

An Oracle White Paper

February, 2012

Oracle Exalogic Elastic Cloud: System Overview



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Executive Summary

The Oracle Exalogic Elastic Cloud is an *Engineered System*, consisting of software, firmware and hardware, on which enterprises may deploy Oracle business applications, Oracle Fusion Middleware or software products provided by Oracle partners. Exalogic is designed to meet the highest standards of reliability, serviceability and performance under widely varied, performance-sensitive, mission-critical workloads. Exalogic dramatically improves the performance of virtually any standard Linux, Solaris and Java application¹ with no code changes required and reduces application implementation and ongoing costs versus traditional enterprise application platforms and private clouds assembled from separately sourced components provided by multiple competing vendors.

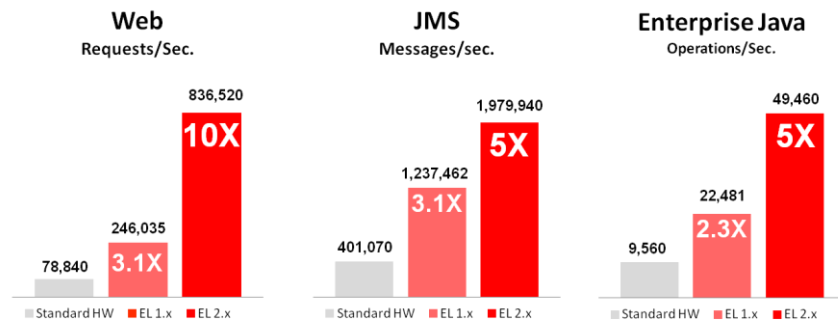


Figure 1 - Exalogic Performance

Exalogic is an open system, assembled by Oracle from our portfolio of standards-based, best-of-breed component products and technologies. The Exalogic system is built from proven, best-of-breed technology and components and reflects best practices learned from thousands of customer deployments and extensive laboratory testing. While the main components of the

¹ Any application that supports Oracle Linux (version 5 update 6 or later, Unbreakable Enterprise Kernel, 64-bit), Oracle Solaris 11 Express (or Solaris 10 Zone, x86)

Exalogic systems are individually orderable, an Exalogic configuration is more than just the sum of its parts.

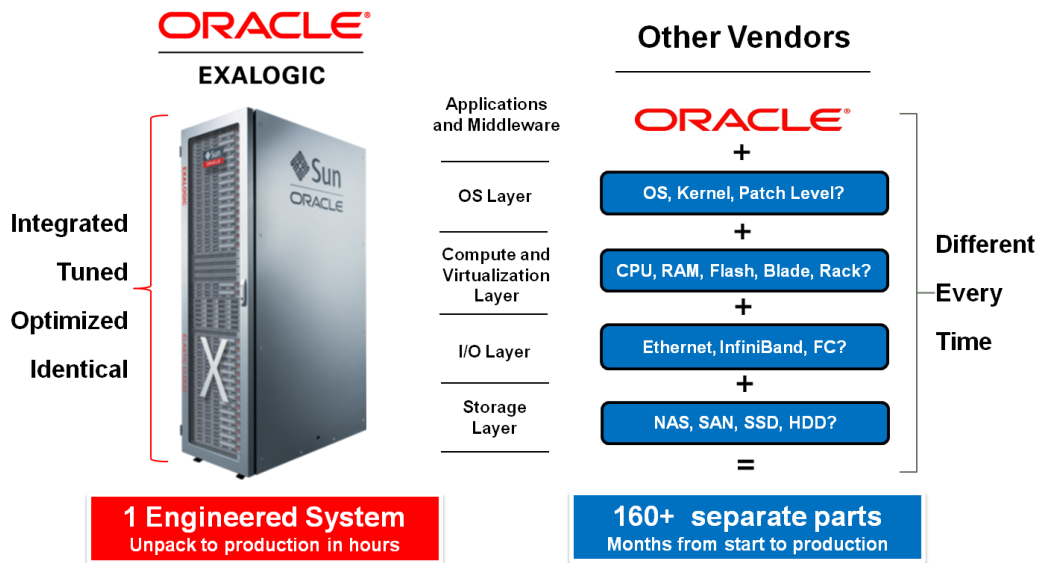


Figure 2 - Exalogic X2-2 versus a typical Custom Platform

With the appropriate investment of resources and time it is possible for customers to study their aggregate application requirements, research the available products and technologies, solicit vendor proposals, select component products, order, receive and install the components, apply firmware and software patches, obtain and install device drivers and finally, test, tune and document the resulting system. Such a system, however, cannot equal an Exalogic system for the simple reason that with an Exalogic system, the design of the components themselves is influenced by the requirements of the Exalogic system: Oracle has made optimizations and enhancements to Exalogic components and Oracle's middleware and applications that cannot be made by customers or by any 3rd party. These range from on-chip network virtualization to operating system and Java Virtual Machine support for extremely high performance Remote Direct Memory Access (RDMA) and Exalogic-aware workload management in Oracle's Java EE application server.

To accelerate production deployments and reduce ongoing maintenance and administration costs the Exalogic system includes a suite of exclusive system-level diagnostic and configuration tools. These tools ensure that every Exalogic system consistently delivers maximum performance and reliability while at the same time requiring less time to install, administer and maintain than

competing systems, slashing hundreds or thousands of hours of lifetime platform investment and eliminating platform selection as a source of project risks and delays.

In real-world performance testing and production deployments Exalogic typically outperforms other platforms by wide margins, often delivering two to ten (or more) times the application performance. Not only do applications become more responsive and deliver a greatly improved user experience, they are also more resource efficient. With an Exalogic system, enterprises are able to support any given application workload with less hardware, less power, less heat, less data center space and less software. Because the Exalogic system is fully pre-integrated by Oracle it is also easier to provision, manage and maintain, further reducing ongoing costs and shortening time to value for new projects. Exalogic systems are designed for high availability and zero-down-time maintenance and can be scaled linearly from a single, Quarter Rack configuration to a large system of eight Full Racks with no service disruption and no additional external hardware required.

Exalogic is at the forefront of the industry-wide shift away from costly and inferior one-off platforms toward *private clouds and Engineered Systems*. For enterprises that want to get more for their IT investment than merely *keeping the lights on*, Exalogic is the only choice.



Figure 3 - On-chip Ethernet-to-InfiniBand Bridge

Hardware and Software Engineered to Work Together

The Exalogic system consists of two major elements:

- Exalogic X2-2: a high performance hardware system, assembled by Oracle at our factory, that integrates storage and compute resources using a high-performance I/O backplane built on with Oracle's Quad Data Rate (QDR) InfiniBand technology
- Exalogic Elastic Cloud Software: an essential package of Exalogic-specific software, device drivers and firmware that is pre-integrated with Oracle Linux and Solaris, enabling Exalogic's advanced performance and management features

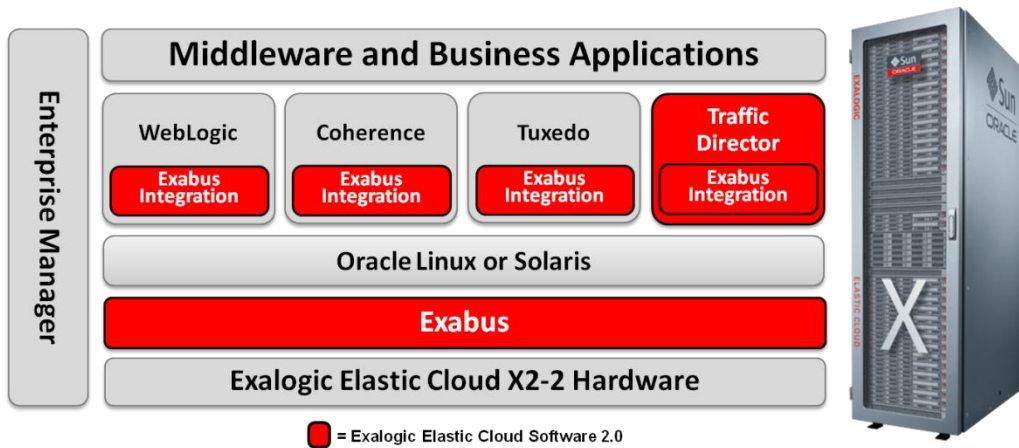


Figure 4 - Exalogic System Delivery

Oracle Standard

It is not possible for any vendor to achieve the level of usability, convenience, reliability, and performance that comes from engineering hardware and software to work together if that vendor does not control the development of both the hardware and software. When it comes to providing a platform for Oracle's business applications and middleware, no other vendor is better able to fulfill the promise of an end-to-end engineered system, and no other cloud infrastructure can compete with Oracle Exalogic in this capacity. Not only is Exalogic designed for Oracle's middleware and business applications, those same middleware products and business applications are being developed and tested on Exalogic. While Oracle remains committed to open systems and support for hardware and operating systems from multiple vendors, there is no mistaking the obvious and intrinsic benefits of engineered systems like Exalogic.

Performance and Scalability

Modern applications, especially those designed in the last few years, have embraced *scale out*² architecture as a solution not only to the challenges of cost, scale and application reliability and serviceability. This approach offers many advantages over legacy approaches which are typically dependent on using increasingly large and costly high-end servers, although it generally suffers from one persistent and challenging limitation: I/O. The performance and efficiency of modern highly distributed systems is primarily constrained by the communication mechanism that connects all of the system components. The central technological advance in Exalogic, therefore, is the *elimination of I/O bottlenecks in at every level* through a networking hardware and software subsystem called *Exabus*. Exabus not only makes applications *run faster*, it also makes them *more efficient*, and it does this consistently and predictably even in extremely large scale deployments with thousands of processor cores and terabytes of memory and for virtually all business applications.

Reliability and Serviceability

Exalogic is designed for mission critical applications that must be highly available. Achieving so called *five-nines* availability requires a system that is both fault tolerant and can accommodate zero-down-time maintenance and administration. Exalogic is designed with no-single-point-of-failure hardware redundancy and automated failover for every major component, with special attention paid to redundancy of power, I/O and cooling (fans). When running scale-out applications, it is possible for every component in the system to be taken out of service in turn, repaired or maintained, and returned to service with no disruption to applications or users. Exalogic features built-in support for block-level storage replication, backup-to-disk and Automated Service Requests³ (ASR). ASR allows Oracle to pro-actively monitor Exalogic X2-2 systems for actual or impending component failure and pro-actively dispatch replacement parts and service personnel, thereby minimizing or completely avoiding service disruptions.

² “Scale out” refers to so-called horizontal scaling, in which applications scale through the addition of new instances of the application business logic to the system and a combination of traffic shaping, state replication and database sharing.

³ ASR is provided as a part of Oracle’s optional Premier Support for Systems support offering.

Exalogic System Architecture

The Exalogic X2-2 is available in four configurations: Eighth Rack, Quarter Rack, Half Rack and Full Rack. Upgrade kits are available which allow for small Quarter Rack configurations to be upgraded to Half Rack configurations, and from Half Rack configurations to Full Rack configurations. It is possible to connect up to eight (8) configurations of any type together using the provided cabling to form a single Exalogic system (sometimes called an *Exalogic fabric*). Through the use of separately orderable datacenter spine switches it is possible to scale an Exalogic system even larger, if desired.

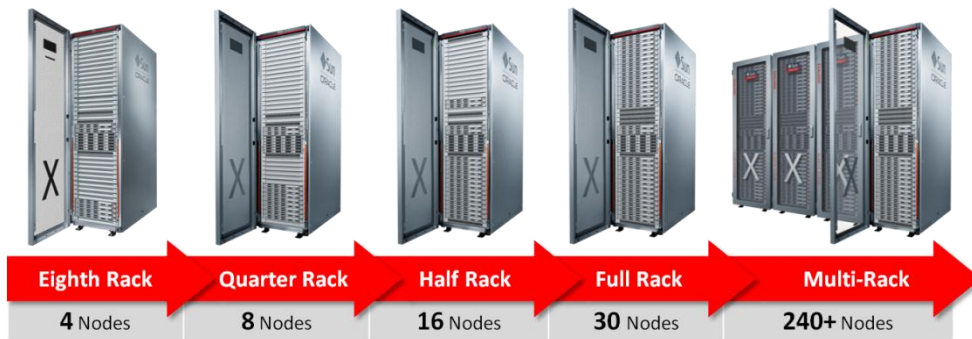


Figure 5 - Exalogic Configurations

An Exalogic configuration consists of the following major components:

- Exabus (InfiniBand switches, gateways, host channel adapters, firmware, device drivers, operating system extensions and software libraries)
- Compute Nodes
- ZFS Storage Appliance
- Management Switch
- Operating System(s)
- Exalogic Management Tools
- Exalogic software, firmware and device drivers

Exabus

The defining architectural feature of Exalogic is the communication (I/O) fabric that ties all of the system components together and provides the basis for Exalogic's reliability, scalability and performance. Within Exalogic, this I/O subsystem is called Exabus, since it performs the function of extending and connecting the PCIe-based system bus used within each of the major

system components. Exabus is based on Quad Data Rate (QDR) InfiniBand, and consists of hardware, software and firmware distributed throughout the system and involving every major system component.

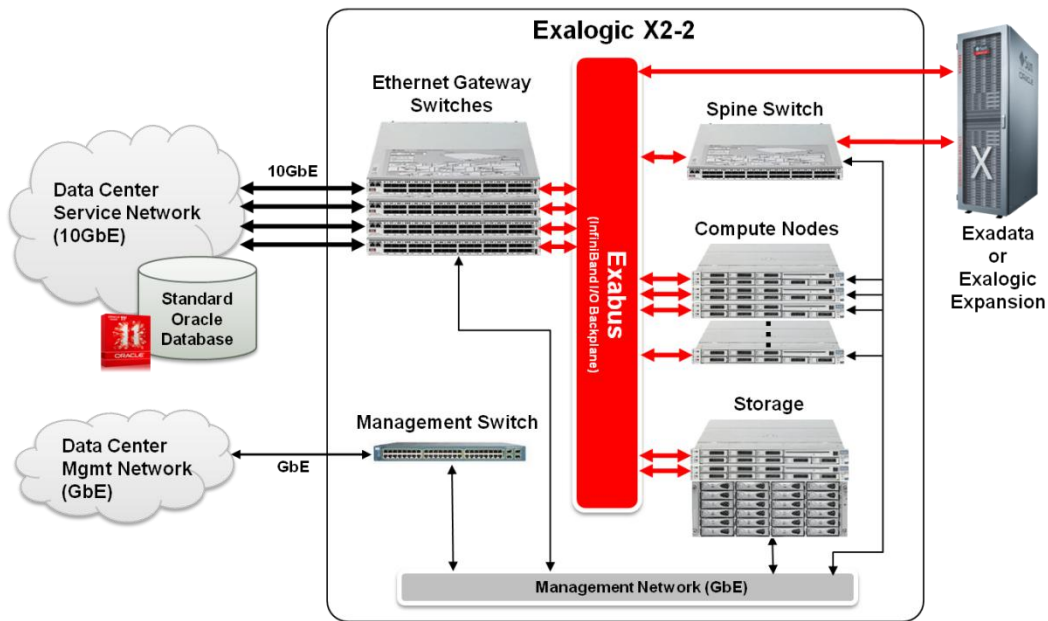


Figure 6 - Exalogic System Architecture

QDR InfiniBand was selected as the foundation technology for Exabus for several reasons:

- Oracle's InfiniBand products provide the greatest available bandwidth per physical port (40Gb/s) and lowest latency ($\sim 1.07\mu\text{sec}$) of any standard interconnect technology available today⁴, allowing applications to reclaim compute capacity otherwise wasted waiting on slow communication links
- InfiniBand provides reliable delivery, security and quality of service at the physical layer in the networking stack and natively supports kernel bypass operations, eliminating much of the inefficiency of using system CPU and main memory

⁴ 3.7x the throughput and 1/5 the latency of 10Gigabit Ethernet, the next best option, according to http://www.hpcadvisorycouncil.com/pdf/IB_and_10GigE_in_HPC.pdf

- Oracle’s InfiniBand products support upper-stack protocols like IP (IPoIB) and Ethernet (EoIB), making it possible for existing applications to run without modification and still benefit from enhanced performance

Exabus InfiniBand Gateways and Switches

One of the most important and differentiating aspects of Exalogic is the ability of the system to present itself to the datacenter network as a single large computer with a large number of 10 Gigabit Ethernet (10GbE) network interfaces. At the physical level, this is achieved through the use of special gateways that connect directly to external 10GbE ports exposed by standard datacenter switches. Exalogic’s Ethernet-to-InfiniBand gateways use a unique InfiniBand-to-Ethernet bridge design that allows each Exalogic compute node, through simple software configuration, to have as many as *1000 virtual 10GbE network interface cards*, each of which appears to the datacenter network as if it is a standard Ethernet device. This approach greatly reduces the number of physical network cards, cables, and switches that must be installed, powered, tested, tuned, managed, and maintained while offering improved application performance, security and reliability. This approach eliminates interoperability issues with existing network management tools and guarantees complete interoperability with existing Ethernet-based switches, firewalls and load balancing appliances, since *Exalogic’s use of InfiniBand is completely invisible to the rest of the data center*.

Exabus supports the creation of Virtual Local Area Networks (vLAN) within the Exalogic system itself as a means of providing application isolation, and can transparently isolate inter-cluster communication to non-Ethernet subnets, thereby providing both enhanced security and improved cluster performance.

Exabus Software, Firmware and Drivers

At the software layer, Exabus extends and enhances the OpenFabrics Enterprise Distribution (OFED™). OFED is an industry standard open-source software toolkit for Remote Direct Memory Access (RDMA) and kernel bypass applications. OFED is widely used in high performance InfiniBand-based computing systems that require maximum throughput, minimal

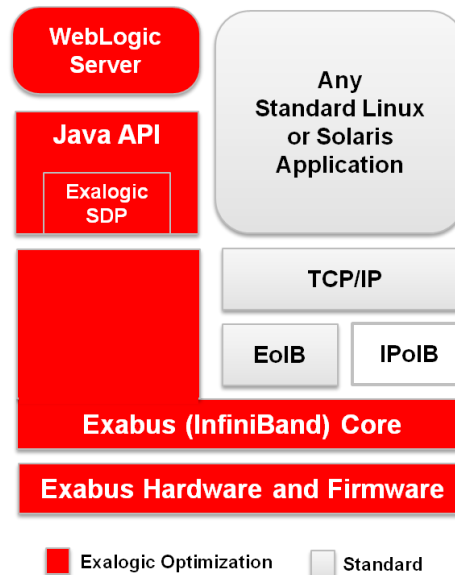


Figure 7 - Exalogic I/O Stack with Exabus

latency and a unified infrastructure for storage access, network virtualization and cluster Inter-Process Communication.

Exabus includes kernel-level drivers, channel-oriented RDMA and send/receive operations, kernel bypasses of the operating system, both kernel and user-level application programming interface (API) and services for parallel message passing, sockets data exchange, storage and file/database system access.

Exabus incorporates a number of reliability, management, and performance features that are not available from any other similar system:

- Unique support for Exalogic's Ethernet-over-InfiniBand (EoIB) gateways
- Simplified management and monitoring with full ILOM and Oracle Enterprise Manager OpsCenter integration
- Quality of Service (QoS) and Partitioning configuration support
- High Availability Sockets Direct Protocol (SDP)
- IPv6 support for SDP, EoIB and IP-over-InfiniBand (IPoIB)
- Automatic disabling of degraded physical links (autonomous port-level failover)
- 100s of separate design fixes and enhancements in the Host Stack and Management Stack, improving compliance, stability, efficiency and performance

Oracle Traffic Director

Oracle Traffic Director is a fast, reliable, and scalable Application Delivery Controller that may be deployed as the entry point for all HTTP and HTTPS traffic to application servers and Web servers in an Exalogic deployment.

- Oracle Traffic Director is fully integrated with the Exabus I/O subsystem and can support both extremely high throughput and low latency application traffic workloads.
- Oracle Traffic Director supports enterprise-grade high availability via, active-passive or active-active failover.
- As the volume of traffic on the Exalogic system varies, Oracle Traffic Director may be easily and dynamically scaled in lock-step with the application compute resources required.
- Oracle Traffic Director may be easily configured to apply multiple, declarative rules when distributing requests to the back-end servers and when forwarding responses to clients.

- Oracle Traffic Director is easy to install, configure, and use. It includes a simple, wizard driven graphical interface as well as a robust command-line interface.

High Availability

Health checks for the back end: If a server in the back end is no longer available or is fully loaded, Oracle Traffic Director detects this automatically through periodic health checks and stops sending client requests to that server. When the failed server becomes available again, Oracle Traffic Director detects this automatically and resumes sending requests to the server.

Backup servers in the back end: When setting up server pools for an Oracle Traffic Director instance, you can designate a few servers in the back end as backup servers. Oracle Traffic Director sends requests to the backup servers only when none of the primary servers is available, ensuring continued availability even when some servers in the back end fail.

Failover for load balancing: To ensure high availability of the load balanced services, you can deploy Oracle Traffic Director instances in an active-passive or active-active failover configuration.

Dynamic reconfiguration: Most configuration changes to Oracle Traffic Director instances can be deployed dynamically, without restarting the instances.

High Performance

SSL/TLS offloading: Oracle Traffic Director can be configured as the SSL/TLS termination point for HTTPS requests, reducing the processing overhead on the servers in the back end.

Content caching: Oracle Traffic Director can be configured to cache (in its process memory) content that it receives from origin servers. By caching content, Oracle Traffic Director helps reduce the load on servers in the back end and helps improve performance for clients.

HTTP compression: You can configure Oracle Traffic Director instances to compress data received from servers in the back end and forward the compressed content to the requesting clients. This feature improves the response time for clients connected on slow connections.

Flexible Routing and Load Control on Back-End Servers

Request-based routing: Oracle Traffic Director can be configured to route HTTP/S requests to specific servers in the back end based on information in the request URI: pattern, query string, domain, source and destination IP addresses, and so on.

Request rate acceleration: You can configure the rate at which Oracle Traffic Director ramp up the load on specific back end servers, so that servers that have just been added to the pool or restarted, to perform startup tasks such as loading data and allocating system resources.

Connection limiting: Oracle Traffic Director can be configured to limit the number of concurrent connections to a server in the back end. When the configured connection limit for a server is reached, further requests that require new connections are not sent to that server.

Controlling the Request Load and Quality of Service

Request rate limiting: Oracle Traffic Director can be set up to limit the rate of requests from specific clients and request types, enabling optimal utilization of available bandwidth, guaranteeing a certain level of quality of service, and preventing denial-of-service attacks.

Quality of service tuning: To ensure equitable utilization of the available network resources, you can configure Oracle Traffic Director virtual servers to limit the number of concurrent connections to clients and the maximum speed at which data can be transferred to clients.

Security

Reverse proxy: By serving as an intermediary between clients outside the network and servers in the back end, Oracle Traffic Director masks the names of servers in the back end and provides a single point for tracking client access to multiple servers in the back end.

Support for SSL 3.0 and TLS 1.0: You can configure SSL/TLS-enabled HTTP listeners for Oracle Traffic Director instances, using either certificates issued by commercial CAs such as VeriSign or RSA- and ECC-type self-signed certificates with key sizes of up to 4096 bits.

Monitoring

Oracle Traffic Director records statistics about server activity at different levels—instances, virtual servers, listeners, connections, and origin servers. For example, for each server instance, Oracle Traffic Director collects statistics about the duration for which the instance has been running, number of requests processed, average load, and so on. You can monitor statistics pertaining to the performance of Oracle Traffic Director instances through several methods: the administration console, the command-line interface, and a report in XML format.

Integration with Oracle WebLogic Server

Oracle Traffic Director is designed to recognize and handle headers that are part of requests to, and responses from, Oracle WebLogic Server instances in the back end.

Oracle Traffic Director can dynamically discover changes in the Oracle WebLogic Server cluster—such as the removal or addition of managed servers, and consider such changes while routing requests.

Virtual Firewall

Exalogic supports a powerful physical I/O traffic separation capability called “InfiniBand partitions”⁵. In an Exalogic system, the QDR InfiniBand fabric is used as the physical foundation on which all other communication networks are virtualized. In Exalogic, the switches in the Exabus I/O backplane of the system enforce the end-point security rules that determine which applications or software components on any given compute node are allowed to send or receive messages (or even see) to any other. This enforcement happens at the lowest possible layer in the system and is highly secure – even securing root level access to compute nodes does not compromise the security of the system as a whole and all applications running on other compute nodes on the system are completely unaffected. In combination with Oracle Traffic Director and technologies like *iptables*⁶, it is possible to implement so-called De-Militarized Zones (DMZ) on the Exalogic system which are as secure as those implemented using traditional hardware firewall appliances.

Exalogic Storage

The Exalogic storage subsystem stores all application binaries, log files and content necessary for the applications to execute. Compute nodes mount configured storage system partitions over the InfiniBand network. This eliminates the need to back up individual compute nodes and in the event of failure of a compute node, the partition can simply be mounted from another compute node while the failed compute node is serviced or replaced.

The Exalogic storage subsystem consists of two physically separate storage heads in an active/standby configuration and large shared disk array. Each of the storage heads is directly attached to the I/O fabric with redundant QRD InfiniBand. The storage subsystem is accelerated with two types of solid state memory that are used as read and write caches, respectively, in order to increase system performance. The storage heads transparently integrate the many Serial Attached SCSI disks in the disk array into a single ZFS cluster which is then made available to Exalogic compute nodes via standard network file systems supported by the compute node’s operating system.

The Exalogic storage subsystem provides its own dedicated management interface and offers a number of user-selectable options for security, reliability and quota management. It also offers

⁵ http://docs.oracle.com/cd/E18476_01/doc.220/e18478/physical_part.htm

⁶ <http://www.netfilter.org/projects/iptables/index.html>

built-in support for storage replication, allowing each Exalogic configuration to be paired with another geographically remote system as part of a larger disaster recovery strategy.

It is also possible to attach selected Oracle storage appliances directly to the Exalogic I/O backplane using InfiniBand in order to expand the system's storage capacity or implement a high-performance backup solution.

Integrated Exalogic Storage Software Features	
File system	Oracle Solaris ZFS (128bit addressability)
File-level protocol	NFS v3/v4, HTTP, WebDAV, FTP/SFTP
Block level protocol	IP over InfiniBand
Data compression	Four levels of data compression available
Data De-duplication	Inline, block-level de-duplication
RAID	Striping, mirroring, triple-mirroring single-parity RAID, double-parity RAID, triple-parity RAID, wide stripes
Snapshots	Read only, restore
Directory service	NIS, AD, LDA
Data security	Checksum data and metadata, antivirus quarantine
Network services	NTP, DHCP, SMTP
Backup	NDMP v3/v4, ZFS NDMP
Clones	Writable snapshots
Remote Replication	Exalogic replication to second remote system, 1:N, N:1, manual, scheduled, continuous

Figure 8 - Exalogic Integrated Storage Software Features

Exalogic Compute Nodes

Each Exalogic X2-2 compute node (sometimes called a *server*) contains two Intel Xeon processors, each of which has multiple cores. Each compute node also has a large amount of high-speed error correcting RAM, enterprise grade solid state disk drives in a RAID configuration, redundant fans, redundant power supplies and a dual-port InfiniBand Host Channel Adapter that connects it to the system's I/O fabric.

Each Exalogic compute node is a physically isolated application environment. While each compute node has built in redundancy, when a compute node does fail or requires servicing, all of the application instances running on that node will fail or must be stopped. For Highly Available applications, it is therefore recommended that application clusters span at least two

compute nodes. From the perspective of Oracle's software licensing, each compute node is a *hard partition*.

Exalogic compute nodes are balanced for maximum single thread performance: the type of memory used and the number and position of memory modules installed are carefully matched to the PCIe system bus and processor frequency. For latency sensitive or memory intensive applications, such as those built using the Java language, an Exalogic compute node's computational performance is up to 40% greater than similar systems which use the same Intel processors.

Compute nodes use their internal Solid State Disks only for the Operating System bootable images and can be quickly and easily re-imaged using the special tools provided with the system.

Exalogic Management Switch

Each Exalogic configuration includes a management switch. Every major component of the Exalogic system is connected directly to this management switch using the standard Gigabit Ethernet and the dedicated built-in management ports. This management switch is the physical integration point with the data center's secure management network, and allows for the complete separation of management traffic from service traffic within the system. In addition to carrying management traffic, the management network is also used to facilitate background replication of data in the Exalogic storage system to paired Exalogic systems in remote sites as part of a disaster recovery solution.

Exalogic Operating Systems

Exalogic provides users with a choice of Oracle Linux or Oracle Solaris operating systems and guarantees 100% compatibility with standard Linux or Solaris applications; no special certification for Exalogic is required. All Oracle applications that are certified for the appropriate releases of Oracle Linux and Oracle Solaris are supported on Exalogic.

Each Exalogic configuration is shipped from the Oracle factory with both Oracle Linux and Oracle Solaris, Exabus software, drivers and firmware and management tools and utilities already installed and ready for final configuration on the customer's premises. While the versions of Linux and Solaris used with Exalogic are not exclusive to Exalogic, the specific bootable disk images Oracle provides are. These disk images are specifically created for use with Exalogic. No other operating system versions are supported on an Exalogic system, and without the unique software, firmware and device drivers incorporated into these Exalogic 'base images' the Exalogic X2-2 hardware is unusable.

Oracle Linux Unbreakable Enterprise Kernel (UEK)

The Oracle Linux Unbreakable Enterprise Kernel delivers the best overall Linux performance available today and provides numerous features in the areas of hardware fault management, data

integrity and diagnostics, including detecting and logging hardware errors before any affect to OS or application and automatic isolation of defective CPUs and memory.

Taking advantage of these enhancements, require no changes to existing Linux applications. The optimizations provide up to 12x InfiniBand performances, 60% higher workload, 50% reduced latency, and 50% improved IPoIB performance⁷.

Oracle Linux is based on the Fedora Core⁸ code base, which is also the foundation for Red Hat Linux and therefore demonstrates a very high degree of compatibility.

Oracle Solaris

Solaris 11 Express is a production-quality, feature limited version of Oracle Solaris 11. In addition to many security, network virtualization, management and fault tolerance features, Oracle Solaris supports a kernel-level server virtualization technology known as *Zones*.

Oracle Solaris Zones is one of the most highly adopted, highly used, mature virtualization technologies on the market today and has been a core feature of Solaris since its introduction in the Solaris 10 release in 2005. Oracle Solaris Zones⁹ includes support for Oracle Solaris 10 Zones, which allows customers to deploy Solaris 10 (x86) applications on Exalogic.

Exalogic Management

Exalogic is manageable using a variety of tools, including the majority of management tools and systems employed in customer data centers today. Irrespective of the specific tools used, managing Exalogic is substantially less complex and error prone than managing traditional systems built from individually sourced components because Exalogic is explicitly designed to be administered and maintained as a single, integrated system.

⁷ Based on Oracle internal product testing and benchmarking results

⁸ <http://fedoraproject.org/>

⁹ See Oracle Solaris Virtualization:

<http://www.oracle.com/technetwork/articles/servers-storage-admin/sol11evirt-186209.pdf>

Exalogic System Utilities

Exalogic includes a number of very specialized tools that ensure the correct installation and configuration of the Exalogic system and can quickly and easily diagnose critical system-level issues.

- **Exalogic Configuration Utility:** A desktop tool used to configure the Exalogic system management and data center service network interfaces and internal subnets.
- **Exalogic Distributed Command Line Interface:** A command-line tool that allows commands to be executed on some or all of the Exalogic nodes simultaneously, at the discretion of the operator.
- **Exalogic Topology Verifier:** verifies the InfiniBand topology of the Exalogic system, ensuring that the correct topology is applied for each given system configuration: Quarter Rack, Half Rack or Full Rack.
- **Exalogic InfiniCheck:** verifies the correct operation of every InfiniBand device and port on the fabric, ensuring that all ports and connectors are functioning correctly.
- **Exalogic Hardware & Firmware Profiler:** verifies that the all of the hardware devices and firmware versions connected to the Exalogic system fabric are verified and supported, with the correct and compatible device firmware versions.
- **Exalogic Software Profiler:** verifies that all of the Linux or Solaris software packages installed on any of the system's compute nodes are of the correct version and do not jeopardize the Exalogic system's performance, security or stability.
- **Exalogic Boot Manager:** This tool allows system operators to easily re-image individual Exalogic compute nodes, via external PXE servers or network-mounted disk images.

Oracle Enterprise Manager

Oracle Enterprise Manager (EM) is an optional suite of management products which can provide application-to-disk management for Exalogic deployments. Enterprise Manager allows every individual hardware component within an Exalogic deployment to be monitored in real time and, at the customer's option, have system status automatically reported to Oracle Support for proactive system maintenance. Through integration with Oracle Support, Enterprise Manager can apply tested patch bundles tailored for Exalogic that cover every layer of the system, from device firmware and operating system to JVM, application server, upper-stack Fusion Middleware, and Oracle applications.

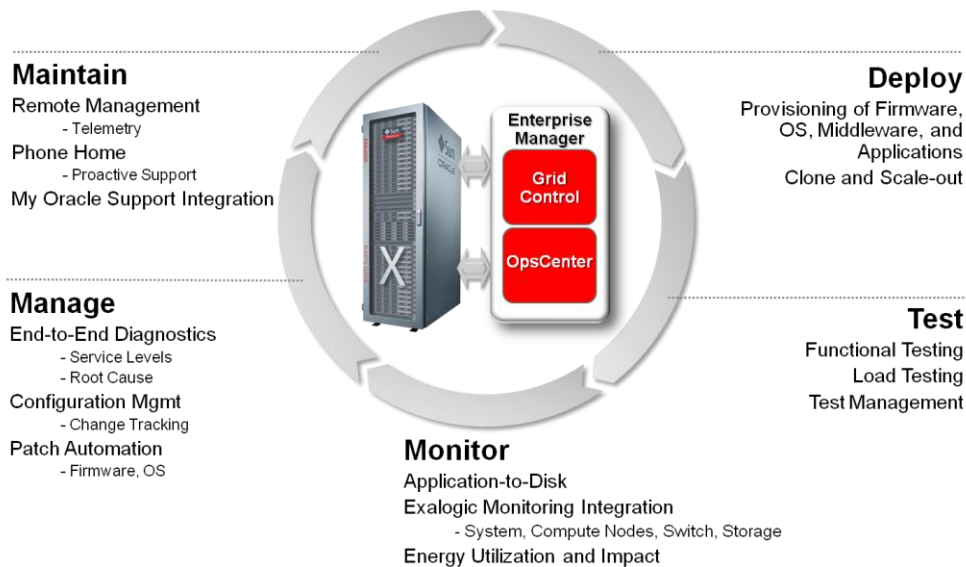


Figure 9 - Exalogic Management

Enterprise Manager Grid Control (EMGC)

EMGC focuses on managing the Fusion middleware and Oracle applications deployed on Exalogic. Exalogic-specific functionality allows representation, management and monitoring of Exalogic deployments:

- Deployed applications
- WebLogic Domains & Managed Servers
- Coherence clusters
- Physical compute node status

The EMGC *Operational Views* for Exalogic include:

- Operational status
- KPI, Response & Load chart
- Alerts & policy violations
- Configuration changes (last 24h)
- Component and JVM metrics

Enterprise Manager Operations Center (EMOC)

EMOC is Oracle's single, integrated solution for managing all aspects of a physical data center. It allows for the discovery, provisioning, update, management, and monitoring of the physical and virtual assets in multiple data centers from a single console. EMOC is an enterprise management solution that communicates with Exalogic's major components through the Integrated Lights

Out Manager (ILOM) service that each component exposes. EMOC Operating System agents may also be deployed for insight into Operating System level metrics if desired.

Oracle Enterprise Manager 11g Ops Center supports the following key features in the Exalogic machine environment:

- Hardware lifecycle management
- InfiniBand fabric views and Ethernet network view
- Integration with My Oracle Support

In addition, Oracle Enterprise Manager Ops Center supports bare metal provisioning, discovery of hardware assets, patch automation, import of firmware images, creation policies, and firmware upgrade for the hardware components of an Exalogic machine.

Exalogic Integrated Lights Out Manager (ILOM)

Exalogic's Integrated Lights Out Manager (ILOM) provides an agent-less means of managing Exalogic's compute nodes, InfiniBand gateways and switches, storage subsystem heads, the storage array and any installed power distribution units. ILOM is implemented in the firmware of each component in the Exalogic system, independent from the Operating System, and is accessible only through the physical management network for added security. ILOM supports both command line and Web-based direct access to the core management capabilities of each component.

Deploying Oracle Exalogic with Oracle Exadata

Oracle Exalogic and Oracle Exadata are, in many respects, one platform. While Oracle Exalogic is designed to provide a platform for application business logic and compute-intensive workloads, Oracle Exadata is designed for application databases and storage-intensive workloads. Exalogic and Exadata share many common technologies and although they can be, and are, deployed independently from each other there are unique technical and operational benefits to deploying them together.

- Are Oracle's standard platforms for the database and middle tier, respectively, for Oracle's Fusion Middleware and business applications products
- Share a number of key technologies and components, including compute node designs, InfiniBand switches and host channel adapters, device drivers and operating system enhancements
- Can be managed using the same management infrastructure, including Enterprise Manager
- Are supported by Oracle using a unique support infrastructure and pool of experts that is expertly trained to diagnose and resolve issues with application deployments that combine both products

Exalogic Maintenance, Expansion, Upgrade

Like all of Oracle's engineered systems, Exalogic is designed to be easy to maintain and upgrade.

Approximately four times per year Oracle releases a set of device firmware and software patches that have been tested together and are approved as a "known good configuration" for the current and supported Exalogic hardware. Security and stability patches are made available for Exalogic as required.

Exalogic configurations may be upgraded to larger configurations through the addition of separately purchasable upgrade kits. It is possible to purchase kits that will upgrade Exalogic X2-2 Quarter Rack configurations to X2-2 Half Rack configurations, and kits that will upgrade X2-2 Half Rack configurations to X2-2 Full Rack configurations. These upgrade kits are installed by Oracle Advanced Customer Services personnel on-premises and may be installed without taking the Exalogic system out of service.

Oracle Advanced Customer Service also offers multi-rack cabling services that allow Exalogic configurations to be integrated as part of an expansion of an installed Exalogic system or an initial Exalogic deployment. Multi-rack cabling services are also available for customers that wish to connect Exalogic and Exadata systems. It is possible to connect up to eight (8) Exalogic and/or Exadata Full Rack configurations with the built-in expansion ports and provided cabling and external InfiniBand switches are not required.

Datacenter Integration

Integration of Exalogic with external systems, such as hardware firewalls, load balancers, databases, storage systems or other application environments is possible using the 10GbE connectivity provided by the Exalogic gateways.

InfiniBand is an important technology within the Exalogic system and is a key enabler of the Exabus. InfiniBand is used only as an internal communications fabric within the Exalogic system, however, or between a very small number of carefully tested Oracle products, such as our Exadata and certain storage appliances and datacenter InfiniBand switches. Oracle does not support connection of Exalogic to any third-party products using InfiniBand.

Installation of an Exalogic system is very straight-forward and can often be completed by Oracle's Advanced Customer Services professionals in a matter of hours, from start to finish.

Conclusion

Oracle Exalogic is an engineered hardware and software system designed to provide the ideal cloud platform for Oracle's middleware and applications. By standardizing and co-locating Oracle applications and middleware on Oracle Exalogic Elastic Cloud, enterprises will:

- Conserve capital by requiring less hardware, software and services investment for any given application when compared with solutions from competing vendors or own-developed platforms
- Increase the performance and efficiency of existing Linux, Solaris and Java applications by 2X, 5X, 10X or more
- Improve application and infrastructure reliability and scalability to levels needed for the most mission-critical systems
- Dramatically reduce application and infrastructure implementation project risk and time-to-value
- Slash ongoing support, administration and maintenance costs

We invite you to begin your datacenter transformation with Exalogic today.



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