



Google Cloud

NetApp Solutions

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Google Cloud

Overview: Oracle Database with Google Cloud NetApp Volumes

Oracle Database workloads require scalable storage capacity that delivers consistent IO response times, bandwidth, and low latency. Google Cloud NetApp Volumes provides a fully managed file storage service supporting NFS protocol access, specifically designed to meet these demanding requirements.

This solution enables organizations to run Oracle Database workloads on Google Cloud while maintaining enterprise-grade storage capabilities.

Benefits of Google Cloud NetApp Volumes

Google Cloud NetApp Volumes offers the following benefits:

Dynamic Resource Management:

Storage resources can be adjusted in real-time to match business requirements. Administrators can scale storage capacity up or down based on demand without service interruption. This flexibility allows organizations to optimize their storage resources efficiently, ensuring they maintain appropriate performance levels while controlling costs. The system provides seamless scaling of both capacity and performance characteristics, adapting to changing workload demands without impacting database operations.

Enterprise-Grade Architecture:

The foundation of NetApp Volumes is built on ONTAP technology, providing a robust and reliable storage platform. The infrastructure is designed with high availability as a core principle, incorporating redundancy at multiple levels. Built-in cross-location volume replication capabilities support comprehensive business continuity planning and disaster recovery. This includes cross-region data protection, ensuring data availability and durability across different geographic locations.

Workload Management:

NetApp Volumes excels in supporting multiple database instances while maintaining proper isolation and performance characteristics. Organizations can implement granular storage management of each database and even database components, such as select datafiles or archival log destinations. The result is optimal performance and management. Storage resources can be scaled individually, providing flexibility in resource allocation. This granular control enables efficient management of various database workloads with different performance and capacity requirements.

Data Protection and Management:

Data protection features include instantaneous snapshots that can capture the application state at specific points in time. The snapshot technology is space-efficient, minimizing storage overhead while maintaining data integrity. The service integrates seamlessly with native backup solutions, supporting comprehensive data lifecycle management. Organizations can implement point-in-time recovery, execute backup and restore operations, and manage data retention according to their business requirements.

Development and Testing Support:

NetApp Volumes streamlines the creation of database copies through efficient volume cloning capabilities.

Development teams can quickly provision test environments at low cost and without impacting production workloads. The platform provides isolation for development workspaces, enabling teams to work independently while sharing infrastructure resources. These capabilities significantly enhance the development and testing cycles, allowing for rapid iteration and validation of database changes.

Storage Architecture:

The service offers multiple tiers to accommodate different workload requirements, from development environments to mission-critical production databases. The architecture supports independent scaling of capacity and performance metrics, allowing fine-tuned optimization for specific database workloads. The platform enables concurrent database operations with low-latency data access, supporting demanding enterprise applications.

Scalability Options:

Storage management becomes straightforward with the ability to add volumes dynamically as needed. The platform scales from gigabytes to petabytes, supporting databases of any size. Performance characteristics can be adjusted based on workload requirements, ensuring consistent performance as databases grow. The scalability features support both planned growth and unexpected spikes in database requirements.

Use cases

High-Performance Production Environments:

NetApp Volumes supports mission-critical Oracle Database deployments requiring sustained IOPS and low-latency performance characteristics. The architecture accommodates both OLTP and OLAP workloads, with configurable service tiers supporting various performance profiles. NetApp Volumes deliver blazing-fast performance, achieving up to 4.6 GiBps for and 340K IOPS for exceptional throughput even under mixed read/write workloads.

Cloud Migration:

The platform facilitates lift-and-shift migrations of Oracle Database environments from on-premises infrastructure to Google Cloud. Options include Oracle Recovery Manager (RMAN), Oracle Data Guard, and Oracle GoldenGate. The NFS storage architecture enables seamless transition with minimal architectural changes, supporting both offline and online migration strategies while maintaining existing backup and recovery procedures.

Database Consolidation Architecture:

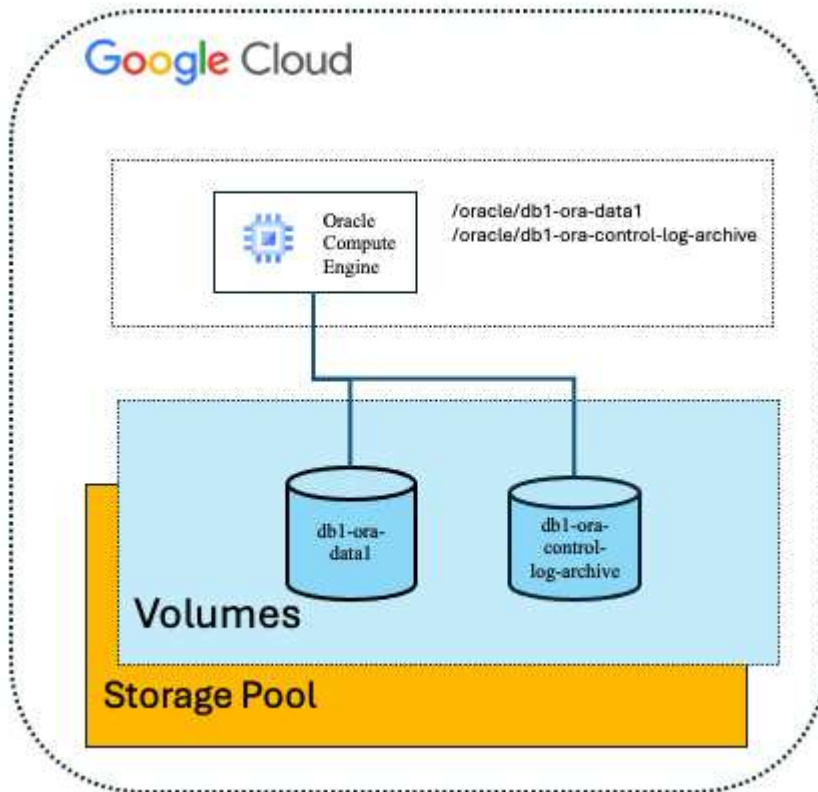
The architecture enables database consolidation through multi-tenant deployment models. Administrators can implement resource isolation at the volume level, with dedicated volumes for Oracle Pluggable Databases, specific data files, redo logs, and archive logs. This design supports Oracle Multitenant architecture and enables efficient resource utilization while maintaining performance isolation between databases.

Enterprise System Replication:

The platform's snapshot and cloning capabilities support rapid provisioning of development and testing environments from production data. Volume cloning technology enables space-efficient database copies with independent performance characteristics. This functionality supports CI/CD (continuous integration and continuous development) pipelines requiring frequent database refreshes and isolated testing environments with production-grade performance capabilities.

Architecture

You can run Oracle databases on Google Compute Engine with one or more storage volumes. The number of volumes depends on the level of data separation. For example, smaller databases might be placed on a single volume. Larger databases with more demanding IO or management requirements may require individual datafile, redo log, and archive log volumes. Additional volumes for application or backup data can be added as well. Each volume can be right-sized for the needs of the data to be hosted.



Preparing the Google Cloud NetApp Volumes

Create Google Cloud NetApp Volumes storage pool of the desired capacity and service level. Check the Quickstart for setting up Google Cloud NetApp Volumes. If you're migrating existing Oracle databases from on-premises to Google, you can utilize Metrics Explorer to obtain current throughput statistics which you need for sizing the Google Cloud NetApp Volumes Storage pool and volumes. Contact your Oracle on Google specialist for details on how to use the service. Available throughput for the volumes in a Storage pool is defined by the size and service level (Standard, Premium, or Extreme, etc..) of the selected storage pool

Scalability

The NetApp Volumes are capable to scale out easily to accommodate growing data and workloads, while supporting many small volumes. An individual storage pool can easily grow from the minimum of 2 TiB to any size up to 10 PiB. Refer the Quotas and limits details.

Components

The solution uses the following components:

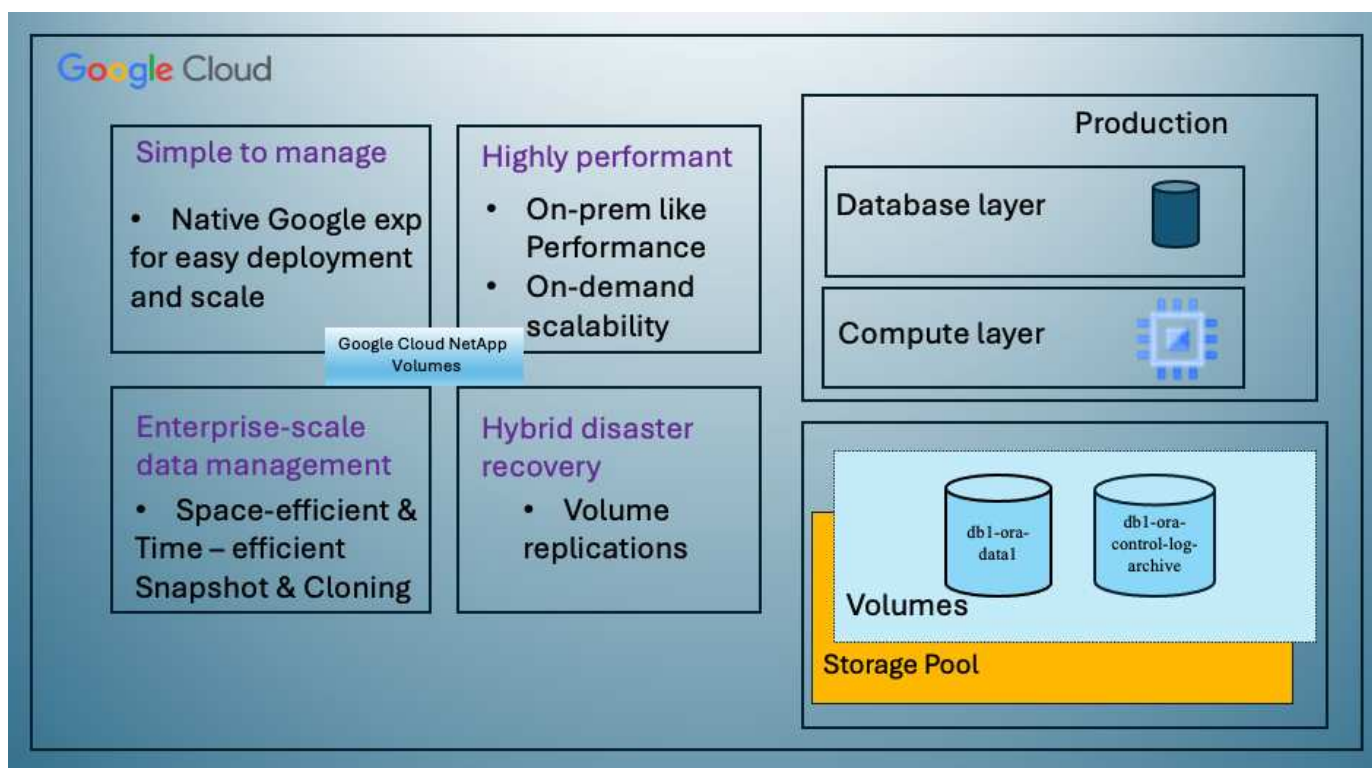
- **Google Cloud NetApp Volumes** is a first-party Google NetApp Volumes is a fully managed, cloud-based

data storage service that provides advanced data management capabilities and highly scalable performance. It's developed by Google and NetApp, a Google partner.

- **Virtual Machines** is an infrastructure-as-a-service (IaaS) offer. You can use compute engine to deploy on-demand, scalable computing resources. Compute Engine provides the flexibility of virtualization but eliminates the maintenance demands of physical hardware. This solution uses [Compute Engine with Oracle Database](#).
- **Google Virtual Private Cloud Virtual Private Cloud (VPC)** provides networking functionality to Compute Engine virtual machine (VM) instances, Google Kubernetes Engine (GKE) clusters, and serverless workloads. VPC provides networking for your cloud-based resources and services that is global, scalable, and flexible.
- **Oracle Database** is a multi-model database management system. It supports various data types and workloads. The dNFS client optimizes I/O paths between Oracle and NFS servers. As a result, it provides significantly better performance than traditional NFS clients.

Key Benefits

This image (Figure 2) shows the benefits of using Google Cloud NetApp Volumes with Oracle Database.



Simple and reliable service

Google Cloud NetApp Volumes operates seamlessly within the Google Cloud, offering a straightforward approach to enterprise storage. As a native service, it integrates naturally with Google Cloud's ecosystem, allowing you to provision, manage, and scale volumes just as you would with other Google Cloud storage options. The service leverages NetApp's ONTAP data management software, providing enterprise-grade NFS volumes specifically optimized for Oracle Database and other critical enterprise applications.

Highly performant systems

Besides using shared and highly scalable storage, Google Cloud NetApp Volumes provides low latency. These factors make this service well-suited for using the NFS protocol to run Oracle Database workloads over

networks.

The Google Cloud compute instances can use high-performance, all-flash NetApp storage systems. These systems are also integrated into the Google Cloud networking. As a result, you get high-bandwidth, low-latency shared storage that's comparable to an on-premises solution. The performance of this architecture meets the requirements of the most demanding, business-critical enterprise workloads. For more information on the performance benefits of Google Cloud NetApp Volumes, see [Google Cloud NetApp Volumes](#).

At its core, Google Cloud NetApp Volumes utilizes a bare-metal fleet of all-flash storage systems, delivering exceptional performance for demanding workloads. This architecture, combined with shared and highly scalable storage capabilities, ensures consistently low latency - making it particularly well-suited for running Oracle Database workloads over NFS protocol.

The integration with Google Cloud compute instances provides access to high-performance. Through deep integration with Google Cloud networking, customers benefit from:

- High-bandwidth, low-latency shared storage
- Performance comparable to on-premises solutions
- Flexible on-demand scalability
- Optimized workload configurations

Enterprise-scale data management

The solution's foundation in ONTAP software sets new standards for enterprise data management. One of its standout features is space-efficient, instantaneous cloning, which significantly enhances development and test environments. The platform supports dynamic capacity and performance scaling, ensuring efficient resource utilization across all workloads.

Snapshot functionality within Google Cloud NetApp Volumes represents a major advancement in database management. These snapshots provide consistent database points with remarkable efficiency. Key advantages include:

- Minimal storage overhead for snapshot creation
- Rapid creation, replication, and restoration capabilities
- Zero performance impact on volume operations
- High scalability for frequent snapshot creation
- Support for multiple concurrent snapshots

This robust snapshot capability enables backup and recovery solutions that meet aggressive Recovery Time Objective (RTO) and Recovery Point Objective (RPO) service level agreements without compromising system performance.

Hybrid DR

Google Cloud NetApp Volumes, delivers comprehensive disaster recovery solutions suitable for both cloud and hybrid environments. This integration supports sophisticated DR plans that work effectively across multiple regions while maintaining compatibility with on-premises datacenters.

The disaster recovery framework provides:

- Seamless cross-location volume replication
- Flexible recovery options

- Consistent data protection across environments

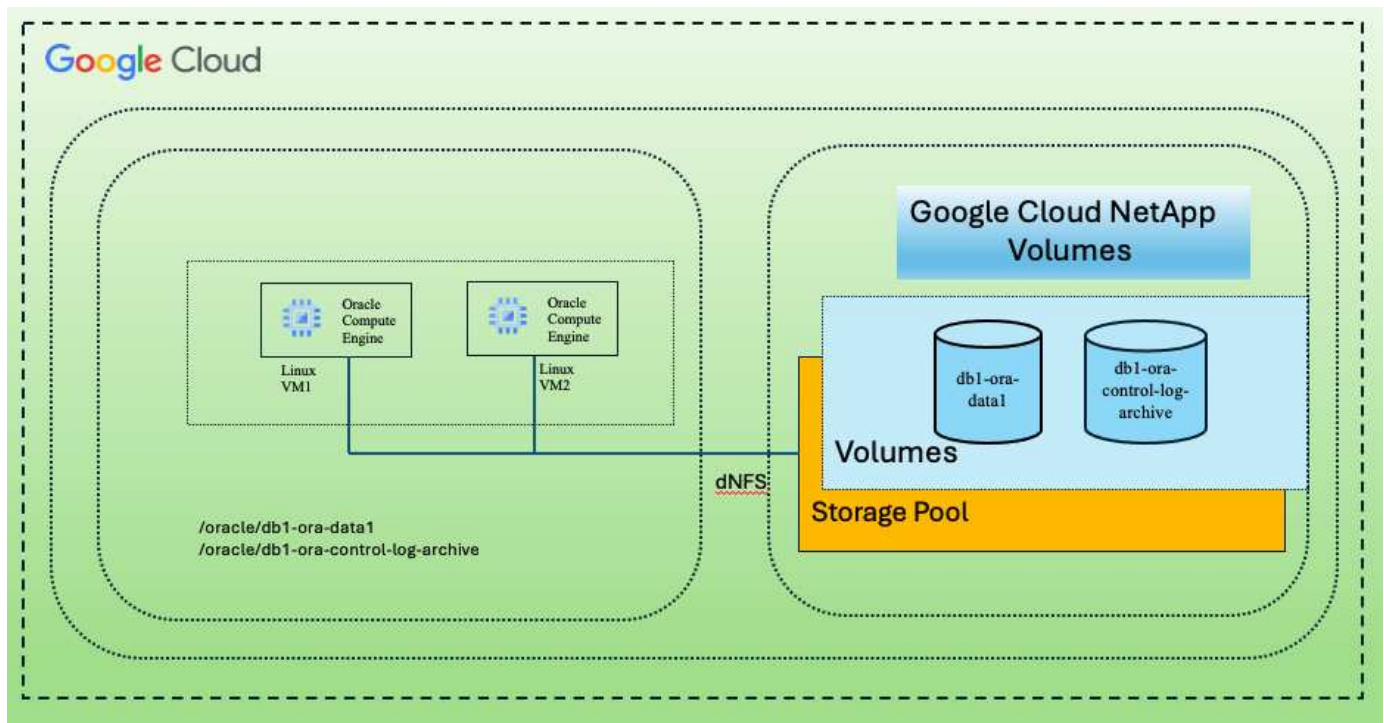
This comprehensive approach to disaster recovery ensures business continuity while maintaining data integrity across all deployment scenarios. The solution's flexibility allows organizations to design and implement DR strategies that align precisely with their business requirements, whether operating entirely in the cloud or in a hybrid environment.

Considerations

The following considerations apply to this solution:

Availability

Google Cloud NetApp Volumes provides enterprise-grade availability through its robust architecture. The service is backed by a comprehensive Service Level Agreement (SLA), which details specific availability guarantees and support commitments. As part of its enterprise-scale data management capabilities, the service offers snapshot functionality that can be effectively utilized in backup and recovery solutions, ensuring data protection and business continuity.



Scalability:

Built-in scalability is a cornerstone feature of Google Cloud NetApp Volumes, as detailed in the highly performant systems section. The service allows dynamic scaling of resources to match changing workload requirements, providing flexibility that traditional storage solutions often lack.

Security:

Google Cloud NetApp Volumes implements comprehensive security measures to protect your data. The security framework includes:

- Built-in data protection mechanisms
- Advanced encryption capabilities

- Configurable policy rules
- Role-based access control features
- Detailed activity logging and monitoring

Cost optimization:

Traditional on-premises configurations typically require sizing for maximum workload requirements, making them cost-effective only at peak usage. In contrast, Google Cloud NetApp Volumes enables dynamic scalability, allowing you to optimize configurations based on current workload demands, thereby reducing unnecessary expenses.

VM Size Optimization:

The service's architecture enables cost savings through VM optimization in several ways:

Performance Benefits:

Low-latency storage access enables smaller VMs to match the performance of larger VMs using ultra disk storage

Network-attached storage can achieve superior performance even with smaller VMs due to reduced I/O limitations

Resource Limitations and Benefits:

Cloud resources typically impose I/O operation limits to prevent performance degradation from resource exhaustion or unexpected outages. With Google Cloud NetApp Volumes:

- Only network bandwidth limits apply, and these affect only data egress VM-level disk I/O limits don't impact performance
- Network limitations are typically higher than disk throughput limitations

Cost-Saving Advantages

The economic benefits of using smaller VMs include:

- Lower direct VM costs
- Reduced Oracle Database license costs, particularly with constrained-code SKUs
- Absence of I/O cost components in network-attached storage
- Overall lower total cost of ownership compared to disk storage solutions

Conclusion

This combination of flexible scaling, optimized performance, and efficient resource utilization makes Google Cloud NetApp Volumes a cost-effective choice for enterprise storage needs. The ability to right-size both storage and compute resources allows organizations to maintain high performance while controlling costs effectively.

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