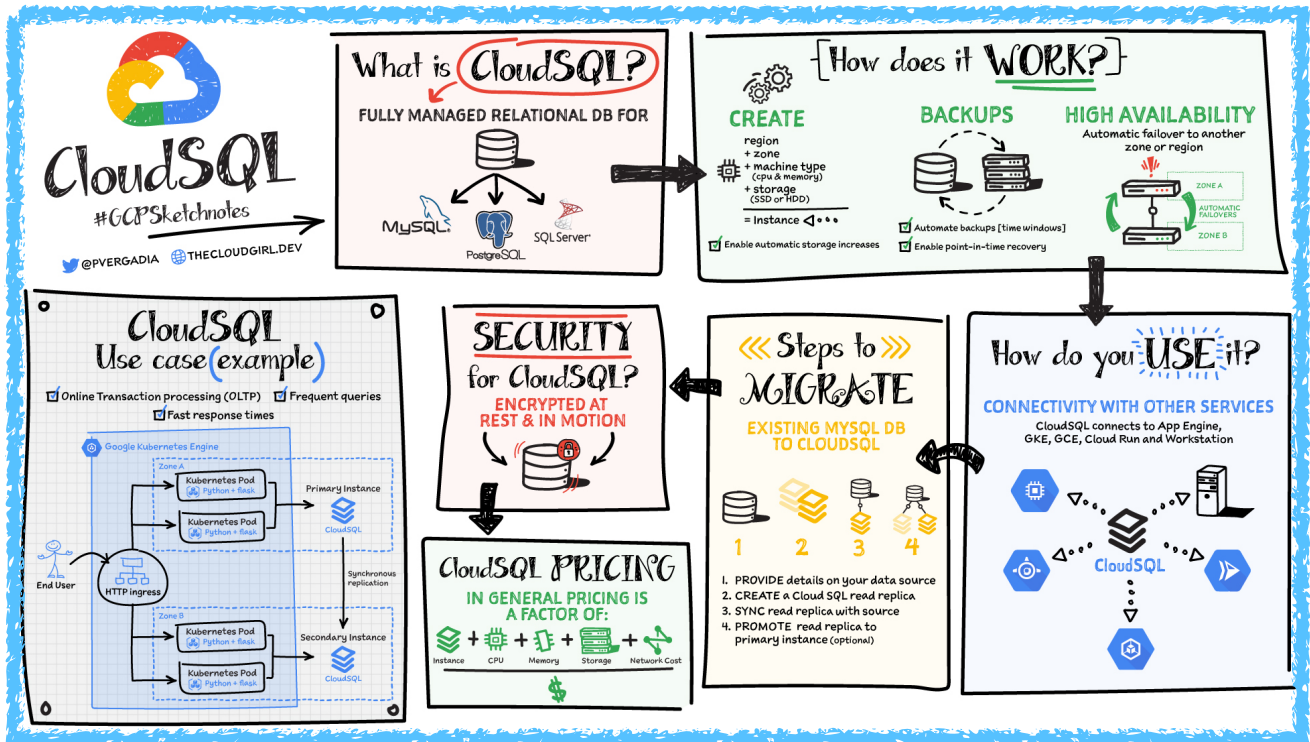


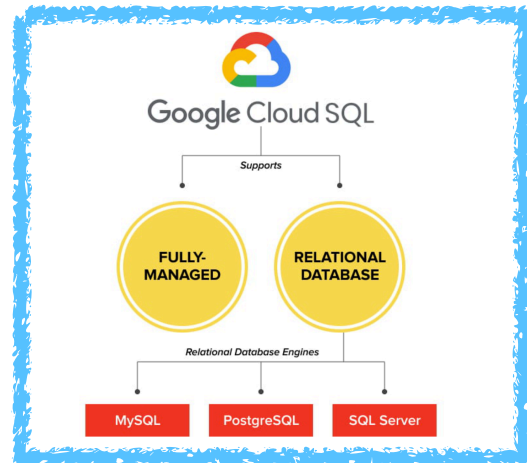
Overview on Google Cloud SQL

- Cloud SQL is Google Cloud's fully managed relational database service for MySQL, PostgreSQL, and SQL Server with rich extension collections, configuration flags, and developer ecosystems.



- It is a server-based service. It provides full compatibility with the source database engines while reducing operations costs by automating database provisioning, storage capacity management, and other time-consuming tasks.
- Cloud SQL has built-in features to ensure business continuity with reliable and secure services, backed by a 24/7 SRE team providing a 99.95% SLA for the service.
- Cloud SQL automatically ensures your databases are reliable, secure, and scalable so that your business continues to run without disruption.
- Can access and manage instances through a command-line interface or a web console without difficulty.
- A Cloud SQL instance has three main components that may need to be scaled: **storage**, **CPU** and **RAM**.

- Lift & shift above database - Migration technique.
- Machine type
 - Shared core
 - Lightweight
 - Standard
 - High memory
- Storage type
 - **SSD** - Most popular choice. Lower latency than HDD with higher QPS and data throughput.
 - **HDD** - Lower performance than SSD with lower storage rates.
- Storage up to 10 - 65,536 GB.
- Scale up to 96 vCPU cores & 624 GB Memory
- No Horizontal Scaling
- Data is encrypted with Google managed key or Customer Managed Encryption Key (CMEK)
- Easy integration with your workstation, as well as other google services like App Engine, Compute Engine, Kubernetes, and BigQuery.
 - JDBC, ODBC connections — API client library
- Cloud SQL used for storing Transactional database like E-commerce, CRM kind application backend.
- No maintenance & auto update
- It is fully integrated with Google Cloud's privacy features and SQL security. It is easy to set up, maintain, and manage.
- Cloud SQL does cross-region replication that reduces operational overhead.
- Cloud SQL automates - Backups, Replication, and failover to ensure your database is reliable, highly available, and flexible to your performance needs.
 - Back-up Database



- On-demand Backup
- Automated backup
- Database Migration Service (DMS) makes it easy to migrate your production databases to Cloud SQL with minimal downtime.
 - This serverless offering eliminates the hassle of manually provisioning, managing, and monitoring migration-specific resources.
- Easily configure replication and backups to protect your data.
 - Export data to
 - gcloud utility or Cloud Console
 - In SQL/CSV format.
 - Import data
 - gcloud utility or Cloud Console
 - In SQL/CSV format.

Architecture	Outage	Cloud SQL Solution	Recovery Point (RPO)	Recovery Window (RTO)
Single Instance	Transient Instance Failure	Reboot	Zero	Minutes
	Rows deleted/ table dropped etc	Backup & recovery + PITR	Seconds/Mins based on last available backup + PITR	Minutes to hours
High Availability	Instance Failure	HA Deployment across Zones	Zero	Minute
	Zone Failure	HA Deployment across Zones	Zero	Minutes
Disaster Recovery	Region Failure	Cloud SQL cross region replicas	Seconds	Minutes

*PITR = Point-in-time recovery

- Automatic Failover among the many physical locations where data is replicated is automatic. So, even if there is a major failure, your data is secure, and your database is available.
- Greater durability and availability of data which is replicated in various geographic locations.

- Availability of instances in Asia, EU and the US.

Supported Database service

- MySQL

- Provided by Oracle
- It is an open-source, fully-managed, relational database management system used for cloud app development and deployment.

- PostgreSQL

- Provided by PostgreSQL Global Development Group
- PostgreSQL is a free, open-source, advanced relational database management system that can handle web services supporting many users at the same time.
- It focuses on extensibility and is referred to as enterprise-class RDBMS.

- SQL Server

- Provided by Microsoft
- SQL Server is a relational database management software product that helps store and extract data when requested by the applications.

Unsupported Database service

- Oracle

- Provided by Oracle
- Move oracle workload to **Bare Metal Solution**. It provides a secure environment in which you can run the specialized workloads on high performance bare metal servers.

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Features of Google Cloud SQL

Fast & easy migrations	<ul style="list-style-type: none">• Database Migration Service makes it easy to migrate databases from on-premises, Compute Engine, and other clouds to Cloud SQL with minimal downtime.
Secure access and connectivity	<ul style="list-style-type: none">• Cloud SQL data is encrypted when on Google's internal networks and when stored in database tables, temporary files, and backups.• Cloud SQL supports private connectivity with Virtual Private Cloud (VPC), and every Cloud SQL instance includes a network firewall, allowing you to control public network access to your database instance.
Built-in high availability	<ul style="list-style-type: none">• Replicate your instance to another zone or region with just a click of a button.• Leverage built-in HA to provide isolation from many types of infrastructure hardware, and software failures.
Scalability	<ul style="list-style-type: none">• Easily scale up as your data grows—add processor cores, RAM and storage, and scale out by adding read replicas to handle increasing read traffic.• Read replicas support high availability, can have their own read replicas, and can be located across regions and platforms.

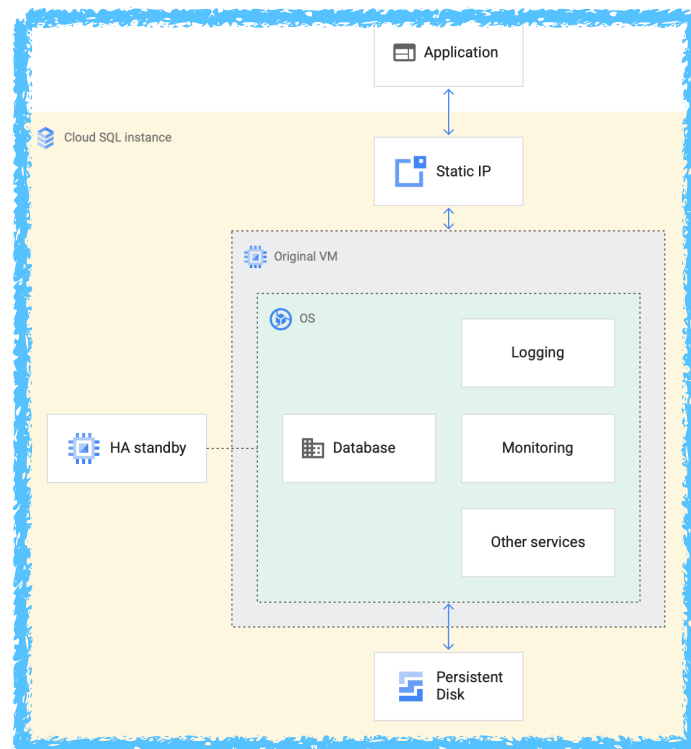
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Automatic storage increases	<ul style="list-style-type: none"> Cloud SQL can automatically scale up storage capacity when you are near your limit.
Cloud SQL Insights	<ul style="list-style-type: none"> Quickly understand and resolve database performance issues on Cloud SQL. Pre-built dashboards and visual query plans help developers identify the root cause of problems. Access database metrics and traces in existing tools using OpenTelemetry. Monitor databases through the lens of the application using query tags.
High performance	<ul style="list-style-type: none"> Cloud SQL supports performance-intensive workloads with very high IOPS and no extra cost for IO.
Easy integration	<ul style="list-style-type: none"> Access Cloud SQL instances from just about any application. Easily connect from App Engine, Compute Engine, Google Kubernetes Engine, and your workstation. Open up analytics possibilities by using BigQuery to directly query your Cloud SQL databases.
Real-time change data capture and replication	<ul style="list-style-type: none"> Synchronize data across heterogeneous databases, storage systems, and applications reliably and with minimal latency with Datastream.

Automatic backups	<ul style="list-style-type: none"> Automate daily backups and binary logging (for replication or point-in-time recovery).
Point-in-time recovery	<ul style="list-style-type: none"> Restore your instance to its state at an earlier point in time.
Compatibility	<ul style="list-style-type: none"> Build and deploy for the cloud faster because Cloud SQL offers standard MySQL, PostgreSQL, and Microsoft SQL Server databases, ensuring application compatibility.
Standard APIs	<ul style="list-style-type: none"> Build and deploy for the cloud faster because Cloud SQL offers standard MySQL, PostgreSQL, and SQL Server databases, ensuring application compatibility. Use standard connection drivers and built-in migration tools to get started quickly.

What is a Cloud SQL instance

- Each Cloud SQL instance is powered by a virtual machine (VM) running on a host Google Cloud server.
- Each VM operates the database program, such as MySQL Server, PostgreSQL, or SQL Server, and service agents that provide supporting services, such as logging and monitoring.
- The high availability option also provides a standby VM in another zone with a configuration that's identical to the primary VM.
- The database is stored on a scalable, durable network storage device called a persistent disk that attaches to the VM.



- A static IP address sits in front of each VM to ensure that the IP address an application connects to persists throughout the lifetime of the Cloud SQL instance.

79. Lab on Creating SQL Instance(PostgreSQL) - Console

80. Lab on Connecting to Cloud SQL Instance

81. Lab on Allow Whitelisting in Cloud SQL Instance

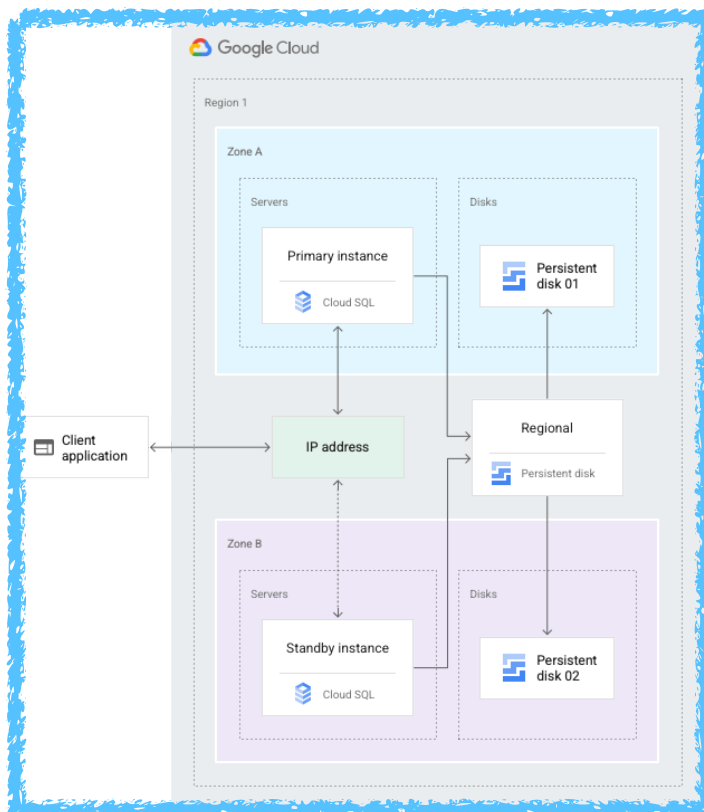
82. Lab on Creating SQL Instance(PostgreSQL) - CLI

83. Lab on Import and Export Data files from Cloud SQL to Cloud Storage

84. Lab on Cloud SQL Failovers[Contd.]

Automatic/Manual Failover in Cloud SQL

- The purpose of an High Availability (HA) configuration is to reduce downtime when a zone or instance becomes unavailable.
- This might happen during a zonal outage, or when an instance runs out of memory. With HA, your data continues to be available to client applications. The HA configuration provides data redundancy.
- A Cloud SQL instance configured for HA is also called a regional instance and has a primary and secondary zone within the configured region. Within a regional instance, the configuration is made up of a primary instance and a standby instance.
- After a failover, the instance that received the failover continues to be the primary instance, even after the original instance comes back online.



Over the life of a Cloud SQL instance, two kinds of updates can occur:

- Configuration updates, which are done by the user.
- System updates, which are performed by Cloud SQL.

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Cloud SQL pricing

Cloud SQL pricing varies with your configuration settings, and depends on

- How much storage you provision, in GiB per month
- How many CPUs you select for your Cloud SQL instance
- How much memory you select for your Cloud SQL instance
- Where you choose to host your data
- How much network traffic leaves your instance
- How many IP addresses you assign and use
- Pricing for Cloud SQL depends on your instance type.

- MySQL and PostgreSQL

- Cloud SQL pricing is composed of the following charges:
 - CPU and memory pricing
 - Storage and networking pricing
 - Instance pricing

- SQL Server

- Cloud SQL for SQL Server is composed of the following charges:
 - CPU and memory pricing(same as MySQL and PostgreSQL)
 - Storage and networking pricing(same as MySQL and PostgreSQL)
 - Licensing

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Benefits of Google Cloud SQL

The benefits of choosing Google Cloud SQL are manifold. Some of which include:

- Less Maintenance Cost

- Being attributed as fully-managed, you do not have to worry about the maintenance of the application data.
- This gives you the flexibility to focus on improving your cloud applications, i.e., framing strategies that give you a competitive edge.

- Ensure Business Continuity

- Cloud SQL ensures data backup and recovery.
- In case of any disaster, you can easily retrieve the application data and continue operations without worrying interruptions.

- Ensures Security and Compliance

- Cloud SQL provides data encryption and firewall protection.
- It is a secure RDBMS service that focuses on providing private connectivity through authentication and user-controlled network access.
- Google service is compliant with SSAE 16, ISO 27001, PCI DSS, and HIPAA.

- Easy-Setup

- The standard connection drivers and migration tools enable you to set up your first Google database app within minutes.
- Google's easy-to-use SQL service provides a hassle-free first-time experience.

- Automated Tasks

- Cloud SQL supports automatic task management to ensure you can focus on scaling your business on the go.

- It is storage management, backup or redundancy management, undergoing updates, capacity management, or providing data access, the Google service offers it all.

- Easy Integration

- Google provides easy access to cloud SQL instances and ensures easy integration with Kubernetes Engine, App Engine, and Compute Engine.

Google Cloud SQL — Advantages and Disadvantages

Prominent advantages of choosing Google Cloud SQL:

- Easy to create and is user-friendly
- Enables automatic data encryption
- Supports well-built APIs, which ensures easy access
- Data replication across locations
- Daily automatic backup
- Automatic failover (moving an application to a standby Google Cloud SQL server in case an instance fails)

Prominent disadvantages of choosing Google Cloud SQL:

- Limited databases vendors availability
- Google Cloud SQL increases as you scale operations
- You cannot customize an instance's IP
- latency issues.

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