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RESEARCH

OFFERING OVERVIEW

Oracle Exadata Cloud Service X8M Brings Leading Elasticity to Enterprise Needs

Say Goodbye to the Rack Era: Welcome to Limitless Elasticity with Oracle Exadata Cloud Service X8M

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EXECUTIVE SUMMARY

This report provides an overview of how Oracle Exadata X8M became a member of the Oracle Cloud Infrastructure offering and analyzes its capabilities to meet enterprises' needs for a next-generation computing platform that allows them to deploy workloads across both on-premises environments and the public cloud. It discusses how Oracle Exadata Cloud Service X8M adds key elasticity to the database computing demands of an enterprise, effectively ending the era of racks and moving on to dynamic computing units in the cloud.

Oracle Gen 2 Cloud Infrastructure is the public cloud manifestation of Oracle's vision for the "chip-to-click" integrated technology stack (i.e., from the CPU silicon, across all ISO/OSI layers and all the way to the end-user mouse click). With the availability of Oracle Exadata X8M in the second half of 2019, Oracle provided a high-performance Oracle Database platform for data-intensive (transactional and analytical) workloads, as well as petabyte-scale data warehouses. Oracle Exadata X8M has followed the traditional "maturation" path of Oracle platforms, first available on-premises, then as part of the Oracle Cloud@Customer offering and now as Exadata Cloud Service in the Oracle Cloud Infrastructure.

Because Oracle uses the same technology stack and machines in both its cloud and on-premises implementations, it has the highest degree of "identicality" across these offerings to be found among all vendors that are part of Constellation Research's Market Overview on next-generation computing platforms. The others are Amazon Web Services' Outposts on-premises portfolio,[1] Google GKE On-Prem,[2] IBM Cloud Private and Microsoft Azure Stack.[3,4] Also of note is the Constellation Vendor Profile on the newest Oracle Exadata Database Machine, Oracle Exadata X8M,[5] as well as the recent Offering Overview about Oracle Autonomous Database and Oracle Dedicated Region becoming part of Oracle Cloud@Customer,[6] the Offering Overview on the latest release of Oracle Autonomous Database,[7] and, finally, the recent blog post on how Oracle brings its complete cloud technology, database and applications stack to the customer's data center.[8]

Business Themes			
New C-Suite	Future of Work	Data to Decisions	Technology Optimization

ABOUT ORACLE DATABASE EXADATA CLOUD SERVICE X8M

Overview

Oracle has a unique vision among vendors in the technology field of next-generation computing platforms, creating the largest "chip-to-click" integrated hardware and software offering—one that ranges from the silicon (the "chip") to the user (the "click") in software-as-a-service (SaaS) offerings. The Exadata Database Machine X8M is an integral part of the overall Oracle Exadata portfolio, serving as the Oracle Database platform in both the Oracle Cloud Infrastructure (OCI) and Oracle Cloud@Customer offerings.

For a long time, Oracle has stressed that the technology in its cloud infrastructure is much the same as the technology in its on-premises stack with the Oracle Cloud@Customer portfolio. The functional scope is 100% identical, with the same set of 50+ capabilities available in Oracle Cloud@Customer. Overall, compared with its competitors, Oracle has the largest functional scope available on-premises, including its SaaS, platform-as-a-service (PaaS)[9] and infrastructure-as-a-service (IaaS) capabilities running on Oracle Exadata and OCI Cloud Infrastructure. Oracle Cloud@Customer is the closest customers can get to having the Oracle "chip-to-click" cloud stack running in their own data centers. An October 13, 2020, announcement focused on the use of the new X8M technology in the Oracle public cloud.

Oracle Exadata Cloud Service X8M brings the following key innovations to the Exadata portfolio:

- **Improved performance capabilities.** Oracle Exadata Cloud Service X8M uses persistent memory (PMEM) and RDMA over Converged Ethernet (RoCE), making it an effective, modern ultra-low latency, high-performance platform, both in read and connectivity performance.

- **Improved scalability and elasticity.** With an architecture separating compute from storage, and the option for customers to scale these resources independently as needed, Oracle Exadata Cloud Service X8M enables key elasticity that enterprises need for their next-generation applications.

- **Improved IT strategy support.** Oracle Exadata Cloud Service X8M enables CIOs to pursue highly desirable IT strategies, from better performance of online transactional processing (OLTP) and data warehouse workloads to database consolidation and the achievement of higher workload portability between cloud and on-premises deployments. It also ensures that there is zero downtime when scaling or patching.

Market Segment

Market Definition

Oracle Exadata Cloud Service X8M competes in the next-generation computing platforms market as a hardware, software and services offering. A next-generation computing platform is defined as a computing paradigm that runs the same infrastructure (with some limitations) for an enterprise on-premises and in the public cloud. When it comes to Oracle, that infrastructure is, to a large degree, Oracle Exadata.

There has been a lot of confusion regarding the term "cloud," with vendors accusing each other of "cloud washing"—that is, trying to rebrand an old product by adding the word "cloud" to its name. In reality, cloud definitions vary from vendor to vendor and even from enterprise to enterprise. Ironically, the vendors that do the most cloud washing are the ones that lack a public cloud of their own, such as Dell EMC, NetApp, HPE and other old-school vendors.

For the purpose of this report, Constellation defines "cloud" as the elastic provisioning of computing, storage and networking. The elasticity manifests itself in the form of dynamic ramping up and ramping down of resource availability, driven by workload demand, even on a per-second basis. The mechanics for this kind of computing have been established and have matured with public cloud IaaS vendors.[10]

CxOs who must manage on-premises workloads also find that value proposition—the elasticity of computing resources—attractive. IaaS vendors have realized this and added offerings that make parts of their IaaS infrastructure available on-premises. Effectively, the public cloud enables the era of "Infinite Computing."[11]

This report discusses six trends shaping the next generation compute market.

Market Trends

The following six market trends characterize the management of computing infrastructure (see Figure 1):

Heterogeneous Computing Demands

CxOs are confronted with rapidly changing computing demands. Beyond the challenge of satisfying the business need for big data, the computing requirements CIOs must meet range from support for machine learning to speech recognition for internal and external digital assistant/chatbot solutions, all the way to the edge of the enterprise. New computing platforms have entered the data center—for instance, with the advent of large GPU racks to run machine learning. An unprecedented platform diversity manifests itself at the edge of the enterprise to support the Internet of Things (IoT). And the pace of change is not slowing down, as shown by new demands for additional workforce support (e.g., augmented/mixed/virtual reality) and new user experience support (e.g., holographic displays).

Figure 1. Six Market Trends Defining a Next-Gen Computing Platform

Heterogeneous Computing Requirements	Data Center Utilization	Need for a Single Control Plane
Rising Complexity of IT Organization	Compliance Pressure	Degree of Cloud Skepticism

Source: Constellation Research

Data Center Utilization

As workloads move from enterprise data centers to public cloud vendors, CIOs struggle to reach the level of utilization they intended when originally planning and investing in their data centers. One part of the challenge is the business practice of letting individual company divisions choose their own automation tools, resulting in a lower degree of predictability for available workloads in on-premises data centers. An additional hurdle for CIOs is that physical infrastructure requests are moving more slowly and have a much longer-lasting financial impact. Data center utilization can quickly change from full capacity to two-thirds utilization. Dropping a single server-refresh cycle will create that scenario, which CxOs experience as they move workloads to the public cloud.

The Need for a Single Control Plane

The era of CxOs simply accepting that new products bring a new control plane is history. CxOs operating next-generation applications[12] must run them as efficiently as possible, via a single control plane. This not only allows for more efficiency in managing infrastructure but also is the best way to effectively manage a heterogeneous landscape. Ramping down and ramping up resources as demand requires cannot be done from a "zoo" of instrumentation. At the same time, it is essential to automate resource scaling so that humans can focus on delivering value instead of spending time and energy on operational tasks.

Rising Complexity of IT Operations

The cloud has not fulfilled its promise to simplify IT for most organizations because they are operating on a fluid automation plane that includes the public cloud (often multiclouds) and on-premises computing resources. Business priorities, timing and write-down cycles all determine the specific time a workload may be moved to the public cloud or whether it should remain on-premises. Changes in executive management often result in a shifting workload mix (for instance, due to SaaS portfolio changes) that affects the overall computing mix. A greater diversity in workloads and new next-gen application use cases create more heterogeneity and increase the complexity of IT operations.

Compliance Pressure

Enterprises are confronted with a rise in compliance requirements that, due to the operation of larger software portfolios, affect more of the computing and storage infrastructure than ever before. Data privacy and data residency regulations often require enterprises to move workloads to different physical locations, and sometimes from the cloud back to on-premises. Enterprises had not even recovered from addressing the European Union's recently enforced General Data Protection Regulation when the California Consumer Privacy Act took effect, and they see more data residency rules coming their way. The rate of regulation will only increase, making CxOs desire a more fluid way to move workloads.

Degrees of Cloud Skepticism

Although many next-generation application use cases are best (and sometimes only) optimally operated in the cloud, there is still a degree of skepticism over computing in the public cloud. It ranges from rational challenges (such as whether IaaS vendor data instances are available inside of a necessary jurisdiction) to reasonable challenges (hardware write-downs and connections to existing on-premises computing resources, such as mainframes) to less-rational concerns (for instance, regarding data safety). Nonetheless, it means that CIOs need to implement and operate workloads in local data centers for at least the next decade.

KEY CAPABILITIES

This section describes the most important capabilities of the Oracle Exadata Cloud Service X8M offering.

The Exadata Vision

Oracle started to ship Oracle Exadata in 2008 and has upgraded the platform over the years, with additional innovations featured in every release. Originally a partnership between Oracle and Hewlett-Packard, Oracle Exadata evolved to combine hardware assets from the subsequent Sun Microsystems acquisition as well as additional R&D. Oracle created a hardware and software

combination engineered at the source-code level to work together, which has received a very strong reception in the market, with several customers now running more than 100 Exadata systems in production environments and some running north of 300 systems. In its most recent quarter, Oracle reported 15% year-on-year growth for its Exadata Database Machine—and twice the backlog of last year—while Dell Servers declined 5% and IBM Power Systems declined 29%, clearly indicating that Oracle continues to gain market share in its Database installed base.

The Exadata vision is defined by the following three pillars (see Figure 2):

1. **Database hardware platform of choice.** As the market leader for relational database systems (RDBMSs), Oracle has set out to build the ideal hardware platform for its database products. Oracle's detailed knowledge of its products' software architecture has led to a unique hardware platform that optimizes for performance, total cost of ownership (TCO), return on investment (ROI) and internal rate of return (IRR).

Figure 2. Oracle Exadata Vision

The Exadata Vision
Dramatically better platform for all database workloads

- **Ideal Database Hardware** – Scale-out, database optimized compute, networking, and storage for fastest performance and lowest cost

- **Smart System Software** – Specialized algorithms vastly improve all aspects of database processing: OLTP, Analytics, Consolidation, IoT, Blockchain, High Frequency Trading

- **Automated Management** – Automation and optimization of configuration, updates, performance, and management culminating in Fully Autonomous Infrastructure and Database

Source: Oracle

2. **Smart system software.** In the past, the different natures of different database and information management processes required differently optimized hardware. With Exadata, Oracle has created a common hardware platform that can morph in its configuration for different database workloads, enabling the optimal configuration for every workload. Oracle has architected a very tight integration between its Exadata platform and Oracle Database to enabled enhanced capabilities for OLTP, Analytics, Data Warehousing and, of course, massive Database Consolidation. Since Oracle owns the entire stack, it understands the Database's needs and can optimize everything from the compute, storage and networking. The company redesigned all the interfaces and the internal software for a specific purpose—the fundamental design of Exadata goes far beyond just reading and writing blocks of data.

3. **Autonomous management.** Oracle chairman and chief technology officer Larry Ellison's vision of the autonomous technology stack has been fully infused and enabled with Oracle Exadata. The ability to run technology stacks autonomously is crucial for enterprises, regardless whether deployment of their workloads is in the cloud or on-premises.

Today, Oracle Exadata is used predominantly within global enterprises that demand high performance, availability and security while operating under challenging conditions from an operational uptime perspective.

- 86% of the Fortune Global 100 run Exadata.
- 28% of the Fortune Global 100 have adopted Exadata Cloud Service.
- 256% five-year ROI with payback in six months after first operating Oracle Exadata Cloud@Customer.

Oracle Exadata X8M Joins Oracle Cloud Infrastructure

Oracle launched Oracle Exadata X8M in the fall of 2019[13] at its Oracle OpenWorld user conference.
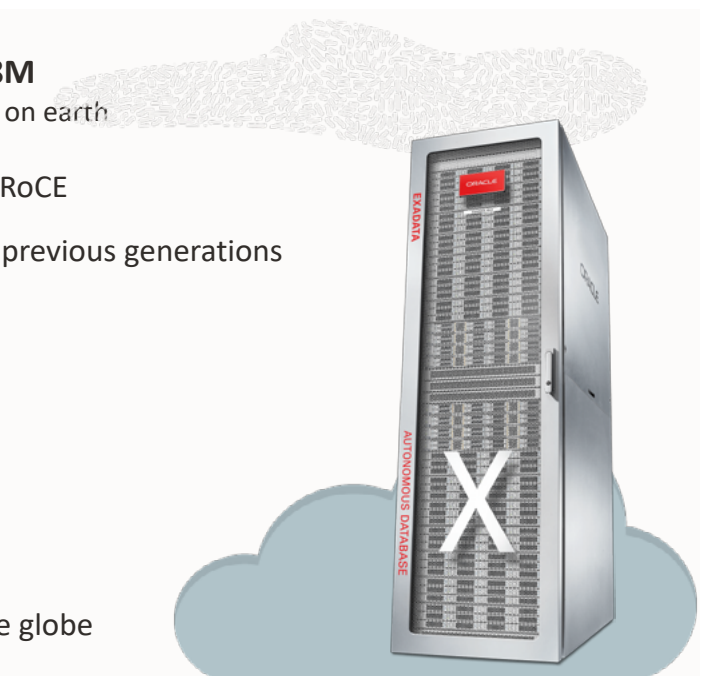
At its core, Oracle Exadata X8M delivered three key innovations:

1. **RoCE for networking.** Oracle eliminated InfiniBand and moved to the widely standard Ethernet, but with RoCE speeds.

2. **PMEM for performance.** Persistent memory is the next-fastest way to make data available; it thus enables the addition of a new tier for data performance management.

3. **KVM as hypervisor.** Oracle replaced Xen with the more familiar and market-winning KVM (for kernel-based virtual machine) hypervisor—a hypervisor CIOs know and trust in enterprises around the world.

With the addition of Oracle Exadata X8M to Oracle Cloud Infrastructure as the new-generation Exadata Cloud Service, Oracle added significant elasticity features for computing (see Figure 3). These are in both the technical elasticity of the platform ("configure what you need") and the commercial elasticity of the platform usage ("pay for what you use"). Both areas are key for giving workloads the flexibility enterprises need in a more challenging business environment.[14]

Figure 3. Oracle Exadata X8M Comes to Oracle Cloud Infrastructure

Introducing Oracle Exadata Cloud Service X8M
The fastest and lowest latency database cloud service on earth

Exadata Cloud Service now fueled by PMEM and RoCE

- State-of-the-art hardware improvements over previous generations
  - PMEM
  - RoCE

- Elasticity built into the platform from the start
  - Configure what you need
  - Pay only for what you use

- KVM-based virtualization

- Available in Oct. in OCI data centers around the globe

Source: Oracle

A Look Inside: Oracle Exadata Cloud Service X8M Hardware

A closer look at the hardware specifications for Oracle Exadata Cloud Service X8M reveals the following (see Figure 4):

Effectively, Oracle Exadata X8M consists of three components:

- **Exadata compute servers.** The Exadata compute nodes manage the Exadata storage cells, and the queries that are funneled to the storage cells. They operate on 2 x 26 core Intel Xeon processors, 1,390 GB of memory (the odd number results from Oracle's system management software) and 25 Gbps of external storage.

- **Exadata storage servers.** The Exadata storage servers do as their name indicates: They not only take care of storage but also process data-intensive SQL queries off-loaded from the compute servers. The Exadata storage server software is highly differentiated as nobody else in the industry off-loads Oracle Database processing from the compute servers to internal storage servers because they lack the innovative source code to do so.

Figure 4. Exadata Cloud at Customer Oracle Database Support

Single Database scales up to:
- 4600 CPU Cores, 9200 Threads
  - 1,600 database cores
  - 3,000 storage cores
- 44 TB DRAM
- 96 TB Persistent Memory
- 1.6 PB Flash
- 25 PB Database Size
  - 2.5 PB uncompressed
  - 25 PB HCC compressed

- Compute intensive
- Memory intensive
- Latency intensive
- IO intensive
- Storage intensive
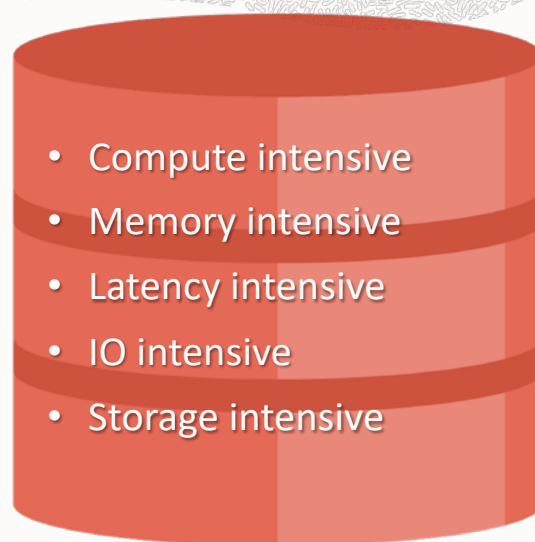
Source: Oracle

These storage cells comprise 2 x 24 core Xeon processors, 192 GB of memory, 1.5 TB of PMEM, 4 x 6.4 TB NvME PCIe 3.0 flash cards and 12 x 14 TB 7,200 RPM disks.

- **Fast networking.** Oracle connects machines and servers with RoCE, setting up a unified 100 Gbps internal fabric.

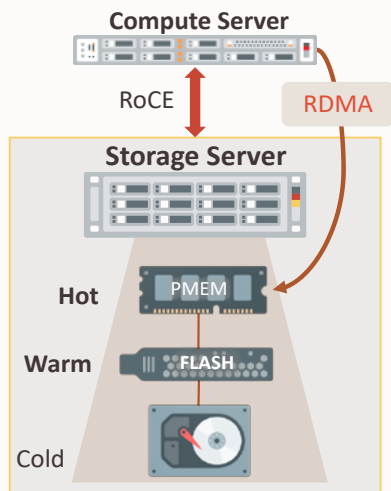## Persistent Memory Adds a Fourth Gear in the Performance Race

Since the rise of flash memory, there has been a three-tier model for making data available for applications. But with the recent advances of PMEM, a fourth tier is now part of high-performance computing (HPC) best practices. PMEM is located between DRAM and flash memory, allowing a persistent extension of DRAM memory. Effectively, PMEM enables content to survive if a power failure occurs. With reads being consistent to DRAM reads, HPC has a valuable extension to its data-caching tiering model with the introduction of PMEM.

The addition of PMEM adds tangible benefits to Oracle Exadata X8M (see Figure 5):

- **Realize higher throughput.** With the addition of the Oracle Persistent Memory Accelerator, Oracle Exadata X8M runs with 2.5x higher I/Os per second than the previous architecture.

- **Improve latency.** Because Oracle Database uses RDMA instead of I/O to read persistent memory, it experiences 10x better latency.

- **Expand capacity.** By using persistent memory for the hottest data-effective cache, capacity increases 10x.

- **Achieve higher fault tolerance.** Oracle Exadata X8M mirrors persistent data automatically across storage servers for fault tolerance.

Figure 5. How Persistent Memory Speeds Up in Oracle Exadata X8M

Exadata Cloud Service X8M Architecture: Bringing PMEM Benefits to the Cloud

Intel® Optane™ DC Persistent Memory

Compute Server

RoCE | RDMA

Storage Server

Hot — PMEM

Warm — FLASH

Cold

<19 usec IO latency (Qtr Rack)

- In-Memory speed with benefits of shared storage
- New Leading-Edge network
  - RDMA over 100 Gb/sec Converged Ethernet – RoCE
- Persistent Memory in Storage accessed using RDMA
  - 10X better transaction processing latency
  - 2.5X higher transaction processing IOs
- Better Consolidation and Lower Costs
  - 2x more Memory per Virtual Machine
  - Runs more workloads on less hardware

Source: Oracle

The Oracle Exadata team has provided several key additional capabilities that leverage persistent memory:

- **Enable the Oracle Exadata X8M Commit Accelerator.** Log writes are usually the bottleneck for database performance. The Oracle Automatic Commit Accelerator feature makes it possible for Oracle Database to directly write to PMEM via RDMA. This can speed log writes by as much as 8x.

- **Optimize for Oracle Database.** Persistent memory in regular storage appliances can merely serve as a fast cache. Because Oracle has engineered Oracle Exadata X8M to work with Oracle Database, it has enabled the database to use RDMA directly over the RoCE network, where network cards directly read and write to PMEM.

- **Take advantage of shared Exadata storage.** Sharing persistent memory in Exadata storage servers has several benefits. PMEM can be shared and tiered across

databases. Security is increased because PMEM can be accessed only via the database, so there is no operating-system or local-level access. And the shared PMEM allows usage by any server and database that needs it, making memory allocation more efficient.

Oracle Exadata Cloud Service X8M Delivers Big Time on Storage Elasticity

A notable cost of IT has been that compute capacity, once procured, could not be "returned." As workload demands of an enterprise oscillated, unused capacity—already paid for—was not utilized. There was no way around the dilemma, because enterprises had to size their on-premises hardware to the expected peaks of the applications and workloads they wanted to run—for example, for the fabled three peaks of ERP (closing books), running payroll and manufacturing resource planning (MRP). Running these jobs in parallel usually was not possible, and the results were a suboptimal customer and/or employee experience.

Enter the public cloud, and with it the era of Infinite Computing,[15] in which, theoretically, compute resources become "infinite." Of course, no resources are truly infinite, but for practical IT purposes a resource is infinite when it fulfills the following criteria:

- **Limitless.** An enterprise cannot exhaust the resource availability. There is just too much capacity, and capacity keeps getting extended at a faster rate than utilization.

- **Affordable.** The provider of Infinite Computing (aka, a public cloud provider) offers the commercial elasticity—charging more when an enterprise uses more and charging less when the enterprise uses less.

What this means for CxOs is that they can leverage Infinite Computing benefits as long as they can tie utilization of the needed resources to business success. As its business ramps up, the enterprise pays more; as its business contracts, the enterprise pays less.

Oracle Database Exadata Cloud Service X8M enables Infinite Computing by allowing organizations to flexibly add database and/or storage servers (see Figure 6). The starting configuration is with two
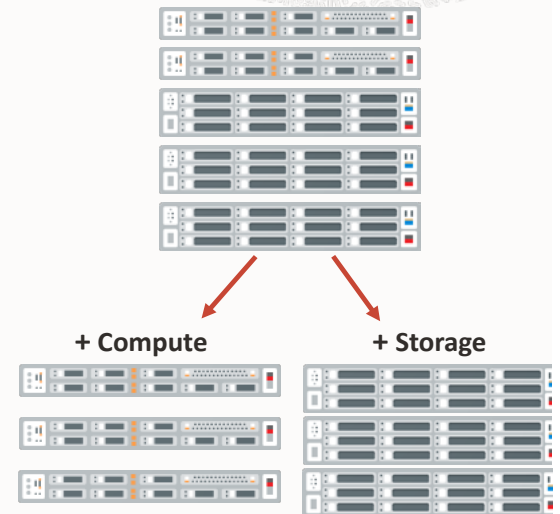
Figure 6. Oracle Exadata Cloud Service X8M Architecture

Start small with minimum size HA configuration

- 2 Compute Servers, 3 Storage Servers
- Dedicated to you – no noisy or malicious neighbors

Add Compute or Storage Servers as needed

- Each compute server adds
  - 50 compute cores, 1.3 TB DRAM
- Each storage server adds
  - 49 TB DB Storage, 25 TB Flash, 1.5 TB PMEM

+ Compute   + Storage

Source: Oracle

database compute nodes and three storage servers. Enterprises can decide to add on the compute side, on the storage side or both.

Capacity can ramp up as follows:

- **Database compute server.** Each database server added will add 50 OCPUs (Oracle CPUs) and 1,390 GB of RAM.

- **Storage server.** Each storage server adds 49 TB of hard disk drive (HDD) storage and 1.5 TB of PMEM.

Needless to say, Oracle Exadata automatically load balances across the available compute servers, making additional capacity quickly available. The autonomous nature of resource changes is key for enabling elasticity. The current limit of the Exadata Cloud Service X8M offering is 32 database compute servers and 64 storage servers, which would provide an organization with 4600 CPU cores, 9,200 threads, 44 TB of DRAM, 96 TB of PMEM, 1.6 PB of Flash, and a 25 petabyte-sized Database (2.5 PB uncompressed, 25 PB HDD compressed). So, whether an organization wants to scale its OLTP

workloads, data warehousing workloads or both, Oracle has delivered an extremely flexible, elastic cloud service that features innovations not found with AWS RDS, AWS Aurora or the latest entrant to the cloud database wars, Snowflake.

Compared with the latest Exadata Cloud Service X8M, AWS lacks true online elasticity because AWS RDS offers no scale-out capabilities; Aurora DB instance scaling "will have an availability impact" according to Amazon; and AWS Redshift offers no read-write elastic scaling. These AWS cloud database services do not offer online patching and maintenance either.

The key milestone of this elasticity is that enterprises can now scale on a compute-server, storage-server basis, practically eliminating the venerable "rack" as a scaling unit. Enterprises do not need to know and manage racks anymore, just capacity. They can scale vertically, scale horizontally and benefit from precise per-second billing.

Oracle Exadata Cloud Service X8M Enables Key IT Strategies

With the ability to scale computing and storage demands to enterprise needs, Oracle Database Exadata Cloud Service X8M enables key IT strategies and scenarios:

- **Use the fastest OLTP database with integrated analytics.** Its high-availability services make Oracle Database Exadata Cloud Service X8M the ideal platform for mission-critical OLTP applications. Especially thanks to PMEM, performance gains are available as well, enabling SQL read latency of as little as 19 microseconds or less. Being able to scale OCPUs without downtime is paramount for both performance and high availability. And the combination of in-memory and flexible CPU capacity enables important next-generation capabilities in regard to real-time recommendations, next-best action prompts and so forth.

- **Enable massive database consolidation.** Enterprises tend to experience database sprawl that needs to be reined in every few years with a consolidation strategy. Often large and/or critical database workloads were excluded from that exercise because the new platforms could not scale to handle the demand. That has changed now

with Oracle Database Exadata Cloud Service X8M, which can handle any relational database size that organizations can throw at it. It can scale not only the relational database needs but also all that a converged database needs to support (JSON, XML, spatial, graph and so on). With ample storage (25 PB) and up to 44 TB of database server memory, organizations won't run into capacity issues. And as a bonus, always-on encryption makes consolidated databases likely safer to operate than they were on their former platforms.

- **Deliver a data warehouse platform.** Data warehouses have demanding requirements in both data volume and processing speeds. With up to 25 PB of data with 10:1 Hybrid Columnar Compression, up to 3,072 OCPUs and up to 1.6 TB/sec SQL throughput, Oracle Database Exadata Cloud Service X8M delivers a very attractive data warehouse platform that is superior in elasticity, scalability and online as well as nondisruptive automated patching vs. its principal competitors, such as AWS RDS, AWS Aurora and the new kid on the block that relies on AWS for its cloud, Snowflake.

- **Achieve high workload portability.** With the extremely high identicality of all Oracle platforms between the cloud and on-premises implementations, putting data and database automation into Oracle Database Exadata Cloud Service X8M allows CIOs to achieve seamless workload portability across the cloud and on-premises (courtesy of Oracle Cloud@Customer).

PRICING

Oracle has optimized the pricing both from a technical (minimum number of cores) and a usage (CPU-based pricing) perspective. CxOs need to make sure that the minimum requirements are not too steep for their workloads and that they can derive a TCO advantage. As usual, enterprises should negotiate with Oracle (as with any other vendor), because discounts, especially in the fourth quarter of the vendor's financial year, are always a possibility.

A detailed Oracle Exadata price list is available here: https://www.oracle.com/assets/exadata-pricelist-070598.pdf

Pricing for the Oracle Exadata Cloud Service is available here: https://cloud.oracle.com/en_US/database/exadata/pricing

And finally, pricing for Oracle Exadata Cloud@Customer is available here: https://cloud.oracle.com/en_US/database/exadata-cloudatcustomer/pricing

ANALYSIS AND OBSERVATIONS

For CxOs making decisions regarding their next-generation computing platform, Oracle brings a lot to the table. With the highest identicality of cloud and on-premises products available, Oracle makes it easy to transfer workloads from on-premises environments to the cloud and vice versa. The new generation of the Oracle Exadata Cloud Service, powered by the company's innovative X8M technology, is a key addition to the product portfolio. The biggest concern arises in relation to some of Oracle's commercial tactics—or the perception of them.

Strengths

Oracle Exadata possesses the following strengths compared with other offerings in this market space (see Figure 7, p. 22):

- **Highest identicality of cloud and on-premises functionality.** Oracle Exadata as a common platform across on-premises and the public cloud delivers flexibility at times of uncertainty, including from legislative, top management and best-practices perspectives. The main aspect of flexibility for computing platforms is the ability to transfer workloads between the cloud and on-premises. Enterprises are attracted to Oracle Exadata by the identicality of the solution in this regard. They run on the same machines and have identical setups—the Oracle Exadata Database Machines. A customer can run Oracle Databases on Exadata on-premises and then move the same Oracle Databases to another Exadata in the cloud and not have to make any software changes. No Oracle competitor can offer that today.

- **Integrated, chip-to-click stack.** Oracle is pursuing Larry Ellison's vision of becoming the IBM of the 21st century, offering a fully integrated technology stack, designed, engineered and operated together, from the silicon all the way to the mouse click of an end user using a SaaS application. No other vendor is currently pursuing such a complete vision of a technology stack. This is likely one of the largest software and hardware engineering efforts of our time and, as such, offers substantial simplification, TCO and efficiency savings, and it all comes from Oracle. Users' desire for the legendary "one butt to kick" has never been closer to being achieved.

- **One database for all needs.** Oracle Database runs more than relational database workloads; it can also run time-series-, XML-, document-, graph- and JSON-based database loads, and more. Most Oracle competitors run these different workloads in different databases with different data models and management paradigms. Oracle's single-database approach makes administration and support easier and offers consolidation strategies using Exadata. It also eliminates data fragmentation, ensures enterprise-grade security and provides for an integrated data management strategy as opposed to isolated islands of data and management tools.

- **A very good product gets even better.** With the addition of Oracle Exadata Cloud Service X8M, Oracle Exadata in OCI gets material improvements in scalability, elasticity, latency and performance. CxOs want to be able to scale their computing needs, and Oracle Exadata Cloud Service X8M enables that with scalable compute and storage servers and fully elastic expansion in the cloud.

Weaknesses

Oracle Exadata possesses the following weaknesses compared with offerings in this market space:

- **Oracle is known predominantly as an RDBMS vendor.** Despite all the investments into PaaS[16] and SaaS, Oracle remains known primarily as a leading database vendor. CxOs traditionally have trusted various other vendors to enable their computing platform via a mix of hardware and networking solutions. Oracle needs to overcome

that RDBMS perception from the past and position itself as a complete hardware, networking, software-layer and cloud provider in the context of Exadata. Oracle Exadata can do much more than "just" running Oracle Database very well. Overall, Oracle is starting to show signs that it has reached a leadership position in enterprise cloud applications as well, as shown in recent market studies.

- **Catch-up mode on public cloud infrastructure versus leaders.** Oracle has made numerous forays into the public cloud, but what Oracle calls the second-generation IaaS has seen traction and success only recently. Oracle needs to showcase IaaS viability and capex investment to give CxOs the confidence that there will always be a cloud option to which they can migrate their workloads. But Oracle is catching up with wins at customers such as Zoom, 8x8 and Nissan for workloads that aren't based on Oracle Database, demonstrating that the company is gaining traction beyond its core Database installed base.

- **CxOs' perception of Oracle.** At best, CxOs see Oracle as a challenging vendor. Too many stories of unfavorable and harsh business tactics are out there—some true, some in the realm of myth. Oracle must make itself easier to do business with and manage the transition from being a respected to a liked technology partner for CxOs. Oracle's recent hires of AWS marketing chief Ariel Kelman as its new CMO and former Infor CMO Ashley Hart as its SVP of Database & OCI Marketing are smart moves that are already driving positive changes to the company's perception in the market.

- **Integrated stacks do not harmonize with heterogeneous systems landscapes.** As enterprises have built up considerable technical debt over time, they operate a vast number of systems and platforms. In some situations, enterprises need to keep operating these platforms for the foreseeable future and cannot move to Oracle Exadata. But any database that runs on x86 and Linux is running in degraded mode and can move to Oracle Exadata—there are no technical limitations from doing so.

Figure 7. Oracle Exadata's Strengths and Weaknesses

STRENGTHS	WEAKNESSES
· Highest identicality of cloud and on-premises functionality · Integrated, chip-to-click stack · One database for all needs · The best platform for Oracle Database gets even better	· Oracle predominantly known as an RDBMS vendor · Catching up to public cloud infrastructure versus leaders · CxOs' unfavorable perception of Oracle · Integrated stacks do not harmonize with heterogeneous systems landscapes

Source: Constellation Research

RECOMMENDATIONS

The following are recommendations for CxOs looking to improve their computing architecture:

- **Enable Enterprise Acceleration.** Enterprises need to move faster than ever before, and IT/computing infrastructures cannot continue to be the shackles on agility that they have been in the past. Therefore, CxOs should look for next-generation computing platforms that allow them to transfer workloads from on-premises to the cloud and vice versa. This is a key strategy for helping the technical side of an enterprise contribute to overall business objectives and the necessity of Enterprise Acceleration.[17]

- **Select vendors that have the greatest capability of identicality.** Identicality is the key to workload portability. The higher the identicality between an on-premises architecture and a cloud architecture, the better the chances to move workloads. This argument is intuitively clear to CxOs leading the transformation, and platforms with high identicality are, therefore, clearly preferred. It is even better when vendors state that they design for identicality and want to keep it high—as high as technically feasible. As stated in this report, Oracle excels at identicality between Exadata on-premises, Oracle Exadata Cloud Service, Oracle Autonomous Database on Exadata Cloud@Customer, and the Oracle Exadata Cloud@Customer platform.

- **Pick your next-generation computing platform carefully.** There are substantial value-proposition differences between the five vendors Constellation has analyzed in the underlying Constellation Market Overview. Differences in hardware provisioning, ownership in managing the offering and functionalities make these five vendors very different partners for enterprises that want to manage their next-generation applications on the right next-generation computing platform.

- **Evaluate Oracle Exadata as existing Oracle Database customers.** Because most customers run Oracle Database in one way or another, it is important that they familiarize themselves with the newest member of the Oracle Exadata product family, Oracle Database Exadata Cloud Service X8M. Being able to lower TCO, reduce support and maintenance, fit sizing to match the load of the machine instead of peaks, consolidate databases, run petabyte-scale data warehouses, burst to the cloud for peaks and transfer loads between Oracle Cloud and on-premises are substantial benefit drivers that CxOs simply cannot ignore. Experienced Oracle customers know that the best deals are usually available in the fourth quarter.

- **Consider Oracle Exadata offerings as a prospect.** Database and tech-stack migrations are challenging, so non-Oracle customers will look at Oracle Exadata from some distance. The benefits of Oracle Exadata are substantial, however, and CxOs need to talk with their respective cloud and technology stack vendors about what they can do in this regard. Should the projected gap of those vendors' future road maps become too large, and the potential cost savings with Oracle Exadata substantial enough, it is time to pay attention—and consider a potential migration.

- **Take a stance on commercial prudence.** Regardless the vendor, enterprises need to make sure that they obtain the value they seek. For Oracle Exadata, CxOs must pay attention to ensure that licenses and services (for instance, costs to burst to the cloud) are still providing their enterprise with an attractive TCO. As with all services-related offerings, prices will fluctuate, need to be contractually agreed upon as long as desired and must be constantly monitored to avoid negative commercial surprises.

RELATED RESEARCH

For the Market Overview, see: Holger Mueller, "Next-Gen Computing: The Enterprise Computing Model for the 2020s," Constellation Research, September 14, 2018. https://www.constellationr.com/research/next-gen-computing-enterprise-computing-model-2020s

For the Offering Overview of Oracle Cloud at Customer, see: Holger Mueller, "Oracle Cloud at Customer Enables Next-Gen Computing," Constellation Research, October 2018. https://www.constellationr.com/research/oracle-cloud-customer-enables-next-gen-computing

For the Offering Overview of Microsoft Azure Stack, see: Holger Mueller, "Microsoft Azure Stack Emerges as Key Next-Gen Computing Option," Constellation Research, February 4, 2019. https://www.constellationr.com/research/microsoft-azure-stack-emerges-key-next-gen-computing-option

For the Amazon Web Services offline offerings, see: Holger Mueller, "AWS Customers Can Finally Consider Hybrid and Offline Use Cases," Constellation Research, January 30, 2019. https://www.constellationr.com/research/aws-customers-can-finally-consider-hybrid-and-offline-use-cases

For a Constellation ShortList™ on IaaS vendors, see: Holger Mueller, "Constellation ShortList Global IaaS for Next-Gen Applications," Constellation Research, February 19, 2010. https://www.constellationr.com/research/constellation-shortlist-global-iaas-next-gen-applications-2

For more details on Infinite Computing, see Holger Mueller, "The Era of Infinite Computing Triggers Next-Generation Applications," June 1, 2018. https://www.constellationr.com/research/era-infinite-computing-triggers-next-generation-applications

For the people-leader perspective on the skills shortage and the need for enterprise acceleration, see: Holger Mueller, "Why People Leaders Must Embrace Enterprise Acceleration," Constellation Research, July 3, 2018. https://www.constellationr.com/research/why-people-leaders-must-embrace-enterprise-acceleration

For more best-practice considerations for PaaS offerings, see: Holger Mueller, "As PaaS Turns Strategic, So Do Implementation Considerations," Constellation Research, May 9, 2018. https://www.constellationr.com/research/paas-turns-strategic-so-do-implementation-considerations

For more on next-gen applications and PaaS offerings, see: Holger Mueller, "Why Next-Gen Apps Start with a Next-Gen Platform as a Service," April 5, 2018. https://www.constellationr.com/research/why-next-gen-apps-start-next-gen-platform-service

RELATED RESEARCH CONTINUED

For a Constellation ShortList on PaaS vendors, see: Holger Mueller, "Constellation ShortList PaaS Tool Suites for Next-Gen Apps," Constellation Research, February 12, 2020. https://www.constellationr.com/research/constellation-shortlist-paas-tool-suites-next-gen-apps-1

Also: Holger Mueller, "Constellation ShortList PaaS Suites for Next-Gen Apps," February 19, 2020. https://www.constellationr.com/research/constellation-shortlist-paas-suites-next-gen-apps-1

For additional IaaS and PaaS selection criteria, see: R "Ray" Wang and Holger Mueller, "Key Questions for Every Public Cloud IaaS/PaaS Decision Matrix," Constellation Research, January 24, 2018. https://www.constellationr.com/research/key-questions-every-public-cloud-iaaspaas-decision-matrix

For next-generation databases, see: Holger Mueller, "Constellation ShortList Next-Gen Databases - RDBMS for On-Premises," Constellation Research, February 12, 2020. https://www.constellationr.com/research/constellation-shortlist-next-gen-databases-rdbms-premises-1

For an example of digital transformation, see: Holger Mueller, "Lufthansa Digitally Transforms the Workplace for Flight Managers," Constellation Research, February 27, 2018. https://www.constellationr.com/research/lufthansa-digitally-transforms-workplace-flight-managers

ENDNOTES

1 *For the Amazon Web Services offline offerings, see: Holger Mueller, "AWS Customers Can Finally Consider Hybrid and Offline Use Cases," Constellation Research, January 30, 2019. https://www.constellationr. com/research/aws-customers-can-finally-consider-hybrid-and-offline-use-cases*

2 *For the Offering Overview of Google GKE On-Prem, see: Holger Mueller, "Google GKE On-Prem Brings the Cloud Stack to the Data Center," Constellation Research, July 3, 2019, https://www.constellationr.com/ research/google-gke-prem-brings-cloud-stack-data-center*

3 *For the Offering Overview of Microsoft Azure Stack, see: Holger Mueller, "Microsoft Azure Stack Emerges as Key Next-Gen Computing Option," Constellation Research, February 4, 2019. https://www. constellationr.com/research/microsoft-azure-stack-emerges-key-next-gen-computing-option*

4 *For the Market Overview, see: Holger Mueller, "Next-Gen Computing: The Enterprise Computing Model for the 2020s," Constellation Research, September 14, 2018. https://www.constellationr.com/research/ next-gen-computing-enterprise-computing-model-2020s*

5 *For more, see: Holger Mueller, "Oracle Exadata X8M: The Fastest Oracle Database Platform," Constellation Research, September 25, 2019. https://www.constellationr.com/research/oracle-exadata- x8m-fastest-oracle-database-platform*

6 *For the addition of Oracle Autonomous Database and Oracle Dedicated Region to Oracle Cloud@ Customer, see: Holger Mieller, "Oracle Raises the Stakes in the Next-Gen Compute Platform Market," Constellation Research, July 22, 2020. https://www.constellationr.com/research/oracle-raises-stakes- next-gen-compute-platform-market*

7 *For more on Oracle Autonomous Database, see: Holger Mueller, "The Automation Imperative Materialized: Oracle Autonomous Database," Constellation Research, June 11, 2020. https://www. constellationr.com/research/automation-imperative-materialized-oracle-autonomous-database*

8 *See the blog post: Holger Mueller, "Oracle Brings Its Complete Public Cloud to On-Premises," Constellation Research, September 8, 2020. https://www.constellationr.com/research/oracle-brings-its-complete-public- cloud-premises*

9 *For more best-practice considerations for PaaS offerings, see: Holger Mueller, "As PaaS Turns Strategic, So Do Implementation Considerations," Constellation Research, May 9, 2018. https://www.constellationr. com/research/paas-turns-strategic-so-do-implementation-considerations*

ENDNOTES CONTINUED

[10] *For a Constellation ShortList™ on IaaS vendors, see: Holger Mueller, "Constellation ShortList Global IaaS for Next-Gen Applications," Constellation Research, August 15, 2018.* https://www.constellationr.com/research/constellation-shortlist-global-iaas-next-gen-applications-1

[11] *For more details, see: Holger Mueller, "The Era of Infinite Computing Triggers Next-Generation Applications," Constellation Research, June 1, 2018.* https://www.constellationr.com/research/era-infinite-computing-triggers-next-generation-applications

[12] *Holger Mueller, "The Era of Infinite Computing Triggers Next-Generation Applications," Constellation Research, June 1, 2018.* https://www.constellationr.com/research/era-infinite-computing-triggers-next-generation-applications

[13] *For more details of Oracle Exadata X8M, see: Holger Mueller "Oracle Exadata X8M: The Fastest Oracle Database Platform", Constellation Research, September 25, 2019.* https://www.constellationr.com/research/oracle-exadata-x8m-fastest-oracle-database-platform

[14] *For more on how to manage your enterprise in the COVID-19 pandemic world, see: Holger Mueller, "Changes in Best Practices in a Pandemic Business World," Constellation Research, June 30, 2020.* https://www.constellationr.com/research/changes-best-practices-pandemic-business-world

[15] *For more on Infinite Computing, see Holger Mueller. "The Era of Infinite Computing Triggers Next-Generation Applications," Constellation Research, June 1, 2018.* https://www.constellationr.com/research/era-infinite-computing-triggers-next-generation-applications

[16] *For more on next-gen applications and PaaS offerings, see: Holger Mueller, "Why Next-Gen Apps Start with a Next-Gen Platform as a Service," Constellation Research, April 5, 2018.* https://www.constellationr.com/research/why-next-gen-apps-start-next-gen-platform-service

[8] *For the people-leader perspective on the need for Enterprise Acceleration, see: Holger Mueller, "Why People Leaders Must Embrace Enterprise Acceleration," Constellation Research, July 3, 2018.* https://www.constellationr.com/research/why-people-leaders-must-embrace-enterprise-acceleration

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