



Enterprise Database Migration

Migrating Oracle Databases to Google Cloud

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Damon here again. Let's talk about migrating Oracle databases to Google Cloud.

Learning objectives

- Explain why running Oracle on Google Cloud makes sense.
- Review the technical specs of the Bare Metal Solution.
- Define common use cases for running Oracle on Google Cloud.



In this module, you learn why running Oracle on Google Cloud makes sense.

You review the technical specifications of the Bare Metal Solution,

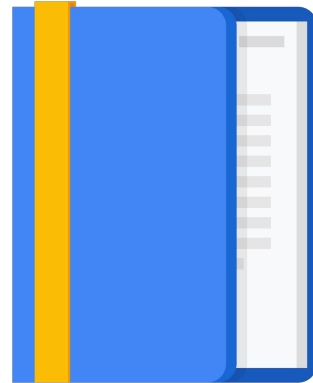
and you define common use cases for running Oracle on Google Cloud.

Agenda

Why Run Oracle on Google Cloud

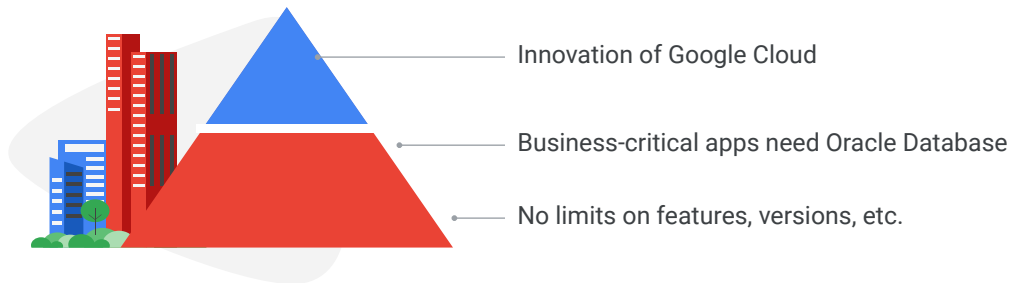
Technical Specs

Use Cases



You may have one or more Oracle servers on-premises and want to migrate them off-premises to the cloud. Google provides an excellent solution for this scenario.

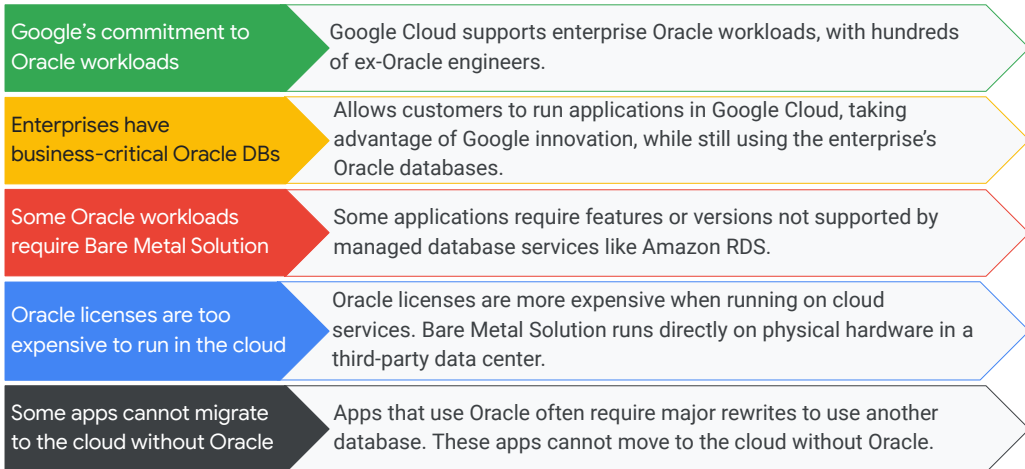
You want the innovation of Google Cloud, but your business-critical apps rely on Oracle with no limitations



You may have existing applications that are heavily dependent on Oracle backends, and uncoupling them might be difficult. Using Cloud SQL or a SQL Server instance may not be an option.

However, you want to benefit from many of Google Cloud's features, such as off-site servers and scalability. Google has a solution that allows you to keep your Oracle database and also migrate to the cloud, with no restrictions or limitations on the Oracle side of things. It is truly a best-of-all-worlds solution.

Bare Metal Solution offers advantages

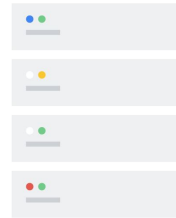


Bare Metal Solution offers many advantages over a traditional on-premises server.

- Google is fully committed to integrating Oracle workloads into its cloud environment and employs many ex-Oracle engineers.
- Many enterprises depend on Oracle databases for their mission-critical applications. Google's solution allows customers to run applications in Google Cloud, taking advantage of Google innovation, while still using the enterprise's Oracle databases.
- Some features of Oracle require bare metal servers. So even though Cloud-based services like AWS RDS support Oracle, many Oracle features are not supported on that service.
- There is also a license penalty when running Oracle on virtual machines. When you use virtualized services like RDS, Oracle charges for licenses by the virtual CPU. That makes the licensing twice as expensive. On Bare Metal Solution, licenses are charged per physical CPU.
- Many times you can't migrate your applications until you also migrate your Oracle database, and moving to a different database might require expensive rewrites that are not practical.

Google's objectives for Oracle workloads

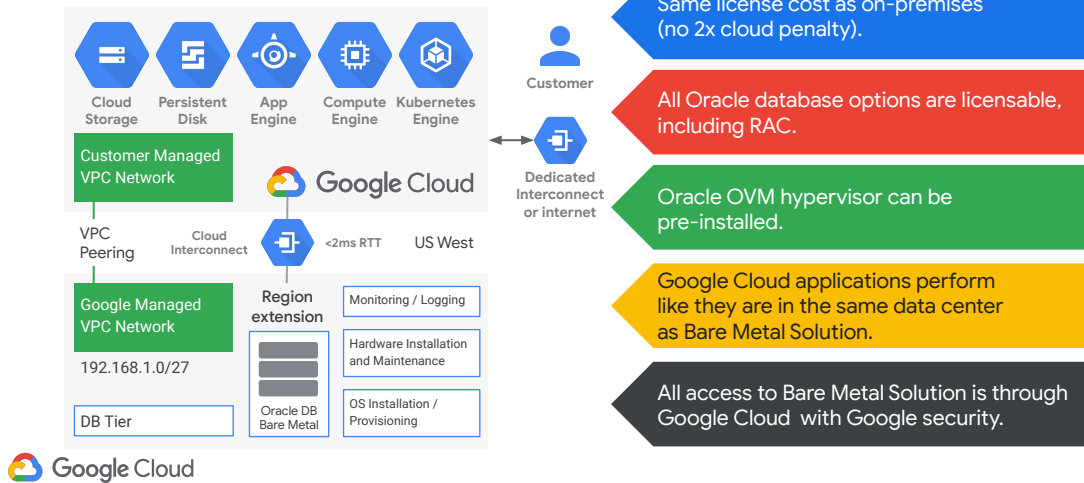
- Support all licensable Oracle database options, including RAC (Real Application Clusters) and Database In Memory.
- Allow all Oracle database features without limits imposed by Cloud managed services.
- Support all applications that use Oracle databases (in Google Cloud or Bare Metal Solution), including SAP on Oracle.
- Avoid 2x license fee penalty imposed on Cloud services by Oracle.
- Provide a solution that is compatible with written Oracle license policies.



Google has several key objectives for Oracle workloads.

- There must be support for all licenseable Oracle database options, including Real Application Clusters and Database In Memory.
- All Oracle database features must be supported without the limits imposed by Cloud-managed services.
- All applications that use Oracle databases, including SAP on Oracle, must be supported.
- There should be no 2x license fee penalty imposed on Cloud services by Oracle.
- Finally, Google's solution must be compatible with Oracle's license policies.

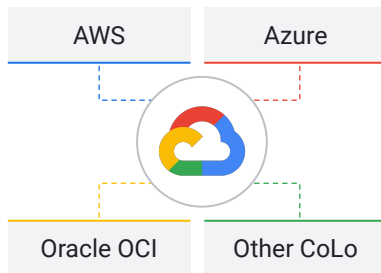
There are no limitations to Oracle on Bare Metal Solution



Bare Metal Solution has no limitations regarding Oracle versions, features, or configurations and has the same license costs as an on-premises server.

Because of the close proximity of the physical Oracle servers to the Google facilities, you get the high performance you would expect as if the servers were in the same data center. Additionally, Google handles the security through Google Cloud.

Bare Metal Solution works with other clouds



- Bare Metal Solution is the only solution that provides a colocation data center with a low-latency (< 2 millisecond RTT) connection to Google Cloud.
- Other vendors (e.g., Equinix) offer high-bandwidth connections to Google Cloud, AWS, Azure, Oracle Cloud, and other offerings.
- If you have an appliance (e.g., Exadata), you can host it in another partner data center or on-premises and have a high-bandwidth network to Google Cloud and Bare Metal Solution.



Bare Metal Solution can also be used by applications running in other clouds.

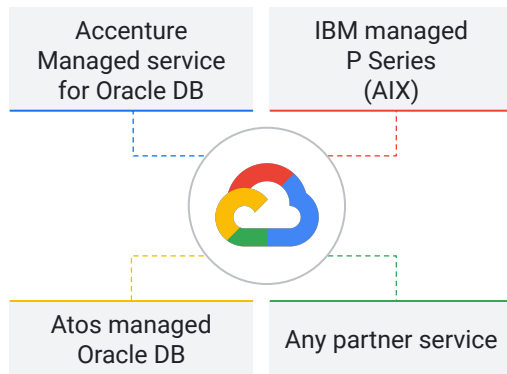
Bare Metal Solution is the only solution that provides a colocation data center with a connection to Google Cloud of less than 2 milliseconds of latency.

Plus, vendors also offer high bandwidth connections to AWS, Azure, Oracle Cloud, and other colocation facilities.

Thus, you can host applications and appliances in another partner data center or on-premises and have a high bandwidth network to Google Cloud and Bare Metal Solution.

Bare Metal Solution works with managed partner services

- Bare Metal Solution provides customer-managed bare metal for Oracle workloads.
- Accenture, Atos, and other partners provide a managed Oracle as a service.
- Non-x86 platforms are also provided by partners (e.g., IBM POWER / AIX).
- The customer signs a separate contract directly with the partner. Costs of managed services are typically higher than self-managed offerings.



Bare Metal Solution leverages other partners for managed Oracle services and hardware.

Other partners like Accenture and Atos provide managed Oracle databases.

non-x86 platforms are offered by partners like IBM.

What about Oracle support and licensing?

- Bare Metal Solution is bare metal in a subprocessor-managed data center, NOT cloud.
 - Hundreds of customers do this with Oracle in Equinix, Atos, Rackspace, etc.
- BullSequana S is officially certified by Oracle.
- The solution meets Oracle's requirements for RAC support.
 - Native storage device supported by the storage vendor (NetApp)
- We recommend engaging a third-party Oracle license compliance firm such as Palisade Compliance.
- Rely on Oracle License Management Services (LMS) or Palisade for licensing policies.
 - Not Oracle sales teams



Because Bare Metal Solution uses Oracle-certified bare metal servers, there is no problem with Oracle licensing and support.

Bare Metal Solution is not a virtualized cloud solution. Thus, all Oracle versions and features are supported.

You need to provide your own Oracle licenses and ensure that you are in compliance.

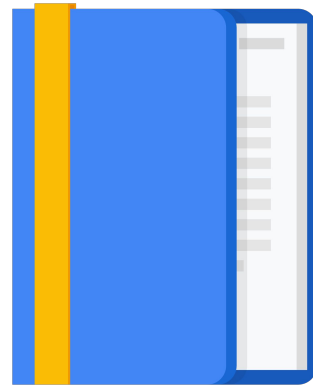
You might consider using a third-party compliance firm to help ensure that you conform to license policies from Oracle.

Agenda

Why Run Oracle on Google Cloud

Technical Specs

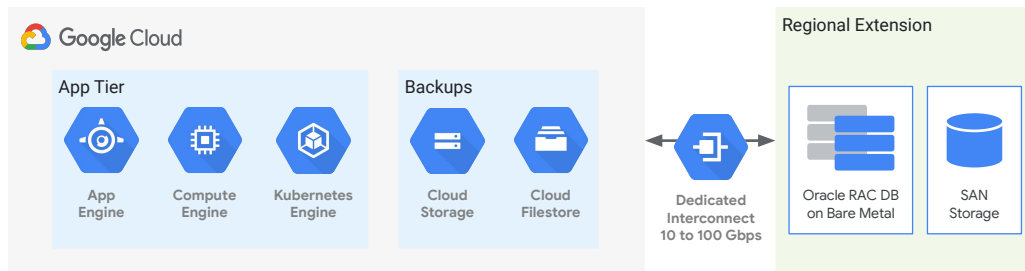
Use Cases



So far we have been talking about running Oracle databases on Google Cloud using Bare Metal Solution.

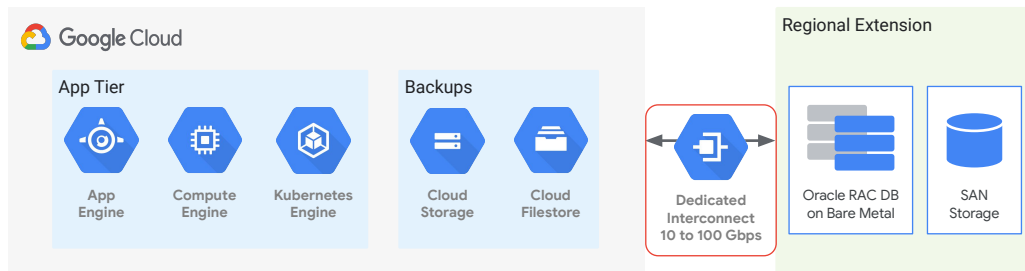
Now, let's look into some of the technical details about how the solution is architected, some of your options, and how you connect to and administer the servers.

Bare Metal Solution provides physical hardware with a high-speed connection to a Google Cloud region



Bare Metal Solution hardware is traditional physical hardware, except it is located close to the Google hardware and has high-speed connections to the Google Cloud region where it's located. This allows the App layer and backups to perform with the same high speed as if they were other Google-provided database solutions.

Bare Metal Solution provides physical hardware with a high-speed connection to a Google Cloud region



The Oracle servers are housed in a Google partner data center. A high-speed interconnect is set up between the partner and your Google region with less than 2-millisecond latency between them.

You select the operating system to be pre-installed on your machines

- Operating system choices include:
 - Red Hat Linux 7.7, 8.1
 - Oracle Linux 7.7
 - SUSE 15
 - Windows 2016 Enterprise, 2019 Enterprise
 - Other versions of Windows and Linux can run in a hypervisor
- Hypervisors can be pre-installed
 - Oracle OVM 3.4.6 or Oracle OLVM
- OS and hypervisors are configured, managed, licensed, and patched by the customer.
- Bring your own license.



You can create an Oracle server just like you would on-premises.

- You can choose the operating system you want on your bare metal servers when you place the order. Red Hat, Oracle Linux, SUSE, and Windows are all supported.
- You can also choose whether to install hypervisors. If you do, you can also run other operating systems.
- You manage and patch your machines as you would on-premises.
- You bring your own existing licenses.

Select the server configuration that meets your database workload

Compute Machine Type	Monthly Price* (3 Year CUD)
16 Cores, 384-GB RAM Xeon Gold 3.2GHz	\$2,000
24 Cores, 768-GB RAM Xeon Gold 3.0GHz	\$2,400
56 Cores, 1,536-GB RAM Xeon Platinum 2.2GHz	\$3,400
112 Cores, 3,072-GB RAM Xeon Platinum 2.7GHz	\$6,800

***Pricing for Bucket I locations, (Bucket II to have a 10% premium)**

Bucket I: Virginia, Los Angeles, Frankfurt, London, Netherlands, Sydney, São Paulo

Bucket II: Tokyo, Singapore

(Pricing subject to change)



You can choose the hardware that fits your needs. Several standard machine configurations are supported. These servers use the latest hardware and CPUs. Details are in the table shown here, but check the documentation for the latest specs and pricing.

Data storage is tuned for Oracle

- Storage is provisioned and tuned as per NetApp's best practices for Oracle database.
- Single capacity-driven metric for simplified sizing:
 - Customer specifies desired IOPS, storage requirements, and LUN configuration.
 - Quality of Service assurances of up to 400,000 IOPS.
- Use Cloud Storage for low-cost blob storage and backups.
- All data over the network and at rest is encrypted.
- Coming soon: protocol support for NFS and CIFS

Storage Type	Monthly Price (3 Year CUD)
All Flash NVMe Storage/TB	\$115
All Disk Storage/TB	\$60



Data Storage uses NetApp best practices for tuning the storage. You specify your desired IOPS, storage requirements, and LUN configuration. Up to 400,000 IOPS is guaranteed.

You should use Cloud Storage for low-cost blob storage and backups.

All data is encrypted at rest and over the network.

Use Cloud Storage for inexpensive backup storage

- Backups can be stored in inexpensive Cloud Storage buckets, including Coldline and Archive storage classes.
- Automated periodic snapshots for database binaries and OS
 - Daily snapshots with three-day retention
 - Weekly snapshots with one-month retention
- Local disk-based storage for hot backups and blobs
- Use the Oracle backup tool of choice (RMAN, etc.)



Cloud Storage



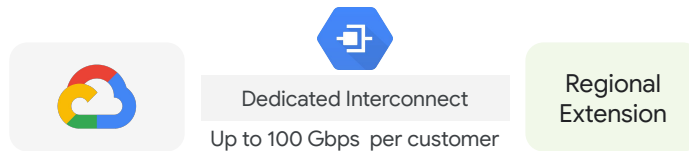
You can backup your databases to Cloud Storage for an inexpensive solution. You pick which Cloud Storage class makes sense for your backups. You can automate snapshots for the database binaries and OS and set a retention period in Cloud Storage, and you can use lifecycle rules to automatically clean up storage over time.

Hot backups can be written to local disk-based storage.

You can use any traditional Oracle backup tool.

Dedicated Interconnect provides high-speed connection from regional extension to Google

- Interconnect between Google Cloud and Region Extension: \$247.00/month per 10 Gbps.
 - Up to 100 Gbps
- Network egress between Google Cloud and the Regional Extension is free.
- Network egress for data that leaves a Google Cloud region is billed at normal egress rates.

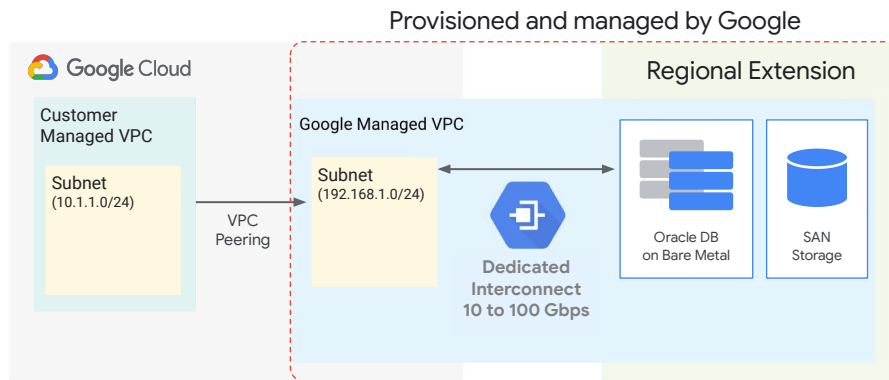


There is a dedicated high-speed interconnect between the Google data center and the regional extension where the Oracle machines are located.

You choose how fast your interconnect has to be. Interconnect between Google Cloud and the Regional Extension costs \$247.00/month per 10 Gbps, up to 100 Gbps.

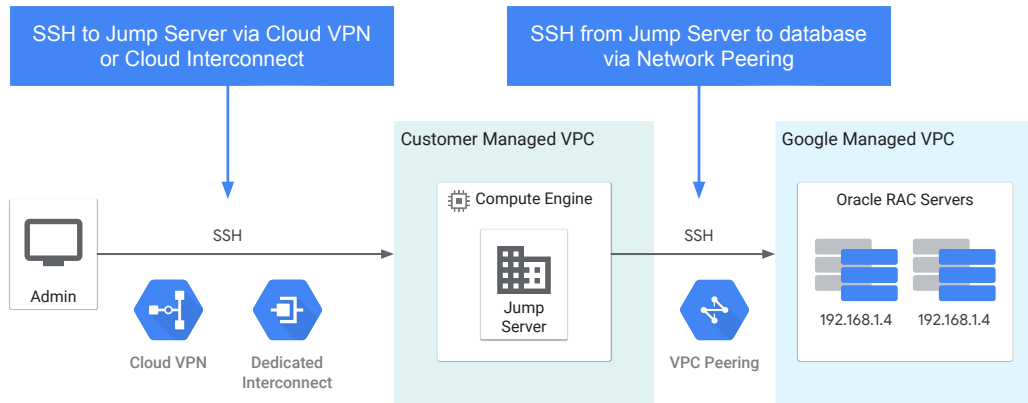
Network egress between Google Cloud and the Regional Extension is free, and egress for data that leaves a Google Cloud region is billed at normal egress rates.

You create a VPC and peer it to a Google-managed VPC for communication to the database



Clients connect to your Oracle instance via a Google-managed VPC. As you did in an earlier lab, a network peering is created between your Google Cloud VPC and a Google-managed VPC that provides access to the bare metal servers.

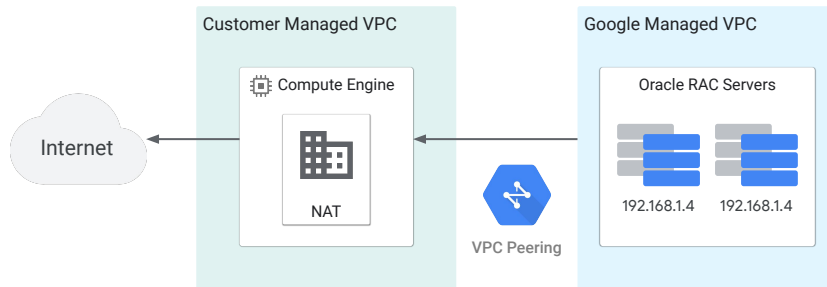
Access your Oracle Bare Metal Servers using a jump server (Bastion host) in your VPC



Connect to a jump server in your customer managed VPC via SSH through Cloud VPN or a Dedicated Interconnect.

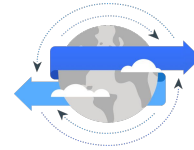
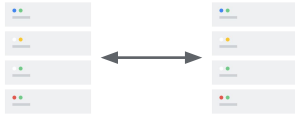
From the jump server, you can use SSH to connect to your Oracle servers through the VPC peering provided by Google. Google will provide the IP addresses and connection information to your servers. You can request specific IP address ranges when placing the order for the servers.

Use a NAT to provide access from the bare metal servers to the internet



If the Oracle server needs access to the internet, that can be provided through NAT. The Oracle servers themselves have no internet access or external IP addresses.

Use the most appropriate tool for migrating data to Bare Metal Solution



Oracle Native Migration Tools	Google Native Migration Tools	Partners
<ul style="list-style-type: none">• RMAN Data Pump• Transportable Tablespaces• Data Guard/Active Data Guard• GoldenGate	<ul style="list-style-type: none">• Oracle backup → Cloud Storage bucket• Oracle backup → Google Transfer Appliance → Cloud Storage bucket• Bare Metal Solution servers can be configured to connect to Cloud Storage buckets	<ul style="list-style-type: none">• Leverage partner for lift and shift tools• Striim for live data migration• Customers often have their own migration scripts and procedures

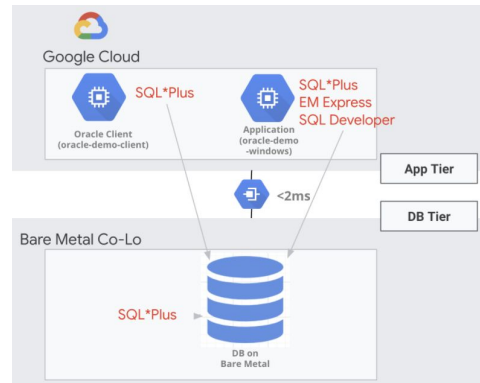


Use the most appropriate tool for migrating data to Bare Metal Solution.

- To get your data into the Oracle server, you can use a variety of tools, such as Oracle-native tools you may be familiar with already.
- Google-provided tools can also be used to move Oracle backups into Cloud Storage buckets. Depending on how much data you have, you can use Google's Storage Transfer Service. For very large amounts of data, you can order a Transfer Appliance.
- You can even use third-party partner tools if they offer a better solution than Oracle or Google provides. Striim is a commonly used third-party migration tool, or maybe you've written one yourself that will do the job.

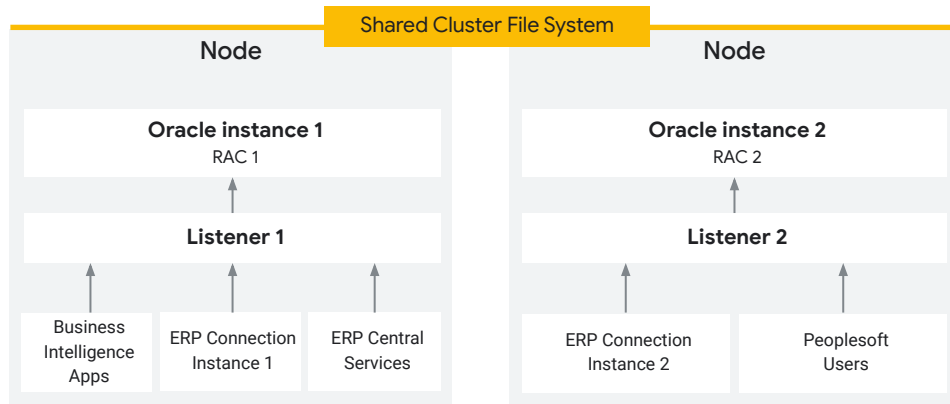
All Oracle tools, features, and options are available and work the same as on-premises

- Connect to Oracle using preferred tools:
 - Sqlplus client
 - SQL Developer/Toad
 - Oracle Enterprise Manager
 - Etc.
- Connect from any VM in your VPC using SSH or RDP.
- Create new applications using Google Cloud services and connect them to your Oracle Database.
- View Oracle OS processes and alert logs.



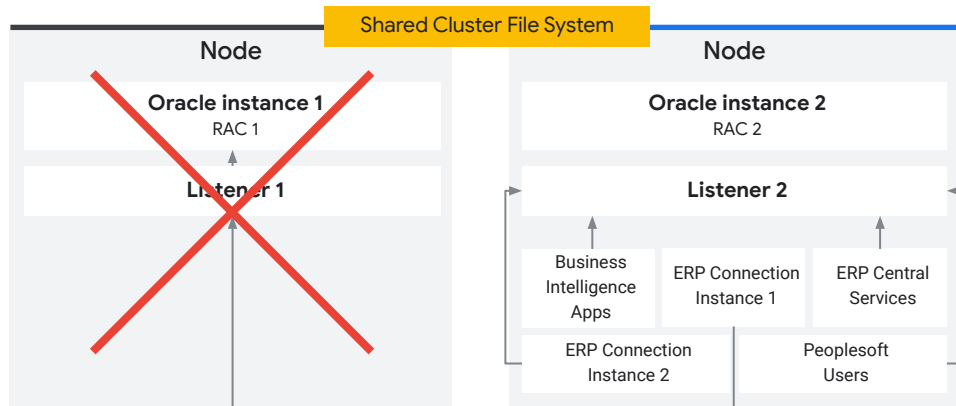
All your familiar tools can be used to connect to the Oracle server just as if it were on-premises. You can connect any VM in your VPC, using either SSH or RDP. You can also create new applications using managed services and connect them to your Oracle server. You can monitor the Oracle processes and logs with standard methods.

Oracle Database RAC (Real Application Clusters) can be configured for high availability



You can even configure Oracle Database RAC if you need high availability. It's exactly like doing it with your own hardware.

RAC provides automatic failover if a node crashes



RAC provides an automatic failover if your node crashes.

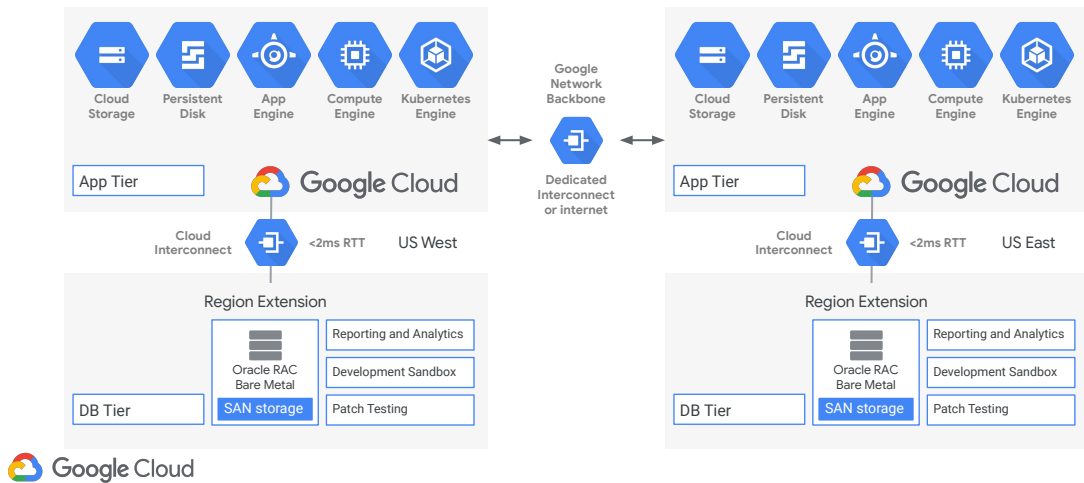
Oracle RAC on Bare Metal Solution

- ↓ [RAC cannot run on cloud-managed database solutions in AWS or Azure.](#)
RAC infrastructure can be configured when setting up the bare metal servers
- ↓ [RAC + Google Cloud HA and DR is a very reliable solution.](#)
Superior to on-premises capabilities. Failover, rolling patches, scale-out.
- ↓ [Bare Metal Solution is compatible with the requirements of RAC.](#)
Bare Metal Solution has native shared storage supported by the storage vendor (NetApp).
- ↓ [RAC can provide higher uptime](#)
Default SLA for Bare Metal Solution is 99.9%. Bare Metal Solution + RAC + a DR site can provide very high availability.



Because the Bare Metal Solution runs on physical machines and has shared storage provided by NetApp, RAC can run just like it would on your own hardware. This can't be done running Oracle in AWS or Azure. This allows you to create a highly available cloud-based Oracle solution.

Deploy to multiple regions for disaster recovery



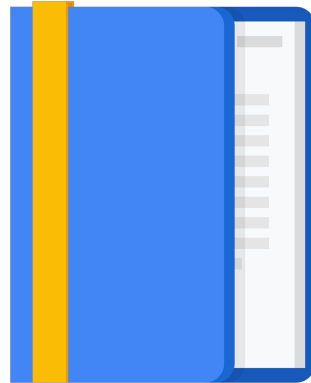
To make your disaster recovery solution even more robust, you can deploy the RAC to multiple regions.

Agenda

Why Run Oracle on Google Cloud

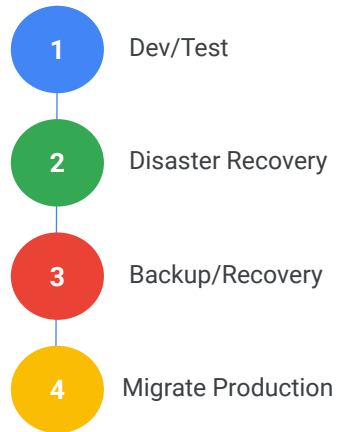
Technical Specs

Use Cases



Now that you understand the technical details, let's explore some use cases.

Use cases for running Oracle on Bare Metal Solution



There are many use cases for running the Oracle on Bare Metal Solution. These include development and test environments, disaster recovery, backup and recovery, and cloud migration.

Dev/Test

Sandbox Testing

- Try new features and functionality (e.g., Multitenant)
- Integration with Google Cloud (BigQuery, ML, Containers)
- Modernization and migration testing

Application Development

- Increased productivity
- Give developers flexibility and performance
- Iterate faster

Patching and Upgrades

- Upgrades (12c, 18c, 19c)
- PSUs, RUs, RURs, and critical one-off patches
- Zero or Near-zero downtime patching and upgrade testing



Instead of building out a physical server on-premises for development and testing, you can build out what you need on the cloud and use it for however long you need. This allows you to prototype and test out building Google Cloud solutions.

- The cloud can provide a great environment for testing and a sandbox for research and development.
- Application developers can use the cloud for increased productivity, flexible resource allocation, and faster development cycles.
- You can also use the cloud as a safe place for testing patches and new versions before putting them in production.

Disaster Recovery

On-premises to Google Cloud

- Leverages Google Cloud native cloud features and Oracle functionalities
- Platform for migration of applications to Google Cloud
- Back up databases to Cloud Storage; restore to Bare Metal Solution

Cross-Region

- Geographic separation and isolation
- Zero or near-zero downtime patching and upgrade testing
- Ensures governance and business continuity

Audit and Testing

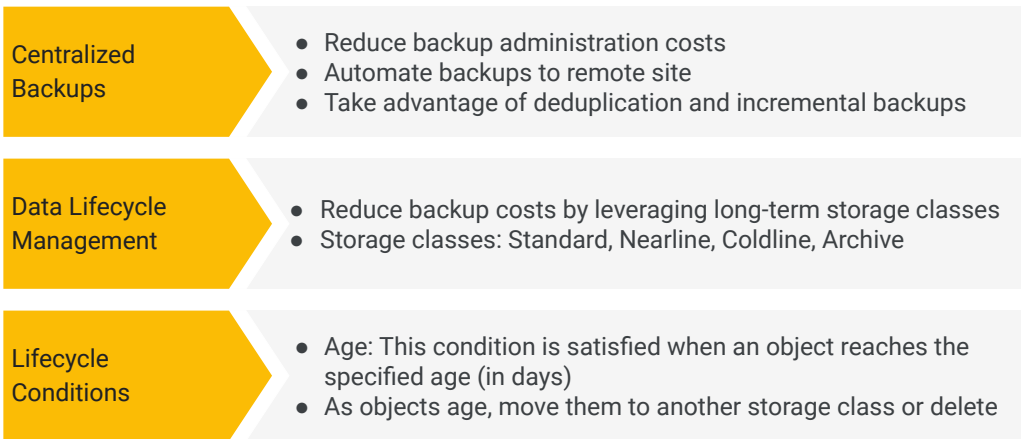
- Periodic testing of regular disaster recovery activities
- Instantiate and validate backups on a regular basis



Disaster recovery is also simplified in the cloud.

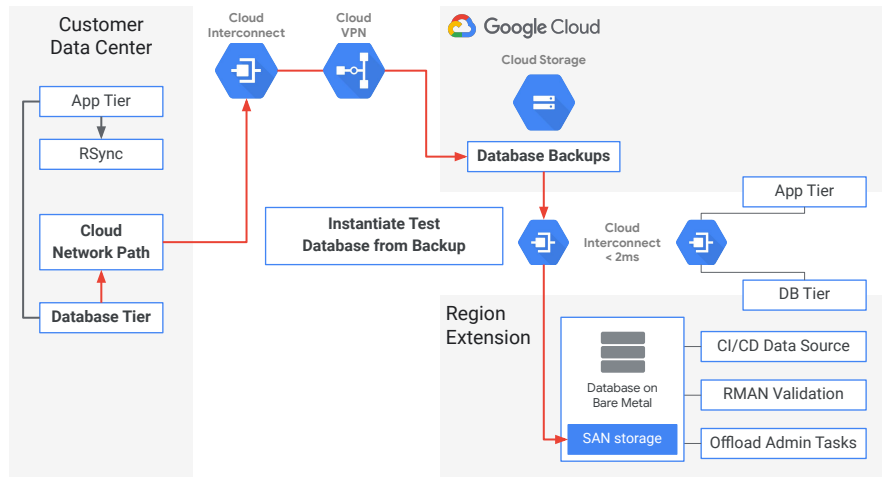
- You can deploy Oracle in the cloud to get Oracle functionality combined with Google Cloud cloud features, and back up and restore the databases to Cloud Storage.
- You can create a cross-region solution that provides greater protection against failure in a single region.
- It is also easier to periodically test and validate the backups.

Backup/Recovery



- Backups can be centralized and stored in Google Cloud Storage buckets. Use the appropriate storage class to reduce costs.
- Automating the backups and taking advantage of deduplication and incremental backups reduces admin costs. Plus, when you need to recover, there is lower latency, which means you can afford to do more frequent validation of your backups to ensure DR readiness.
- Leverage lifecycle rules in Cloud Storage to move objects to different storage classes as they age. At some point, backups become so old you would never restore them. You can also use lifecycle rules to delete them.

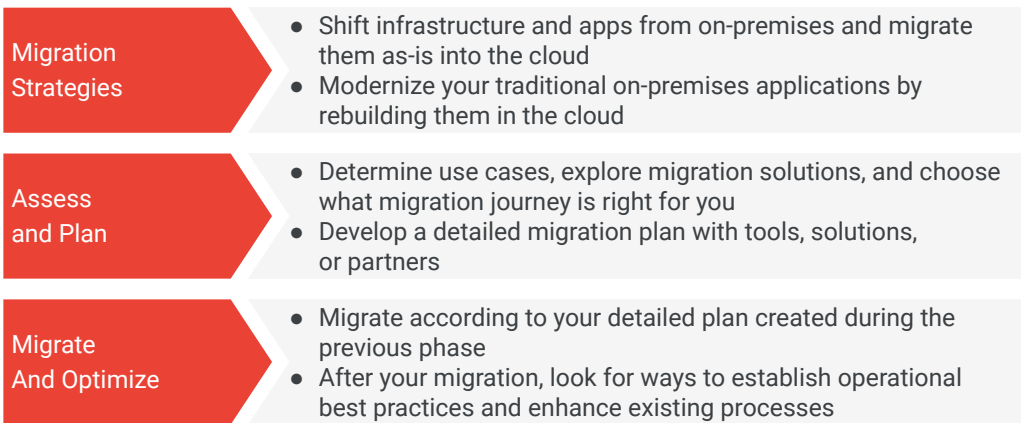
Flow for hybrid backup and recovery



For hybrid scenarios, you may be running your production workloads on-premises, but you can securely copy your backups into the cloud using a Cloud Interconnect or VPN connection, depending on the amount of bandwidth required.

Use a Bare Metal Solution in a regional extension to run a test database, or in the event of a disaster, use it to spin up a failover server.

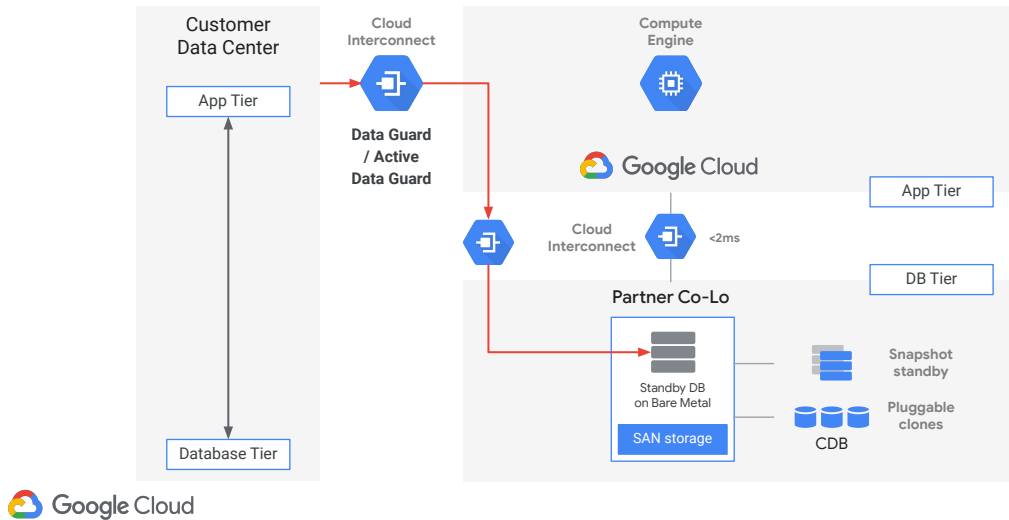
Migrate Production to Cloud



Another use case is to move away from an on-premises Oracle server to host it in the cloud. Then you can continue to run your traditional apps as-is but also start to develop new cloud-based apps to leverage Google's innovations.

- There are many options for migrating, so it is a good idea to develop a detailed migration plan and pick the tools that work best for you.
- Follow Google's Cloud Migration process. Start with a detailed assessment and develop a detailed migration plan with tools, solutions, or partners.
- Then, automate your migration. After your migration, look for ways to establish operational best practices and enhance existing applications by moving to a microservice architecture that leverages managed cloud services.

Use Oracle Data Guard for native database replication

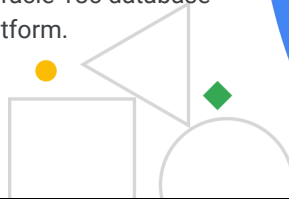


During the migration phase, you will probably need to replicate your on-premises Oracle databases with your databases running in Bare Metal Solution. You can use Oracle Data Guard for native database replication.

Lab intro

Deploying the Oracle on Bare Metal Solution

- Configure VPC network peering between projects.
- Download the Oracle 18c Installer from the Oracle Technology Network.
- Install an Oracle 18c Database on a Bare Metal Server.
- Verify connectivity to the Oracle 18c database from Google Cloud's AI Platform.



This lab demonstrates what you will need to do when managing an Oracle database running on the Bare Metal Solution. This is a simulation in that there is no bare metal server for you to connect to. Rather, you will install Oracle on a virtual machine. The lab architecture does replicate closely what you would do in a real BMS environment however.

In this lab, you configure a VPC network. You download and install Oracle 18c on a Bare Metal Solution server and connect to it from Google Cloud.

Lab review

Deploying the Oracle on Bare Metal Solution

In this lab, you:

- Configured VPC network peering between projects.
- Downloaded the Oracle 18c Installer from the Oracle Technology Network.
- Installed an Oracle 18c Database on a Bare Metal Server.
- Verified connectivity to the Oracle 18c database from Google Cloud's AI Platform.



In this lab, you configured VPC network peering between projects.

You downloaded the Oracle 18c Installer from the Oracle Technology Network, and installed an Oracle 18c Database on a simulated Bare Metal Server.

Lastly, you verified connectivity to the Oracle 18c database from Google Cloud's AI Platform.

Module review



In this module, you:

- Learned why running Oracle on Google Cloud makes sense.
- Reviewed the technical specifications of the Bare Metal Solution.
- And defined common use cases for running Oracle on Google Cloud.

