Six-Core Intel® Xeon® L5640 (2.26 GHz) Processors
Exadata Smart Flash Cache	384 GB
System Memory	24 GB
Disk Controller	Disk Controller HBA with 512MB Battery Backed Write Cache
InfiniBand Connectivity	Dual-Port QDR (40Gb/s) InfiniBand Host Channel Adapter
Power Supplies	Dual-redundant, hot-swappable power supply
Remote Management	Sun Embedded Integrated Lights Out Manager (ILOM)
Disk Drives	12 x 600 GB 15,000 RPM High Performance SAS or 12 x 3 TB 7,200 RPM High Capacity SAS For raw disk capacity, 1 GB = 1 billion bytes. Actual formatted capacity is less.
Remote Management	Integrated Lights Out Manager (ILOM) Ethernet port

Oracle Exadata Storage Server X2-2 Key Capabilities	
High Performance SAS disks	• Up to 1.8 GB/second of uncompressed raw disk bandwidth per cell • Up to 5.4 GB/second of uncompressed Flash data bandwidth per cell • 7.2 TB of raw disk data capacity • Up to 3.25 TB of uncompressed usable capacity per cell
High Capacity SAS disks	• Up to 1.3 GB/second of uncompressed raw disk bandwidth per cell • Up to 4.9 GB/second of uncompressed Flash data bandwidth per cell • 36 TB of raw disk data capacity • Up to 16 TB of uncompressed usable capacity per cell

Oracle Exadata Storage Server X2-2 Environmental Specifications	
Dimensions and Weight	Height: 3.43 in. (87.12 mm) Width: 16.75 in. (425.45 mm) Depth: 30.0 in. (762.0 mm) Weight: 65 lbs. (29.54 kg)
Environment	Operating temperature: 5 ºC to 35 ºC (41 ºF to 95 ºF) Non-operating temperature: -40 ºC to 70 ºC (-40 ºF to 158 ºF) Operating relative humidity 10% to 90% non-condensing Non-operating relative humidity: up to 93%, non-condensing Operating altitude: Up to 3,000 m, maximum ambient temperature is derated by 1° C per 300 m above 900 m Non-operating altitude: Up to 12,000 m Acoustic noise: 7.6 B operating
Power	Dual-redundant, hot-swappable power supply Maximum output power: 1200 W Maximum AC input current at 100 V AC and 1200 W output: 13.0 A Specified power supply efficiency at 1200 W (100%) load: 90%
Regulations [1]	Safety: UL 60950-1 2nd Ed, EN60950-1:2006 2nd Ed, CB Scheme with all country differences RFI/EMI: FCC CFR 47 Part 15 Subpart B Class A, EN 55022:2006+A1:2007 Class A, EN 61000-3-2:2006, EN 61000-3-3:1995+A1:2001+A2:2002, ETSI EN 300 386 V1.4.1 (2008) Immunity: EN 55024:1998+A1:2001:+A2:2003
Certifications [1]	Safety: UL/cUL, CE, BSMI, GOST R, S-Mark, CSA C22.2 No. 60950-1-07 2nd Ed. EMC: CE, FCC, VCCI, ICES, C-Tick, KCC, GOST R, BSMI Class A Other: Complies with WEEE Directive (2002/96/EC) and RoHS Directive (2002/95/EC)

[1] In some cases, as applicable, regulatory and certification compliance were obtained at the component level.

Oracle Exadata Storage Server X2-2 Software
• Oracle Exadata Storage Server Software 11g Release 2 (release 11.2.2.1 or later) • Oracle Linux 5 Update 7 • Requires Oracle Database 11g Release 2 Enterprise Edition or later for the database accessing Exadata storage
High-Availability Features
• Redundant power supplies • Redundant InfiniBand ports • Hot swappable disk drives • Oracle Automatic Storage Management: All database files either double or triple mirrored; Disk failures do not abort queries or transactions • Oracle Exadata Storage Server Software: Storage server failure can be tolerated without data loss or aborting queries or transactions
Manageability Features
• Oracle Embedded Integrated Lights Out Manager (ILOM) • Oracle Enterprise Manager Grid Control and Exadata Plug- In
Support Services Provided By Oracle
• Hardware Warranty: 1 year with a 4 hour web/phone response during normal business hours (Mon-Fri 8AM-5PM), with 2 business day on-site response/Parts Exchange
• Oracle Premier Support for Systems: Oracle Linux and Solaris support and 24x7 with 2 hour on-site hardware service response (subject to proximity to service center)
• Oracle Premier Support for Operating Systems
• Oracle Customer Data and Device Retention
• System Installation Services
• Software Configuration Services
• Oracle Exadata Start-Up Pack
• System Upgrade Support Services including hardware installation and software configuration
• Oracle Auto Service Request (ASR)

Contact Us

For more information about the Oracle Exadata Storage Server, please visit oracle.com or call +1.800.ORACLE1 to speak to an Oracle representative.

Oracle is committed to developing practices and products that help protect the environment

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