# Cloud SQL features

This page describes the major features and capabilities of Cloud SQL. Cloud SQL is available for MySQL (#mysql), PostgreSQL (#postgres), and SQL Server (#sqlserver).

## Cloud SQL for MySQL

### Features

- Fully managed MySQL Community Edition databases in the cloud.
- Second Generation instances support MySQL 5.6 or 5.7, and provide up to 416 GB of RAM and 30 TB of data storage, with the option to automatically increase the storage size as needed.
- First Generation instances support MySQL 5.5 or 5.6, and provide up to 16 GB of RAM and 500 GB of data storage.

**Note:** Second Generation is replacing First Generation; support for First Generation instances ends January 30, 2020. To upgrade a First Generation instance to Second Generation, see Upgrading a First Generation Instance to Second Generation (https://cloud.google.com/sql/docs/mysql/upgrade-2nd-gen).

- Create and manage instances in the Google Cloud Console (https://console.cloud.google.com/).
- Instances available in US, EU, Asia or Australia.
- Customer data encrypted on Google's internal networks and in database tables, temporary files, and backups.
- Support for secure external connections with the Cloud SQL Proxy or with the SSL/TLS protocol.
- Support for private IP (private services access).
- Data replication between multiple zones with automatic failover.

- Import and export databases using `mysqldump`, or import and export CSV files.
- Support for MySQL wire protocol and standard MySQL connectors.
- Automated and on-demand backups, and point-in-time recovery.
- Instance cloning.
- Integration with Stackdriver logging and monitoring.
- ISO/IEC 27001 (http://www.iso.org/iso/home/store/catalogue_ics/catalogue_detail_ics.htm?csnumber=54534) compliant.

## Supported languages

You can use Cloud SQL for MySQL with App Engine applications that are written in Java, Python, PHP, Node.js, Go, and Ruby. You can also use Cloud SQL for MySQL with external applications using the standard MySQL protocol.

## How you can connect to Cloud SQL for MySQL instances

You can connect to a Cloud SQL instance for MySQL from:

- A `mysql` client. Learn more (https://cloud.google.com/sql/docs/mysql/connect-admin-ip).
- Third-party tools like SQL Workbench or Toad for MySQL. Learn more (https://cloud.google.com/sql/docs/mysql/admin-tools).
- External applications. Learn more (https://cloud.google.com/sql/docs/mysql/connect-external-app).
- App Engine applications. Learn more (https://cloud.google.com/sql/docs/mysql/connect-app-engine).
- Applications running on Compute Engine. Learn more (https://cloud.google.com/sql/docs/mysql/connect-compute-engine).
- Applications running on Google Kubernetes Engine. Learn more (https://cloud.google.com/sql/docs/mysql/connect-kubernetes-engine).
- Cloud Functions. Learn more (https://cloud.google.com/sql/docs/mysql/connect-functions).
- Google Apps Script scripts Learn more (https://developers.google.com/apps-script/jdbc).

Connecting to Cloud SQL by using Private Google access is not supported. Private services access is supported. For more information, see Private Access Options for Services (https://cloud.google.com/vpc/docs/private-access-options).

## Differences between Cloud SQL and standard MySQL functionality

In general, the MySQL functionality provided by a Cloud SQL instance is the same as the functionality provided by a locally-hosted MySQL instance. However, there are a few differences between a standard MySQL instance and a Cloud SQL for MySQL instance.

### Unsupported features

- User defined functions (https://dev.mysql.com/doc/refman/5.7/en/adding-functions.html)
- InnoDB memcached plugin (https://dev.mysql.com/doc/refman/5.7/en/innodb-memcached.html)
- Federated Engine (https://dev.mysql.com/doc/refman/5.7/en/federated-storage-engine.html)
- Memory Storage Engine (https://dev.mysql.com/doc/refman/5.7/en/memory-storage-engine.html)
- The SUPER privilege (https://dev.mysql.com/doc/refman/5.7/en/privileges-provided.html#priv_super)

**Note:** Because Cloud SQL is a managed service, it restricts access to certain system procedures and tables that require advanced privileges.

### Unsupported statements

Sending any of the following types of SQL statements will generate an error with the message "Error 1290: The MySQL server is running with the google option so it cannot execute this statement":

- `LOAD DATA INFILE`

  Note that `LOAD DATA LOCAL INFILE` *is* supported.
- `SELECT ... INTO OUTFILE`
- `SELECT ... INTO DUMPFILE`
- `INSTALL PLUGIN ...`

- `UNINSTALL PLUGIN`
- `CREATE FUNCTION ... SONAME ...`

### Unsupported statements for Second Generation instances

The following statements are not supported because Second Generation instances use GTID replication:

- `CREATE TABLE ... SELECT` statements
- `CREATE TEMPORARY TABLE` statements inside transactions
- Transactions or statements that update both transactional and nontransactional tables

For more information, see the MySQL documentation (https://dev.mysql.com/doc/refman/5.7/en/replication-gtids-restrictions.html).

### Unsupported functions

- `LOAD_FILE()`

### Unsupported client program features

- `mysqlimport` (https://dev.mysql.com/doc/refman/5.7/en/mysqlimport.html) without using the `--local` option. This is because of the `LOAD DATA INFILE` restriction. If you need to load data remotely, use the Cloud SQL import function (https://cloud.google.com/sql/docs/mysql/import-export/importing).
- `mysqldump` (https://dev.mysql.com/doc/refman/5.7/en/mysqldump.html) using the `--tab` option or options that are used with `--tab`. This is because the FILE (https://dev.mysql.com/doc/refman/5.7/en/privileges-provided.html#priv_file) privilege is not granted for instance users. All other `mysqldump` options are supported.
- If you want to import databases with binary data into your Cloud SQL for MySQL instance, you must use the `--hex-blob` option with `mysqldump`.

  Although `hex-blob` is not a required flag when you are using a local MySQL server instance and the `mysql` client, it is required if you want to import any databases with binary data into your Cloud SQL instance. For more information about importing data, see Importing Data (https://cloud.google.com/sql/docs/mysql/import-export/importing).

- Not all MySQL options and parameters are enabled for editing as Cloud SQL flags (https://cloud.google.com/sql/docs/mysql/flags).

  To request the addition of a configurable Cloud SQL flag, use the Cloud SQL Discussion group (https://groups.google.com/forum/#!forum/google-cloud-sql-discuss).
- For Second Generation instances, InnoDB is the only supported storage engine. For help with converting tables from MyISAM to InnoDB, see the MySQL documentation (https://dev.mysql.com/doc/refman/5.7/en/converting-tables-to-innodb.html).
- You cannot import or export triggers, functions, stored procedures, or views into Cloud SQL. However, you can create and use these elements on a Cloud SQL instance.

#### Notable MySQL options

Cloud SQL runs MySQL with a specific set of options. If an option might impact how your applications work, we note it here for your information.

**`skip-name-resolve`**

This flag impacts how hostnames are resolved for client connections. Learn more (https://dev.mysql.com/doc/refman/5.7/en/server-options.html#option_mysqld_skip-name-resolve).

## Cloud SQL for PostgreSQL

### Features

- Fully managed PostgreSQL databases in the cloud, based on the Cloud SQL Second Generation platform.
- Custom machine types with up to 416 GB of RAM and 64 CPUs.
- Up to 30 TB of storage available, with the ability to automatically increase storage size as needed.
- Create and manage instances in the Google Cloud Console (https://console.cloud.google.com/).
- Instances available in US, EU, Asia or Australia.
- Customer data encrypted on Google's internal networks and in database tables, temporary files, and backups.

- Support for secure external connections with the Cloud SQL Proxy or with the SSL/TLS protocol.
- Data replication between multiple zones with automatic failover.
- Import and export databases using SQL dump files.
- Support for PostgreSQL client-server protocol and standard PostgreSQL connectors.
- Automated and on-demand backups.
- Instance cloning.
- Integration with Stackdriver logging and monitoring.
- Support for multiple PostgreSQL versions (https://cloud.google.com/sql/docs/postgres/db-versions).

## Features not yet available

Some PostgreSQL features are not yet available for Cloud SQL:

- Point-in-time recovery (PITR)
- Import/export in CSV format using Cloud Console or the `gcloud` command-line tool.

Postgres 11 (default) features that are not yet available for Cloud SQL:

- Logical replication
- Allow setting WAL size during initdb
- JIT plan compilation

## Supported extensions

Cloud SQL for PostgreSQL supports many PostgreSQL extensions. For a complete list, see PostgreSQL Extensions (https://cloud.google.com/sql/docs/postgres/extensions).

## Supported procedural languages

Cloud SQL for PostgreSQL supports the `PL/pgSQL` SQL procedural language (https://www.postgresql.org/docs/9.6/static/plpgsql.html).

## Supported languages

You can use Cloud SQL for PostgreSQL with App Engine applications running in the flexible environment that are written in Java, Python, PHP, Node.js, Go, and Ruby. You can also use Cloud SQL for PostgreSQL with external applications using the standard PostgreSQL client-server protocol.

## How you can connect to Cloud SQL for PostgreSQL instances

You can connect to a Cloud SQL instance for PostgreSQL from:

- A `psql` client. Learn more (https://cloud.google.com/sql/docs/postgres/connect-admin-ip).
- Third-party tools that use the standard PostgreSQL client-server protocol.
- External applications. Learn more (https://cloud.google.com/sql/docs/postgres/connect-external-app).
- App Engine applications. Learn more (https://cloud.google.com/sql/docs/postgres/connect-app-engine).
- Applications running on Compute Engine. Learn more (https://cloud.google.com/sql/docs/postgres/connect-compute-engine).
- Applications running on Google Kubernetes Engine. Learn more (https://cloud.google.com/sql/docs/postgres/connect-kubernetes-engine).
- Cloud Functions. Learn more (https://cloud.google.com/sql/docs/postgres/connect-functions).

Connecting to Cloud SQL by using Private Google access is not supported.

## Differences between Cloud SQL and standard PostgreSQL functionality

In general, the PostgreSQL functionality provided by a Cloud SQL instance is the same as the functionality provided by a locally-hosted PostgreSQL instance. However, there are a few differences between a standard PostgreSQL instance and a Cloud SQL for PostgreSQL instance.

### Unsupported features

- Any features that require `SUPERUSER` privileges

An exception to this rule is made for the `CREATE EXTENSION` statement, but only for supported extensions (#extensions).

- Custom background workers
- The `psql` client in Cloud Shell does not support operations that require a reconnection, such as connecting to a different database using the `\c` command.

**Notable differences**

- There are some PostgreSQL options and parameters that are not enabled for editing as Cloud SQL flags (https://cloud.google.com/sql/docs/postgres/flags).

  To request the addition of a configurable Cloud SQL flag, use the Cloud SQL Discussion group (https://groups.google.com/forum/#!forum/google-cloud-sql-discuss).

## Cloud SQL for SQL Server

### Features

- Fully managed SQL Server databases in the cloud.
- Custom machine types with up to 416 GB of RAM and 64 CPUs.
- Up to 30 TB of storage available, with the ability to automatically increase storage size as needed.
- Create and manage instances in the Google Cloud Console (https://console.cloud.google.com/).
- Instances available in US, EU, Asia or Australia.
- Customer data encrypted on Google's internal networks and in database tables, temporary files, and backups.
- Support for secure external connections with the Cloud SQL Proxy or with the SSL/TLS protocol.
- Import databases using native BAK and SQL files.
- Export databases using native BAK files.
- Automated and on-demand backups.
- Integration with Stackdriver logging and monitoring.

## SQL Server features unavailable for Cloud SQL

### General features unavailable for Cloud SQL

- SQL Server Reporting Services (SSRS), but you can use Compute Engine or a self-managed environment (from which you connect to Cloud SQL)
- SQL Server Analysis Services (SSAS), but you can use Compute Engine or a self-managed environment (from which you connect to Cloud SQL)
- SQL Server Integration Services (SSIS), but you can use Compute Engine or a self-managed environment (from which you connect to Cloud SQL)
- AD Authentication
- SP_Configure settings (but see Configuring database flags (https://cloud.google.com/sql/docs/sqlserver/flags))
- Stretch database
- Backing up to Microsoft Azure Blob Storage
- Buffer pool extension
- BULK INSERT and OPENROWSET(BULK...) features
- Data Quality Services
- Database Log Shipping
- Always On Availability Groups
- Database Mail
- Distribution Transaction Coordinator (MSDTC)
- File tables
- FILESTREAM support
- Maintenance Plans
- Performance Data Collector
- Policy-Based Management
- PolyBase
- Machine Learning and R Services (requires OS access to install it)
- Replication
- Resource Governor

- SQL Server Audit
- Server-level triggers
- Service Broker endpoints
- T-SQL endpoints (all operations using `CREATE ENDPOINT` are unavailable)
- WCF Data Services

**Other operations unavailable for Cloud SQL**

- ADMINISTER BULK OPERATIONS
- ALTER ANY CREDENTIAL
- ALTER ANY EVENT NOTIFICATION
- ALTER ANY EVENT SESSION
- ALTER ANY SERVER AUDIT
- ALTER RESOURCES
- ALTER SETTINGS
- AUTHENTICATE SERVER
- CONTROL_SERVER
- CREATE DDL EVENT NOTIFICATION
- CREATE ENDPOINT
- CREATE TRACE EVENT NOTIFICATION
- EXTERNAL ACCESS ASSEMBLY
- RESTORE
- SHUTDOWN
- CLR ASSEMBLIES

## Supported syntax

Cloud SQL for SQL Server supports the Transact-SQL syntax (https://docs.microsoft.com/en-us/sql/t-sql/language-elements/transact-sql-syntax-conventions-transact-sql?view=sql-server-2017)

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## Supported languages

You can use Cloud SQL for SQL Server with App Engine applications running in the flexible environment that are written in Java, Python, PHP, Node.js, Go, and Ruby.

## How you can connect to Cloud SQL for SQL Server instances

You can connect to a Cloud SQL instance for SQL Server from:

- SQL Server Management Studio (SSMS) (https://docs.microsoft.com/en-us/sql/ssms/sql-server-management-studio-ssms?view=sql-server-2017)
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- A client. Learn more (https://cloud.google.com/sql/docs/sqlserver/connect-admin-ip).
- The sqlcmd utility (https://docs.microsoft.com/en-us/sql/ssms/scripting/sqlcmd-use-the-utility?view=sql-server-2017).

Connecting to Cloud SQL by using Private Google access is not supported.

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