ACHIEVING THE MULTI-CLOUD PROMISE WITH ORACLE

ORACLE DATABASE@AZURE POWERED BY AMD DRIVES THE MODERN BUSINESS

SITUATION ANALYSIS

The promise of the multi-cloud data estate starkly contrasts with the real world. While solutions vendors paint promises of workloads and applications running in concert, with real-time responsiveness, lockdown security, and lower costs, the reality is different for most enterprise organizations. The cost, complexity, latency, and vulnerability of applications and data that move from cloud to cloud are constant sources of angst for enterprise IT organizations.

This research brief will explore the challenges and roadblocks organizations face in deriving maximum value from their data estates.

Further, it will detail how Oracle may stand alone as an enabler of multi-cloud for the enterprise by implementing Oracle Database@Azure and how Oracle Exadata, powered by AMD EPYC processors, plays a critical role in the performance, cost savings, and security of the Oracle Database@Azure environment.

THE APPLICATION – DATA CHALLENGE

To say we live in a data-driven world is ironically both cliché and misleading. We live in an intelligence-driven world, with data simply the raw material that feeds analytics engines and training models. This results in market insights, answers to customers' questions, real-time monitoring of operations, and more. But it all starts with the vast amount of data generated, collected, and stored across the enterprise.

Time and accuracy – how fast an application generates insights and how accurate the insight is – are two keys to success in this intelligence-driven world. Time to value may be a term that we grow tired of hearing, but it is a real measurement for IT organizations for good reason.

Given the distributed nature of today's data estate, where tools and data reside and run everywhere, achieving satisfactory performance with these applications can seem impossible.

This challenge rings especially true for organizations that have leveraged the cloud in its decades of maturation. Consider the following numbers regarding enterprise adoption of multi-cloud strategy in research commissioned by Oracle:

- Virtually all enterprise organizations (98%) employ a multi-cloud strategy.
- 94% consume multiple cloud-based applications (SaaS[1]).
- The top three drivers for multi-cloud adoption are resiliency, data management, and business agility and innovation.

Despite this bullish approach to deploying and consuming multi-cloud services, the same IT and business executives expressed serious concerns. While a multi-cloud strategy can achieve resilience, questions remain about data management and agility. Interconnectivity, data portability, and cross-cloud application performance were cited as major roadblocks to fully embracing multiple clouds.

Oracle's findings align with what Moor Insights & Strategy (MI&S) has heard from customers and reviewed in other studies. Anecdotally, the story of a current multi-cloud implementation that occurred organically is quite common. This has resulted in applications residing in multiple clouds, and the need to connect across clouds to run these applications presents performance and security challenges.

FIGURE 1: MANAGING APPLICATIONS AND DATA IN THE MULTI-CLOUD ENVIRONMENT
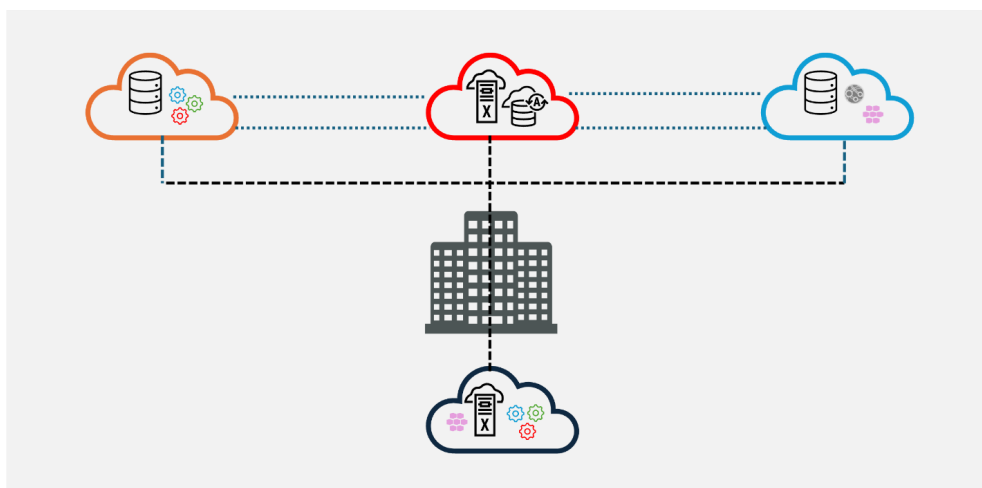
The multi-cloud environment presents performance, management and security challenges
Source: Moor Insights & Strategy

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[1] https://www.oracle.com/cloud/multi-cloud/mainstream/

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To emphasize this point further, PwC's 2023 cloud survey reveals that while 78% of organizations have adopted cloud in most or all their business, only half have realized their desired outcomes[2]. The study distinguishes between those that have employed the cloud and those that have fully embraced the cloud (cloud-powered). The study finds only 10% of respondents were cloud-powered, although those 10% realized significant value. When looking at agility, time to market, and profitability, organizations that figured out how to leverage the cloud significantly outperformed those that didn't:

- 94% of cloud-powered organizations saw increased business agility versus 39% of those that didn't fully embrace the cloud.
- 92% realized faster time to market (versus 38%).
- 92% saw increased profitability (versus 42%).

The main readout is that the opportunity for success in multi-cloud is significant. However, the barriers to successfully adopting such an architecture are high. MI&S' experience aligns with forecasts that show mission-critical application migration to the cloud is lagging considerably.

Through many conversations MI&S analysts have had with enterprise IT leaders, two common themes have emerged as barriers:

1. A current multi-cloud estate that grew organically, lacking governance or direction, is all too common.
2. The cloud service provider (CSP) market is competitive, with many players looking for ways to lock in customers rather than enabling an open multi-cloud environment to overcome the above challenge.

However, MI&S has identified one major CSP delivering multi-cloud value to the enterprise – Oracle Cloud Infrastructure (OCI). As Oracle approached the cloud market relatively late, it has had the advantage of looking at the cloud landscape and architecting an environment that better enables how organizations use its services and the cloud in general. Based on this, the company has created differentiation through technology and partnerships, including industry-firsts in terms of interconnectivity and actual, native multi-cloud capabilities.

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[2] https://www.pwc.com/us/en/tech-effect/cloud/cloud-business-survey.html

ORACLE HAS BEEN LEADING THE MULTI-CLOUD CHARGE

While many CSPs have been discussing enabling the multi-cloud experience, OCI has been investing in frictionless user experiences and seamless cloud-to-cloud connectivity and interoperability. Based on what MI&S has seen, Oracle clearly understands OCI is one of many clouds its customers use and is finding ways to enable full productivity instead of lock-in.

Plenty of evidence supports OCI's claim of enabling the connected cloud. One of the most significant examples is the technology partnership Oracle has with Microsoft to implement a secure, high-speed interconnect between the two clouds. Customers can connect applications running in Azure with, say, Autonomous Database or MySQL HeatWave residing in OCI over a private, low-latency, high-speed connection through the Oracle Interconnect for Microsoft Azure.

Consider the case where a customer would like to use business intelligence services in Azure on data residing in OCI-hosted Oracle databases. Through this low-latency interconnect, analysis is as simple as pointing to the data source for highly performant analytics without exorbitant data egress fees.

While the Oracle Interconnect for Microsoft Azure addresses the seamless connectivity challenge of multi-cloud, there is still the need for frictionless consumption of services. And, of course, Oracle has also been active in this space as well. A good demonstration of this work can be seen in the MySQL HeatWave service. This managed database service that combines transaction, analytics, machine learning, and database capabilities that complement generative AI services into a single cloud database offering has been wildly popular. While this OCI service has been widely utilized, the Oracle team received feedback from MySQL customers that they could benefit from HeatWave but had other portions of their workloads that needed to run in other clouds.

Of course, Azure application users can access MySQL via the Oracle Interconnect for Microsoft Azure. But for other customers using services on AWS, Oracle developed an AWS-native version of MySQL HeatWave. As a result, the full capabilities and features enjoyed by MySQL HeatWave users in OCI can now be used in other clouds.

Given the services Oracle has developed for multi-cloud connectivity and interoperability, it would be safe to say the company has embraced the open cloud. The company has taken even a step further with its latest creation, Oracle Database@Azure—the industry's first native, multi-cloud service.

ORACLE DATABASE@AZURE DELIVERS THE INDUSTRY'S FIRST NATIVE AND INTEGRATED MULTI-CLOUD

Oracle Database@Azure is the true definition of multi-cloud. It is the literal deployment of OCI services and infrastructure in Azure datacenters, with Oracle Exadata infrastructure running OCI's Exadata Database Service and Autonomous Database. Connected directly to Azure's internal network and accessed like other native services through the Azure Resource Manager, applications can access databases running on Oracle Database@Azure with the same low, microsecond latency as other Azure services. This low latency lets "chatty" applications run in a multi-cloud environment – something that wouldn't be possible without this innovation.

From an operations perspective, the native integration of Oracle Database@Azure delivers a seamless experience. This service can be provisioned directly from the Azure console and consumed with Azure credits. Meanwhile, Oracle continues to manage the infrastructure and Oracle Database services via the Interconnect for Azure.

FIGURE 2: ORACLE DELIVERS ON CUSTOMER NEEDS
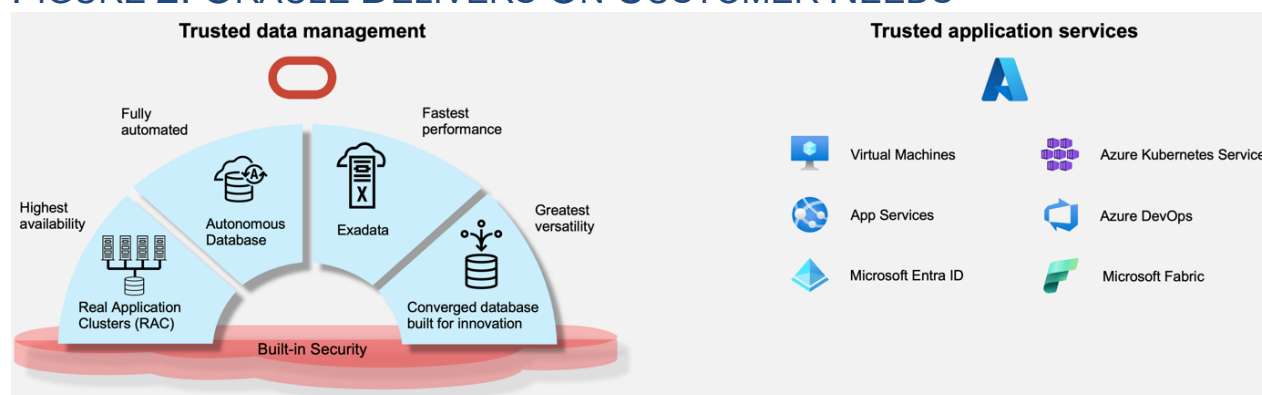
Oracle Database@Azure combines the power of Oracle and Azure to meet customer needs
Source: Oracle

For those that question why Oracle would go to such an extent to deliver this native multi-cloud experience, the answer is rather obvious. Connecting data with the applications and tools that use this data is critical to enterprise organizations. However, the inability to effectively connect these across clouds has, until now, led to a hesitancy to migrate workloads – particularly mission-critical ones – to multi-cloud environments.

While many organizations across industries have taken a cloud-first approach in IT operations, only 31% of enterprise workloads have moved off-premises. Based on MI&S' observations, this hesitancy is because of cost, performance, security, and

complexity – all challenges that must be accounted for when data resides in a separate cloud from the applications and services that use it.

Understanding what Oracle and Microsoft have achieved on the four themes of cost, performance, security, and complexity is key to appreciating the impact of this partnership.

- **Cost**: When relying on multiple clouds to connect applications and data, there are multiple cost elements to consider. These include data egress fees, operational and performance inefficiencies, and costs associated with monitoring and managing the cross-cloud environment.

  With Oracle Database@Azure, these additive costs are removed. The service is consumed and managed directly from the Azure console, using Azure credits. The indirect costs associated with managing multiple services across multiple clouds are removed.

- **Performance**: Oracle Exadata delivers extremely high performance for all types of database workloads, from OLTP to analytics – including JSON documents, spatial data, graph data, and more. This is why leaders across various industries run their mission-critical workloads on Oracle Exadata platforms in on-premises data centers and OCI. Many of these organizations are also employing Microsoft applications and services, including Power BI and custom applications that can benefit from accessing Oracle Database data with Exadata performance.

  By deploying their mission- and business-critical applications on Oracle Database@Azure, customers can realize low latency access that will rival or, in some cases, exceed on-premises performance. The result is microsecond access latency from Azure applications to Oracle databases delivered by hardware and software that is purpose-built to deliver Oracle Database performance - all running in the Azure datacenter and with direct access from Azure services.

- **Security**: Security and privacy are critical for every data-driven organization. One of the reasons for the lagging adoption of multi-cloud architectures for enterprise workloads is tied directly to concerns around data being used across multiple clouds and the potential for its exploitation.

  Migrating to Oracle Database@Azure affords customers a strong security posture, as applications, services, and data all reside in the same secure cloud

and on the same secure infrastructure. In addition, the security capabilities built into services running on Exadata in OCI are present here as well, with always-on encryption and the proven portfolio of Oracle Database security capabilities available to further strengthen their security posture.

- **Complexity**: The ideal cloud consumption model is frictionless. Unfortunately, most multi-cloud deployments introduce a complex organizational structure, as dedicated resources are required to support operations, from cost to consumption to management and optimization of all these elements. While observability tools and platforms are designed to simplify this operation, MI&S has yet to speak with an IT or business executive who does not cite the complexity of multi-cloud management as an organizational challenge, as each cloud has its own console, procedures, policies, etc.

By embedding the Oracle Cloud in Azure through Oracle Database@Azure, multi-cloud resources are available through a single console and a single payment structure from a single team. And this is the genius and elegance of the Oracle-Microsoft partnership. Customers can employ the Oracle Exadata based database services as an Azure service from deployment to utilization to service.

FIGURE 3: ORACLE AND AZURE DELIVER MICROSECOND LATENCY
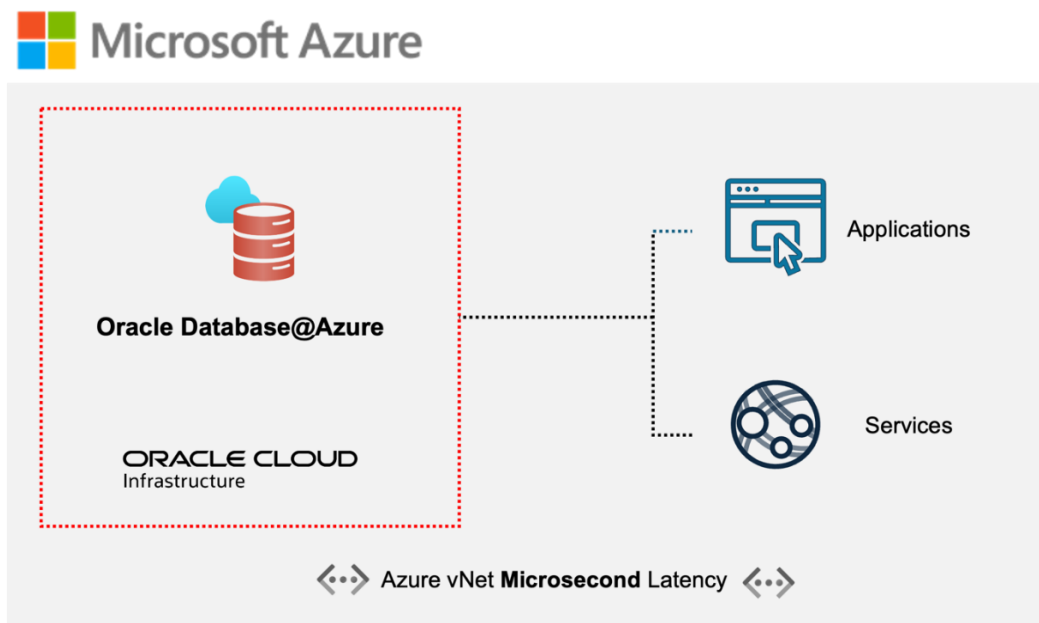
Oracle Database@Azure delivers microsecond latency for mission critical applications
Source: Oracle

The level of interoperability – and how it impacts the everyday life of IT – is perhaps most impressive when considering this Oracle-Azure partnership. While any CSP could theoretically install its infrastructure in another cloud provider's datacenter, this is the first time that two cloud providers have taken the customer's interests first and made it happen. It is much more than an exercise in racking and network connectivity; it is about two CSPs modifying their business models and processes to help their joint customers.

To fully integrate one cloud's fabric from a consumption, serviceability, and operational perspective into another requires a commitment to openness that is guided by a customer-first strategy. And this is what makes Oracle's work with Microsoft stand alone in the cloud space.

Whether an organization is looking to migrate its enterprise applications to the cloud, modernize with CI/CD processes gradually and build new applications, or take some hybrid approach, MI&S sees Oracle Database@Azure as the natural landing spot for a performant, frictionless experience.

HIGH AVAILABILITY IS NON-NEGOTIABLE

The challenges associated with multi-cloud get even trickier when considering the high availability that customers need for their mission- and business-critical applications. Setting up a solution stack that spans multiple cloud data centers requires tight integration and continual vigilance.

Exadata platforms and OCI Oracle Database services inside Azure data centers offer customers the same fault tolerance built into Exadata with technologies such as Oracle Real Application Clusters and the disaster recovery capabilities available with Oracle Data Guard. With Oracle Database@Azure, customers can easily benefit from these proven HA/DR capabilities.

ORACLE EXADATA ON AMD EPYC – DESIGN MEETS PERFORMANCE

When considering the significance of Oracle Database@Azure, it is essential to understand that performance and availability are built into the most minute details of the Exadata design. Exadata is a fully integrated system, which Oracle refers to as an engineered system, focusing on delivering Oracle Database performance, scalability, and availability.

Oracle Exadata is not a traditional server with some firmware settings aligned with tuned database software. It's not even a server that's been designed with local flash storage for low latency. It's much more than that.

Exadata is purpose-built for Oracle Database with optimized database software, intelligent system software, and automated management. In fact, Oracle points out that Exadata is co-engineered with the database to signify that the hardware and software are optimized together to deliver customers the ultimate Oracle Database platform.

Exadata enables customers to independently scale compute and storage resources to match their workloads instead of what Oracle pre-ordained as correct. Put more plainly, the company understands that simple "T-shirt sized" configurations do not allow for the systems to scale, based on a customer's need. For example, organizations can add more database servers for OLTP-style workloads, more storage servers for data-intensive workloads, or more of both for database consolidation.

Furthermore, Exadata storage servers are smart, offloading the execution of SQL queries from database servers and minimizing internal communications so those servers can process more transactions and support more users.

Oracle has engineered every aspect of Exadata to deliver maximum performance. This includes everything from automated multi-tier data caching to database I/O that bypasses typical networking to operating system overhead that helps provide the lowest possible data access latency and highest throughput.

It is important to understand that this level of performance is key to the value Exadata provides to customers. When customers deploy on Exadata, database I/O latency drops from upwards of 2 milliseconds to 19 microseconds. While this reduction may seem both impressive and meaningless at the same time, there is real-world value. Lower latency means individual transactions happen faster – considerably faster – which means greater customer satisfaction. And faster transactions means that more of them can be run on a given set of hardware, reducing the need for additional systems and costs.

The design of Oracle's Exadata system makes its deployment in Azure unique and powerful; customers can fully embrace the microsecond access latency and microsecond database I/O latency that can't be replicated on traditional cloud server and storage hardware.
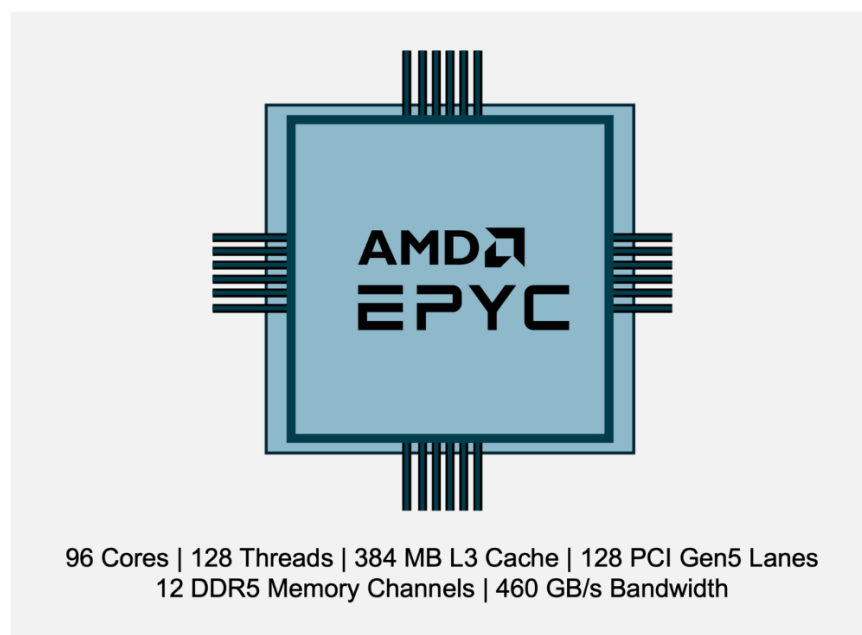
Achieving The Multi-cloud Promise With Oracle

From a cost perspective, customers will benefit as workloads and workload requirements vary over time. If fewer workloads require fewer cores to run Oracle Database right now, customers don't have to pay database license fees for the cores not being utilized. With Oracle Database@Azure, workloads consume just the number of cores needed with either software-included licensing or the ability for customers to bring their own licenses (BYOL) to Azure from on-premises deployments.

IT ALL BEGINS WITH AMD EPYC PROCESSORS

Database performance – Exadata performance – begins in silicon, and AMD EPYC processors are the choice for Oracle. The ideal CPU for database performance will be rich in features: high-performing cores, a big cache, a lot of memory that can be accessed quickly, and a lot of fast I/O lanes to move data in and out of storage.

The Exadata systems used in Oracle Database@Azure start with 252 cores and 3 TB of memory for database processing, allowing them to process thousands of concurrent transactions for OLTP workloads with extremely low latency. Organizations can scale their available Exadata compute resources by provisioning additional servers, enabling them to have more than 4,000 processor AMD EPYC cores working together to address their enterprise-wide Oracle Database needs.

FIGURE 4: AMD EPYC INDUSTRY LEADING SPECIFICATIONS

96 Cores | 128 Threads | 384 MB L3 Cache | 128 PCI Gen5 Lanes
12 DDR5 Memory Channels | 460 GB/s Bandwidth

EPYC's architecture is designed for database performance
Source: Moor Insights & Strategy

More importantly, the real-world performance of AMD EPYC processors makes them an ideal foundational element to Oracle's Exadata platform. The large number of high-performing cores accompanied by a very large per-socket memory footprint and cache mean more transactions can be processed faster on fewer cores, resulting in fewer database servers and a lower cost than on other systems. And because analytical queries can be offloaded to smart storage servers, these workloads can complete in a fraction of the time it takes the same analysis to execute on traditional x86 servers with traditional storage.

It is clear that Oracle has refused to compromise on delivering the ultimate customer experience, and its selection of AMD EPYC processors as the cornerstone of Exadata is evidence of this. The Exadata team has engineered a database machine to fully exploit and extend these features into real-world benefits, resulting in more transactions, more complex analysis, fewer servers, and lower costs.

SUMMARY

Our IT environments live in a multi-cloud world. While this may seem like an obvious (and overplayed) statement, it has never been truer. However, most enterprises lag in deploying their most critical workloads to the cloud (and even more so to multiple clouds) due to the many challenges this multi-cloud environment presents.

With cost, performance, security, and complexity being chief concerns of virtually every IT and business professional with whom MI&S speaks, the thought of migrating and/or modernizing mission- and business-critical workloads presents serious risks and concerns.

While many CSPs speak of delivering multi-cloud services, barriers that effectively create lock-in have yet to be lowered. In fact, in the distributed data estate, implementing a multi-cloud environment is as challenging as ever. While few CSPs are working to enable a seamless and frictionless multi-cloud operating model, fewer still have made this a design point.

Oracle has demonstrated its intent to deliver the best possible multi-cloud experience through partnerships and technology. Since the inception of OCI, the company has utilized this design philosophy to better connect its legacy data management with the cloud services already in use by enterprise organizations – resulting in true differentiation.

Given Oracle's legacy and footprint in virtually every enterprise data estate, delivering the multi-cloud experience with Oracle Database@Azure was a natural next step in the integrated native multi-cloud journey.

Oracle Database@Azure is undoubtedly a game-changer. The seamless and frictionless consumption of multiple cloud services that eliminate much of the technical, operational, and business complexity is precisely what enterprises both want and require to take their next step in their cloud journey.

MI&S believes Oracle is setting the tone for the CSP market, and we expect to see a trend emerging where cross-cloud and intercloud partnerships drive toward a unified customer experience. Further, we expect Oracle to continue driving such differentiation across the market.

For more information on Oracle Database@Azure, please visit oracle.com/azure.

IMPORTANT INFORMATION ABOUT THIS PAPER

CONTRIBUTOR
Matt Kimball, Vice President and Principal Analyst, Servers

PUBLISHER
Patrick Moorhead, CEO, Founder and Chief Analyst at Moor Insights & Strategy

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