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OFFERING OVERVIEW

# Oracle´s Data Platform Gets an EPYC™ Boost

**How Autonomous Database Running on AMD EPYC™ Processor-Powered Exadata Systems in OCI Enables Competitive Advantages and Lower Costs in the Cloud**

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This report provides an overview of how the Oracle Data Platform running with Oracle Autonomous Database enables Enterprise Acceleration,[1] with a special focus on how Oracle's use of AMD EPYC™ processors in Exadata enables better, more-efficient results in an organization's application and database portfolio. It analyzes how Exadata in Oracle Cloud Infrastructure (OCI) helps organizations meet their needs for a next-generation computing platform that allows them to deploy and move workloads across on-premises environments and the public cloud.

Exadata 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). No matter where it's deployed, the Exadata system provides high performance for data-intensive transactional and analytical workloads as well as data warehouses with tens of petabytes of capability. New, more powerful and efficient processors are crucial to keep Oracle's offerings at the forefront of attractiveness for CxOs searching for enterprise data management solutions. The partnership between AMD and Oracle is critical to meet requirements that are evermore complex and demanding as Oracle continues to deliver leading performance and cost savings, making Exadata on OCI simply the best system for Oracle Database to run on.

Because Oracle uses the same technology stack in both its cloud and on-premises implementations, it has the highest degree of Identicality[2] across these offerings to be found among all vendors that are part of Constellation Research's Market Overview on next-generation computing platforms.[3] The others are AWS Outposts[4] on-premises portfolio, Google Anthos,[5] IBM Satellite,[6] and Microsoft Azure Stack.[7] The Identicality that Oracle offers between the cloud solutions discussed here and its Exadata Cloud@Customer hybrid cloud solution makes it easier for customers to run the same workloads in different environments or move workloads between environments when needed.

## BUSINESS THEMES

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

# ABOUT ORACLE EXADATA

## 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. Oracle Exadata is an integral part of this entire stack, supporting Oracle, ISV, and customer applications running on top of Oracle Database, as the foundation for Autonomous Database, and as the database infrastructure behind Oracle's SaaS offerings.

For a long time, Oracle has stressed that the technology in its cloud infrastructure is much the same as the technology it delivers in customer data centers with Exadata Cloud@Customer and Exadata Database Machine. In fact, the functional scope is 100% identical, with the same set of more than 50 unique Exadata capabilities available in Oracle Cloud Infrastructure, EU Sovereign Data Centers, and OCI Dedicated Region and accessible in multicloud environments. Overall, compared with its competitors, Oracle has the largest functional scope available on-premises, including its SaaS, platform-as-a-service (PaaS),[8] and infrastructure-as-a-service (IaaS) capabilities running on Oracle Exadata and OCI.

With the addition of AMD EPYC processors to Exadata systems in OCI, Oracle can deliver further benefits to enterprises, including:

- **Improved performance.** With up to 4,032 CPU cores based on AMD EPYC CPUs in its database servers and unique Smart Scan capabilities that offload SQL queries to intelligent storage servers, Oracle Exadata Cloud Infrastructure is the most powerful database system available in the cloud. Better performance enables faster insights, better user experiences, and superior enterprise performance for all types of workloads.

- **Enabled Enterprise Acceleration.** Enterprises must move faster and become more agile; in short, they must deliver Enterprise Acceleration. This can happen only when vendors bring their offerings to faster and more-efficient platforms to increase performance and agility. This is exactly what Oracle and AMD are doing with the delivery of Oracle Exadata in OCI based on AMD EPYC processors.

- **Lower TCO delivered.** Faster processors enable enterprises to run workloads faster and to do so on smaller platforms. In a consumption-based pricing setup such as the cloud, this means lower consumption costs and a smaller cloud footprint for enterprises, thus delivering a lower total cost of ownership (TCO).

## Market Segment

### Market Definition

Exadata Cloud Infrastructure is the manifestation of Oracle Exadata in OCI and competes in the next-generation computing platforms market as a coengineered 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, the system on which Oracle Autonomous Database—a core service for Oracle Data Platform—runs.

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, Hewlett Packard Enterprise (HPE), and other old-school vendors.

For the purpose of this report, Constellation defines *cloud* as the elastic provisioning of apps, computing, storage, and networking—with consumption-based pricing. 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.[9] Some cloud providers, such as Oracle, have leveraged their IaaS to deliver higher-level services including databases and applications.[10]

CxOs who must manage on-premises workloads also find that value proposition—the elasticity of computing resources with consumption-based pricing—attractive. IaaS vendors, including Oracle, have realized this and added offerings that make parts or all of their IaaS infrastructure and even SaaS applications available on-premises. Effectively, the public cloud enables the era of Infinite Computing.

## Market Trends

The following six market trends characterize the market of next-generation computing platforms (see Figure 1):

### 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 that CIOs must meet range from support for machine learning (ML) 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 ML. 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).

### 2. 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. As a result, 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.
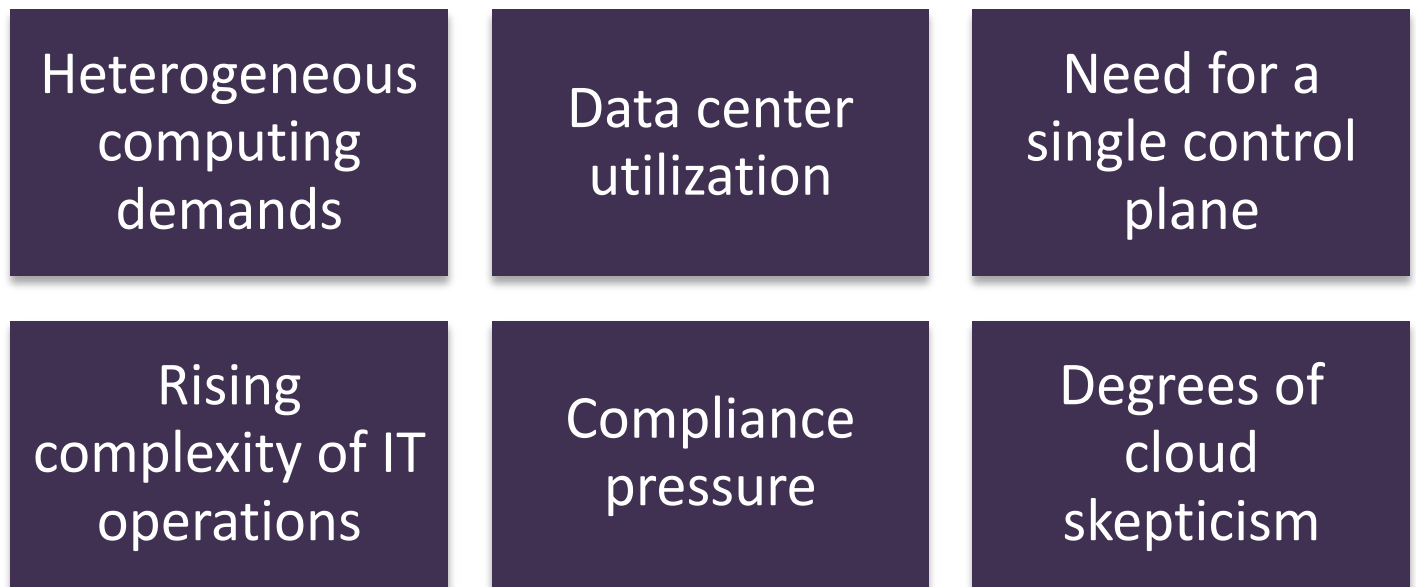
### 3. The Need for a Single Control Plane

The era of CxOs simply accepting that new products bring a new control plane is history. CxOs operating next-generation applications[11] 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.

### 4. 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 multicloud) and on-premises computing

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

| | | |
|---|---|---|
| Heterogeneous computing demands | Data center utilization | Need for a single control plane |
| Rising complexity of IT operations | Compliance pressure | Degrees of cloud skepticism |

**Source:** Constellation Research

resources. Business priorities, timing, and write-down cycles all determine the specific time that 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.

### 5. 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 General Data Protection Regulation (GDPR) requirements 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.

### 6. 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 security). Nonetheless, it means that CIOs need to implement and operate their critical workloads in local data centers for at least the next decade.

## KEY CAPABILITIES

This section describes the most important capabilities of Autonomous Database running on Exadata Cloud Infrastructure in OCI and how this benefits organizations using the Oracle Data Platform.
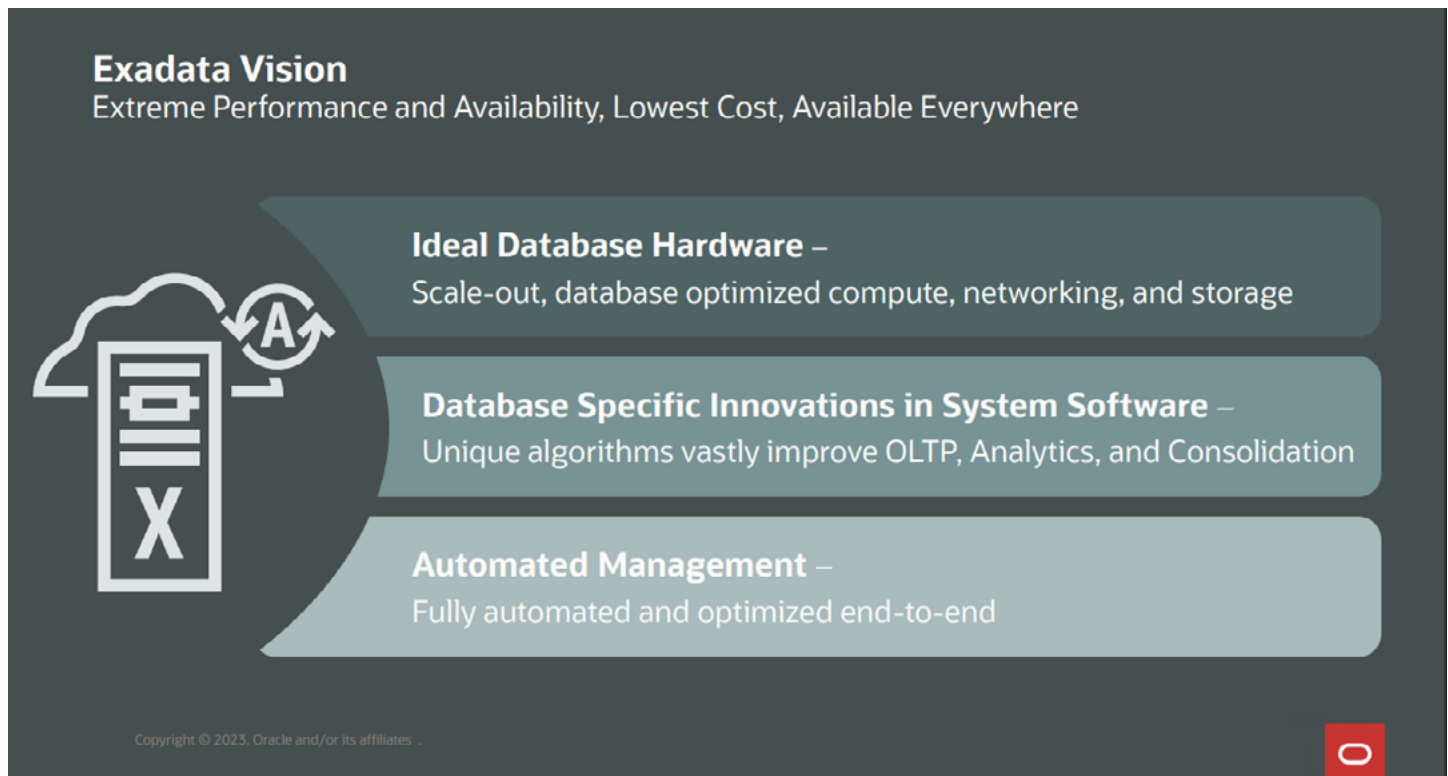
## The Exadata Vision

Oracle started to ship Oracle Exadata in 2008 and has upgraded the platform for Oracle Database over the years, with additional innovations featured in every release. Originally a partnership between Oracle and HPE, Oracle Exadata evolved to combine hardware assets from the subsequent Sun Microsystems acquisition as well as substantial additional R&D. With Exadata, Oracle created a hardware and software combination engineered at the source-code level with Oracle Database, which has received a very strong reception in the market: There are customers now running more than 100 Exadata systems in production environments, and others are running north of 300 Exadata systems.

The Exadata vision is defined by the following three pillars (see Figure 2), designed to achieve extreme performance and availability at the lowest cost, and makes Exadata available on-premises, managed by Oracle on-premises and in the public cloud with OCI, and in partnership with Microsoft Azure:

1. **Ideal database hardware.** As the market leader for relational database management 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 system that optimizes for performance, TCO, return on investment (ROI), and internal rate of return (IRR). Exadata systems have a scale-out architecture with redundant servers, networking, and storage that is optimized to provide high performance and availability for Oracle Database—including Autonomous Database on-premises, in the Oracle Cloud, and in hybrid deployment options.

2. **Database-specific innovations in system software.** In the past, the natures of different database and information management processes required hardware to be optimized in different ways. With Exadata, Oracle has created a common hardware system that can morph its configuration for different database workloads, enabling the optimal configuration for every workload. The "magic sauce" for that lives in the Oracle Exadata system software, which enables optimal configuration and performance for diverse workloads and use cases such as online transaction processing (OLTP), online analytical processing (OLAP), and database consolidation.

**Figure 2. Oracle Exadata Vision**



**Exadata Vision**
Extreme Performance and Availability, Lowest Cost, Available Everywhere

**Ideal Database Hardware –**
Scale-out, database optimized compute, networking, and storage

**Database Specific Innovations in System Software –**
Unique algorithms vastly improve OLTP, Analytics, and Consolidation

**Automated Management –**
Fully automated and optimized end-to-end

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**Source:** Oracle

3.  **Automated 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 automatically and to allow them to self-optimize is a crucial capability for enterprises, regardless of whether deployment of their workloads is in the cloud or on-premises. The addition of Autonomous Database on Exadata cloud infrastructure further extends this automation to the full database stack so organizations can focus on their applications and data instead of managing the database stack.

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.

• 87% of the Fortune Global 100 run Exadata.

- 44% of the Fortune Global 100 have adopted Exadata Cloud.

- Customers achieve as much as a 256% five-year ROI with payback in six months after first operating Oracle Exadata Cloud@Customer.

Beyond global enterprises, Exadata is also the infrastructure for Oracle Autonomous Database – Shared, which makes this powerful combination available to small dynamic organizations around the world.

## Introducing Oracle Data Platform

Oracle has always had its roots in the data of enterprises, beginning with its first offering of Oracle Database in the 1970s. Since then, data has sprawled into many different categories and once-unimaginable volumes. Consequently, enterprises need a new approach for how to handle their data—effectively a next-generation data platform (see Figure 3).

### Figure 3. Oracle Data Platform
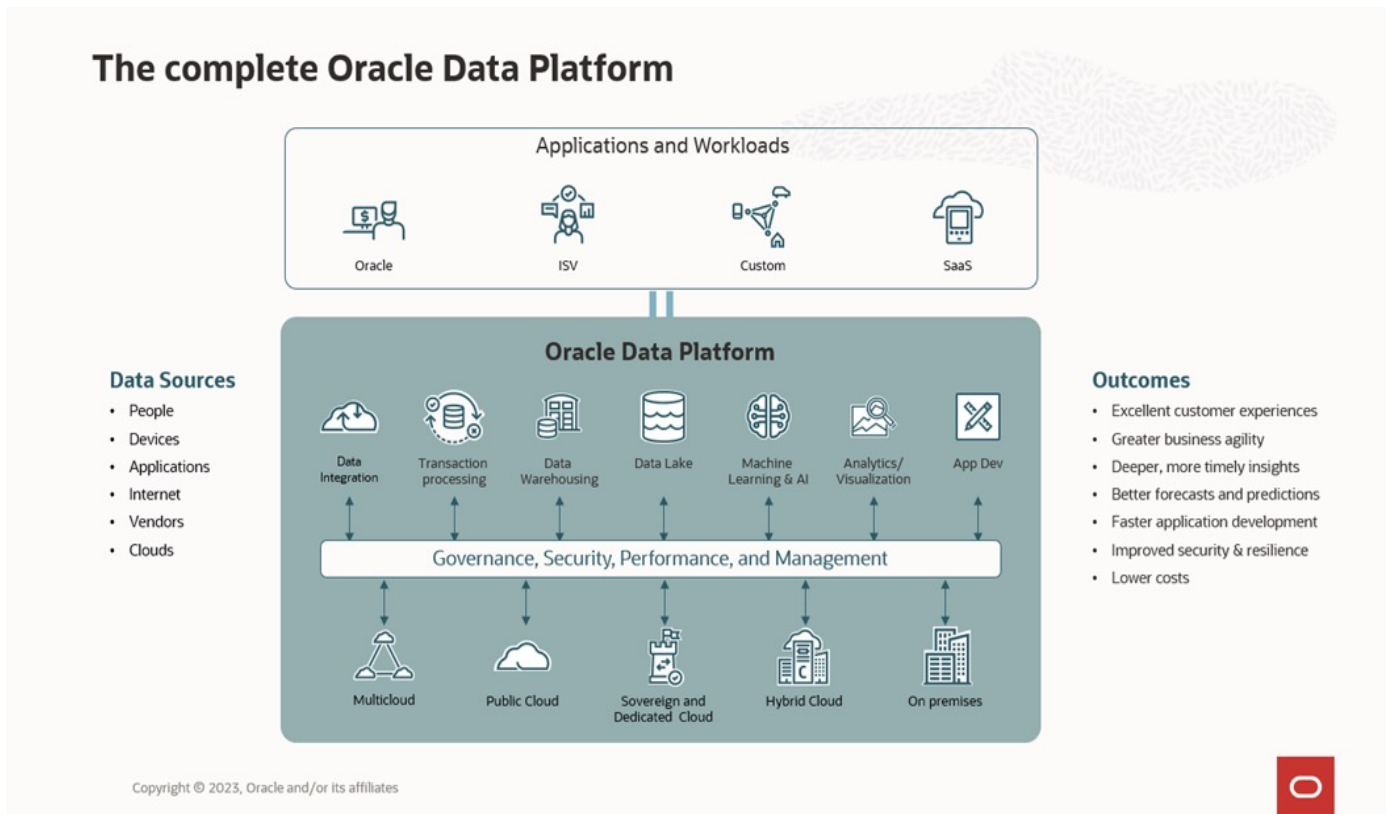


**Source:** Oracle

The Oracle Data Platform is a comprehensive, open, and integrated environment that helps organizations get the most value out of their data with consistent governance, security, and performance via a single pane of glass. It helps them manage data effectively throughout its lifecycle, including securing it against failures, human errors, and cyberattacks. The platform's comprehensiveness and high level of integration minimize the number of separate services and data transformations that an enterprise needs to support its suite of workloads. Its open, modular framework allows organizations to use only those portions of the framework that they need at any particular time and to replace or extend with other third-party or bespoke services developed by the organization.

Oracle Data Platform supports many types of capabilities, including:

- **Data integration.** Data does not live in isolation, and enterprises need to be able to integrate their data with other in-house and external data sources. Oracle Data Platform includes proven Oracle GoldenGate and Data Integrator technologies that allow customers to plug in their other data integration services.

- **Transaction processing.** Transactions remain the gold standard for enterprise record keeping: Everything of meaning in an enterprise activity requires one or more transactions when it is created or modified. Oracle Database and Autonomous Database are the gold standard for transaction processing, standing as the single source of truth for global enterprises.

- **Data warehousing.** Data warehouses are the primary repository for transactional data and metadata derived from other sources. They are heavily used to quickly generate analytical insights. Oracle Database and Autonomous Database offer converged database capabilities that allow organizations to combine different data types into a single data warehouse that can be analyzed together using accelerated Exadata performance.

- **Data lake and data lakehouse.** Bringing together all data of an enterprise, including unstructured and semistructured data for analytical purposes, is the job of the latest incarnation of Hadoop-like platforms: the data lake. The combination of a data lake and data warehouse is referred to as a data

lakehouse. Users of Autonomous Database or MySQL HeatWave can query information from external sources (such as cloud-based object storage) in data lakes and lakehouses as well as internal data stores.

- **ML and artificial intelligence (AI).** Enterprises need to automate with the help of AI/ML, and data is critical for that. Bringing together data and AI/ML capabilities is key for the future of enterprise automation. Autonomous Database incorporates AI/ML capabilities that take advantage of high Exadata performance, including built-in ML notebooks and the ability to run Python and R inside the database.

- **Analytics/visualization.** A picture says more than a thousand words, and visualization allows people to grasp deep data and information structures quickly and efficiently. In a comparable way, analytics deliver insight faster than traditional reporting. Oracle Data Platform includes Oracle Analytics, which is tightly integrated with and benefits from the Autonomous Database's extreme levels of performance.

- **AppDev.** Enterprises become technology companies, and software is holding them together and operating them. The ability to build applications is critical for enabling enterprises to deliver and operate their own code assets, allowing them to automate digital transformation or even execute on digital disruption strategies. Oracle Data Platform includes low-code development environments such as Oracle APEX that enable developers—and even power users—to create and maintain applications with up to 98% less code than traditional techniques.

In addition to security and data governance, which are built into Oracle Data Platform, enterprises need and want to deploy their data platform across multiple deployment forms. Unlike other vendors who profess to have a "complete data platform" but are confined to a public cloud only, Oracle Data Platform supports the following diverse environments:

- **Multicloud.** Multicloud is a reality when it comes to today's enterprise automation, and Oracle Data Platform can support applications and use services running on multiple public clouds. For example,

the Oracle Database Service for Azure makes it easy for applications running on Azure to benefit from Autonomous Database and Exadata systems in Oracle Cloud Infrastructure.

- **Sovereign and dedicated cloud.** Regulation and statutory requirements often force enterprises to operate within sovereign country borders or on-premises. Oracle Data Platform can be deployed on OCI Dedicated Region in either environment along with the entire suite of Oracle IaaS, PaaS, and SaaS offerings.

- **Hybrid cloud.** Being able to run workloads in an enterprise's data center and in the public cloud is key so customers can choose the optimal place to run them to meet performance or regulatory requirements. Autonomous Database is available on Oracle Exadata Cloud@Customer, which has been installed in more than 60 countries around the world.

- **On-premises.** On-premises automation is alive and well for performance, statutory, and cloud-skepticism reasons. Oracle supports running Oracle Data Platform on-premises and combines on-premises resources with the Exadata Cloud@Customer hybrid-cloud platform. Some organizations adopt a "cloud-adjacent" architecture, whereby they cross-connect on-premises Exadata or Exadata Cloud@Customer systems with an application layer running on AWS or Azure. This is usually achieved in a large colocation facility that hosts multiple cloud providers, such as what Equinix provides.

- **Public cloud.** The public cloud is the platform for most business' best-practice innovation, powered by both its commercial and architectural elasticity. For Oracle, the public cloud means OCI, which is available in 41 different regions across the globe at the time of this writing.

With the combination of its capabilities and variable deployment forms, Oracle Data Platform is not only able to work with Oracle's SaaS and PaaS offerings but also is a platform for independent software vendors (ISVs) and for custom application development of next-generation applications.

The breadth and depth of the offering makes the Oracle Data Platform one of the most functionally rich and complete offerings in the market. And enterprises look for suite offerings such as Oracle Data Platform to reduce cost of operation, increase automation, and improve vital and critical insights from

data. And, ultimately, that comes as no surprise as one of the golden rules in enterprise software applies here: Suites always win (in the long run).

## How the AMD EPYC Architecture Propels Oracle Exadata Forward

With the partnership between AMD and Oracle, OCI gets access to one of the most modern processor architectures available, upgrading the specs and with that the performance and capabilities of Oracle Exadata (see Figure 4):

- **Compute-intensive workloads run better and faster.** AMD EPYC processors offer advantageous performance characteristics that allow customers to deploy Oracle Exadata in OCI with as few as 252 available processor cores and as many as 4,032 cores in database servers. That is 2.5 times more cores than Oracle Exadata X8M has, making this the fastest Oracle Database system ever available for any database workload or database consolidation environment.

### Figure 4. Exadata Cloud Infrastructure in OCI, Powered by AMD EPYC Processors



**Exadata Cloud Infrastructure X9M in OCI**
The first Exadata powered by AMD EPYC processors

**Supports any workload:**
- Compute intensive workloads
- Memory intensive workloads
- Latency intensive workloads
- IO intensive workloads
- Storage intensive workloads

**Single Database scales up to:**
- 4,032 CPU cores in database servers
  - Using 64-core AMD EPYC CPUs — 2.5x the cores of Exadata X8M
- 44 TB DRAM
- 96 TB low-latency cache
- 1.6 PB NVMe Flash
- 3.2 PB Database Size

**Exadata Storage**
- Up to 3,072 CPU cores
- PCIe 4.0 for Flash, IO, and Networking

**Runs Autonomous Database and Exadata Database Service**

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**Source:** Oracle

- **Memory-intensive workloads accelerate.** When enterprises need to accelerate a workload, they put it into memory. For Oracle Exadata, each database server comes with its own high-performance memory that's optimized for AMD EPYC processors. With up to 44TB of dynamic random access memory (DRAM) in a fully scaled system, Oracle Exadata has enough room to run any workload or consolidated environment.

- **Latency-intensive workloads excel.** An extremely fast system thanks to AMD EPYC CPUs combined with plenty of in-memory DRAM can quickly challenge network throughput, but with up to 96TB of low-latency cache, Oracle Exadata is well set up to excel in running extreme OLTP and other latency-sensitive workloads.

- **I/O-intensive workloads thrive.** Large database applications can quickly bring I/O challenges, but with up to 1.6PB of NVMe flash memory in intelligent storage servers, Oracle Exadata has enough memory to keep critical data in fast flash memory. And, with almost 3TB/second of throughput for analytics and ML training, organizations can use that data orders of magnitude faster than databases that have to move every byte of data to the database server for processing.

- **Storage-intensive workloads have plenty of space.** With 3.2PB of database space, which amounts to 32PB with Oracle Hybrid Columnar Compression (HCC), even the most storage-intensive workloads will find the ideal platform with Oracle Exadata.

The combination of these specifications and the new AMD EPYC CPUs allows Oracle Exadata to run more smoothly, enabling better customer experiences, deeper insights, faster time to market, and a lower TCO.

## How AMD EPYC Processors Elevate the Oracle Data Platform

Clearly, these are some impressive numbers, but what does it mean for an organization that's trying to deploy a data platform?

The five categories below demonstrate how AMD EPYC processors deliver Autonomous Database's high performance and scalability benefits that power Oracle Data Platform.

- **Enabling IT to operate smoothly and more efficiently.** Mission-critical applications need to run flawlessly, with high performance and availability. AMD EPYC processors help Exadata and Autonomous Database process more-concurrent transactions because hundreds or thousands of processors can work in parallel on separate transactions within the same database. Consumption automatically scales up to meet peak loads and back down to minimize costs.

- **Providing end users with more information and better experiences.** Today's users want individualized, context-sensitive information presented to them so they can make more-informed decisions about purchases, investments, or which movie they should watch. This requires more data to be processed with more-complex methods, including machine learning inference, in less time. The combination of AMD EPYC processors with Exadata's scale-out architecture is uniquely suited to do this.

- **Giving analysts and corporate decision-makers deeper and more-timely insights.** Analytics is in vogue these days, particularly when it involves machine learning or does its work in real time. The impact of AMD EPYC processors on the ML and analytics capabilities of Exadata is profound, with 2.5x more processing cores than the previous-generation Exadata. This enables complex graph, spatial, and business analytics in the database servers and machine learning users to employ traditional Python and R capabilities *inside* Oracle Database and Autonomous Database. With Exadata, the compute and the data reside together—there is no need to drag the data to the compute as in other architectures.

- **Allowing organizations to accelerate time to market.** Developers creating apps on top of Autonomous Database can benefit from its self-service, self-tuning, self-scaling, and self-securing capabilities to simplify their life, but how can more CPU cores help speed up application delivery? While it won't drastically impact how fast an individual developer works, the greater the number and

performance of AMD EPYC CPUs in Exadata allows an organization to efficiently test, deploy, and scale modern, microservice, and event-based apps in less time—leading to faster overall time to market.

- **Enabling organizations to lower costs and reduce their environmental footprint.** The higher number of processing cores in AMD EPYC processors enables organizations to consolidate their databases on fewer database and storage servers. Since those databases can automatically scale up using a pool of shared resources, organizations don't need to overprovision infrastructure to prevent downtime during upgrades. All of these lead to lower consumption costs for databases in the cloud, lower infrastructure requirements, and less cost. Furthermore, the reduction in provisioned database servers and lower consumption rates also result in a lower environmental impact since fewer systems and active cores consume less power. When you combine this together with Oracle's pledge to have OCI use 100% renewable energy by 2025 and the fact that it's already doing this in Europe, the impact is a substantial reduction in environmental footprint when compared with on-premises environments.

Not only is Oracle adopting AMD EPYC processors for Exadata Cloud Infrastructure, but also it is doing so in other areas that will help enterprises with workloads that utilize the Oracle Data Platform including:

- **MySQL HeatWave gets a speed push.** When running in OCI, MySQL HeatWave uses AMD EPYC CPUs exclusively to deliver superior performance for real-time analytics and machine learning at better price performance than other services.

- **More choice for Oracle Cloud VMware Solution customers.** Joint customers of Oracle Exadata and VMware can now move their on-premises installations to OCI and take advantage of the performance and low cost of AMD EPYC processor-based systems for both the database and application portions of their workloads.

- **More OCI compute shape options.** Modern clouds are all about giving customers choices, and that includes different compute platforms and different shapes for these platforms. OCI customers can now deploy workloads on AMD EPYC processor-powered shapes, giving them access to a leading and high-performance computing platform.

Overall, this is a great showcase for how the adoption of a modern compute platform, in this case based on AMD EPYC processor architectures, elevates all offerings in OCI, to the benefit of its customers.

## ANALYSIS AND OBSERVATIONS

For CxOs making decisions regarding their next-generation computing platform, Oracle offers many well-differentiated capabilities. 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.

### Strengths

Oracle Exadata possesses the following strengths compared with other offerings in this market space (see Figure 5):

- **Highest Identicality of cloud and on-premises functionality.** Oracle Exadata as a common platform across on-premises and the public cloud delivers flexibility in times of uncertainty—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 environments. Enterprises are attracted to Oracle Exadata by the Identicality of the solution.

- **Oracle Exadata got (even) better.** With AMD EPYC processors powering Oracle Exadata in OCI, the best cloud system on which to run Oracle Database got even better. That is great news for enterprises, allowing them to push the envelope even further for their mission-critical applications.

- **OCI runs modern compute shapes.** Variety of both processor architecture and compute shapes defines the modern cloud by making it attractive for enterprises to run their workloads in the most

efficient manner. With AMD EPYC processors, OCI offers additional compute shapes that are useful for enterprises.

- **AMD EPYC processors elevate Oracle offerings.** Thanks to the innovation delivered by AMD in its EPYC processor line, Oracle has been able to elevate multiple Oracle offerings—not only Oracle Exadata but also MySQL HeatWave and Oracle Cloud VMware Solution—as well as add more OCI compute shapes for customers to use.

- **A comprehensive Data Platform.** Oracle has long been in the broader data business, but its strengths were often hidden due to its database origins. Oracle Data Platform clearly articulates how organizations can better integrate, manage, and benefit from existing and new enterprise data sources—benefiting from advances in both Oracle Autonomous Database and Exadata.

## Weaknesses

Oracle possesses the following weaknesses compared with other cloud database providers in this market space:

- **Needs to improve its perception as a services company.** For the longest time, Oracle has been a perpetual-license market leader in the database field. With enterprises moving to a cloud-based subscription economy, they expect technology providers to become service providers that manage and operate these subscriptions. Although Oracle has delivered on the service value proposition, its perception in the market still lags in this category compared with some of its competitors. This perception could change as organizations begin to take note of Oracle Data Platform and other new OCI capabilities.

- **Understanding of OCI capabilities needs to catch up with reality.** Oracle has a history of changing the architecture and value proposition of its public cloud offerings. With OCI Gen 2, Oracle has gotten the offering in the right place, and customers are taking note of the progress but still have not fully realized and bought into the OCI value proposition. Although the perception has improved compared

with what it was just a year ago, Oracle needs to increase awareness and education with an OCI evangelist push. Clearly, recent wins at Uber, Nvidia, and leading AI startups such as Character.AI indicate that a shift in perceptions—and increased adoption—of OCI is underway.

- **Some CxOs continue to have an unfavorable perception of Oracle.** At best, some CxOs see Oracle as a challenging vendor. Too many stories of unfavorable and harsh business tactics are out there—some true, and 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 continuing transition to a services company including consistent global pricing based on a universal credits model has received recognition in the industry. In addition, Oracle's open approach to working with other cloud service providers on multicloud initiatives such as Microsoft Azure may have softened the original perception.

## Figure 5. Oracle Exadata Cloud Infrastructure Strengths and Weaknesses

| STRENGTHS | WEAKNESSES |
|---|---|
| • Highest Identicality across deployment options | • Oracle needs to improve its perception as a services company |
| • Exadata got (even) better | • Understanding of OCI needs to catch up with reality |
| • OCI runs modern compute shapes | • Some CxOs continue to have an unfavorable perception of Oracle |
| • AMD EPYC processors elevate Oracle offerings | |
| • A comprehensive Data Platform | |
| • Oracle Data Platform makes Oracle's capabilities easier to understand | |

**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, such as Oracle Exadata, 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 points to the necessity of Enterprise Acceleration.

- **Select vendors that have the greatest 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 seamlessly move workloads. This argument is intuitively clear to CxOs leading the transformation, and the 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. Oracle excels at Identicality between Oracle Exadata Cloud Infrastructure in the OCI public cloud, Oracle Exadata Cloud@Customer and OCI Dedicated Region hybrid cloud offerings, and Exadata Database Machine on-premises deployment options.

- **Pick their 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. Oracle Exadata delivers the highest Oracle Database performance at the lowest price compared with alternative on-premises and cloud database providers and only got better with its availability on AMD EPYC processors.

- **Evaluate Oracle Exadata as an existing Oracle Database customer.** Because most Oracle customers run Oracle Database in one way or another, it is important that they familiarize themselves with the newest members of the Oracle Exadata product family including the benefits of running Oracle Autonomous Database on Exadata in OCI. Being able to lower TCO; automate most database administration; automatically scale consumption to fit the actual database queries being executed; consolidate databases; run petabyte-scale data warehouses; and transfer loads between Oracle Cloud Infrastructure and on-premises is a substantial benefit driver 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. No matter where it gets used, the benefits of Identicality in 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 roadmaps become too large compared with Oracle's, and the potential cost savings with Oracle Exadata become substantial enough, it is time to pay attention—and consider a potential migration.

- **Take a stance on commercial prudence.** Regardless of vendor, enterprises need to make sure that they obtain the value they seek. For Oracle Exadata, CxOs must pay attention to ensure that cloud services or software licenses used on-premises or in 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@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, 2020.* 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," Constellation Research, 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," Constellation Research, April 5, 2018.* https://www.constellationr.com/research/why-next-gen-apps-start-next-gen-platform-service

*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

# RELATED RESEARCH CONTINUED

*Also see: 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] *The term* Enterprise Acceleration *was defined by the author in this Constellation Big Idea report, "Why the C-Suite Must Embrace Enterprise Acceleration," Constellation Research, May 2, 2019.* https://www.constellationr.com/research/why-c-suite-must-embrace-enterprise-acceleration

[2] *The term* Identicality *was defined by the author in the Market Overview referenced in Footnote 3, and refers to the identical technology stack being available between the public cloud and the on-premises offering of a vendor's next-gen computing offering.*

[3] *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

[4] *For more on Amazon Web Services Outposts, see: Holger Mueller, "AWS Outposts Powers Next-Gen Computing—With a Differentiating Twist," Constellation Research, February 19, 2021.* https://www.constellationr.com/research/aws-outposts-powers-next-gen-computing-differentiating-twist

[5] *For the Offering Overview of Google Anthos, see: Holger Mueller, "Google Changes the Cloud Market for the Better With Anthos," Constellation Research, December 10, 2020.* https://www.constellationr.com/research/google-changes-cloud-market-better-anthos

[6] *For the Offering Overview of IBM Satellite, see: Holger Mueller, "IBM Cloud Satellite Gives CxOs More Choices for Running Next-Gen Apps," Constellation Research, April 19, 2021.* https://www.constellationr.com/research/ibm-cloud-satellite-gives-cxos-more-choices-running-next-gen-apps

[7] *For more on Microsoft Azure Arc and Azure Stack offerings, see: Holger Mueller, "Microsoft Enables the Multicloud Next-Gen Computing Platform With Azure Arc," Constellation Research, April 15, 2021.* https://www.constellationr.com/research/microsoft-enables-multicloud-next-gen-computing-platform-azure-arc

[8] *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

[9] *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

[10] *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

# ENDNOTES CONTINUED

[11] *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

# Holger Mueller

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Holger Mueller is a vice president and principal analyst at Constellation Research. He provides guidance for the fundamental enablers of the cloud, IaaS, and PaaS, with forays up the tech stack into big data, analytics, and SaaS. Mueller provides strategy and counsel to key clients, including chief information officers, chief technology officers, chief product officers, investment analysts, venture capitalists, sell-side firms, and technology buyers.

Prior to joining Constellation Research, Mueller was VP of products for NorthgateArinso, a KKR company. He led the transformation of products to the cloud and laid the foundation for new business-process-as-a-service (BPaaS) capabilities. Previously he was the chief application architect with SAP and was also VP of products for FICO. Before that he worked for Oracle in various management functions—on both the application development (CRM, Fusion) and business development sides. Mueller started his career with Kiefer & Veittinger, which he helped grow from a startup to Europe's largest CRM vendor from 1995 onward. Mueller has a Diplom-Kaufmann degree from the University of Mannheim, with a focus on information science, marketing, international management, and chemical technology. A native European, Mueller speaks six languages.

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· Organizers of the Constellation Connected Enterprise—an innovation summit and best practices knowledge-sharing retreat for business leaders.
· Founders of Constellation Executive Network, a membership organization for digital leaders seeking to learn from market leaders and fast followers.

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