

Oracle Exadata Cloud@Customer X9M comparisons to AWS RDS, AWS RDS on AWS Outposts, and Microsoft Azure SQL Server

Exadata Cloud@Customer X9M is a high-performance cloud database platform delivered in an organization's data center, enabling them to benefit from cloud automation and consumption-based economics while also meeting data sovereignty, security, and latency requirements. Customers can run OLTP, analytics, and in-database machine learning workloads with IO latencies as low as 19 microseconds, up to 22.4 million SQL IOPS, and up to 540 GB/second of scan throughput for analytics.

Exadata Cloud@Customer X9M builds on a unique scale-out design and implements more than 60 optimizations that are co-engineered with Oracle Database and are not available on other cloud services or cloud platforms delivered in customer data centers. For instance, the use of database-transparent persistent memory (PMEM) with Remote Direct Memory Access over Converged Ethernet (RoCE) enables Oracle Database to read data from storage servers with less than 19 microsecond latency, which is 50X faster than AWS RDS and 100x faster than Microsoft Azure SQL Server.

Exadata Cloud@Customer X9M compared to AWS RDS in the AWS cloud

Customers can run Oracle Database in AWS RDS in the AWS cloud. For this comparison, we are looking at the highest performance available to a single Oracle Database instance. The highest performing AWS RDS platforms in the cloud are the db.r5b configurations using EBS on SSD io2 Block Express storage. This solution provides EBS throughput of "Up to 60 Gbps of EBS bandwidth" (equal to 7.5 GB/second) and "sub-millisecond" latency without specifying what the actual latency value is.

The relative advantage for Exadata Cloud@Customer X9M is calculated as:

Exadata X9M Latency advantage (lower latency is better):

- $\text{AWS RDS Latency} / \text{Exadata Cloud@Customer X9M latency} = 999 / 19 = 52.5x$

Exadata X9M Throughput advantage (higher is better):

- $\text{Exadata Cloud@Customer X9M throughput} / \text{AWS RDS throughput} = 540 / 7.5 = 72x$

AWS's supporting information can be found at:

<https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-volume-types.html> and <https://aws.amazon.com/rds/instance-types/>

Exadata Cloud@Customer X9M compared to AWS RDS on AWS Outposts

AWS also supports RDS on AWS Outposts that can be deployed in customer data centers. However, AWS RDS on AWS Outposts does not support Oracle Database or the same configurations as their cloud-based platform. For this comparison, we are comparing the best IO latency available and the aggregate throughput available for a single deployment since this presents the AWS solution in the best possible way.

The AWS Outposts OR-HSZHMMF configuration is a “Memory optimized large unit, (that) can be used for running large on-premises databases” since it provides the largest number of compute nodes and supports shared EBS storage which increases availability and business continuity should a compute node go down. This configuration is comprised of twelve (12) r5.24xlarge nodes, each one of which provide 19,000 Mbps (2.375 GB/s) of EBS bandwidth. For a full-size AWS Outposts system, this would amount to 28.5 GB/second. The highest performance storage on AWS Outposts are EBS General Purpose SSD gp2 volumes that deliver “single-digit millisecond latencies.”

The relative advantage for Exadata Cloud@Customer X9M is calculated as:

Exadata X9M Latency advantage (lower latency is better):

- AWS RDS on AWS Outposts Latency/Exadata Cloud@Customer X9M latency= $1000/19 = 52.6x$

Exadata X9M Throughput advantage (higher is better):

- Exadata Cloud@Customer X9M throughput/AWS RDS on AWS Outposts throughput = $540/28.5 = 18.9x$

If Oracle Database did run on AWS RDS on AWS Outposts, its throughput would be limited to that of a single node, which would be 2.375 GB/second and the single-database throughput advantage for Exadata Cloud@Customer X9M would be $540/2.375 = 227x$.

Supporting AWS documentation can be found at:

<https://aws.amazon.com/outposts/pricing/>
<https://aws.amazon.com/ec2/instance-types/r5/> and
<https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-volume-types.html>

Exadata Cloud@Customer X9M compared to Microsoft Azure SQL Server

Microsoft Azure SQL Server runs the Microsoft SQL Server database for use by enterprise customers. It is not running Oracle Database. For this comparison, we are looking at the highest performance available to a single Oracle Database instance on Exadata Cloud@Customer X9M compared to a single Microsoft Azure SQL Server database. According to Azure documentation, the maximum “Data/Log IOPS” rate for a Business Critical system is 320,000, with this IOPS rate supported for IOs of up to 64 KB (65,536 Bytes) in size, resulting in a maximum throughput of $320,000 \times 65,536 = 19.53$ GB/second after adjusting gigabytes to their power-of-2 equivalent (1,073,741,824). Similarly, Azure documentation states that the minimum IO latency is 2 milliseconds for the premium service tier.

The relative advantage for Exadata Cloud@Customer X9M is calculated as:

Exadata X9M Latency advantage (lower latency is better):

- Azure SQL Server/Exadata Cloud@Customer X9M latency= $2,000/19 = 105.2x$

Exadata X9M Throughput advantage (higher is better):

- Exadata Cloud@Customer X9M throughput/Azure SQL Server throughput = $540/19.53 = 27.6x$

The supporting Azure documentation can be found at:

<https://docs.microsoft.com/en-us/azure/azure-sql/database/service-tiers-dtu> and
<https://docs.microsoft.com/en-us/azure/azure-sql/managed-instance/resource-limits>

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