Enterprise Strategy Group™ by TechTarget

TECHNICAL VALIDATION

Oracle Database@Azure

Delivering Oracle's Exadata Database Services With a Microsoft Azure-native Experience

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Introduction

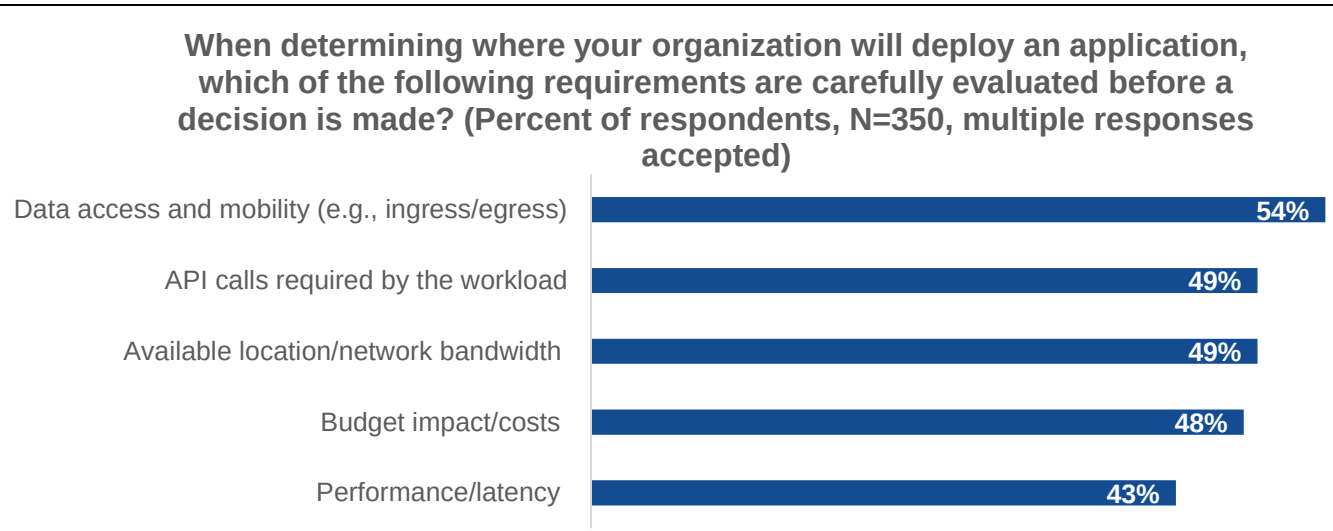
This Technical Validation from TechTarget's Enterprise Strategy Group documents our evaluation of Oracle Database@Azure. We specifically review how Oracle Database@Azure greatly simplifies how organizations can use the Oracle Exadata Database Service with Microsoft Azure services without creating multi-cloud architectural and management complexity or sacrificing database performance.

Background

Distributed applications—specifically those that span multiple public clouds—are continuing to emerge as organizations recognize the value they add. In fact, Enterprise Strategy Group research found that a majority of respondents to a recent survey view distributed applications across multiple public clouds as beneficial to their business. Specifically, 32% view distributed application architectures as offering strategic benefits, while another 31% view distributed applications as beneficial in several use cases.[1]

To ensure that the most value is obtained, organizations must evaluate multiple requirements when deploying these applications across public clouds. Figure 1 shows the top five requirements most commonly cited by respondents when determining where their organization will deploy an application, with data access and mobility (54%) and performance/latency (43%) ranking amongst the top five.

Figure 1. Requirements Evaluated When Deploying Distributed Applications Across Multiple Clouds



Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Numerous large organizations rely on Oracle Database to support their business- and mission-critical applications running in on-premises or hosted data centers. As these applications are migrated to the public cloud, customers have opted to continue to use Oracle Database instead of database services native to the public cloud provider. For those organizations looking to run applications on Microsoft Azure, they can either migrate the database onto Oracle Cloud Infrastructure (OCI) or run them on Azure IaaS compute and storage instances.

Running a distributed application across data centers can present several challenges:

[1] Source: Enterprise Strategy Group Research Report, *Multi-cloud Application Deployment and Decision Making*, June 2023. All Enterprise Strategy Group research references and charts in this Technical Validation have been taken from this research report.

- Architecting the inter-cloud connections so that applications running on Microsoft Azure can access Oracle Database in OCI can be complex and hard to manage, affecting how data is retrieved. In fact, research uncovered that 37% of organizations manage dozens of inter-cloud integrations, while another 51% estimate that they manage at least 100 of these integrations. While Oracle and Microsoft have worked together to simplify this process, work remains for customer IT teams to ensure that the integrations work as intended.
- More importantly, database performance (in terms of query response time) can be negatively affected in a distributed, multi-cloud environment since both queries and results must be sent between two data centers. Even if these data centers are close together, the route of the network between them may be long.
- Organizations are stuck with two different subscription plans with two different user interfaces to use. Coordinating the ongoing management of multi-cloud applications becomes more complex and incurs unwanted time and costs that organizations cannot afford.

Organizations can also run an Oracle Database in Azure's IaaS by purchasing and downloading the software from the Azure Marketplace. However, operating Oracle software on Azure infrastructure may not deliver the performance, scaling, and availability benefits that organizations experience when using Oracle-native technologies, specifically Oracle Real Application Clusters (RAC) and Oracle Exadata platforms in their own data centers. (Running Oracle Database on Azure IaaS may work for some applications, but some customers prefer to use a managed cloud service with built-in high availability for crucial applications.)

Oracle Database@Azure

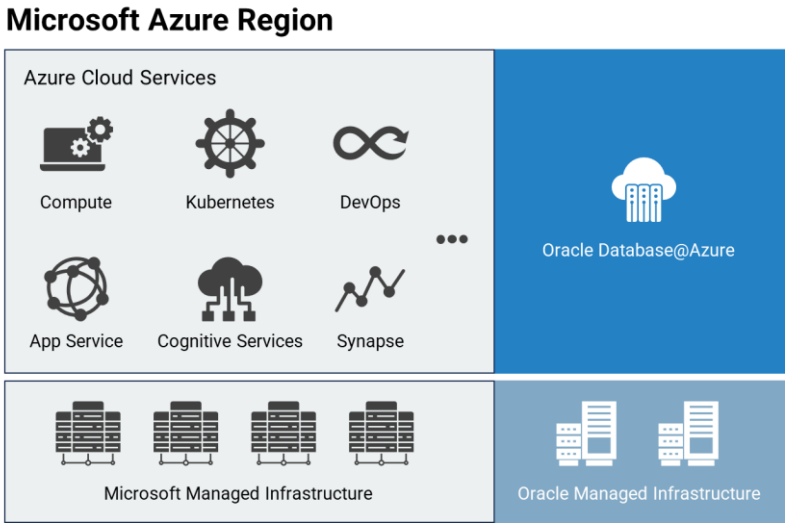
Oracle Database@Azure is a **joint offering** of Oracle and Microsoft that enables organizations to provision Oracle Exadata Database Service, running on Oracle Cloud Infrastructure located in Azure data centers. Provisioning is done through the Microsoft Azure control plane, while consumption is paid for through a Microsoft Azure commercial relationship (see Figure 2).

This offering is substantially different from simply purchasing a software license from the Microsoft Azure Marketplace to run a third party's database and installing the software on Microsoft Azure infrastructure. The partnership between Oracle and Microsoft makes Oracle databases running on Oracle Exadata Database Service available in Microsoft Azure data centers. Oracle manages and maintains the database cloud services and Exadata infrastructure that make up Oracle Database@Azure in the same way it does with OCI data centers.

To achieve high performance, the Oracle Exadata Infrastructure that runs the Oracle Autonomous Database and Oracle Exadata Database Service in OCI is placed in an Azure data center and close to Azure resources. The close proximity of Oracle Exadata platform to Azure compute resources is key to providing high database performance and the lowest possible access latency. Latency is measured in microseconds and is the same as between any two native Azure services.

With Oracle Database@Azure, direct network connectivity exists between the Oracle Database services in the Azure data center and the Azure network. To ensure data security, all data stored in Oracle Database@Azure is encrypted at rest and in transit. This offering is currently operational in the East US, Germany West Central, and UK South Azure regions, with more to come.

Figure 2. Oracle Database@Azure Overview



Source: Oracle and Enterprise Strategy Group, a division of TechTarget, Inc.

High database performance and scale on Exadata hardware is supported by AMD EPYC processors, designed to enable high transaction throughput and fast analytic queries with high core counts, large memories, and fast memory bandwidth. These high-performance processors are used in the Exadata database servers that provide the core Oracle Database capabilities and offload low-level SQL queries and analytics to multiple smart storage servers. The Exadata infrastructure installed in Azure data centers is the same used in OCI data centers. In both locations, organizations can independently scale database compute and storage capabilities from starter configurations with 252 available AMD EPYC cores and 190 TB of usable storage to ones with more than 4,000 cores and 3 PB of capacity.

To simplify provisioning of Oracle Database@Azure, the service is presented as an Oracle-branded resource type in Microsoft Azure. Organizations no longer need to use two separate portals (Azure and OCI) when setting up an Oracle Database instance and connecting it to Azure-based applications. Running Autonomous Database or Exadata Database Service on Oracle Database@Azure provides the same user experience as running Oracle Exadata Database Service in OCI.

Paying for Oracle Database@ Azure is also simplified. Organizations have a commercial relationship with Microsoft and can leverage Microsoft Azure Consumption Commitments (MACC) to pay for services. Existing Oracle customers can continue to leverage Oracle Unlimited License Agreements (ULA), the ability to bring your own license (BYOL), and Oracle Support Rewards—which reduces software license support costs based on the amount of OCI consumption (Oracle Database@Azure uses OCI resources, so consuming these services in Azure also counts toward these rewards).

Enterprise Strategy Group Technical Validation

Enterprise Strategy Group validated how Oracle Database@Azure simplifies the experience of provisioning, configuring, and managing the Oracle Exadata Database Service as a resource to be used by an application running in Microsoft Azure, without compromising overall performance.

Deploying and Managing Oracle Databases Natively in Microsoft Azure

Organizations that want to run Oracle databases in the public cloud with applications on Microsoft Azure no longer need to deal with separate user interfaces to provision, deploy, and manage these components. With Oracle Database@Azure, organizations can provision and manage a database in OCI using a Microsoft Azure account.

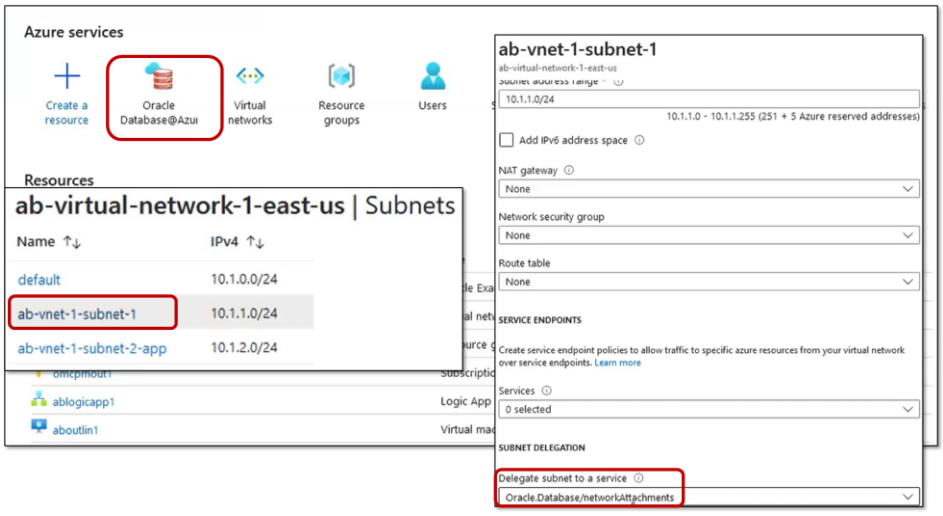
Enterprise Strategy Group Testing

Enterprise Strategy Group evaluated how the user experience is simplified by provisioning and configuring Oracle Database@Azure within the East US region of Microsoft Azure. We should emphasize that we worked in a live production environment.

We signed into an existing Azure subscription using Microsoft Entra ID (formerly known as Azure Active Directory) and landed on the Azure portal. To deploy Oracle Database@Azure services, we first provisioned an Azure Virtual Network (VNet) with at least two subnets, as one needs to be delegated to the Oracle Database@Azure service. (This is a requirement for using Oracle Database@Azure.) We should emphasize that Oracle Database@Azure provides the latest version of Oracle Exadata Database Service and runs on the same version of Exadata Cloud Infrastructure used in OCI. Feature parity with OCI is available from the onset. Thus, for our purposes, we did not use a beta version or previous release.

Figure 3 shows that Oracle Database@Azure is a resource offered natively in the Azure portal. This removes the need to provision the application and associated Oracle Database in two separate public clouds and establish interconnectivity. After creating the VNet and subnets, one subnet was formally delegated (according to prerequisite) to Oracle Database@ Azure by inputting “Oracle.Database/NetworkAttachments.” Following this step establishes communication between the Azure resources in the subnet and Oracle Database@Azure.

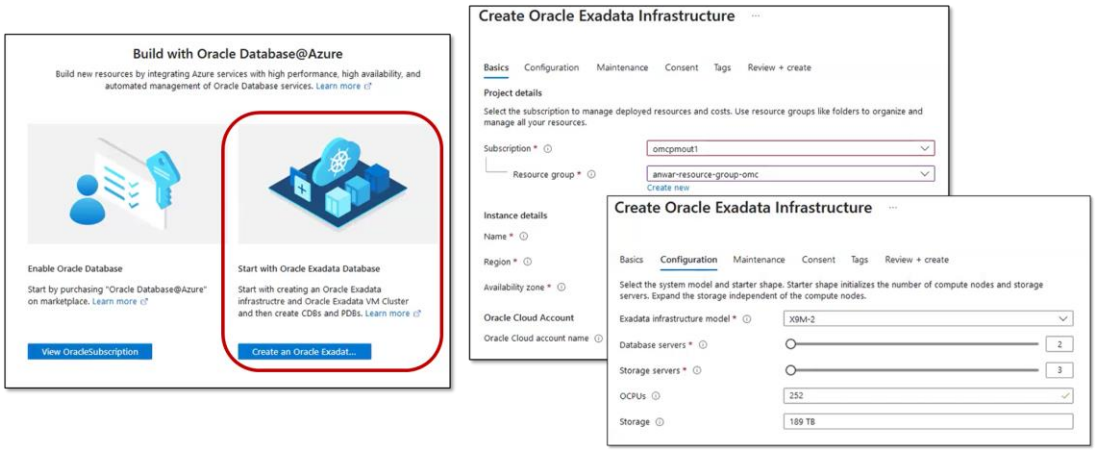
Figure 3. Oracle Database@Azure Displayed Natively in Microsoft Azure



Source: Enterprise Strategy Group, a division of TechTarget, Inc.

After clicking on the Oracle Database@Azure icon, we chose to deploy a minimum configuration of Exadata Cloud Infrastructure with 252 AMD EPYC processor cores and 190 TB of usable storage (see Figure 4). Again, we worked within the Azure portal and did not switch to an OCI portal.

Figure 4. Creating the Database Infrastructure via the Azure Portal

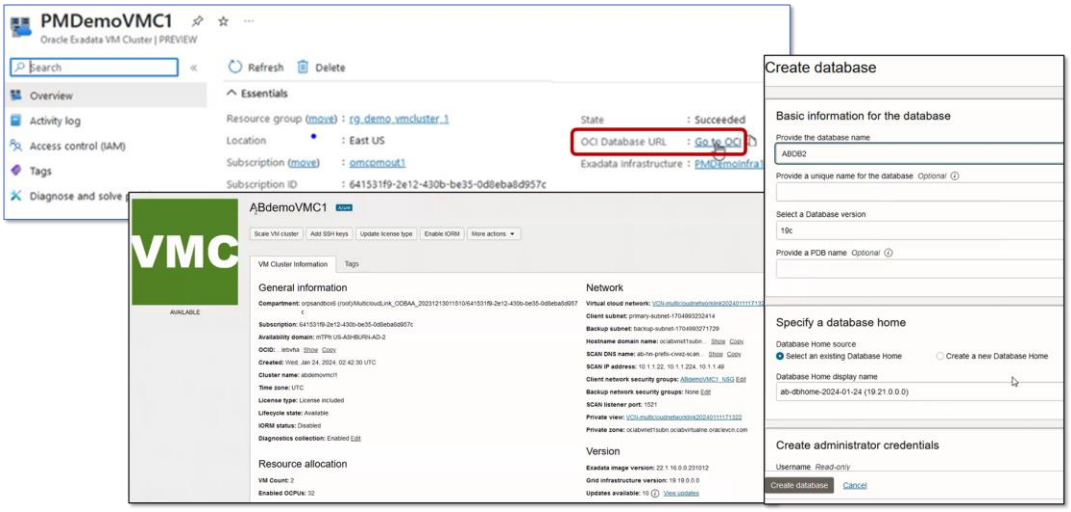


Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Enterprise Strategy Group then proceeded to deploy the database infrastructure. Figure 4 shows the starter configuration. As business needs dictate, the number of database servers (and available processor cores counted in OCPUs) and storage servers (and storage capacity measured in terabytes) can be scaled to meet changing business requirements. We then created an Oracle Exadata VM Cluster with the Azure portal "PMDemoVMC1," defining the number of OCPUs, memory, and storage allocated to each database and storage server VM. We noted that that the number of OCPUs in use and, therefore, licensed at any one time can be less than the total number of OCPUs available.

Once we deployed the database VM cluster, we proceeded to configure the database by clicking on a link from the Azure portal named "Go to OCI," which brought us to the OCI interface (noted by the red box in Figure 5). Because of identity federation between Azure and OCI, we were able to directly access the OCI user interface from Azure without having to log in again. Within the OCI interface, we could select the database version we wanted to use and the database home and also set other basic information for each database.

Figure 5. Configuring Database in OCI User Interface



Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Why This Matters

Organizations deploying applications in the cloud no longer must restrict themselves to a single cloud service provider's environment. In fact, Enterprise Strategy Group research has found that 38% of respondents are using between three and five (inclusive) IaaS offerings to deploy their applications. When it comes to deploying components of their distributed applications, the logical approach would be to use select resources and services from individual cloud service providers that offer optimized overall cost, availability, and performance of an application. However, managing applications using multiple, separate cloud infrastructures can easily become too costly and complex to manage.

Enterprise Strategy Group validated that the Oracle Database@Azure environment provides users with the same capabilities to configure and deploy databases in Azure that are available in OCI. We observed the simplicity of deploying Oracle databases, running in OCI, for Azure applications. Specifically, we examined the easy integration of Oracle Database Services into the Azure Resource Manager, the provisioning of OCI resources within the Azure portal, and the access to detailed database administration tasks completed in the OCI portal, without having to independently log in to OCI. With this level of integration, organizations have a consistent user experience while avoiding the need to create and manage multi-cloud integrations, thus saving both time and cost.

Delivering High Database Performance to Microsoft Azure-based Applications

Oracle Database@Azure delivers the high performance required by organizations that run business- and mission-critical applications. With this joint offering, Oracle Database@Azure can achieve latency of under 120 microseconds between Azure and OCI resources in the same Azure data center, supporting the high database performance organizations expect from Oracle.

Enterprise Strategy Group Testing

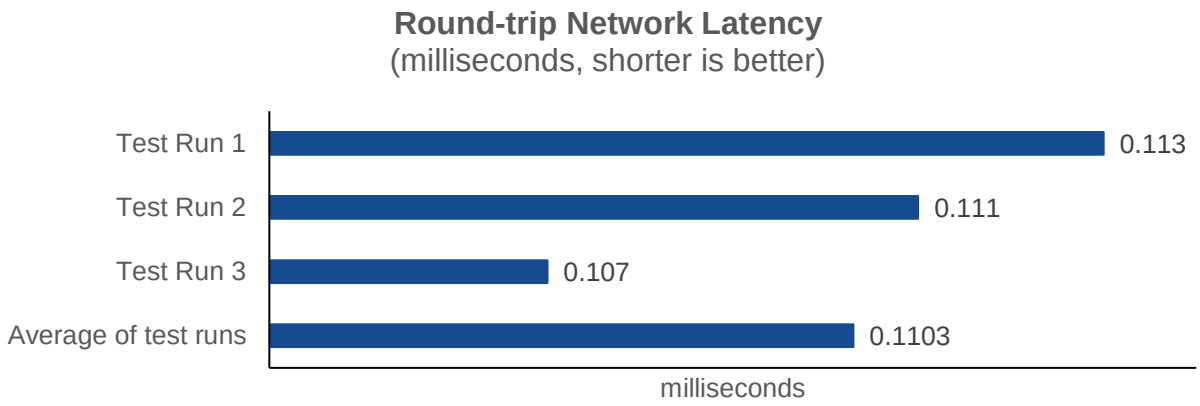
To begin our assessment of database performance, Enterprise Strategy Group first considered the latency achieved between Azure and OCI when using Oracle Database@Azure. Using a deployed VNet in the East US region of Microsoft Azure, we installed one subnet that contained a VM installed with Microsoft Power BI (Business Intelligence) Desktop, while the other contained a VM running on the Oracle Database@Azure VM cluster in the second subnet.

After establishing network connectivity in the previous section, we ran a test to show round-trip latency between the VM installed with Power BI and the Oracle Database@Azure VM cluster. To measure latency, we chose oratcptest, a general purpose Jave-based tool that is provided by Oracle and available for download.

oratcptest was determined to be the more appropriate tool, as it measures latency using TCP packets, which better mimics applications and utilities that require low-latency communications with Oracle Database. While others have typically used the ping command to measure latency, the tool was not appropriate, as it uses ICMP packets that are transmitted at the lower priority in Azure. As a result, much longer latencies than an application would experience when contacting a service running on Oracle Database@Azure would be incorrectly measured.

Figure 6 shows the results of three test runs as well as the average. Based on the numbers, Enterprise Strategy Group found that the round-trip network latency between the application VM and the Oracle Database@Azure VM cluster averaged around 0.110 milliseconds (or 110 microseconds).

Figure 6. Network Latency Between Microsoft Azure and OCI With Oracle Database@Azure

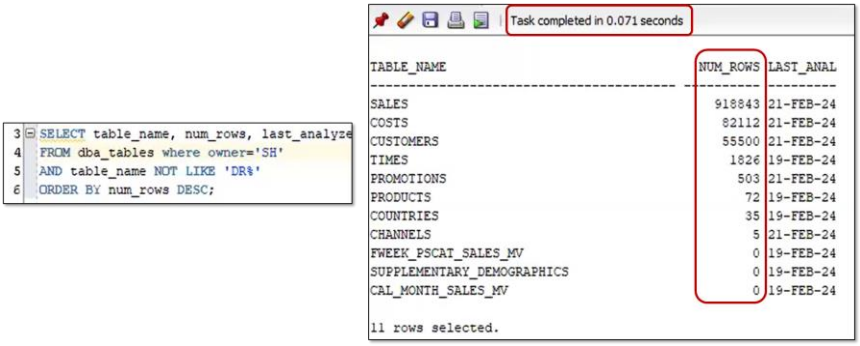


Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Enterprise Strategy Group then examined the results of tests showing the database performance achieved by Oracle Database@Azure. The Oracle Database instance was running on the Oracle Exadata Database Service and Exadata X9M infrastructure powered by AMD EPYC processors. The database contained sale data recorded in 11 tables, with each containing zero to 918,043 rows and a number of columns.

As a sys user from a remote desktop session, we logged onto the Power BI application and ran a query to count the number of records (or counting the data inside the schema existing within the database). Figure 7 shows that query completion time was 0.071 seconds. Note that this query required the reading of data simultaneously from 11 tables, each containing different row counts.

Figure 7. Counting the Number of Database Records



```
3  SELECT table_name, num_rows, last_analyze
4  FROM dba_tables where owner='SH'
5  AND table_name NOT LIKE 'DR$'
6  ORDER BY num_rows DESC;
```

Task completed in 0.071 seconds

TABLE_NAME	NUM_ROWS	LAST_ANAL
SALES	918843	21-FEB-24
COSTS	82112	21-FEB-24
CUSTOMERS	55500	21-FEB-24
TIMES	1826	19-FEB-24
PROMOTIONS	503	21-FEB-24
PRODUCTS	72	19-FEB-24
COUNTRIES	35	19-FEB-24
CHANNELS	5	21-FEB-24
FWEEK_PSCAT_SALES_MV	0	19-FEB-24
SUPPLEMENTARY_DEMOGRAPHICS	0	19-FEB-24
CAL_MONTH_SALES_MV	0	19-FEB-24

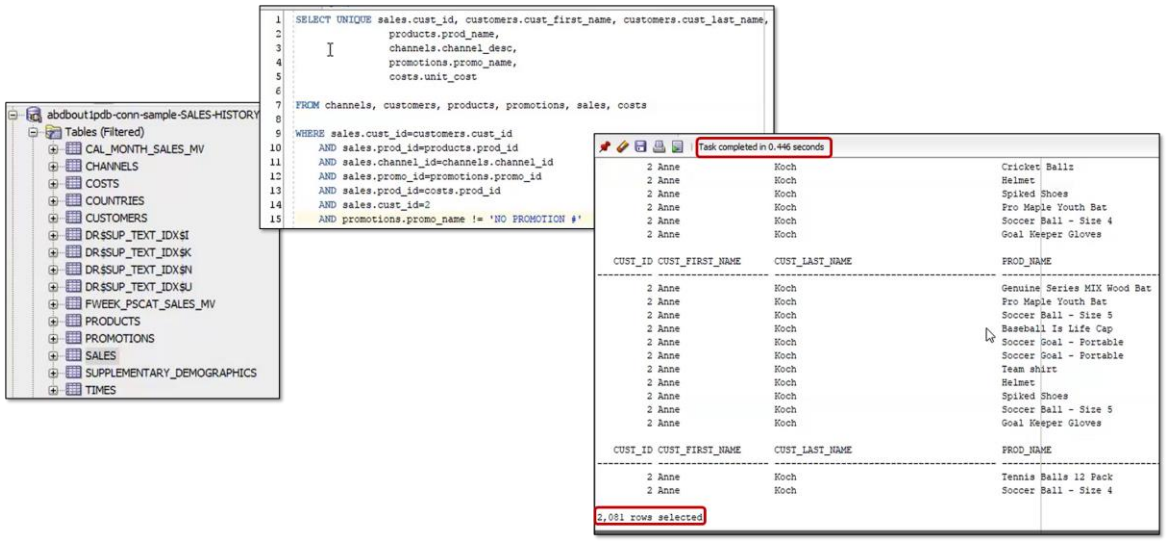
11 rows selected.

Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Enterprise Strategy Group then logged into Power BI as another user and ran a query that examined six out of the 11 tables simultaneously, applied a filter, then only presented specified fields (see Figure 8). Query completion time was 0.046 seconds (46 milliseconds). Note that 2,081 rows were extracted from over 900,000 rows in the entire database.

The AMD EPYC processors in the Exadata Cloud Infrastructure enabled our queries to run in parallel and with high performance. The processors also include cryptographic accelerators that enable queries to run at full speed when the underlying data is encrypted, which is required with Oracle Database@Azure.

Figure 8. Query to Read From Multiple Tables, Filter Data, and Extract Specified Records



Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Why This Matters

While organizations want to migrate applications to the cloud, some are unfortunately not viable candidates, as the required performance cannot be achieved more cost-effectively—the top concern noted by 36% of Enterprise Strategy Group survey respondents. For distributed applications spanning multiple public clouds, this concern is no surprise given the time, effort, and cost required to establish the inter-cloud connections and optimize performance of business- and mission-critical applications.

Enterprise Strategy Group validated that Oracle Database@ Azure supports the performance and latency organizations expect from using Oracle Exadata infrastructure in OCI. In a live production environment, we observed the sub-120 microsecond network latency achieved between a VM running a remote desktop session of Microsoft Power BI and an Oracle Database VM running on an Exadata VM cluster in OCI. We also ran several database queries and observed millisecond query times that organizations have come to expect from Oracle.

Integrating Oracle Database@Azure With Microsoft Azure OpenAI

AI-based applications must fulfill demanding performance requirements, especially when using multiple large language models (LLMs) to deliver relevant and contextually aware responses that end users expect. For organizations using Microsoft Azure OpenAI (based on ChatGPT-4), Oracle Autonomous Database,[2] running on Oracle Database@Azure, can support how effectively natural language responses are created.

Enterprise Strategy Group Testing

Enterprise Strategy Group began by deploying a Kubernetes node cluster with Azure Kubernetes Service (AKS) and 30 nodes running Linux. Autoscaling was enabled. Oracle Autonomous Database is running on Oracle Database@Azure. We added Microsoft Copilot (based on ChatGPT-4) to illustrate the use case of an end user

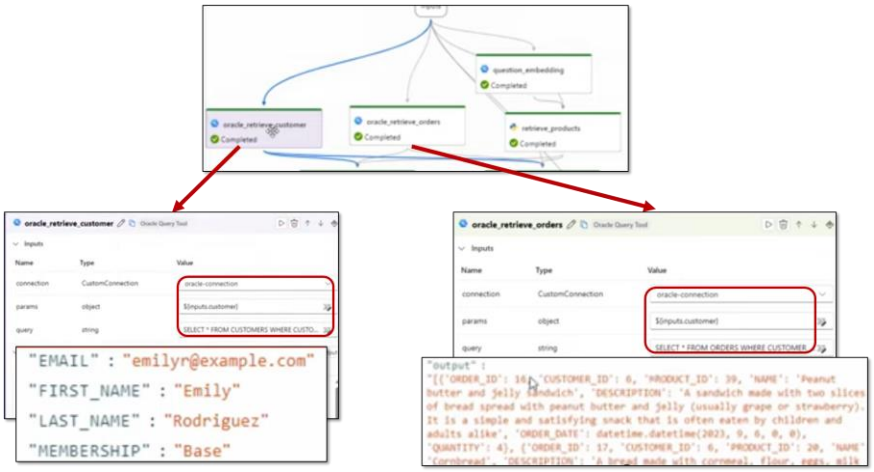
[2] Oracle Autonomous Database enables organizations to analyze data using self-service data integration and analysis capabilities, including built-in text, spatial, machine learning and graph analytics.

looking for food options from the fictional company named “GrabDish.” We entered the question, “Do you have anything sweet?”

Within the Azure portal, we then observed the “prompt flow” used by Azure AI Studio to generate a response (see Figure 9). Creating the response required Azure AI to retrieve data from the Oracle Autonomous Database on the customer who submitted the question along with previous orders they had placed. This was verified by the “oracle-connection” parameter entered for the database containing all customers and their previous GrabDish orders. We saw that Emily Rodriguez, who previously ordered peanut butter and jelly sandwiches, was the customer.

Figure 10 shows the generated customer prompt from the prompt flow, along with the guidelines used to create it. Time to generate this response was 2.39 seconds.

Figure 9. Generating a Response to a Prompt Using Data Within Oracle Autonomous Database



Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Figure 10. Generating the Customer Prompt

Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Why This Matters

Organizations that offer LLM-enabled services to their end users must ensure that contextually aware and relevant responses are generated in truly little time. Not doing so risks end-user dissatisfaction and, subsequently, negative business consequences such as losing revenue, customer goodwill, and brand equity.

Enterprise Strategy Group validated that using Oracle Autonomous Database on Oracle Database@Azure can support the end-to-end high performance required by AI-based services by providing them with historical data stored in an enterprise's transactional database. We observed how Oracle Autonomous Database, running on Oracle Database@ Azure, supports Microsoft OpenAI's quick creation of a contextually aware prompt to a customer query.

Conclusion

Organizations recognize the benefits of pursuing a multi-cloud strategy. Instead of being locked into a single cloud service provider, organizations can pick those services that best support their business- and mission-critical applications with the highest performance possible, while balancing overall cloud costs. Yet, the architectural and management complexity that comes with operating a multi-cloud environment can easily become too costly and difficult to maintain. Organizations using Microsoft Azure applications supported by databases running in OCI clamored for a solution to address these challenges.

The solution is Oracle Database@Azure, a joint offering of Oracle and Microsoft that enables organizations to deploy Oracle Exadata Cloud Infrastructure powered by AMD EPYC processors and use Oracle Autonomous Database or Oracle Exadata Database Services running in Microsoft Azure data centers.

Unlike downloading Oracle database software from the Azure Marketplace and installing it on Azure VMs, Oracle Database@Azure enables organizations to deploy databases on Oracle's Exadata platform and have it managed by Oracle's OCI experts. Deploying and configuring the database infrastructure within Azure is simplified, as Oracle Database@Azure is listed as an Azure resource, and organizations no longer need to use both the Azure and OCI portals separately. With Oracle Database@Azure, organizations can expect the same database performance, availability, and scalability that is offered by Oracle Exadata Database Service in OCI.

Enterprise Strategy Group validated that Oracle Database@Azure delivers the benefits that help to decrease the complexity and incurred costs of deploying Oracle database applications in Microsoft Azure, while maintaining the performance required by business- and mission-critical applications. Specifically, we validated that Oracle Database@Azure:

- Drastically simplifies how Oracle databases are deployed for Azure services using a single Azure portal, eliminating the need to navigate separate interfaces for Azure and Oracle services.
- Delivers the millisecond database performance expected by Oracle customers for Microsoft Azure-based applications.
- Supports the performance organizations expect of AI-based applications.

A multi-cloud strategy no longer needs to be limited to using different services from separate public clouds, stitched together with internet connections. Oracle and Microsoft have taken the first step to redefine how that strategy is implemented in real production environments. If your organization's goal is to decrease architectural and management complexity encountered when supporting Microsoft Azure-based distributed applications using Oracle databases running in OCI, Enterprise Strategy Group urges you to take a closer look at Oracle Database@Azure.

About Enterprise Strategy Group
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