ORACLE EXADATA STORAGE EXPANSION RACK X3-2

FEATURES

- Grow the storage capacity of Oracle Exadata Database Machines and Oracle SuperCluster
- Includes from 4 to 18 Oracle Exadata Storage Servers
- Mirrored usable capacity of up to 288 TB per rack before compression
- Up to 216 CPU cores dedicated to SQL processing in storage
- Up to 28.8 TB of Exadata Smart Flash Cache
- Connected directly to Exadata Database Machines X3-2 and X3-8 and SuperCluster via 40 Gb/second InfiniBand
- Uncompressed I/O bandwidth of up to 130 GB/second per rack
- Hybrid Columnar Compression delivers 10X-15X compression ratios
- Complete redundancy for high availability

FACTS

- Engineered scale-out storage architecture pre-configured to easily expand system capacity and performance, online
- Simple upgrade to meet the needs of any size application
- Over 4.5 Petabytes of user data can be stored in a rack using the included Hybrid Columnar Compression
- Scale the configuration by connecting up to 18 Exadata Database Machines and Exadata Storage Expansion Racks by simply connecting via InfiniBand cables. Larger configurations can be built with additional InfiniBand switches

The Oracle Exadata Database Machine and Oracle SuperCluster delivers extreme performance and scalability for all your database applications including Online Transaction Processing (OLTP), Data Warehousing (DW) and consolidation of mixed workloads. The Oracle Exadata Storage Expansion Rack is engineered to be the simplest, fastest and most robust way to add additional storage capacity to an Exadata Database Machine or SuperCluster. A natural extension of the Exadata Database Machine, the Exadata Storage Expansion Rack can be used to satisfy the Big Data requirements of the largest mission critical databases.

Engineered System For Fast Deployment of All Your Databases

The Exadata Database Machine and SuperCluster are easy to deploy systems that include all the hardware needed for running the Oracle Database. The database servers, storage servers and network are pre-configured, pre-tuned, and pre-tested by Oracle experts, eliminating the weeks of effort that is typically required to deploy a high performance system. Extensive end-to-end testing ensures all components work seamlessly together and there are no performance bottlenecks or single points of failure that can affect the complete system. The Exadata Storage Expansion Rack takes this to the next level.

Extreme Performance and Capacity

The Exadata Storage Expansion Rack enables you to grow the Exadata storage capacity and bandwidth of any Exadata Database Machine or SuperCluster. It is designed for database deployments that require very large amounts of data including: historical or archive data, backups, documents, images, XML, LOBs, etc. Available in Full Rack, Half Rack and Quarter Rack sizes, it connects to the Exadata Database Machine or SuperCluster using the integrated InfiniBand fabric. The expansion rack is extremely simple to configure as there are no LUNs or mount points to set up. Storage is configured and added to a database online with a few simple commands, completed in minutes.
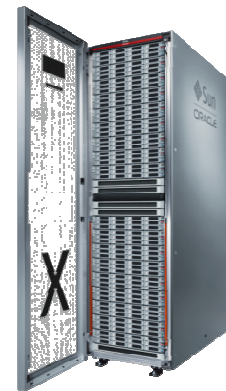
Extreme Performance by Offloading Data Intensive Processing

As data volumes grow exponentially, conventional storage arrays struggle to efficiently access terabytes of data and push that data through storage networks.

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RELATED PRODUCTS

- Oracle Exadata Database Machine X3-8
- Oracle Exadata Database Machine X3-2
- Oracle Exadata Storage Server X3-2
- Oracle SuperCluster
- Oracle Database 11g and 12c
- Real Application Clusters
- Partitioning
- Multitenant
- Advanced Compression
- Advanced Security
- Active Data Guard
- GoldenGate
- 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
- Oracle Premier Support for Systems
- Oracle Infrastructure as a Service On-Premise (IaaS)
- Oracle Platinum Services
- Oracle PlatinumPlus Services
- Consulting Services
- Oracle University courses

The Exadata Database Machine and SuperCluster not only provide high performance and scalability, they also include a unique technology that offloads data intensive SQL operations into the Oracle Exadata Storage Servers. By pushing SQL processing to the Exadata Storage Servers, data filtering and processing occurs immediately and in parallel across all storage servers as data is read from disk. Exadata storage offload reduces database server CPU consumption and greatly reduces the amount of data moved between storage and database servers.

Each Exadata Storage Server includes two 6-core Intel® Xeon® processors that are used for database offload. A Full Rack Exadata Storage Expansion Rack has a total of 216 storage processing cores. The CPUs in Exadata Storage Servers do not replace database CPUs. Instead they accelerate data intensive workloads similar to how graphics cards accelerate image intensive workloads.

Extreme System Scalability and Growth

Three versions of the Exadata Storage Expansion Rack are available. From the Full Rack configuration with 18 Exadata Storage Servers; to the Half Rack with 9 Exadata Storage Servers; to the Quarter Rack system with 4 Exadata Storage Servers; there is a configuration that fits any application. One version can be upgraded online to another ensuring a smooth upgrade path as processing requirements grow. All three versions of the expansion rack are delivered with the same 600 GB High Performance disks or 3 TB High Capacity disks, and Exadata Smart Flash Cache, available in the Exadata Database Machine. In addition to upgrading from a small to large Exadata Storage Expansion Rack, Oracle continues to use a building-block approach to connect the Exadata Storage Expansion Rack to the Exadata Database Machine and SuperCluster using the integrated InfiniBand fabric to easily scale the system to any size. Exadata Storage Expansion Full, Half and Quarter Racks can be coupled to Exadata Database Machine Full, Half and Quarter Rack systems in almost any combination. Up to 18 Exadata Database Machine racks and Exadata Storage Expansion Racks can be easily connected via InfiniBand cables. An 18 rack Exadata configuration has a raw disk capacity of up to 11,520 TB and 3,840 CPU cores dedicated to SQL processing. Larger configurations can be built with additional InfiniBand switches.

As new Exadata Storage Expansion Racks are connected to an Exadata Database Machine or SuperCluster the storage capacity and performance of the system grow. The system can be run in single system image mode or logically partitioned for consolidation of multiple databases. Scaling out is easy with Exadata Database Machine, SuperCluster and Exadata Storage Expansion Racks. Automatic Storage Management (ASM) dynamically and automatically
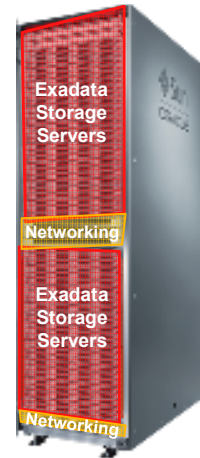
balances the data across Exadata Storage Servers, online, evenly spreading the I/O load across the racks, fully utilizing all the hardware and easily integrating the expansion rack into the configuration. The I/O Resource Manager can also be used to apportion I/O bandwidth to different databases and users of the system to deliver on business service level targets.

Extreme Performance from Exadata Smart Flash Cache

Exadata systems use the latest PCI flash technology rather than flash disks. PCI flash greatly accelerates performance by placing flash directly on the high speed PCI bus rather than behind slow disk controllers and directors. Each Exadata Storage Server includes 4 PCI flash cards with a total capacity of 1.6 TB of flash memory. A Full Rack Exadata Storage Expansion Rack includes 72 PCI flash cards providing 28.8 TB of flash memory. The flash modules used in Exadata X3 have an expected endurance of 10 years or more for typical database data.
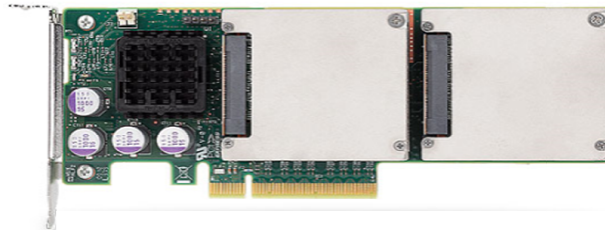
Sun Flash Accelerator F40 PCIe Card

The Exadata Smart Flash Cache automatically caches frequently accessed data in PCI flash while keeping infrequently accessed data on disk drives. This provides the performance of flash with the capacity and low cost of disk. The Exadata Smart Flash Cache understands database workloads and knows when to avoid caching data that will never be reused or will not fit in the cache. The Oracle Database and Exadata storage optionally allow the user to provide SQL directives at the database table, index and segment level to ensure that specific data is retained in flash. Tables can be retained in flash without the need to move the table to different tablespaces, files or LUNs like you would have to do with traditional storage and flash disks.

The combination of scale-out storage, InfiniBand networking, database offload, and PCI flash allows a single Exadata Storage Expansion Rack to deliver up to 130 GB per second of I/O bandwidth and up to 1,900,000 random 8K read I/O operations per second (IOPS) to database workloads. This performance is orders of magnitude faster than traditional storage arrays. It is important to note that these are real-world end-to-end performance figures measured running SQL workloads on a single rack Exadata system with an Exadata Storage Expansion Rack. They are not component level measurements based on low level IO measurement tools.

The Exadata Smart Flash Cache also caches database block writes. Write caching eliminates disk bottlenecks in large scale OLTP and batch workloads. The flash write capacity of a single Exadata system with Exadata Storage Expansion Rack exceeds 1,350,000 8K write I/Os per second. The Exadata write cache is transparent,

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persistent, and fully redundant. The I/O performance of the Exadata Smart Flash Cache is comparable to dozens of enterprise disk arrays with thousands of disk drives.

The Exadata Smart Flash Cache also implements algorithms to reduce the latency of log write I/Os. The time to commit user transactions or perform critical updates is very sensitive to the latency of log writes. Smart Flash Logging takes advantage of the flash memory in Exadata storage combined with the high speed RAM memory in the Exadata disk controllers to speed up log writes and bypass the latency spikes that can occur in flash solutions. The Exadata Smart Flash Logging algorithms are unique to the Exadata system.

Flash and RAM memory are central to the architecture of the Exadata Database Machine X3. Prior database systems were disk-centric with flash memory used to accelerate database execution. The Exadata Database Machine X3 systems are flash-centric, with large RAM memory footprints used to further accelerate workload execution. In order to realize the highest level of performance at the lowest cost, the Exadata X3 system implements a mass memory hierarchy that automatically moves active data into flash memory and the most active data into RAM memory while keeping less active data on low-cost disks.

Exadata uses only enterprise grade flash that is designed by the flash manufacturer to have high endurance. Exadata is designed for mission critical workloads and therefore does not use consumer grade flash that can potentially degrade or fail unexpectedly after a few years of usage. The enterprise grade flash chips used in Exadata X3 have an expected endurance of 10 years or more for typical database workloads.

The automatic data tiering between RAM, flash and disk implemented in Exadata provides tremendous advantages over other flash-based solutions. When third-party flash cards are used in a traditional database server, the data placed on flash is only available on that server since flash cards cannot be shared between servers. This precludes the use of RAC and limits the database deployment to the size of single server handicapping performance, scalability, availability, and consolidation of databases. Any component failure, like a flash card, in a single server can lead to a loss of database access. Local flash can become crippled without failing when it hangs, experiences intermittent poor performance, or data loss on power cycle, and may not trigger failover or alerts. In addition it will not automatically be protected by high-level mirroring like Exadata. There is no Hybrid Columnar Compression so the expensive flash resource is underutilized and does not provide I/O resource management for prioritizing bandwidth. Third party flash lacks the storage hierarchy and tiering automatically provided in Exadata and is much more complex to administer.

When considering third party flash arrays (storage arrays comprised solely of flash) they have other limitations. Flash arrays will be data bandwidth limited since they have to transfer all the data from SQL queries to the database server as they do not provide offload functionality like Exadata Smart Scans. They require much more administrative overhead than Exadata storage since LUNs, mount points and

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tablespaces must be created. No special backup procedures are required for Exadata flash while backup and recovery procedures are required for flash arrays. With flash arrays there is no automatic dynamic tiering of the data between disk, flash and memory, as in Exadata. And of critical importance, as data usage patterns change the administrator must monitor and reconfigure the data placed on flash arrays to maintain good performance since the data is statically tied to the flash array; unlike Exadata. None of this extra administrative overhead is required for Exadata.

Optimizing Storage Use and I/O Through Compression

Compressing data provides 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 tremendous cost-savings and performance improvements due to reduced I/O. Storage savings range from 5x to 20x with typical storage savings of 10x. On conventional systems, enabling high data compression has the drawback of reducing performance. Because the Exadata Database Machine is able to offload compression overhead into large numbers of processors in Exadata storage, most workloads run faster using Hybrid Columnar Compression than they do without it. Hybrid Columnar Compression combines the compression and analytic performance benefits of column storage while avoiding the dramatic slowdown that pure columnar stores experience for drilldown operations.

Two modes of Hybrid Columnar Compression are available. Query optimized compression mode is suitable for read intensive workloads such as Data Warehouses and provides large storage savings while maintaining excellent performance. Archive compression mode provides the highest degree of compression and is targeted at rarely accessed data that is kept online.

Enterprise-Class Security with Extreme Performance

Exadata Database Machine is the world's most secure database machine. Building on the high security capabilities in the Oracle Database, Exadata moves decryption processing from database server software into the Exadata Storage Server hardware. Exadata storage leverages hardware decryption and compression together to provide the highest performance secure databases. Encryption occurs after the data is compressed so that the cost of decryption is decreased by the degree of compression. By leveraging both technologies, Exadata is able to query fully encrypted and compressed databases with near zero overhead at hundreds of gigabytes of user data per second.

Extreme Backup & Recovery Speed

On example of the Big Data strengths of the Exadata Storage Expansion Rack is when used as a destination for Exadata Database Machine backups. A full database backup can be created at up to 27 TB/hour when backing up uncompressed data that is being written to mirrored disk in an Exadata Storage Expansion Rack. It is capable of backing up hundreds of terabytes per hour when doing incremental database backups and petabytes per hour with incremental backups of Hybrid Columnar Compressed data. A disk backup on an Exadata Storage Expansion Rack

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is usable directly without loss of performance and without having to do a restore. This is a unique backup capability only available when backing up to an Exadata Storage Expansion Rack. It is by far the fastest and simplest way to backup and recover your Oracle Exadata Database Machine.

Mission Critical High Availability

The Exadata Storage Expansion Rack is engineered to provide the highest levels of availability. All types of failures are protected against including simple failures such as disk, server, or network, as well as complex site failures and human errors. Each Exadata Storage Expansion Rack has completely redundant hardware including redundant InfiniBand networking, redundant Power Distribution Units (PDU), redundant power supplies and storage servers. Oracle RAC protects against database server failure. ASM provides data mirroring to protect against disk or storage server failures. Oracle RMAN provides extremely fast and efficient backups to disk or tape. Oracle's Flashback technology allows backing out user errors at the database, table or even row level. Using Oracle Data Guard, a second Exadata Database Machine can be configured to maintain a real-time copy of the database at a remote site to provide full protection against site failures and disasters.

Because of its industry leading availability, the Exadata Database Machine and the Exadata Storage Expansion Rack have been deployed by leading companies for their most critical applications including interbank fund transfers, online securities trading, real-time call tracking, and web-based retailing. Mission Critical availability is not restricted to OLTP workloads; it also applies to warehousing and analytics workloads.

Highest Level of Service

Oracle offers a complete set of support services for the Exadata family of products including: 24x7 hardware service, system monitoring, software installation and configuration among other standard and custom offerings.

Of particular value is Oracle Platinum Services which is available exclusively for Oracle's Engineered Systems. Platinum Services provides remote fault monitoring and, should an issue occur, provides faster response times and expedited escalation to development. With Platinum Services, software maintenance and patching is performed remotely by Oracle engineers. Platinum Services provides a higher level of support than has ever been available before for all software and hardware within an Engineered System including the Oracle Database. Platinum Services is provided free of charge to Exadata customers.

IT Agility

Exadata is a complete system for running databases including storage, servers, and internal networks. Management of a traditional database system is typically spread across the management teams of each of the components such as the database team, the storage team, and the system administration team. In contrast, an Exadata system is typically managed by a single Database Machine Administration team. Database Machine Administrators have full control of all resources in the Exadata Database Machine including storage resources. New database deployments and configuration changes can be implemented by the Database Machine Administrators without

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coordination across different component management teams that are often overloaded and have differing priorities. Database Machine Administrators can focus on application and business specific enhancements rather than coordinating across component teams, or tuning and triaging of low level configuration issues.

Dramatically Lower Costs

Because of the extreme performance, high storage capacity, and unique compression capabilities delivered by the Exadata Database Machine, workloads that would require very large traditional hardware systems can be run on much smaller Exadata systems. The hardware needed for an application deployed on an Exadata system is often reduced 10X compared to a traditional system.

Exadata provides a huge RAM, flash and disk footprint for large data sets. Raw storage on an Exadata full rack exceeds 500TB and Hybrid Columnar Compression often expands storage and memory capacity 10X. By intelligently moving active data across storage and memory tiers, Exadata simultaneously delivers the highest performance and the lowest cost.

Exadata has the unique ability to consolidate many databases supporting multiple workloads in a single cloud platform. High-end OLTP, analytics, batch, reporting, and backups can all be run simultaneously within and across databases with extreme performance. The extreme performance and capacity of Exadata enables very large numbers of databases and workloads to be consolidated on Exadata. Consolidating databases on Exadata reduces system hardware cost, software cost, and greatly reduces ongoing operations cost.

The uniformity of Exadata Database Machine configurations results in large cost savings. Exadata standardizes not just technologies, but also integration, testing, hardening, tuning, and support. Customers deploy Exadata systems much faster and with a lot less labor than traditional systems. Low level tuning, integration, and maintenance is reduced or eliminated. Because all Exadata users run a configuration that is identical to thousands of other users, and is identical to Oracle's internal configurations, it is far less likely that issues will be encountered, and issue resolution is quicker and simpler reducing both operations cost and downtime cost.

Exadata Business Benefits

Beyond the operational benefits of extreme performance, availability, and security at low cost, Exadata also directly benefits the business.

Exadata accelerates time to market for new business applications since the time needed for system configuration, tuning, and testing is largely eliminated. Deployment times are reduced from months to days, and the risk of unexpected system level issues after go-live is greatly reduced. When a new application is deployed, it is common for unanticipated application usage patterns to create performance issues. Exadata's huge I/O, network, and compute throughput can absorb spikes created by unanticipated workloads without slowing response times of mission critical workloads. Overall Exadata speeds application deployment and reduces risk allowing businesses to innovate faster.

Exadata's extreme performance and large memory and flash capacity directly

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improves employee productivity and customer satisfaction by greatly improving user response times. Users spend more time doing useful work, and less time waiting for the system to respond.

Exadata's extreme performance does not just improve business efficiency, it also enables business users to make smarter decisions, discover growth opportunities, and reduce costs. Users can analyze data in real-time, explore different possibilities, and perform rapid iteration to find better solutions. Exadata enables:

- Real-time business data analysis

- Faster financial closes

- Better planning and budgeting

- More effective and faster projections

Exadata delivers a fully integrated database platform with the latest hardware technologies and unique software to deliver extreme performance, availability, and security. This coupled with cost savings, ease of management, and enhanced supportability result in greater business agility and efficiency. Given what can be achieved with Exadata, it is no surprise it is the new global standard for running the Oracle Database.

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Exadata Storage Expansion Rack X3-2 Key Capabilities						
	Full Rack		**Half Rack**		**Quarter Rack**	
	HP[1] Disks	HC[1] Disks	HP Disks	HC Disks	HP Disks	HC Disks
Maximum disk bandwidth [2]	32 GB/s	23 GB/s	16 GB/s	11.5 GB/s	7.2 GB/s	5 GB/s
Maximum disk IOPS [3]	64,000	36,000	32,000	18,000	14,400	8,000
Disk data capacity (raw) [5]	128 TB	648 TB	64 TB	324 TB	28 TB	144 TB
Disk data capacity (usable) [6]	58 TB	288 TB	29 TB	144 TB	13 TB	64 TB
Maximum flash bandwidth [2]	130 GB/s	121 GB/s	65 GB/s	60.5 GB/s	29 GB/s	27 GB/s
Maximum flash read IOPS [3]	1,900,000		950,000		425,000	
Maximum flash write IOPS [4]	1,350,000		675,000		300,000	
Flash data capacity (raw) [5]	28.8 TB		14.4 TB		6.4 TB	
Maximum full backup rate	27 TB/hour		13.5 TB/hour		6 TB/hour	

Actual system performance varies by application.

[1] HP = High Performance; HC = High Capacity

[2] Bandwidth is peak physical scan bandwidth achieved running SQL, assuming no data compression. Effective user data bandwidth is higher when compression is used.

[3] Based on 8K IO requests running SQL. Note that the IO size greatly affects Flash IOPS. Others quote IOPS based on 2K or smaller IOs and are not relevant for databases.

[4] Based on 8K IO requests running SQL. Flash write I/Os measured at the storage servers after ASM mirroring. Database writes will usually issue multiple storage IOs to maintain redundancy.

[5] Raw capacity is measured in standard disk drive terminology with 1 GB = 1 billion bytes. Capacity is measured using normal powers of 2 space terminology with 1 TB = 1024 * 1024 * 1024 * 1024 bytes. Actual formatted capacity is less.

[6] 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 Storage Expansion Rack X3-2 Hardware		
Full Rack	**Half Rack**	**Quarter Rack**
18 x Exadata Storage Servers X3-2: • 216 CPU cores for SQL processing • 72 PCI flash cards with 28.8 TB Exadata Smart Flash Cache • 216 x 600 GB 15,000 RPM High Performance disks or 216 x 3 TB 7,200 RPM High Capacity disks	9 x Exadata Storage Servers X3-2: • 108 CPU cores for SQL processing • 36 PCI flash cards with 14.4 TB Exadata Smart Flash Cache • 108 x 600 GB 15,000 RPM High Performance disks or 108 x 3 TB 7,200 RPM High Capacity disks	4 x Exadata Storage Servers X3-2: • 48 CPU cores for SQL processing • 16 PCI flash cards with 6.4 TB Exadata Smart Flash Cache • 48 x 600 GB 15,000 RPM High Performance disks or 48 x 3 TB 7,200 RPM High Capacity disks
3 x 36 port QDR (40 Gb/sec) InfiniBand Switches		2 x 36 port QDR (40 Gb/sec) InfiniBand Switches
Spares Kit Included: • 2 x 600 GB High Performance disks or 2 x 3 TB High Capacity disks • 2 x 400 GB Exadata Smart Flash Cache cards • InfiniBand cables	Spares Kit Included: • 1 x 600 GB High Performance disk or 1 x 3 TB High Capacity disk • 1 x 400 GB Exadata Smart Flash Cache card InfiniBand cables	
Additional Hardware Components Included: • Ethernet switch for administration of the Storage Expansion Rack • 2 x Redundant Power Distributions Units (PDUs) • 42U rack packaging		

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Exadata Storage Expansion Rack X3-2 Connectivity and Upgrades		
Connection to Exadata Database Machine	**Half Rack to Full Rack Upgrade**	**Quarter Rack to Half Rack Upgrade**
Connect any combination of Exadata Database Machine X3-2 or Exadata Storage Expansion Racks via the included InfiniBand fabric with at most 1 Quarter Rack in the configuration Connect a maximum of 2 Quarter Rack Exadata systems via included InfiniBand fabric Other configuration considerations: • Up to 18 racks can be connected without requiring additional InfiniBand switches • InfiniBand cables to connect 3 racks are included in the rack Spares Kit • Additional optical InfiniBand cables required when connecting 4 or more racks	Upgradability: Field upgrade from Half Rack to Full Rack Additional Hardware Components Included With The Upgrade: • 9 x Exadata Storage Servers X3-2 with 12 x 600 GB 15,000 RPM High Performance disks or 12 x 3 TB 7,200 RPM High Capacity disks • InfiniBand and Ethernet cables to connect all the components • Upgrade to Full Rack Spares Kit	Upgradability: Field upgrade from Quarter Rack to Half Rack Additional Hardware Components Included With The Upgrade: • 5 x Exadata Storage Servers X3-2 with 12 x 600 GB 15,000 RPM High Performance disks or 12 x 3 TB 7,200 RPM High Capacity disks • 1 x 36 port QDR (40 Gb/sec) InfiniBand switch • InfiniBand and Ethernet cables to connect all the components • Upgrade to Half Rack Spares Kit
	Upgrade Support Services: • Hardware installation and software configuration	

Exadata Storage Expansion Rack X3-2 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 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 Infrastructure as a Service On-Premise (IaaS) • Oracle Platinum Services • Oracle PlatinumPlus Services • Business Critical Service for Systems • Oracle Exadata Start-Up Pack • System Upgrade Support Services including hardware installation and software configuration • Oracle Auto Service Request (ASR)

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Exadata Storage Expansion Rack X3-2 Environmental Specifications			
	Full Rack	**Half Rack**	**Quarter Rack**
Height	78.66" - 1998 mm		
Width	23.62" – 600 mm		
Depth	47.24" – 1200 mm		
Weight	Weight: 1,824 lbs. (827.4 kg)	Weight: 1,138 lbs. (516.2 kg)	Weight: 771 lbs. (349.7 kg)
Acoustic noise (operating)	8.2 B	7.9 B	7.6 B
Environmentals With High Performance Disk			
Maximum power usage	10.0 kW (10.2 kVA)	5.6 kW (5.7 kVA)	2.8 kW (2.9 kVA)
Typical power usage [1]	7.0 kW (7.1 kVA)	4.0 kW (4.1 kVA)	1.9 kW (2.0 kVA)
Cooling at maximum usage	34,100 BTU/hour (36,000 kJ/hour)	19,100 BTU/ hour (20,150 kJ/ hour)	9,500 BTU/ hour (10,000 kJ/ hour)
Cooling at typical usage	23,900 BTU/hour (25,200 kJ/hour)	13,650 BTU/ hour (14,400 kJ/ hour)	6,700 BTU/ hour (7,000 kJ/ hour)
Airflow at maximum usage [2]	1,600 CFM	900 CFM	440 CFM
Airflow at typical usage [2]	1,100 CFM	650 CFM	310 CFM
Environmentals With High Capacity Disk			
Maximum power usage	8.7 kW (8.9 kVA)	5.0 kW (5.1 kVA)	2.5 kW (2.6 kVA)
Typical power usage [1]	6.1 kW (6.2 kVA)	3.5 kW (3.6 kV)	1.8 kW (1.9 kVA)
Cooling at maximum usage	29,700 BTU/hour 31,300 kJ/hour)	17,100 BTU/hour (18,000 kJ/hour)	8,500 BTU/hour 9,000 kJ/hour)
Cooling at typical usage	20,800 BTU/hour 21,950 kJ/hour)	11,950 BTU/hour 12,600 kJ/hour)	6,150 BTU/hour 6,500 kJ/hour)
Airflow at maximum usage [2]	1,375 CFM	790 CFM	400 CFM
Airflow at typical usage [2]	960 CFM	550 CFM	285 CFM

Operating temperature/humidity: 5 ºC to 32 ºC (41 ºF to 89.6 ºF), 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 [3] • 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 [3] • 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 2011/65/EU (2002/95/EC)
[1] Typical power usage varies by application load.
[2] Airflow must be front-to-back.
[3] In some cases, as applicable, regulatory and certification compliance were obtained at the component level.

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Oracle Database Software (sold separately)	
For storage servers	Oracle Exadata Storage Server Software
	Licenses are transferable from one system to another.

Exadata Storage Server Software Features
• 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
• Redundant power supplies and fans 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 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

Manageability Features
• Oracle Embedded Integrated Lights Out Manager (ILOM)
• Oracle Enterprise Manager Cloud Control 12c

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.

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

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