Next Generation Service Integration Platform

Oracle SOA Suite on Oracle Exalogic Elastic Cloud and Oracle Exadata Database Machine
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Executive Overview

Proliferation of mobile devices, data explosion, and cloud enablement has caused a dramatic shift in IT. Organizations need to rethink their application infrastructures to accommodate increased processing speeds, heightened security and availability concerns for their applications, all while meeting lowered total cost of ownership. Traditional infrastructures may not be sufficient to accommodate the diversity and complexity of integrations in this new era. Oracle SOA Suite on Oracle Exalogic Elastic Cloud & Oracle Exadata Database Machine is fine-tuned all the way from the hardware to the application layer, specifically for SOA to deliver on performance, business agility, lowered total cost of ownership and faster time to market, to become the next generation IT platform. Together these solutions provide complete and best-of-breed solutions for running and integrating high performance, mission critical applications.

Introduction

Many of today’s IT organizations rely on a Service Oriented Architecture (SOA) backbone to keep their businesses running. SOA delivers on good design principles that result in software reuse across multiple technologies. SOA adoption and acceptance across industries have led to platform maturity at the application layer level. However, we are at the start of an era where there is a new modus operandi for organizations to thrive and deliver continuously on competitive differentiation. This change is a result of market globalization, explosion in the number of mobile devices, unparalleled growth in voluminous data and innovation that crosses organizational boundaries. Social, mobile, cloud and data are terms that are revolutionizing the way organizations operate.

As business leaders step up to the plate to deliver on innovative models, SOA as the underlying IT platform, has to evolve to deliver on unprecedented performance, flexibility, and lowered total cost of ownership. A new approach where every layer of the infrastructure right from the hardware to the application layer is fine tuned for performance can deliver on this next generation IT platform.

Demands of the Next Generation Service Integration Platform

Cloud Infrastructure Solutions

Cloud-hosted solutions can sound like the nirvana to lowering in-house complexity, reducing costs and hastening time-to-market. When done right, it can result in lowered barrier to entry and allow focusing on core competencies. However, it brings with it, a heightened demand for better reliability, flexibility,
management and performance of the underlying platform for third parties to deliver mission critical applications.

While hosting a cloud platform as a service, performance and security issues can turn into a nightmare, and turn away customers. Customers may opt for private, public or a hybrid solution but in all three cases, the same issues surrounding performance and security become pertinent for SOA.

Mobile Enablement and Social Media

Mobile internet usage is on the verge of exceeding internet desktop usage. Cheaper, more powerful devices, faster speeds and low cost mobile network connectivity are driving an explosion in the number of connected devices and the data generated by them. In addition social networks are creating new operating models for customer interaction. With the proliferation of mobile devices, organizations strategize to harness new revenue streams and increase customer retention, by building out mobile fronts to enterprise applications. To deliver value on value added services, organizations have to integrate and deliver quickly on native mobile and social as well as device data.

SOA can mobile-enable existing enterprise applications flexibly and reliably without affecting existing traditional usage of enterprise applications and services. However, with mobile enablement, the number of users could increase drastically, demanding better scale and throughput of the application. In addition, the application needs to be highly-available, as users access applications at all hours of the day and from all possible locations.

Big Data & Fast Data

There is an explosion in the velocity, volume and variety of data as a result of proliferation of mobile devices and successful adoption of social media channels. Deriving business value involves processing this data at high speeds for actionable insight and then taking action. Big Data processing typically involves a time delay in responding to the data from the time the events were generated. Fast Data, on the other hand, is less accommodating of delays and requires quick response as the data is very time sensitive and loses relevance with delay. SOA helps create a responsive architecture to derive maximum value from this data explosion. The performance requirements of the underlying platform are to match the low latency, high throughput and scalability requirements of the generated events.

Increased Demands of Existing Enterprise Applications

Organizations are looking to differentiate themselves from their competitors and deliver on increased customer demands with improved operational execution. Heightened security and increased compliance requirements place a load on IT. Business diversification, growth and IT consolidation are additional drivers. The volume of information and transactions is constantly on the increase as IT has become a reliable medium for business over the past few decades.

For example credit card companies’ process 50-60 million messages per day, mobile service providers’ process 5000 transactions per second and B2B gateways require hundreds of long-lived transaction processes per second; Healthcare is going through tremendous regulatory and compliance changes that are transforming operations. Across industries, the demand for better performance, decreased cost of
operations and simplicity of managing several moving parts in IT has become a requirement.

Overview of Service Oriented Architecture

Organizations leverage SOA as the underlying platform for delivering mission critical applications. Each service that makes up an SOA application is designed to provide a tightly defined set of functions. SOA transforms complex application integration into agile and reusable service-based connectivity by mediating, routing, and managing interactions between services and applications in the enterprise and in the cloud. Requirements for application integration have significantly expanded over the last decade to include support for business activity monitoring, event processing, business rules, B2B integration, and more. Organizations now need a unified development, runtime, monitoring, and management interface across these components.

Standards-based, SOA creates an open infrastructure that interoperates with existing IT investments and lowers upfront costs. In addition, rules-driven service orchestration automation enables improved efficiency and agility. Oracle SOA Suite is the industry’s most complete SOA offering that has proven value with wide adoption as a high performing application platform. SOA reduces risk; speeds time to market; allows faster response to business requirements, and lowers total cost of ownership.

![Oracle SOA Suite diagram]

Figure 1: Oracle SOA Suite

Let’s take a look at the different layers in the Oracle SOA Suite, as an example of a full-featured SOA platform. The lowest layer of the Oracle SOA Suite has three types of connectivity delivered through adapters

- Cloud for delivering software-as-a-service integration at both the application as well as discrete service level,
- On-premise application integration such as legacy mainframe, web service, FTP, database, and file system adapters
- Standards based adapters for B2B integration

Oracle Service Bus is an Enterprise Service Bus (ESB) which is a software architecture that provides fundamental services for more complex architectures, such as service virtualization and mediation. This
helps the underlying implementation of services decouple from functionality. Business Process Execution Language (BPEL) Process Manager and Business Rules deliver on orchestration and rule driven decisions - both used to develop composite applications. And lastly the Analytics layer includes Business Activity Monitoring (BAM) that delivers real-time monitoring and Oracle Event Processing which delivers on Fast Data.

Extensible Markup Language (XML) is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine readable. XSLT (Extensible Style sheet Language Transformations) is a language for transforming XML into other XML documents. SOA applications typically leverage XML/XSLT extensively. Hence the processing speed of XML/XSLT can determine overall performance of the SOA applications.

Translating New Business Imperatives to IT Requirements

The challenge introduced by the new business imperatives heightens the existing quality of service for SOA and introduces a proliferation of new infrastructure requirements. The following table summarizes how business strategies translate to IT imperatives and in turn guide infrastructure requirements.

<table>
<thead>
<tr>
<th>Business Strategies</th>
<th>IT Imperatives</th>
<th>Infrastructure Requirements</th>
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</thead>
<tbody>
<tr>
<td><strong>Cloud Solutions</strong></td>
<td>Future proof environment</td>
<td>Maximum availability</td>
</tr>
<tr>
<td>Secure and high performing</td>
<td>Flexible and scalable business technology platform</td>
<td>Increased scalability</td>
</tr>
<tr>
<td>platform that delivers for</td>
<td></td>
<td>Architect for disaster recovery</td>
</tr>
<tr>
<td>private, hybrid and public</td>
<td></td>
<td>Improve IT efficiency</td>
</tr>
<tr>
<td>options</td>
<td></td>
<td></td>
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<tr>
<td><strong>Mobile Enablement</strong></td>
<td>Fast deployment of innovative solutions</td>
<td>Lower total cost of ownership</td>
</tr>
<tr>
<td>Expose new and existing</td>
<td>Secure platform that meets regulations and compliance</td>
<td>Higher granularity of integration</td>
</tr>
<tr>
<td>business assets over multiple</td>
<td></td>
<td>Higher concurrency</td>
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<tr>
<td>channels and deliver on new</td>
<td></td>
<td></td>
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<tr>
<td>revenue streams through</td>
<td></td>
<td></td>
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<tr>
<td>innovative business models</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Big Data &amp; Fast Data</strong></td>
<td>Seamless end-to-end monitoring and management of all</td>
<td>Information lifecycle management</td>
</tr>
<tr>
<td>Capacity to handle massive</td>
<td></td>
<td>High throughput</td>
</tr>
<tr>
<td>volumes of data arriving</td>
<td></td>
<td>Very high reliability</td>
</tr>
<tr>
<td>over multi-channels; process data</td>
<td></td>
<td>Real-time latency</td>
</tr>
<tr>
<td>accurately to identify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>patterns to glean insight</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Traditional SOA Use Cases</strong></td>
<td>Complete and unified platform with lowered business risks</td>
<td>End to end monitoring and reporting</td>
</tr>
<tr>
<td>Competitive Differentiation,</td>
<td></td>
<td>Guaranteed performance</td>
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<tr>
<td>improved operational execution,</td>
<td></td>
<td></td>
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<tr>
<td>risk and regulatory mastery</td>
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</tbody>
</table>

Figure 2: Translating Business Strategies to IT Infrastructure Requirements
Introducing Engineered Systems

Engineered systems can deliver on the promise for a next generation platform, optimized across all layers of the infrastructure—from hardware to the application. They provide business value with faster time to market, lowered operating costs and reduced business risks. They are capable of delivering on every infrastructure requirement that translates from the new business imperatives handed down to IT.

Better performance, simplicity of management and agility are key enablers for engineered systems. As a result, IT becomes an innovation partner that delivers on optimal experience and the IT systems and applications serve as enablers rather than liabilities for change.

Figure 3: Advantages of engineered systems

Oracle Delivers on Next Generation SOA

Oracle is in a unique position in the industry as a proven leader in both SOA as well as engineered systems. Oracle Engineered Systems family of products are integrated systems where hardware and software are engineered together to provide high performance, reliability and scalability. Oracle designs engineered systems that are pre-integrated to reduce the cost and complexity of IT infrastructures while increasing productivity and performance. Only Oracle can innovate and optimize at every layer of the stack to simplify data center operations, drive down costs, and accelerate business innovation. Oracle has leveraged expertise in both areas of middleware and engineered systems to deliver an optimal solution for SOA that helps organizations capitalize on the new wave of innovation.

Oracle Exalogic Elastic Cloud (hereby referred to as Exalogic) and Oracle Exadata Database Machine (hereby referred to as Exadata) are members of the Oracle Engineered Systems family of products and deliver integrated platforms for running business applications, middleware and databases. Oracle offers a complete integrated suite of products for SOA, with the ability to leverage all of the pre-integrated solution or any combination of products.

Exalogic and Exadata are engineered, integrated, optimized, tested, certified and benchmarked to run Oracle SOA Suite. In addition, Oracle SOA Suite has been architected to leverage the underlying high-performance infrastructure. Exalogic used as the infrastructure for the application tier, and Exadata
used as the infrastructure for the database tier, takes SOA performance to a whole different level. Enhancements that are generic to the Exalogic platform such as at the hardware, operating system and application server are transparent to the SOA applications and do not require any special configuration. On the other hand, leveraging SOA specific enhancements requires configuration changes – since no two SOA applications are alike, this provides the opportunity to customize and tweak the system for individualized peak performance.

Figure 4: Engineered System - Oracle SOA Suite on Exalogic Elastic Cloud

**Oracle Exalogic** is a complete hardware and software platform for Enterprise applications delivered as pre-assembled building blocks that are easy to buy, deploy and operate. Exalogic is an Engineered System: an assemblage of best-of-breed storage, compute, network, operating system and software products that are integrated, tested, tuned, optimized, delivered and supported by Oracle as a single factory-assembled unit.

**Oracle Exadata** is a rack-based system containing compute nodes (x86 servers), RAM, PCI attached Flash, and storage, all pre-integrated and optimized for the purpose of running Oracle Database exceptionally well. Numerous changes have been made to Oracle Database to better support the hardware, so that Exadata delivers performance and scalability that is unattainable through other means.

**Oracle Exabus**: InfiniBand is a communication link for high performance computing and is the standard for both internal and external communication on both Exalogic and Exadata. A defining feature of Exalogic is the near-elimination of Input/Output (I/O) bottlenecks through a subsystem called Oracle Exabus. This subsystem is a collection of technology including InfiniBand switches, gateways, host channel adapters, firmware, device drivers, operating system extensions and software libraries. Exabus allows data to travel faster through the Exalogic system, e.g. from one SOA Suite instance to another, by bypassing several layers of the stack.

**Oracle Cloud Application Foundation**: Built on standards-based technologies for portability, efficiency, and ease of integration, Oracle Cloud Application Foundation brings together key industry-leading technologies that include Oracle WebLogic Server for Java EE; Oracle Coherence in-memory
data grid; Oracle JRockit and Hotspot Java SE solutions; Oracle Virtual Assembly Builder; and Oracle Traffic Director.

**Oracle Coherence** is an in-memory distributed data grid solution, providing the ability to access terabytes of data within microseconds. Applications can store plain old Java objects (POJOs) and database objects as represented by various object relational mapping frameworks (ORMs). Storing objects in Oracle Coherence improves performance and scalability through eliminating load on the database and other systems.

**Oracle WebLogic** provides a fast, reliable, secure, and powerful container for Java EE applications. It has tight integrations with Oracle JRockit, Oracle Database, and Oracle Exalogic. Oracle JRockit is the industry’s fastest JVM, providing a stable runtime for Java-based applications, deterministic performance, and numerous tooling options.

**Oracle Enterprise Manager** is a single fully integrated apps-to-disk management and monitoring solution, for both Oracle and non-Oracle products. It offers complete lifecycle management for all Oracle products, while improving SLAs and deployment flexibility.

**Oracle Traffic Director** is a robust and scalable software-based load balancer that is built into Oracle Exalogic, Oracle’s hardware platform for Oracle applications. Oracle Traffic Director eliminates the need to use web servers for load balancing, which makes it easier to scale up or down based on real-time demand. Because it’s hardware-accelerated and natively leverages the InfiniBand network found in Oracle Exalogic, the performance is unbeatable.

**Oracle HTTP Server** is a web server based on the Apache HTTP server. It sits behind Oracle Traffic Director and is responsible for serving static content (e.g. images, JavaScript files, CSS files, etc) up to a Content Delivery Network (CDN).

**Oracle Virtual Assembly Builder:** Oracle Virtual Assembly Builder makes it possible for administrators to quickly configure and provision entire multi-tier enterprise applications including Oracle SOA Suite onto virtualized and cloud environments. It provides a framework for automatically:

- Capturing the configuration of existing software components and packaging them as self-contained software appliances
- Composing configurable blueprints of multi-tier application topologies called assemblies
- Provisioning whole assemblies onto a pool of virtual and cloud resources with minimal user input

**Performance**

One of the primary reasons customers tend to leverage Oracle SOA Suite on Exalogic and Exadata is for performance. In this section we’ll take a look at the Hardware, Operating System, Database and In-Memory caching enhancements and how they specifically affect SOA application performance. The following table summarizes each quality of service (QoS) requirement for service integration applications and maps it to a feature in the SOA on Exalogic & Exadata engineered system that delivers on it.
<table>
<thead>
<tr>
<th>Quality of Service Requirement for SOA</th>
<th>Delivered by SOA on Exalogic Platform</th>
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</thead>
<tbody>
<tr>
<td>High throughput</td>
<td>Java, JMS, HTTP Optimized, Oracle Traffic Detector</td>
</tr>
<tr>
<td>Low Latency</td>
<td>Infiniband Network, Exabus</td>
</tr>
<tr>
<td>High Availability</td>
<td>1/8th RACK to Multiple Exalogic RACKs</td>
</tr>
<tr>
<td>Scalability</td>
<td>Hardware &amp; Software Redundancy</td>
</tr>
<tr>
<td>Reliability</td>
<td>Standardized Hardware &amp; Software Environment</td>
</tr>
<tr>
<td>Ease of Deployment</td>
<td>Virtualization, Virtual Assemblies</td>
</tr>
<tr>
<td>Manageability</td>
<td>Enterprise Manager</td>
</tr>
<tr>
<td>Security</td>
<td>Virtualization, InfiniBand Partition</td>
</tr>
<tr>
<td>OS/Network Resource Isolation</td>
<td>Application &amp; Server Virtualization</td>
</tr>
</tbody>
</table>

Figure 5: SOA on Exalogic delivers on improved Quality of Service (QoS) for Service Integration

**Hardware Performance Enhancements**

Exalogic and Exadata have hardware, software, storage, and network architecture built into each system that ensures enterprise grade qualities of service, such as high availability, fault tolerance, performance, and scalability – straight out of the box. Exalogic leverages Exabus to provide “bus speed” - extremely fast, high-throughput interconnect between all of the hardware units within a deployment and provides scale, application isolation, and elasticity. As a result, SOA on Exalogic delivers on 2x faster response time than on traditional commercial off-the-shelf (COTS) hardware.

Each configuration of Exalogic and Exadata contains the optimal amount of RAM (Random Access Memory), SSD (Solid State Drive), and storage so that the system is balanced for maximum performance. Hardware configurations come with flexible options and may be upgraded without any downtime. RAM optimization provides parallelization in XML/XSLT processing. In addition the File Adapter has an inbuilt flash which optimizes performance and control for file processing.

Due to these optimizations of leveraging Infiniband and near elimination of I/O, SOA large file processing also translates to 2X improvement for higher payloads.
Operating System Performance Enhancements

The Oracle Linux and Solaris 11 operating systems have been extensively tuned for the underlying hardware on Exalogic and Exadata. In addition Oracle’s Java Virtual Machines (HotSpot and JRockit) and Oracle WebLogic Server have been modified and tuned to transparently take advantage of the hardware and software below them. The kernel and operating system’s TCP/IP stack is bypassed for most inter-process communication across the entire InfiniBand fabric. Within the same Java process, I/O bottlenecks are minimized through extensive tuning at all layers. This vertical integration between software and hardware is part of what enables Exalogic and Exadata to provide such exceptional performance for applications at the top of the stack.

Database Performance Enhancements and In-Memory Caching

Exadata is engineered to be the highest performance and most available platform for running the Oracle Database. Built using industry-standard hardware, intelligent database and storage software, Exadata delivers performance for all types of database workloads including Online Transaction Processing (OLTP), Data Warehousing (DW) and consolidation of mixed workloads. Exadata is an easy to deploy system that includes 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.

In addition, other than Exadata optimizations, SOA takes advantage of Oracle Coherence for in-memory caching for BPEL operations to improve response time and scalability. Oracle SOA Suite paired with Exalogic and Exadata provides unparalleled performance for the next generation IT platform to deliver on SOA.

Exalogic optimized Coherence cache, overall enhanced in-memory processing and optimizations within SOA and Exalogic to handle concurrency, along with a highly optimized BPEL scheduler has shown significant performance improvement of orchestration claims processes use cases, which were built similar to Oracle Fusion Apps. The throughput gains with SOA on Exalogic were 15X more than on COTS.
Integrated Manageability

Typically, IT spends over two-thirds of its budget just maintaining existing systems. Oracle changes this scene with integrated manageability from the hardware all the way to the application. Costs can be dramatically reduced and efficiency increased with manageability built directly into the entire technology stack, from applications to disk. Customers quickly benefit from zero-overhead instrumentation, integrated optimization advisory and complete lifecycle management. Oracle Enterprise Manager delivers end-to-end manageability and monitoring of Oracle SOA Suite and applications that are deployed on it and Oracle Engineered Systems (Exadata, Exalogic). The integrations between these best-of-breed products and unified management allows for unparalleled end-to-end visibility, management, monitoring and ease of maintenance resulting in reduced costs and complexity. Finally, embedded hardware diagnostic capabilities allow Exalogic to “phone home” to file Oracle Service Requests in case of hardware failures.

Agility and Faster Time-to-Market

Enterprise SOA applications sharing resources with other middleware applications have the option of server and application virtualization. This allows multi-tenant on the same shared infrastructure, providing operating-system level isolation, resource level isolation, network level isolation and storage level isolation.

SOA performance on a virtual node closely matches the performance on a physical node. Oracle Virtual Machine (OVM) with SOA Suite pre-installed speeds up the process of migrating to the virtual
environment with pre-built templates that can speed up enterprise application deployment and simplify lifecycle management.

![SOA Performance - Exalogic Virtual vs. Physical](image)

Figure 8: Exalogic (Virtual) performance is comparable to Exalogic physical

A consolidated management framework from application-to-disk delivers business critical applications onto a fully virtualized environment and simplifies application delivery. In addition, it lowers risk by standardizing on infrastructure from development to testing to production without increasing costs. Patching and maintenance becomes easy as a single patch can cover all components from applications to disk.

**Oracle Event Processing Optimizations on Exalogic**

Oracle Event Processing is a complete solution used to build applications that filter, correlate and process events in real-time. Oracle Event Processing is a component of the SOA Suite and can be leveraged to handle Fast Data. Oracle Event Processing in addition has options to deploy standalone, independent of the SOA Suite as well as a Java embedded component.

As event-driven architecture and complex event processing have become prominent features of the enterprise computing landscape, more and more enterprises have begun to build mission-critical applications using them. Today, mission-critical event processing applications can be found in many different industries. For example, event processing is being used in the power industry to make utilities more efficient by allowing them to react instantaneously to changes in demand for electricity, in the credit card industry to detect potentially fraudulent transactions as they occur in real time, and in capital markets for applications like order routing and algorithmic trading.

Oracle Event Processing has been optimized to run on Exalogic to leverage Exabus and the underlying optimizations of the operating system kernel and to run directly on the JVM without Oracle WebLogic Server. Parallel processing leveraging in-memory caching with Oracle Coherence delivers on higher performance. Oracle Event Processing provides very high throughput and low latency to deliver on the Fast Data business imperative. In performance benchmarks, it was able to sustain an event injection rate of up to one million events per second on a single Exalogic compute node, while maintaining low
average and peak latencies. At an injection rate of one million events per second the average event latency for the full processing path on the server was 32 microseconds with 99.99 percent of the events processed in less than 2 milliseconds.

Customer Success Stories

Square Two Financial

SquareTwo Financial increased database transaction speed four-fold and realized a 28% improvement in performance to meet exponential company growth. Performance tests showed that the system could handle as many as 25,000 daily users—demonstrating it had the scalability to handle additional growth. The out-of-the-box functionality enabled the customer to implement the products in just 134 days. And the number of environments requiring updates for new system rollouts was reduced from 98 to 2. Read more on Square Two Financial.

Yarra Valley Water

By leveraging SOA on Exalogic and Exadata, Yarra Valley Water, has reduced application response times from up to 9 seconds to a sub-second, lowered average customer call times by 30 seconds, and cut the overnight batch processing time by 71%. It has also reduced the time required for development, testing, and production tasks by 30%. Read more on performance improvement in Yarra Valley Water and details of the SOA implementation at Yarra Valley Water.

Directorate General of Civil Aviation

The Directorate General of Civil Aviation manages air traffic for more than 3 million flights per year, supporting 125 million passengers across 500 airports. Consolidated key business applications using Oracle SOA Suite and Oracle Exalogic, saves more than 1,000 worker days annually to maintain applications, and approximately US$1 million for technical outsourcing. Read more on Directorate General of Civil Aviation.

Conclusion

A new wave of innovation that stems from widespread adoption of mobile devices, big & fast data and cloud enablement is changing traditional operating models, requiring a next-generation IT platform for applications and services. The new business imperatives that are created from this wave of innovation require heightened standards of performance, flexibility and reduced total cost of ownership. The combination of complete hardware and software engineered solution right from the application layer to the hardware delivers high-performance, low risk and easy manageability for all enterprise applications.

Oracle SOA Suite on Oracle Exalogic Elastic Cloud and Oracle Exadata Database Machine is the next generation IT platform that allows organizations to capitalize on this new wave of innovation. SOA on Exalogic engineered systems delivers 15X more throughput gains, 2X faster response time, and 2X improvement in SOA file processing for large payloads.