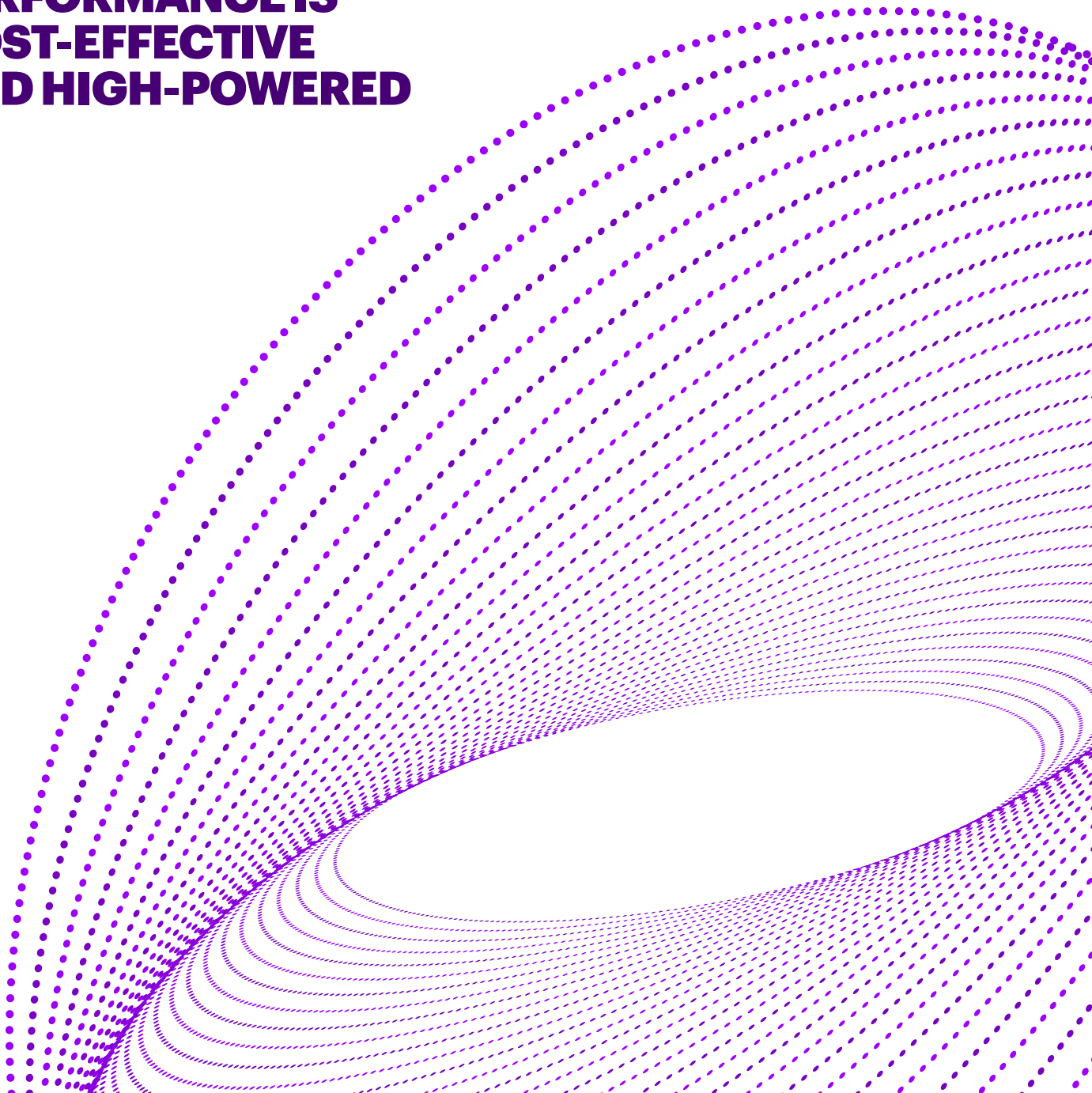




DESTINATION: AUTONOMOUS

**ORACLE DATABASE
PERFORMANCE IS
COST-EFFECTIVE
AND HIGH-POWERED**



In recent years, Accenture has conducted several tests of Oracle Databases running in various cloud environments, finding that Oracle Database on Oracle Cloud Infrastructure (OCI) offers customers the best performance and the best price for that performance.

New tests from Accenture reinforce that Oracle databases run very well on OCI, and Oracle Autonomous Data Warehouse (ADW) provides an added edge to performance and cost.

But Oracle products—and technology in general—continue to evolve and change. So too do the demands that business puts on computing. As organizations continue to see their data grow at exponential rates, there is a continuous need to enhance how it is used, managed, and secured. This is particularly true as organizations look for new methods to monetize their data. To really get the most out of the data available, organizations need to find ways to focus on analyzing and using the data. Unfortunately, many organizations have found themselves stuck in an endless cycle of maintenance, draining their ability to focus on effective use of this valuable asset. With these realities and our customers in mind, Accenture recently ran an entirely new set of tests designed to provide a clear picture of the performance that Oracle offers today.

In these tests, engineers set out to measure the performance of Oracle Database running in Oracle and other clouds. What's more, Accenture's engineers took the time during these tests to further understand how Oracle

Autonomous Data Warehouse (ADW) can streamline database activity and improve DBA efficiency.

These recent tests clearly demonstrate that the best performance results came from Oracle databases running on Oracle Cloud Infrastructure.

This means that today's companies can access the performance they need to handle the large, high-powered database workloads that are fundamental to critical enterprise applications. What's more, the analysis showed that it's 97 percent cheaper per query to run on OCI using NVME SSD storage, compared to other clouds' SSD.

Nearly all companies are developing or executing on their cloud plans, which have now begun to include business critical workloads. Since many of these workloads are anchored on Oracle's Database, it is critical to understand the options that are in the market when it comes to price and performance. The findings of these tests provide new insights into what to expect, and how Oracle technology can fit with companies' cloud plans.

ORACLE CLOUD INFRASTRUCTURE: STILL THE BEST PLACE FOR ORACLE DATABASES

To measure Oracle performance, the engineers leveraged Swingbench, an industry standard performance testing solution for Oracle Database.

The team used Swingbench to build up a 40GB data warehouse data set, and then deployed that same workload to a non-Oracle IaaS Cloud, OCI and Oracle's Autonomous Data Warehouse as shown below. It's important to note that all 3 configurations are "like for like" based on processing speeds, shapes and how each cloud can be configured.

The research team chose these various configurations because in terms of processing power, they were as close to the same as possible. When considering the deployment servers on Oracle Cloud Infrastructure versus other clouds, it's important to remember that an OCPU is the same as a full CPU core. That means customers get two processing threads for every OCPU. On other public clouds,

a vCPU is the same as a single thread. In order to make the processing power equivalent, it was important to choose servers with twice as many vCPU as the OCPUs for the Oracle servers.

When considering the processing power of the Autonomous Data Warehouse implementations, the team started with the same number of OCPUs as the OCI servers. The key here is that Oracle has chosen to deploy ADW exclusively on Exadata. With more than a decade of experience implementing thousands of Exadata, our team understood that ADW would likely perform quite well with even fewer OCPUs. As such, the team chose to go with a substantially-smaller processing footprint to understand the difference.

Table 1

	Other Cloud		OCI Servers		ADW	
Storage Type	Standard Disk	SSD	Block Storage	NVME SSD	Exadata Storage	Exadata Storage
Storage Size	1 TB	1 TB	1 TB	6.4 TB	1 TB	1 TB
CPUs	16 vCPU	16 vCPU	8 OCPU	8 OCPU	8 OCPU	2 OCPU
Memory	128 GB	128 GB	120 GB	120 GB	N/A	N/A

In order to ensure a level playing field, Accenture deployed the database to servers with the same exact configuration using automated Ansible scripts. When moving the data to Oracle's Autonomous Data Warehouse (ADW), the engineers simply imported the data with the settings that Oracle delivers by default. At no time did they intervene with any tuning or configuration changes.

The tests found that Oracle's options for running Oracle Database continue to provide the best value. Accenture's testing once again demonstrated that storage is the key to an effective cloud deployment of an Oracle Database (Table 2).

When running a database, performance is paramount, but the real measure of value is cost. Typically, people look at the cost

of the infrastructure itself. While that's an interesting statistic, it's not a good way to assess the real cost. Instead, companies should start by considering the overall cost of infrastructure and software, particularly when thinking about running a powerhouse like Oracle Database.

The cost of purchasing new Oracle Database Enterprise Edition and Oracle Advanced Security Option licenses and paying for them over a three-year period is shown in table 3. We've included both the database licensing as well as security licensing because proper security of data in the public cloud is critical to success. When deploying mission-critical, sensitive data to any public cloud, basic capabilities like encryption are no longer a luxury, they are a must.

Table 2

	Other Cloud		OCI Servers		ADW	
	Standard Disk	SSD	Block Storage	NVME SSD	Exadata Storage (8 OCPU)	Exadata Storage (2 OCPU)
Queries/Hour	-	65	52	1,264	11,975	2,453

Table 3

		Other Cloud		OCI Servers		ADW	
Storage Type		Standard Disk	SSD	Block Storage	NVME SSD	Exadata Storage	Exadata Storage
Storage Size		1 TB	1 TB	1 TB	6.4 TB	1 TB	1 TB
CPUs		16 vCPU	16 vCPU	8 OCPU	8 OCPU	8 OCPU	2 OCPU
Memory		128 GB	128 GB	120 GB	120 GB	N/A	N/A
Commitment Term		36 Months	36 Months	None	None	36 Months	None
3 Yr DB Cost		\$830,000.00	\$830,000.00	\$415,000.00	\$415,000.00	-	-
Monthly Cost	Infrastructure	\$390.64	\$446.96	\$232.37	\$744.60	\$8,465.82	\$3,901.49
	Amortized DB Cost	\$23,055.56	\$23,055.56	\$11,527.78	\$11,527.78	-	-
	Amortized Total	\$23,446.20	\$23,502.52	\$11,760.15	\$12,272.38	\$8,465.82	\$3,901.49

In many cases, however, this is an unfair comparison—because organizations may have already purchased enough database licenses to cover a new implementation of a single database in the Cloud. With that in mind, Accenture also analyzed cost by removing the initial purchases of the license, assuming three years of support, as shown in table 4.

This price comparison begins to shed some light on the true cost of running Oracle databases in the cloud, but it doesn't tell the whole story. It's also important to consider the amount of work that can be performed for the cost. To measure this, Accenture considered the cost of a single transaction based on the amortized monthly cost of the infrastructure and software. Table 5 provides the real value case in determining the best place to run Oracle Databases.

Table 4

		Other Cloud		OCI Servers		ADW	
Storage Type		Standard Disk	SSD	Block Storage	NVME SSD	Exadata Storage	Exadata Storage
Storage Size		1 TB	1 TB	1 TB	6.4 TB	1 TB	1 TB
CPU		16 vCPU	16 vCPU	8 OCPU	8 OCPU	8 OCPU	2 OCPU
Memory		128 GB	128 GB	120 GB	120 GB	N/A	N/A
Commitment Term		36 Months	36 Months	None	None	36 Months	None
3 Yr DB Cost		\$330,000.00	\$330,000.00	\$165,000.00	\$165,000.00	-	-
Monthly Cost	Infrastructure	\$390.64	\$446.96	\$232.37	\$744.60	\$8,465.82	\$3,901.49
	Amortized DB Cost	\$9,166.67	\$9,166.67	\$4,583.33	\$4,583.33	-	-
	Amortized Total	\$9,557.31	\$9,613.63	\$4,815.70	\$5,327.93	\$8,465.82	\$3,901.49

Table 5

		Other Cloud		OCI Servers		ADW	
Storage Type		Standard Disk	SSD	Block Storage	NVME SSD	Exadata Storage (8 OCPU)	Exadata Storage (2 OCPU)
With Database Purchase							
Amortized Monthly Cost		\$23,446.20	\$23,502.52	\$11,760.15	\$12,272.38	\$8,465.82	\$3,901.49
Queries/ Hour		-	65	52	1,264	11,975	2,453
Cost/ Hour		\$32.12	\$32.20	\$16.11	\$16.81	\$11.60	\$5.34
Cost/ Query		N/A	\$0.4953	\$0.3098	\$0.0133	\$0.0010	\$0.0022
Without Database Purchase							
Amortized Monthly Cost		\$9,557.31	\$9,613.63	\$4,815.70	\$5,327.93	\$8,465.82	\$3,901.49
Queries/ hour		-	65	52	1,264	11,975	2,453
Cost/ Hour		\$13.09	\$13.17	\$6.60	\$7.30	\$11.60	\$5.34
Cost/ Query		N/A	\$0.2026	\$0.1269	\$0.0058	\$0.0010	\$0.0022

Altogether, these comparisons point to a number of conclusions. First, as noted previously, storage is important to the performance of an Oracle Database. When comparing the other cloud's high-performance infrastructure to Oracle Cloud Infrastructure's DenseIO virtual machines, we can see that the total cost to run on OCI is roughly half that of the competitor's cost. More important, it is 97 percent cheaper per query to run on OCI using NVME SSD storage, compared to other clouds' SSD.

What's more, running a 4X smaller footprint in ADW—just two OCPUs—involves roughly half the total hourly cost of the other cloud, and is still 99 percent cheaper per query.

That's just the beginning. The tests showed that it is more than 99 percent cheaper per transaction to run the same infrastructure sizing (8 OCPU vs. 16 vCPU) on ADW as opposed to other clouds. What's more, running a 4X smaller footprint in ADW—just two OCPUs—involves roughly half the total hourly cost of the other cloud, and is still 99 percent cheaper per query.

This comparison is very useful, but it doesn't take into account two questions.

Q1. What if a company wants to run workloads for only a few days or even a few hours?

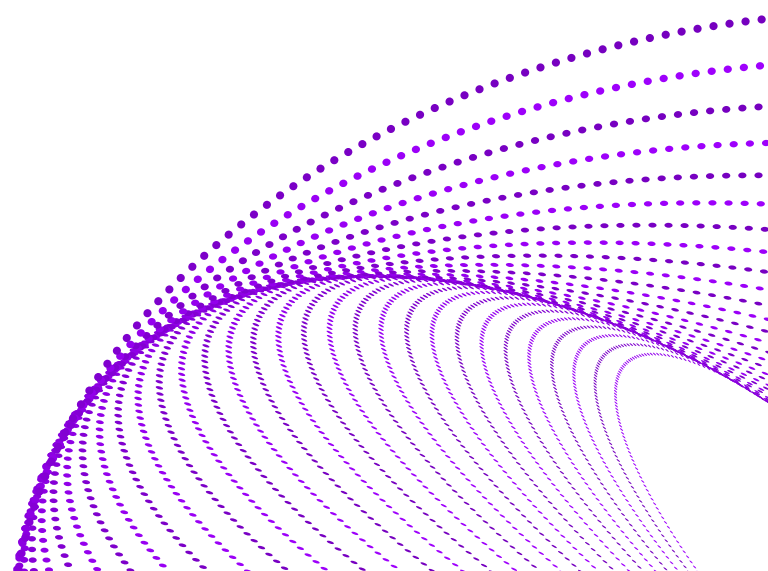
When deploying a new server and installing Oracle Database on that server, an organization needs to have licensing for

the database. That means either finding available licenses for a very short time period or purchasing new licenses. With ADW, however, the traditional pricing structure no longer applies.

Developers can spin up an ADW instance, use it for what they need, and then turn it off. There's no additional database licensing needed. On top of that, ADW provides features such as Real Application Clusters (RAC), In-Memory, Advanced Security, and Partitioning, which are not included in the base license of Oracle Database Enterprise Edition.

Q2. How easy and cost-effective is it to use and run?

When running the fully automated Oracle Database install, setting up the database still took hours. ADW, on the other hand, spins up in minutes and is ready to use immediately. In addition, there's no longer a need to have a DBA deploy the database—it can be done quickly by a developer. Oracle handles all the patching, security, and tuning on ADW automatically. So even if a developer needed to run a database for multiple hours, days, months, or more, there would be no need to bring a DBA into the mix.



SUMMARY

Running Oracle Database in a public cloud environment is a very real need as organizations continue to assess the future of their data and business critical applications. This need becomes even more critical as organizations look to their years of data accumulation and ask themselves how they can make better use of it to meet their business goals.

With Oracle Autonomous Data Warehouse, Oracle has developed a very compelling and performant solution that provides options that allow IT professionals to reduce run costs and complexity, while improving the performance of workloads in a flexible pricing model.

Oracle Autonomous Data Warehouse reduces management time, so organizations can stop worrying about the mundane tasks associated with administering a database and can focus on driving true value from their data.

In years past, work reduction used to mean headcount reduction, but today it means reallocation of skills. With Oracle Autonomous Database, IT shops can now give their DBAs more interesting work focused on furthering their mission related to better data use.

As important as cost, performance, and ease of use is the ability to effectively secure data in the public cloud. Many organizations can take weeks or even months to apply critical security patches to their most sensitive and business critical applications. The longer a vulnerability is left unresolved, the more likely and susceptible an organization becomes to a security breach.

These findings demonstrate that running Oracle databases on Oracle Cloud Infrastructure provides cost-savings and speed, but the value goes beyond that. Oracle Autonomous Data Warehouse allows organizations to address threats automatically and in real-time, with no downtime. While this study doesn't attempt to calculate the variable cost implications of data security, IT organizations will assign a very real value to security.

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Based in Wisconsin, Chris oversees Accenture's work and business related to Oracle Technology in North America, including Oracle IaaS and PaaS. Chris is responsible for Accenture's work on Autonomous Database in North America and the expansion of cloud native development on Oracle Cloud Infrastructure for Accenture.

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