

ORACLE EXADATA DATABASE MACHINE X2-8

FEATURES AND FACTS

FEATURES

- 160 CPU cores and 4 TB of memory for database processing
- 168 CPU cores dedicated to SQL processing in storage
- 2 database servers
- 14 Oracle Exadata Storage Servers
- 5.3 TB of Exadata Smart Flash Cache
- QDR (40 Gb/second) InfiniBand Switches
- Uncompressed usable capacity of up to 224 TB per rack
- Uncompressed I/O bandwidth of up to 75 GB/second per rack
- Hybrid Columnar Compression delivers 10X-15X compression ratios
- Complete redundancy for high availability

FACTS

- Ability to perform up to 1,500,000 database I/O operations per second
- Easily upgrade to meet the needs of any size application
- Scale by connecting multiple Exadata Database Machine X2-8 racks or Exadata Storage Expansion Racks. Up to 8 racks can be connected by simply connecting via InfiniBand cables. Larger configurations can be built with additional InfiniBand switches
- Pre-configured system optimized for all database applications

The Oracle Exadata Database Machine X2-8 delivers extreme performance and scalability for all your database applications including Online Transaction Processing (OLTP), Data Warehousing (DW) and consolidation of mixed workloads. Built using industry-standard hardware from Sun, and intelligent database and storage software from Oracle, the Exadata Database Machine is a complete optimized package of software, servers, and storage. Simple and fast to implement, the Exadata Database Machine is ready to tackle your largest and most important database applications — and often run them 10x faster, or more.

Extreme Performance for Online Transaction Processing, Data Warehousing and Consolidating Mixed Workloads

Oracle is offering a fully integrated platform for hosting all your database applications. The Exadata Database Machine is an easy to deploy out of the box solution for hosting the Oracle Database. Ready to go day one much of the integration effort, cost and time of database deployment has been eliminated. Whether its OLTP, DW or mixed application workloads, a common deployment creates a tremendous opportunity for consolidation economies of scale in the data center. All this with breakthrough performance.

The unique technology driving the performance advantages of the Exadata Database Machine is the Oracle Exadata Storage 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. As data volumes continue to grow exponentially, conventional storage arrays struggle to efficiently process terabytes of data, and push that data through storage networks to achieve the performance necessary for demanding database applications.

Exadata Storage Servers provide a high-bandwidth, massively parallel solution delivering up to 75 GB per second of raw I/O bandwidth and up to 1,500,000 database I/O operations per second (IOPS). Much of these performance gains come from the incorporation of Exadata Smart Flash Cache in each Exadata Storage Server and the Oracle Databases' storage hierarchy. With 14



RELATED PRODUCTS AND SERVICES

RELATED PRODUCTS

- Oracle Exadata Database Machine X2-2
- Oracle Exadata Storage Expansion Rack
- Oracle Exadata Storage Server X2-2
- 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

RELATED SERVICES

The following services are available from Oracle:

- Advanced Customer Services
- Consulting Services
- Oracle University courses

Exadata Storage Servers in a 42U Rack, 5.3 TB of Exadata Smart Flash Cache is integrated into the Exadata Database Machine X2-8.

Oracle has implemented a smart flash cache directly in the Oracle Exadata Storage Server. 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.

Extreme Scalability

The Exadata Database Machine X2-8 is a full rack system with 2 database servers and 14 Exadata Storage Servers. Each database server comes with 80 Intel CPU cores (8 x ten-core Intel® Xeon® E7-8870 processors) and 2 TB of memory. It is

available with either 600 GB High Performance SAS disks or 3 TB High Capacity SAS disks.

While an Exadata Database Machine X2-8 rack is an extremely powerful system, a building-block approach is used that allows Exadata Database Machine X2-8 to scale to almost any size. Exadata Database Machine X2-8 racks can be connected using the integrated InfiniBand fabric. As new racks of Exadata Database Machines are incrementally added to a system, the storage capacity and performance of the system grow. A system composed of two Exadata Database Machines X2-8 racks is simply twice as powerful as a single rack system providing double the I/O throughput and double the storage capacity. It can be run in single system image mode or logically partitioned for consolidation of multiple databases. Scaling out is easy with Exadata Database Machine. Oracle Real Application Clusters (RAC) can dynamically add more processing power and Automatic Storage Management (ASM) can dynamically rebalance the data across Exadata Storage Servers to fully utilize all the hardware in each configuration.

When even larger storage capacity is required for your Exadata Database Machine deployment, the Exadata Storage Expansion Rack is available. The Exadata Storage Expansion Rack enables you to grow the Exadata storage capacity and bandwidth of any X2-2 and X2-8 Exadata Database Machine. 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 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 Exadata Database Machine X2-8 has complete redundancy built in to support the demands of mission critical applications. Each Exadata Database Machine has redundant InfiniBand connectivity, redundant Power Distribution Units (PDU), and the servers all have hot-swappable power supplies for high availability. Oracle RAC protects against database server failure and ASM provides disk mirroring to protect against disk failures. Hot swappable components ensure the database can tolerate server and disk drive failure. In addition, data is mirrored across storage servers to protect against loss of data, or inhibit data accessibility.

Oracle Enterprise Manager Cloud Control 12c uses a holistic approach to manage the Exadata Database Machine 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 drill down from the database to the storage layer of Exadata to identify and diagnose problems such as performance bottlenecks or hardware faults. Lights-out monitoring within 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 Database Machine 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 Exadata Database Machine delivers the industry's highest levels of performance, scalability and reliability, and is backed by Oracle Support.

Exadata Database Machine X2-8 Key Capabilities
Exadata Database Machine X2-8 Full Rack with High Performance SAS Disks
Up to 25 GB/second of uncompressed raw disk bandwidth ¹
Up to 75 GB/second of uncompressed Flash data bandwidth ¹
Up to 50,000 Database Disk IOPS ²
Up to 1,500,000 Database Flash IOPS ²
100 TB of raw disk data capacity ³
Up to 45 TB of uncompressed usable capacity ⁴
Data Load Rate: Up to 12 TB/hour
Exadata Database Machine X2-8 Full Rack with High Capacity SAS Disks
Up to 18 GB/second of uncompressed raw disk bandwidth ¹
Up to 68 GB/second of uncompressed Flash data bandwidth ¹
Up to 28,000 Database Disk IOPS ²
Up to 1,500,000 Database Flash IOPS ²
504 TB of raw disk data capacity ³
Up to 224 TB of uncompressed usable capacity ⁴
Data Load Rate: Up to 12 TB/hour
Actual system performance varies by application.
¹ Bandwidth is peak physical scan bandwidth achieved running SQL, assuming no data compression. Effective data bandwidth is higher when compression is used.
² Based on read IO requests of size 8K running SQL. Note that the IO size greatly affects Flash IOPS. Others quote IOPS based on 2K, 4K or smaller IOs and are not relevant for databases. Exadata Flash read IOPS are so high they are typically limited by database server CPU, not IO. This is especially true for the Storage Expansion Racks.
³ For raw capacity, 1 GB = 1 billion bytes. Capacity calculated using normal space terminology of 1 TB = 1024 * 1024 * 1024 bytes. Actual formatted capacity is less.
⁴ Actual space available for a database after mirroring (ASM normal redundancy) while also providing adequate space (one disk on Quarter and Half Racks and two disks on a Full Rack) to reestablish the mirroring protection after a disk failure.

Exadata Database Machine X2-8 Hardware

2 x Database Servers, each with:

- 8 x Ten-Core Intel® Xeon® E7-8870 Processors (2.40 GHz)
- 2 TB Memory
- Disk Controller HBA with 512MB Battery Backed Write Cache
- 8 x 300 GB 10,000 RPM SAS Disks
- 8 x InfiniBand QDR (40Gb/s) Ports
- 8 x 10 Gb Ethernet Ports based on the Intel 82599 10GbE Controller
- 8 x 1 Gb Ethernet Ports
- 1 x ILOM Ethernet Port
- 4 x Redundant Hot-Swappable Power Supplies

3 x 36 port QDR (40 Gb/sec) InfiniBand Switches

14 x Exadata Storage Servers X2-2 with 12 x 600 GB 15,000 RPM High Performance SAS disks or 12 x 3 TB 7,200 RPM High Capacity SAS disks

Includes:

- 168 CPU cores for SQL processing
- 5.3 TB Exadata Smart Flash Cache

Additional Hardware Components Included:

- InfiniBand cables
- Ethernet switch for administration of the Database Machine
- 2 x Redundant Power Distributions Units (PDUs)
- 42U rack packaging

Spares Kit Included:

- 2 x 600 GB High Performance SAS disks or 2 x 3 TB High Capacity SAS disks
- 2 x 96 GB Exadata Smart Flash Cache cards
- InfiniBand cables

Exadata Database Machine X2-8 Support Services

- 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 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)

Exadata Database Machine X2-8 Upgrades

Upgradability: Connect any combination of Exadata Database Machine X2-8 or Exadata Storage Expansion Full or Half Racks via included InfiniBand fabric. Connect a maximum of 1 Exadata Storage Expansion Quarter Rack to any multi-rack Exadata Database Machine X2-8 configuration, of Half or Full Racks, via included InfiniBand fabric

- InfiniBand cables to connect 3 racks come in the Spares Kit
- Additional optical InfiniBand cables required when connecting 4 or more racks
- Up to 8 racks can be connected without requiring additional InfiniBand switches

Exadata Database Machine X2-8 Environmental Specifications

• Height: 42U, 78.66" - 1998 mm

• Width: 23.62" – 600 mm

• Depth: 47.24" – 1200 mm

Weight: 2,162 lbs. (980.7 kg)

Power

• Maximum power usage: 17.7 kW (18.1 kVA)

• Typical power usage (varies by application load): 12.4 kW (12.7 kVA)

Cooling

• At maximum usage: 60,350 BTU/hour (63,630 kJ/hour)

• At typical usage: 42,280 BTU/hour (44,580 kJ/hour)

Airflow

• At maximum usage: 2,781 CFM

• At typical usage: 1,950 CFM

• Airflow must be front-to-back

Acoustic noise: 8.5 B operating

Operating temperature/humidity: 5 °C to 32 °C (41 °F to 89.6 °F), 10% to 90% relative humidity, non-condensing

Altitude Operating: Up to 3,048 m, max. ambient temperature is de-rated by 1° C per 300 m above 900 m

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 61000-3-11:2000, EN 61000-3-12:2005, 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, CCC

• EMC: CE, FCC, VCCI, ICES, KCC, GOST R, BSMI Class A, AS/NZ 3548, CCC

• 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 Database Software (sold separately)	
For database servers	Oracle Database 11g Release 2 Enterprise Edition (11.2.0.2 or higher required), Oracle Real Application Clusters, Oracle Partitioning, and other Oracle Database options
For storage servers	Oracle Exadata Storage Server Software Licenses are transferable from one system to another.
Oracle Software (included)	
For database servers	Oracle Linux 5 Update 7 with the Unbreakable Enterprise Kernel Zero-loss Zero-copy Datagram Protocol (ZDP) InfiniBand protocol used to communicate between the Exadata Storage Servers and the Oracle Database which is based on the Reliable Datagram Sockets (RDS) OpenFabrics Enterprise Distribution (OFED)
Exadata Storage Software Features	
<ul style="list-style-type: none"> • Smart Scan Technology • Smart Flash Cache • Smart Flash Logging • IO Resource Manager • Storage Index Technology • Hybrid Columnar Compression • Smart Scans of Data Mining model scoring 	
High-Availability Features	
<ul style="list-style-type: none"> • Redundant power supplies for all servers • Redundant InfiniBand switches • Redundant Power Distribution Units • Oracle Automatic Storage Management: All database files mirrored; disk failures do not interrupt query processing • Oracle Real Application Clusters: database server failures are tolerated • Oracle Exadata Storage Server Software: storage server failures are tolerated • Backup is performed using Oracle Recovery Manager • Point in time restores are performed using Oracle Flashback Technologies • Oracle Data Guard for protection against disasters 	
Manageability Features	
<ul style="list-style-type: none"> • Oracle Embedded Integrated Lights Out Manager (ILOM) • Oracle Enterprise Manager Grid Control • Oracle Quality of Service Management (requires Oracle Database 11.2.0.2) 	

Contact Us

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



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