RDS for MariaDB

Service Overview

Issue 01

Date 2025-10-21

HUAWEI

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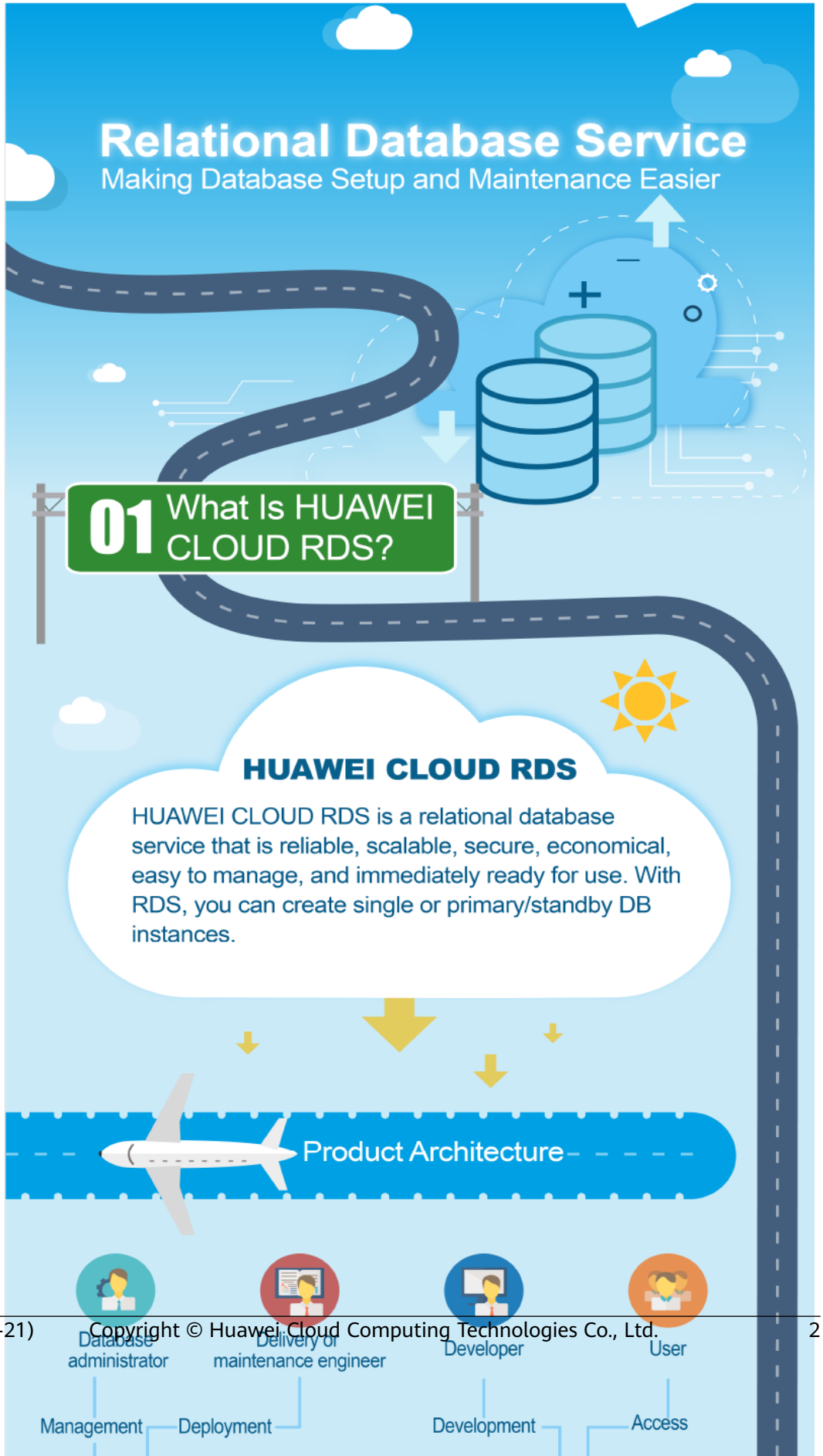


2 What Is RDS for MariaDB?

MariaDB was founded by Monty, the founder of MySQL, and is one of the most popular open-source databases.

RDS is highly compatible with MySQL. As a powerful, high-performance, secure, and reliable database management system, it is suitable for various applications. RDS for MariaDB has the following advantages:

- It allows you to easily migrate your databases to the cloud without refactoring existing applications.
- A web-based console provides comprehensive visualized monitoring for easier operations.
- You can flexibly scale resources to meet business needs and pay for only what you use.

For details about the versions supported by RDS, see **DB Engines and Versions**.

For more information, see the official documentation at **https://mariadb.org/**.

3 Advantages

Easy Management

- Quick Setup

  You can create a DB instance on the management console within minutes and access the DB instance from an ECS over a private network to reduce the application response time and avoid paying for the traffic that would be generated by regular public access.

- Elastic Scaling

  Cloud Eye monitors changes in the load on your database and storage capacity. You can flexibly scale resources accordingly and pay for only what you use.

- High Compatibility

  You use RDS the same way as you would use a native engine. RDS is compatible with existing programs and tools.

- Easy O&M

  Routine maintenance and management operations, including hardware and software fault handling and database patching, are easy to perform. With a web-based console, you can reboot DB instances, reset passwords, modify parameters, view error or slow query logs, and restore data. Additionally, the system helps you monitor DB instances in real time and generates alarms if errors occur. You can check DB instance information at any time, including CPU usage, IOPS, database connections, and storage space usage.

High Performance

- Optimized Performance

  Combining years of experience in database R&D, setup, and maintenance with cloud-based technology, Huawei Cloud has built a database service that is highly available, reliable, secure, scalable, and easy to maintain.

- Optimized Hardware

  RDS offers stable and high-performance database services using servers that have been proven robust by customer success in a wide range of applications.

- Optimized SQL Solutions

  RDS can detect slowly-executed SQL statements, so you can optimize the code accordingly.

- High-Speed Access

  You can access DB instances directly from ECSs deployed in the same region. This means applications can respond faster, and saves money as it is an intranet connection so there are no traffic charges generated.

High Security

- Network Isolation

  Virtual Private Clouds (VPCs) and network security groups are used to isolate and secure your DB instances. VPCs allow you to define which IP addresses are allowed to access your DB instance. You can configure subnets and security groups to control access to DB instances.

- Access Control

  RDS controls access through the account/IAM user and security groups. When you create an RDS instance, an account is automatically created. To separate out specific permissions, you can create IAM users and assign permissions to them as needed. VPC security groups have rules that govern both inbound and outbound traffic for DB instances.

- Transmission Encryption

  RDS uses Transport Layer Security (TLS) and Secure Sockets Layer (SSL) to encrypt transmission. You can download a Certificate Agency (CA) certificate from the RDS console and upload it when connecting to a database for authentication.

- Storage Encryption

  RDS encrypts data before storing it. Encryption keys are managed by Key Management Service (KMS).

- Data Deletion

  When you delete an RDS instance, its attached disks, storage space its automated backups occupy, and all data it stores will be deleted. You can restore a deleted DB instance using a manual backup or rebuild the DB instance from the recycle bin within the retention period.

- Security Protection

  RDS for MariaDB is protected by multiple layers of firewalls to defend against various malicious attacks, such as DDoS attacks and SQL injections. For security reasons, you are advised to access DB instances through a private network.

High Reliability

- Dual-Host Hot Standby

  RDS for MariaDB uses the hot standby architecture, in which failover upon fault occurrence takes only some seconds.

- Data Backup

  The system automatically backs up data every day and stores backup files as packages in Object Storage Service (OBS). The backup files can be stored for 732 days and can be restored with just a few clicks. You can set a custom backup policy and create manual backups at any time.

- Data Restoration

You can restore data from backups to any point in time during the backup retention period. In most scenarios, you can use backup files to restore data to an existing or a new DB instance at any time point within 732 days. After the data is verified, data can be migrated back to the primary DB instance.

Deleted DB instances can be moved to the recycle bin. You can rebuild the DB instance that was deleted up to 7 days ago from the recycle bin.

- Data Durability

  RDS provides a data durability of 99.9999999%, ensuring data security and reliability and protecting your workloads from faults.

Comparison Between RDS for MariaDB and On-Premises Databases

Table 3-1 Comparison

Item	RDS for MariaDB	On-Premises Database
Service availability	For details, see **ECS Advantages**.	Requires device procurement, primary/standby relationship setup, and RAID setup.
Data reliability	For details, see **What Is EVS?**	Requires device procurement, primary/standby relationship setup, and RAID setup.
Database backup	Supports automated backups, manual backups, and custom backup retention periods.	Requires device procurement, setup, and maintenance.
Hardware and software investment	Supports on-demand pricing and scaling without requiring hardware and software investment.	Requires large investment in database servers.
System hosting	Not required.	Requires two servers for primary/standby DB instances.
Maintenance cost	Not required.	Requires large labor investment and professional database administrator (DBA) for maintenance.
Deployment and scaling	Supports elastic scaling, fast upgrade, and on-demand enabling.	Requires procurement, deployment, and coordination of hardware that matches original devices.

4 Typical Use Cases

Reducing Read Pressure with Read/Write Splitting

RDS supports read replicas to offload read traffic from primary DB instances.

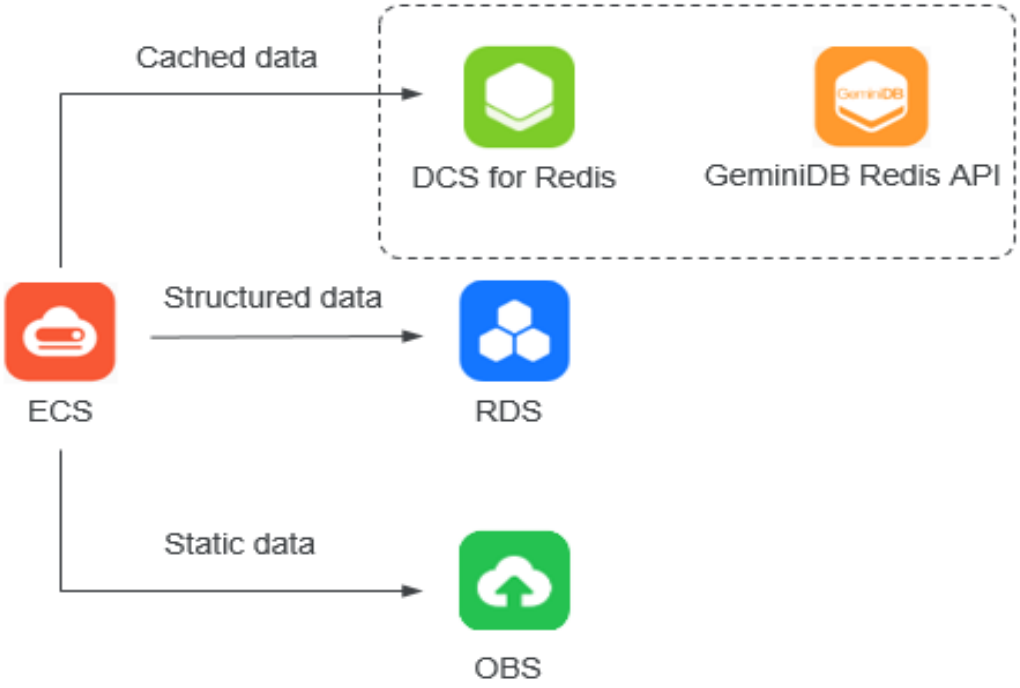
RDS primary instances and read replicas have independent connection addresses. A maximum of 5 read replicas can be created for each primary/standby instance. For details about how to create a read replica, see **Creating a Read Replica**.

To offload read pressure on the primary DB instance, you can create one or more read replicas in the same region as the primary instance. These read replicas can process a large number of read requests and increase application throughput.

Storing Diverse Data Types

RDS can work with Distributed Cache Service (DCS) for Redis, GeminiDB Redis API, and OBS to store different types of data.

Figure 4-1 Storing diverse data types



5 Functions

You can check if a certain function is available in a region on the RDS for MariaDB console.

Billing

Yearly/monthly and pay-per-use billing modes are available.

- **Yearly/Monthly**: A prepaid billing mode in which you pay for resources before using it. Bills are settled based on the subscription period. The longer you use the service, the more discounts you get. This mode is a good option for long-term, stable workloads.
- **Pay-per-use**: A postpaid billing mode. You pay as you go and just pay for what you use. The DB instance usage is calculated by the second but billed every hour. This mode allows you to adjust resource usage easily. You neither need to prepare for resources in advance, nor end up with excessive or insufficient preset resources.
- You can switch between the yearly/monthly and pay-per-use modes.

For more information, see **Billing Overview**.

Connecting to a DB Instance

You can connect to an RDS for MariaDB instance through Data Admin Service (DAS), a private network, or a public network.

- Through DAS: DAS is a professional database administration service. It enables you to connect to and manage DB instances with ease using a web-based console. The permission required for remotely connecting to DB instances has been enabled for you by default. Using DAS to connect to your DB instance is recommended, which is more secure and convenient.
- Through a private network: The system assigns a floating IP address to your instance by default. If your application is deployed on an ECS that is in the same region and VPC as your DB instance, you are advised to use a floating IP address to connect to the DB instance from the ECS.
- Through a public network: If you cannot access a DB instance through a floating IP address, bind an EIP to the DB instance and connect it through the EIP.

For more information, see **RDS for MariaDB Instance Connection**.

Resetting the Administrator Password

If you forget the password of your administrator account when using RDS, you can reset the password. If an error occurs on the **root** account, for example, if your **root** account credentials are lost or deleted, you can restore the **root** account permissions through resetting the password. For more information, see **Resetting the Administrator Password to Restore Root Access**.

Enabling Public Network Access

You can bind an EIP to an RDS for MariaDB instance for public access and can unbind the EIP from an instance as required.

- You can bind an EIP only to a primary DB instance or a read replica.
- If a DB instance has already been bound with an EIP, you must unbind the EIP from the instance first before binding a new EIP to it.

For more information, see **Binding and Unbinding an EIP**.

Read Replicas

In read-intensive scenarios, a single DB instance may be unable to handle the read pressure and workloads may be affected. To offload read pressure on the primary DB instance, you can create one or more read replicas in the same region as the primary instance. These read replicas can process a large number of read requests and increase application throughput. For more information, see **Introduction to Read Replicas**.

Scaling Up Storage Space

You can scale up storage space if it is no longer sufficient for your workloads. If the DB instance status is **Storage full** and data cannot be written to databases, you need to scale up storage space. Workloads are not interrupted during storage scale-up. For more information, see **Scaling Up Storage Space**.

Changing Instance Class

You can change the instance class (vCPUs and memory) of an instance if needed. For more information, see **Changing a DB Instance Class**.

Data Backup

RDS for MariaDB offers various backup types. To learn about their concepts and differences, see **Backup Solutions**.

A backup file is generated each time a backup is complete. If the instance fails or data is damaged, you can use the backup file to restore the instance, ensuring data availability.

Data Restoration

RDS for MariaDB supports the following restoration methods:

- Instance-level restoration: Automated or manual backups can be used to restore an entire DB instance.
- Database- or table-level restoration: Automated backups can be used to restore databases or tables to a specific point in time.
- Cross-region restoration: If a DB instance in one region fails, you can use backups stored in another region to restore data to a new DB instance.

For more information, see **Restoration Solutions**.

Parameter Templates

You can use database parameter templates to manage DB engine configurations. A database parameter template acts as a container for engine configuration values that can be applied to one or more DB instances.

When creating a DB instance, you can associate a default or custom parameter template with it. After the DB instance is created, you can also change its parameter template.

- Default parameter template

  Each default parameter template contains database engine defaults and database system defaults.
- Custom parameter template

  If you want to use your custom parameter settings, you can create a parameter template and apply it with your DB instance.

For more information, see **Managing Parameter Templates**.

DBA Assistant

DBA Assistant provides you with a range of database O&M functions, making it easy to diagnose database problems, locate faults, analyze and optimize database performance. For more information, see **Problem Diagnosis and SQL Analysis**.

Logs

- Error logs are generated when the database is running. These logs can help you analyze problems with the database.
- Slow query logs record statements that exceed the **long_query_time** value (1 second by default). You can view log details and statistics to identify statements that are executing slowly and optimize the statements.
- Failover/switchover logs help you evaluate the impact on workloads.
- Once SQL Audit is enabled, all SQL operations will be logged. You can download audit logs and query details.

For more information, see **Log Management**.

API

RDS supports v3 APIs. You can call RDS APIs to perform a range of operations, such as DB instance creation and deletion, backup and restoration, and parameter query and modifications. For more information, see **API Reference**.

SDK

Using SDKs provided by RDS, you can easily call RDS APIs to set up Internet applications on Huawei Cloud. Java, Python, and Go languages are supported. For more information, see **SDK Developer Guide**.

6 Product Series

Table 6-1 and **Table 6-2** list different DB instance types and their function comparisons of RDS.

Table 6-1 DB instance types

DB Instance Type	Description	Notes	Advantages	Scenarios
Single-node	A single-node architecture is less expensive than a primary/standby DB pair.	If a fault occurs on a single-node instance, the instance cannot recover in a timely manner.	This instance type supports the creation of read replicas and supports the queries of error logs and slow query logs. Different from primary/standby DB instances that have two database nodes, a single-node DB instance has only one node, greatly reducing costs. If the node fails, the restoration will take a long time. Therefore, single-node DB instances are not recommended for workloads that are highly sensitive to database availability.	• Personal learning • Microsites • Development and testing environment of small- and medium-sized enterprises

DB Instance Type	Description	Notes	Advantages	Scenarios
Primary/Standby	An HA architecture. A pair of primary and standby DB instances shares the same IP address and can be deployed in different AZs.	• When a primary instance is being created, a standby instance is provisioned synchronously to provide data redundancy. The standby instance is invisible to you after being created. • If the primary instance fails, a failover occurs, during which database connection is interrupted. If there is a replication delay between the primary and standby instances, the failover takes an extended period of time. The client needs to be able to reconnect to the instance.	The standby node of a primary/standby DB instance is only used for failover and restoration. It does not provide services. The performance of single-node DB instances is similar to or even higher than primary/standby DB instances because standby nodes cause extra performance overhead.	• Production databases of large and medium enterprises • Applications for the Internet, Internet of Things (IoT), retail e-commerce sales, logistics, gaming, and other industries

Table 6-2 Function comparisons

Function	Single-Node	Primary/Standby
Number of nodes	1	2

Function	Single-Node	Primary/Standby
Specifications	vCPUs: a maximum of 64 Memory: a maximum of 512 GB Storage: a maximum of 4,000 GB Final specifications on the console may differ slightly.	vCPUs: a maximum of 64 Memory: a maximum of 512 GB Storage: a maximum of 4,000 GB Final specifications on the console may differ slightly.
Monitoring and alarms	Supported	Supported
Security group	Supported	Supported
Backup and restoration	Supported	Supported
Parameter settings	Supported	Supported
SSL	Supported	Supported
Log management	Supported	Supported
Read replicas (which need to be created)	Supported	Supported
SQL audit	Supported	Supported
DBA Assistant	Supported	Supported
Standby DB instance migration	Not supported	Supported
Manual primary/ standby switchover	Not supported	Supported
Instance class change	Supported	Supported
Storage scale-up	Supported	Supported
Recycle bin	Supported	Supported

7 DB Instance Description

7.1 DB Instance Types

The smallest management unit of RDS is DB instance. A DB instance is an isolated database environment on the cloud. Each DB instance can contain multiple user-created databases, and you can access a DB instance using the same tools and applications that you use with a stand-alone DB instance. You can easily create or modify DB instances using the management console or HTTPS-compliant application programming interfaces (APIs). RDS does not have limits on the number of running DB instances. Each DB instance has a unique identifier.

DB instances are classified into the following types.

Table 7-1 DB instance types

DB Instance Type	Description	Notes
Single-node	A single-node architecture is less expensive than a primary/ standby DB pair.	If a fault occurs on a single-node instance, the instance cannot recover in a timely manner.

DB Instance Type	Description	Notes
Primary/ Standby	An HA architecture. In a primary/standby pair, each instance has the same instance class. The primary and standby instances can be deployed in different AZs.	• When a primary instance is being created, a standby instance is provisioned synchronously to provide data redundancy. The standby instance is invisible to you after being created. • If a failover occurs due to a primary instance failure, your database client will be disconnected from the instance briefly and then reconnects to the instance. • The default replication mode between the primary and standby instances is semi-synchronous.
Read replica	A single-node or HA architecture	If the replication between a read replica (single-node or HA) and the DB instance is abnormal, it can take a long time to rebuild and restore the read replica (depending on the data volume). If the physical server where the primary read replica is deployed fails, the standby read replica automatically takes over workloads. When you purchase a read replica, select the same value for **Table Name** as that of the DB instance.

7.2 DB Instance Storage Types

The database system is generally an important part of an IT system and has high requirements on storage I/O performance. You can select a storage type based on service demands. You cannot change the storage type after the DB instance is created.

Description

RDS supports **Local SSD** (also called **Ultra-high I/O**) to suit different performance requirements of your workloads.

Cloud SSD/Ultra-high I/O: stores data in cloud disks for decoupled storage and compute. The maximum throughput is 350 MB/s.

- For RDS for MariaDB instances, this storage type is normally displayed as **Cloud SSD**, but for existing instances in certain regions it is displayed as **Ultra-high I/O**.
- The supported IOPS depends on the I/O performance of the Elastic Volume Service (EVS) disk. For details, see the description about ultra-high I/O in **Disk Types and Performance** of the *Elastic Volume Service Service Overview*.

Performance

Table 7-2 Performance

Item	Cloud SSD
I/O performance	Subpar I/O performance due to additional network I/O overheads
Elastic scalability	Scaling in seconds
Maximum IOPS	50,000
Maximum throughput	350 MB/s
Read/write latency	1 ms

7.3 DB Engines and Versions

Table 7-3 lists the DB engines and versions supported by RDS.

For new applications, you are advised to use the latest major version of the DB engine, for example, MariaDB 10.5. When you create a DB instance, you can select a major DB engine version only. The system will automatically select an appropriate minor version for you. After the DB instance is created, you can view the minor version in the **DB Engine Version** column on the **Instances** page.

Table 7-3 DB Engines and Versions

DB Engine	Single-Node	Primary/Standby
MariaDB	• 10.5 (minor version: 10.5.16) • 10.11 (minor version: 10.11.11) RDS for MariaDB 10.11 is supported only in some regions. For details, see **Supported Regions**. If the service is unavailable in your region, **create a service ticket** on the console to submit a request.	• 10.5 (minor version: 10.5.16) • 10.11 (minor version: 10.11.11) RDS for MariaDB 10.11 is supported only in some regions. For details, see **Supported Regions**. If it is unavailable in your region, **submit a service ticket** on the console to obtain permissions.

Supported Regions

RDS for MariaDB 10.11 is available only in some regions, including:

- CN South-Guangzhou-InvitationOnly and CN South-Guangzhou
- CN North-Beijing4
- CN East-Shanghai1
- CN-Hong Kong
- AP-Bangkok, AP-Jakarta, AP-Manila, and AP-Singapore
- AF-Cairo and AF-Johannesburg
- LA-Mexico City1, LA-Mexico City2, LA-Sao Paulo1, and LA-Santiago
- TR-Istanbul
- ME-Riyadh

7.4 DB Instance Statuses

DB Instance Statuses

The status of a DB instance indicates the health of the DB instance. You can use the management console or API to view the status of a DB instance.

Table 7-4 DB instance statuses

Status	Description
Available	A DB instance is available.
Abnormal	A DB instance is abnormal.
Creating	A DB instance is being created.
Cloning	A DB instance is being cloned.
Creation failed	A DB instance has failed to be created.
Switchover in progress	A standby DB instance is being switched over to the primary DB instance.
Changing type to primary/ standby	A single-node DB instance is being changed to a primary/ standby DB instance.
Rebooting	A DB instance is being rebooted.
Changing port	A DB instance port is being changed.
Changing instance class	The CPU or memory of a DB instance is being modified.
Scaling up	Storage space of a DB instance is being scaled up.

Status	Description
Backing up	A DB instance is being backed up.
Restoring	A DB instance is in the process of being restored from a backup.
Restore failed	A DB instance fails to be restored.
Frozen	A DB instance is frozen when your account balance is less than or equal to $0 USD. Retained frozen DB instances are unfrozen only after your account is recharged and the overdue payments are cleared.
Storage full	Storage space of a DB instance is full. Data cannot be written to databases. You need to scale up the storage space to make the instance available.
Deleted	A DB instance has been deleted and will not be displayed in the instance list.
Upgrading minor version	A DB instance minor version is being upgraded.
Upgrading	A DB engine version is being upgraded.
Promoting to primary	A read replica is being promoted to a primary DB instance.
Parameter change. Pending reboot	A modification to a database parameter is waiting for an instance reboot before it can take effect.
Stopping	A DB instance is being stopped.
Stopped	A DB instance has been stopped. It can be stopped for up to seven days. You can manually restart it or it will be automatically restarted after seven days.
Starting	A stopped DB instance is being started.
Changing read/write permissions of the instance	The read/write permissions of a DB instance are being changed.
Forced to read-only	A DB instance is set to read-only and operations that cause data changes, such as data writes and updates, are not allowed for the instance.

8 DB Instance Classes

To learn about the DB engine versions supported by RDS for MariaDB, see **DB Engines and Versions**.

Table 1 lists the instance classes based on the x86 CPU architecture available to RDS for MariaDB instances using cloud SSDs.

Table 8-1 Instance classes

Instance Class	Description	Scenario	Constraints
General-purpose (recommended)	CPU resources are shared with other general-purpose DB instances on the same physical machine. CPU usage is maximized through resource overcommitment. This instance class is a cost-effective option and suitable for scenarios where performance stability is not critical.	Suitable for scenarios that have high requirements on cost-effectiveness.	Only available in the following regions: • CN North-Beijing4 and CN North-Ulanqab1 • CN East-Shanghai1 • CN South-Guangzhou and CN South-Guangzhou-InvitationOnly • CN Southwest-Guiyang1 • AP-Bangkok and AP-Singapore • CN-Hong Kong • LA-Sao Paulo1, LA-Santiago, LA-Mexico City1, and LA-Mexico City2 • AF-Johannesburg
Dedicated (recommended)	The instance has dedicated CPU and memory resources to ensure stable performance. The performance of a dedicated instance is never affected by other instances on the same physical machine. This instance class is good when performance stability is important.	Suitable for core database scenarios such as e-commerce, gaming, finance, government, and enterprise applications.	

Table 8-2 Detailed specifications of general-purpose and dedicated instance classes

Instance Class	Specification Code for Primary/ Standby Instances	Specification Code for Read Replicas	Specification Code for Single-Node Instances	vCPUs	Memory (GB)
General-purpose	rds.mariadb.n1.large.2.ha	rds.mariadb.n1.large.2.rr	rds.mariadb.n1.large.2	2	4
	rds.mariadb.n1.large.4.ha	rds.mariadb.n1.large.4.rr	rds.mariadb.n1.large.4	2	8
	rds.mariadb.n1.xlarge.2.ha	rds.mariadb.n1.xlarge.2.rr	rds.mariadb.n1.xlarge.2	4	8

Instance Class	Specification Code for Primary/ Standby Instances	Specification Code for Read Replicas	Specification Code for Single-Node Instances	vCPUs	Memory (GB)
	rds.mariadb.n1.xlarge.4.ha	rds.mariadb.n1.xlarge.4.rr	rds.mariadb.n1.xlarge.4	4	16
	rds.mariadb.n1.2xlarge.2.ha	rds.mariadb.n1.2xlarge.2.rr	rds.mariadb.n1.2xlarge.2	8	16
	rds.mariadb.n1.2xlarge.4.ha	rds.mariadb.n1.2xlarge.4.rr	rds.mariadb.n1.2xlarge.4	8	32
Dedicated **NOTE** • To use the dedicated instance class (vCPU:Memory = 1:2) supported for cloud SSDs, you need to contact customer service to apply for the required permission. • The DB instance specifications vary according to site requirements.	rds.mariadb.x1.large.2.ha	rds.mariadb.x1.large.2.rr	rds.mariadb.x1.large.2	2	4
	rds.mariadb.x1.large.4.ha	rds.mariadb.x1.large.4.rr	rds.mariadb.x1.large.4	2	8
	rds.mariadb.x1.large.8.ha	rds.mariadb.x1.large.8.rr	rds.mariadb.x1.large.8	2	16
	rds.mariadb.x1.xlarge.2.ha	rds.mariadb.x1.xlarge.2.rr	rds.mariadb.x1.xlarge.2	4	8
	rds.mariadb.x1.xlarge.4.ha	rds.mariadb.x1.xlarge.4.rr	rds.mariadb.x1.xlarge.4	4	16
	rds.mariadb.x1.xlarge.8.ha	rds.mariadb.x1.xlarge.8.rr	rds.mariadb.x1.xlarge.8	4	32
	rds.mariadb.x1.2xlarge.2.ha	rds.mariadb.x1.2xlarge.2.rr	rds.mariadb.x1.2xlarge.2	8	16
	rds.mariadb.x1.2xlarge.4.ha	rds.mariadb.x1.2xlarge.4.rr	rds.mariadb.x1.2xlarge.4	8	32
	rds.mariadb.x1.2xlarge.8.ha	rds.mariadb.x1.2xlarge.8.rr	rds.mariadb.x1.2xlarge.8	8	64
	rds.mariadb.x1.4xlarge.2.ha	rds.mariadb.x1.4xlarge.2.rr	rds.mariadb.x1.4xlarge.2	16	32
	rds.mariadb.x1.4xlarge.4.ha	rds.mariadb.x1.4xlarge.4.rr	rds.mariadb.x1.4xlarge.4	16	64
	rds.mariadb.x1.4xlarge.8.ha	rds.mariadb.x1.4xlarge.8.rr	rds.mariadb.x1.4xlarge.8	16	128
	rds.mariadb.x1.8xlarge.2.ha	rds.mariadb.x1.8xlarge.2.rr	rds.mariadb.x1.8xlarge.2	32	64
	rds.mariadb.x1.8xlarge.4.ha	rds.mariadb.x1.8xlarge.4.rr	rds.mariadb.x1.8xlarge.4	32	128

Instance Class	Specification Code for Primary/ Standby Instances	Specification Code for Read Replicas	Specification Code for Single-Node Instances	vCPUs	Memory (GB)
	rds.mariadb.x1.8xlarge.8.ha	rds.mariadb.x1.8xlarge.8.rr	rds.mariadb.x1.8xlarge.8	32	256
	rds.mariadb.x1.16xlarge.2.ha	rds.mariadb.x1.16xlarge.2.rr	rds.mariadb.x1.16xlarge.2	64	128
	rds.mariadb.x1.16xlarge.4.ha	rds.mariadb.x1.16xlarge.4.rr	rds.mariadb.x1.16xlarge.4	64	256
	rds.mariadb.x1.16xlarge.8.ha	rds.mariadb.x1.16xlarge.8.rr	rds.mariadb.x1.16xlarge.8	64	512

The DB instance classes vary according to site requirements.

9 Security

9.1 Shared Responsibilities

Huawei guarantees that its commitment to cyber security will never be outweighed by the consideration of commercial interests. To cope with emerging cloud security challenges and pervasive cloud security threats and attacks, Huawei Cloud builds a comprehensive cloud service security assurance system for different regions and industries based on Huawei's unique software and hardware advantages, laws, regulations, industry standards, and security ecosystem.

Unlike traditional on-premises data centers, cloud computing separates operators from users. This approach not only enhances flexibility and control for users but also greatly reduces their operational workload. For this reason, cloud security cannot be fully ensured by one party. Cloud security requires joint efforts of Huawei Cloud and you, as shown in **Figure 9-1**.

- **Huawei Cloud**: Huawei Cloud is responsible for infrastructure security, including security and compliance, regardless of cloud service categories. The infrastructure consists of physical data centers, which house compute, storage, and network resources, virtualization platforms, and cloud services Huawei Cloud provides for you. In PaaS and SaaS scenarios, Huawei Cloud is responsible for security settings, vulnerability remediation, security controls, and detecting any intrusions into the network where your services or Huawei Cloud components are deployed.
- **Customer**: As our customer, your ownership of and control over your data assets will not be transferred under any cloud service category. Without your explicit authorization, Huawei Cloud will not use or monetize your data, but you are responsible for protecting your data and managing identities and access. This includes ensuring the legal compliance of your data on the cloud, using secure credentials (such as strong passwords and multi-factor authentication), and properly managing those credentials, as well as monitoring and managing content security, looking out for abnormal account behavior, and responding to it, when discovered, in a timely manner.

Figure 9-1 Huawei Cloud shared security responsibility model

Cloud security responsibilities are determined by control, visibility, and availability. When you migrate services to the cloud, assets, such as devices, hardware, software, media, VMs, OSs, and data, are controlled by both you and Huawei Cloud. This means that your responsibilities depend on the cloud services you select. As shown in **Figure 9-1**, customers can select different cloud service types (such as IaaS, PaaS, and SaaS services) based on their service requirements. As control over components varies across different cloud service categories, the responsibilities are shared differently.

- In on-premises scenarios, customers have full control over assets such as hardware, software, and data, so tenants are responsible for the security of all components.
- In IaaS scenarios, customers have control over all components except the underlying infrastructure. So, customers are responsible for securing these components. This includes ensuring the legal compliance of the applications, maintaining development and design security, and managing vulnerability remediation, configuration security, and security controls for related components such as middleware, databases, and operating systems.
- In PaaS scenarios, customers are responsible for the applications they deploy, as well as the security settings and policies of the middleware, database, and network access under their control.
- In SaaS scenarios, customers have control over their content, accounts, and permissions. They need to protect their content, and properly configure and protect their accounts and permissions in compliance with laws and regulations.

9.2 Identity Authentication and Access Control

Identity Authentication

When you access RDS, the system authenticates your identity using a password or IAM.

- **Password verification**

  To manage your instance, you need to use Data Admin Service (DAS) to log in to your instance. The login is successful only after your account and password are verified.

- **IAM verification**

  You can use **Identity and Access Management (IAM)** to provide fine-grained control over RDS permissions. IAM provides identity authentication, permissions management, and access control, helping you efficiently manage access to your Huawei Cloud resources. IAM users can use RDS resources only after their accounts and passwords are verified. For details, see **Creating an IAM User and Logging In**.

Access Control

- **Permissions control**

  If you need to assign different permissions to different employees in your enterprise to access your instance resources, IAM is a good choice. For details, see **Permissions**.

- **VPCs and subnets**

  A VPC is a logically isolated, configurable, and manageable virtual network. It helps improve the security of cloud resources and simplifies network deployment. You can define security groups, virtual private networks (VPNs), IP address segments, and bandwidth for a VPC. This facilitates internal network configuration and management and allows you to change your network in a secure and convenient manner.

  A subnet provides dedicated network resources that are logically isolated from other networks for security.

  For details, see **Creating a VPC and Subnet**.

- **Security groups**

  A security group is a logical group that provides access control policies for the ECSs and RDS instances that have the same security protection requirements and are mutually trusted within a VPC. To ensure database security and reliability, you need to configure security group rules to allow only specific IP addresses and ports to access your RDS instances.

  For details, see **Configuring a Security Group Rule**.

9.3 Data Protection

RDS provides a series of methods and features to ensure data security and reliability.

Table 9-1 Methods for data security

Method	Description	Reference
Secure Sockets Layer (SSL)	RDS instances support both non-SSL and SSL connections. SSL is recommended for enhanced security.	RDS for MariaDB: **Configuring an SSL Connection**
Cross-AZ deployment	To ensure high availability, RDS for MariaDB allows you to deploy primary and standby DB instances in different AZs. AZs are physically isolated but interconnected through an internal network.	RDS for MariaDB: **Buy an Instance and Deploy It Across AZs**
Deletion protection	RDS allows you to move unsubscribed yearly/monthly DB instances and deleted pay-per-use DB instances to the recycle bin. You can rebuild a DB instance that was deleted up to 7 days ago from the recycle bin.	RDS for MariaDB: **Modifying a Recycling Policy**

9.4 Audit and Logs

Audit

- Cloud Trace Service (CTS)

  CTS is a log audit service intended for cloud security. It records operations on the cloud resources in your account. You can use the logs generated by CTS to perform security analysis, track resource changes, audit compliance, and locate faults.

  After you enable CTS and configure a tracker, CTS can record management and data traces of RDS for auditing.

  For details about how to enable and configure CTS, see **CTS Getting Started**.

  - For details about RDS for MariaDB management and data traces that can be tracked by CTS, see **Key Operations Supported by CTS**.

- Database Security Service (DBSS)

  DBSS is based on machine learning and big data analytics technologies. It provides functions such as database audit, SQL injection attack detection, and risky operation identification to ensure the security of databases on the cloud.

  You are advised to use DBSS to provide extended data security capabilities. For details, see **Database Security Service**.

  Advantages:

  - DBSS can help you meet security compliance requirements.
    - DBSS can help you comply with DJCP (graded protection) standards for database audit.

        - DBSS can help you comply with security laws and regulations, and provide compliance reports that meet data security standards (such as Sarbanes-Oxley).
      - DBSS can back up and restore database audit logs and meet the audit data retention requirements.
      - DBSS can monitor risks, sessions, session distribution, and SQL distribution in real time.
      - DBSS can report alarms for risky behavior and attacks and respond to database attacks in real time.
      - DBSS can locate internal violations and improper operations and keep data assets secure.

    Deployed in bypass pattern, database audit can perform flexible audits on the database without affecting user services.

      - Database audit monitors database logins, operation types (data definition, operation, and control), and operation objects based on risky operations to effectively audit the database.
      - Database audit analyzes risks and sessions, and detects SQL injection attempts so you can stay apprised of your database status.
      - Database audit provides a report template library to generate daily, weekly, or monthly audit reports according to your configurations. It sends real-time alarm notifications to help you obtain audit reports in a timely manner.

Logs

- You can view database-level logs, including error logs and slow SQL query logs.

  For details, see **Viewing and Downloading Error Logs**.
- Slow query logs record statements that exceed **long_query_time** (1s by default). You can view log details and statistics to identify statements that are executing slowly and optimize the statements.

  For details, see **Viewing and Downloading Slow Query Logs**.
- If you enable SQL Audit, the system records all SQL operations in audit logs to audit operations such as adding, deleting, modifying, and querying data.

  For details, see **Enabling or Disabling SQL Audit**.

9.5 Risk Monitoring

Monitoring Metrics

RDS works with Cloud Eye to monitor instances in your account in real time, reporting alarms and sending notifications based on your settings. You can get details about running metrics and storage usage of your instances in real time.

For details about RDS for MariaDB metrics and how to create alarm rules, see **Configuring Displayed Metrics**.

Protection for Critical Operations

With critical operation protection enabled, to enhance the security of your data and configurations, the system requires your identity to be authenticated before critical operations like deleting an instance can be performed. For more information, see **Critical Operation Protection**.

9.6 Fault Recovery

RDS automatically creates backups for your DB instance during a backup window you specify. The backups are stored based on a preset retention period (1 to 732 days).

To restore instance data, you can choose one of the following methods:

- **Restoring a DB instance from backups**
- **Restoring a DB instance to a point in time**

Cross-Region Backup

RDS can store backups in a different region from the DB instance for disaster recovery. If the DB instance ever fails, you can use backups in the other region to restore data to a new DB instance.

If you enable cross-region backup, backups are automatically stored in the region you specify.

Multiple-AZ Deployment

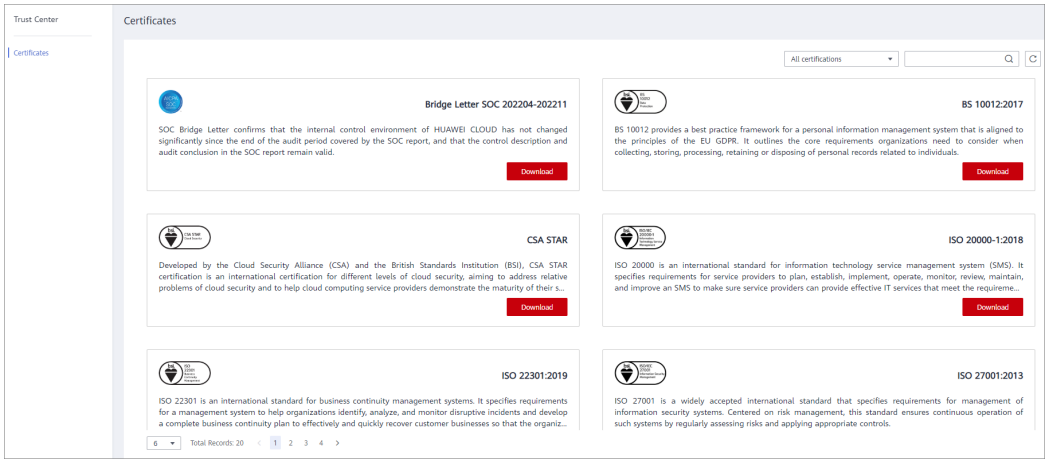
An AZ is a physical region where resources have their own independent power supply and networks. AZs are physically isolated but interconnected through a private network. You can deploy primary and standby DB instances in a single AZ or across AZs to achieve failover and high availability.

9.7 Certificates

Compliance Certificates

Huawei Cloud services and platforms have obtained various security and compliance certifications from authoritative organizations, such as International Organization for Standardization (ISO), system and organization controls (SOC), and Payment card industry (PCI) compliance standards. These certifications are available for **download**.

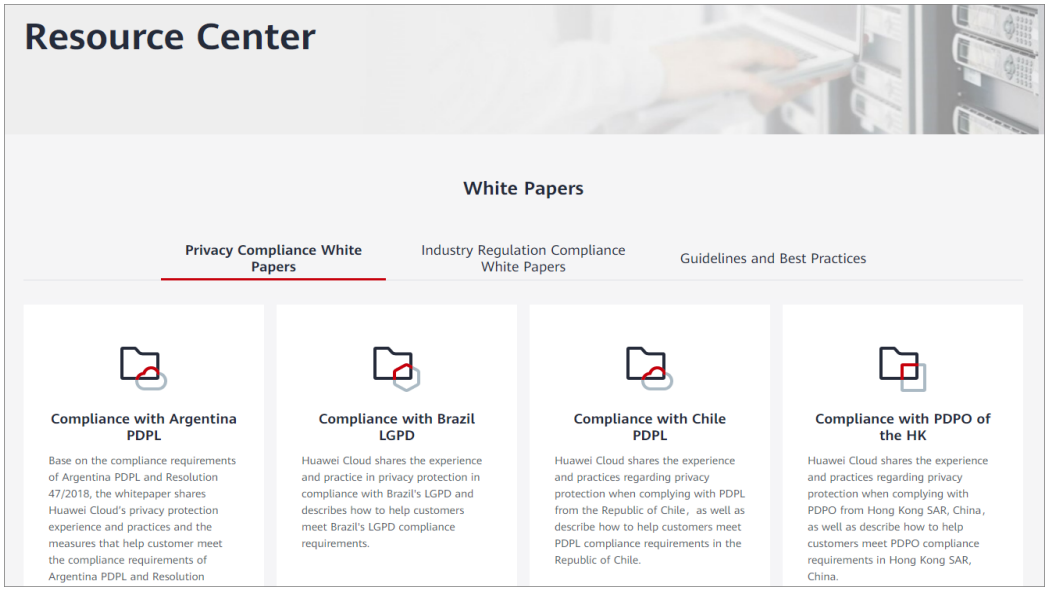
Figure 9-2 Downloading compliance certificates



Resource Center

Huawei Cloud also provides the following resources to help users meet compliance requirements. For details, see **Resource Center**.

Figure 9-3 Resource center



10 Permissions

If you need to assign different permissions to personnel in your enterprise to access your RDS resources, Identity and Access Management (IAM) is a good choice for fine-grained permissions management. IAM provides identity authentication, permissions management, and access control, helping you to securely access your Huawei Cloud resources.

With IAM, you can create IAM users and assign permissions to control their access to specific resources. For example, if you want some software developers in your enterprise to use RDS resources but do not want them to delete RDS instances or perform any other high-risk operations, you can create IAM users and grant permission to use RDS instances but not permission to delete them.

If your Huawei account does not require individual IAM users for permissions management, you can skip this section.

IAM is a free service. You only pay for the resources in your account. For more information about IAM, see **IAM Service Overview**.

RDS Permissions

New IAM users do not have any permissions assigned by default. You need to first add them to one or more groups and attach policies or roles to these groups. The users then inherit permissions from the groups and can perform specified operations on cloud services based on the permissions they have been assigned.

RDS is a project-level service deployed for specific regions. When you set **Scope** to **Region-specific projects** and select the specified projects in the specified regions, the users only have permissions for RDS instances in the selected projects. If you set **Scope** to **All resources**, the users have permissions for RDS instances in all region-specific projects. When accessing RDS instances, the users need to switch to the authorized region.

You can grant permissions by using roles and policies.

- Roles: A coarse-grained authorization strategy provided by IAM to assign permissions based on users' job responsibilities. Only a limited number of service-level roles are available for authorization. Cloud services depend on each other. When you grant permissions using roles, you also need to attach any existing role dependencies. Roles are not ideal for fine-grained authorization and least privilege access.

- Policies: A fine-grained authorization strategy that defines permissions required to perform operations on specific cloud resources under certain conditions. This type of authorization is more flexible and is ideal for least privilege access. For example, you can grant users only permission to manage database resources of a certain type. A majority of fine-grained policies contain permissions for specific APIs, and permissions are defined using API actions. For the API actions supported by RDS, see **Permissions and Supported Actions**.

Table 10-1 lists all the system-defined permissions for RDS.

Table 10-1 System-defined permissions for RDS

Role/Policy Name	Description	Type	Dependencies
RDS FullAccess	Full permissions for Relational Database Service	System-defined policy	Purchasing a yearly/monthly DB instance requires the following actions: bss:order:update bss:order:pay To use storage autoscaling, an IAM user must be granted the following actions: • Creating a custom policy: – iam:agencies:listAgencies – iam:agencies:createAgency – iam:permissions:listRolesForAgencyOnProject – iam:permissions:grantRoleToGroupOnProject – iam:roles:listRoles – iam:roles:createRole • Adding system role **Security Administrator**: 1. Select a user group to which the user belongs. 2. Click **Authorize** in the **Operation** column. 3. Add the **Security**

Role/Policy Name	Description	Type	Dependencies
			Administrator role. To create a yearly/monthly instance using a RAM-based shared KMS key, an IAM user must be granted the following actions: • iam:agencies:listAgencies • iam:roles:listRoles • iam:agencies:pass • iam:agencies:createAgency • iam:permissions:grantRoleToAgency **RDS FullAccess** already contains the **iam:agencies:listAgencies**, **iam:roles:listRoles**, and **iam:agencies:pass** actions. RDS is a region-level service, and IAM is a global service. If you grant a user the **RDS FullAccess** policy for a specific project, grant **BSS ServiceAgencyCreatePolicy** (global service) for the project as well. Granting **RDS FullAccess** for all projects eliminates the need for additional

Role/Policy Name	Description	Type	Dependencies
			configuration when using IAM actions. **BSS ServiceAgencyCreatePolicy** contains the following actions: **iam:agencies:createAgency** and **iam:permissions:grantRoleToAgency**.
RDS ReadOnlyAccess	Read-only permissions for Relational Database Service	System-defined policy	N/A
RDS ManageAccess	Database administrator permissions for all operations except deleting RDS resources	System-defined policy	N/A
RDS Administrator	Administrator permissions for RDS	System-defined role	**Tenant Guest** and **Server Administrator** roles, which must be attached in the same project as the **RDS Administrator** role. If only the **RDS Administrator** role is attached, to use storage autoscaling, an IAM user must be granted the actions on storage autoscaling listed in **Table 10-3**.

Table 10-2 lists the common operations supported by system-defined permissions for RDS.

Table 10-2 Common operations supported by system-defined permissions

Operation	RDS FullAccess	RDS ReadOnlyAccess	RDS ManageAccess	RDS Administrator
Creating an RDS DB instance	√	x	√	√
Deleting an RDS DB instance	√	x	x	√
Querying an RDS DB instance list	√	√	√	√

Table 10-3 Common operations and supported actions

Operation	Actions	Remarks
Creating a DB instance	rds:instance:create rds:param:list	Selecting a VPC, subnet, and security group requires the following actions: • vpc:vpcs:list • vpc:vpcs:get • vpc:subnets:get • vpc:securityGroups:get • vpc:securityGroupRules:get Creating an encrypted instance requires the **KMS Administrator** permission for the project. Purchasing a yearly/monthly DB instance requires the following actions: bss:order:update bss:order:pay
Changing DB instance specifications	rds:instance:modifySpec	N/A

Operation	Actions	Remarks
Scaling up storage space	rds:instance:extendSpace	N/A
Rebooting a DB instance	rds:instance:restart	N/A
Deleting a DB instance	rds:instance:delete	N/A
Querying a DB instance list	rds:instance:list	N/A
Querying DB instance details	rds:instance:list	Displaying VPCs, subnets, and security groups on the instance details page requires **vpc:*:get** and **vpc:*:list**.
Changing a DB instance password	rds:password:update	N/A
Changing a database port	rds:instance:modifyPort	N/A
Changing a floating IP address	rds:instance:modifyIp	Querying unused IP addresses requires the following actions: vpc:subnets:get vpc:ports:get
Changing a DB instance name	rds:instance:modify	N/A
Changing a maintenance window	rds:instance:modify	N/A
Performing a manual switchover	rds:instance:switchover	N/A
Changing the replication mode	rds:instance:modifySynchroni-zeModel	N/A
Changing the failover priority	rds:instance:modifyStrategy	N/A
Changing a security group	rds:instance:modifySecurityGro up	N/A

Operation	Actions	Remarks
Binding or unbinding an EIP	rds:instance:modifyPublicAccess	Querying public IP addresses requires the following actions: vpc:publicIps:get vpc:publicIps:list
Modifying the recycling policy	rds:instance:setRecycleBin	N/A
Querying the recycling policy	rds:instance:list	N/A
Enabling or disabling SSL	rds:instance:modifySSL	N/A
Enabling or disabling event scheduler	rds:instance:modifyEvent	N/A
Applying for a private domain name	rds:instance:createDns	N/A
Migrating a standby DB instance to another AZ	rds:instance:create	Standby DB instance migration involves operations on the IP address in the subnet. For encrypted DB instances, you need to configure the **KMS Administrator** permission in the project.
Restoring tables to a specified point in time	rds:instance:tableRestore	N/A
Configuring TDE permission	rds:instance:tde	N/A
Changing host permission	rds:instance:modifyHost	N/A
Querying hosts of the corresponding database account	rds:instance:list	N/A
Obtaining a parameter template list	rds:param:list	N/A
Creating a parameter template	rds:param:create	N/A

Operation	Actions	Remarks
Modifying parameters in a parameter template	rds:param:modify	N/A
Applying a parameter template	rds:param:apply	N/A
Modifying parameters of a specified DB instance	rds:param:modify	N/A
Obtaining the parameter template of a specified DB instance	rds:param:list	N/A
Obtaining parameters of a specified parameter template	rds:param:list	N/A
Deleting a parameter template	rds:param:delete	N/A
Resetting a parameter template	rds:param:reset	N/A
Comparing parameter templates	rds:param:list	N/A
Saving parameters in a parameter template	rds:param:save	N/A
Querying a parameter template type	rds:param:list	N/A
Setting an automated backup policy	rds:instance:modifyBackupPolicy	N/A
Querying an automated backup policy	rds:instance:list	N/A
Creating a manual backup	rds:backup:create	N/A
Obtaining a backup list	rds:backup:list	N/A
Obtaining the link for downloading a backup file	rds:backup:download	N/A

Operation	Actions	Remarks
Deleting a manual backup	rds:backup:delete	N/A
Replicating a backup	rds:backup:create	N/A
Querying the restoration time range	rds:instance:list	N/A
Restoring data to a new DB instance	rds:instance:create	Selecting a VPC, subnet, and security group requires the following actions: vpc:vpcs:list vpc:vpcs:get vpc:subnets:get vpc:securityGroups:get vpc:securityGroupRules:get
Restoring data to an existing or original DB instance	rds:instance:restoreInPlace	N/A
Obtaining the binlog clearing policy	rds:binlog:get	N/A
Merging binlog files	rds:binlog:merge	N/A
Downloading a binlog file	rds:binlog:download	N/A
Deleting a binlog file	rds:binlog:delete	N/A
Configuring a binlog clearing policy	rds:binlog:setPolicy	N/A
Obtaining a database backup file list	rds:backup:list	N/A
Obtaining a backup database list at a specified time point	rds:backup:list	N/A
Querying a database error log	rds:log:list	N/A
Querying a database slow log	rds:log:list	N/A
Downloading a database error log	rds:log:download	N/A

Operation	Actions	Remarks
Downloading a database slow log	rds:log:download	N/A
Enabling or disabling the audit log function	rds:auditlog:operate	N/A
Obtaining an audit log list	rds:auditlog:list	N/A
Querying the audit log policy	rds:auditlog:list	N/A
Obtaining the link for downloading an audit log	rds:auditlog:download	N/A
Obtaining a switchover log	rds:log:list	N/A
Creating a database	rds:database:create	N/A
Querying details about databases	rds:database:list	N/A
Querying authorized databases of a specified user	rds:database:list	N/A
Dropping a database	rds:database:drop	N/A
Creating a database account	rds:databaseUser:create	N/A
Querying details about database accounts	rds:databaseUser:list	N/A
Querying authorized accounts of a specified database	rds:databaseUser:list	N/A
Deleting a database account	rds:databaseUser:drop	N/A
Authorizing a database account	rds:databasePrivilege:grant	N/A
Revoking permissions of a database account	rds:databasePrivilege:revoke	N/A
Viewing a task center list	rds:task:list	N/A

Operation	Actions	Remarks
Deleting a task from the task center	rds:task:delete	N/A
Submitting an order for a yearly/monthly DB instance	bss:order:update	Purchasing a yearly/monthly DB instance requires the following actions: bss:order:pay
Managing a tag	rds:instance:modify	Tag-related operations depend on the tms:resourceTags:* permission.
Configuring autoscaling	rds:instance:extendSpace	To enable storage autoscaling, an IAM user (instead of your Huawei account) must be granted the following actions: • Creating a custom policy: – iam:agencies:listAgencies – iam:agencies:createAgency – iam:permissions:listRolesForAgencyOnProject – iam:permissions:grantRoleToGroupOnProject – iam:roles:listRoles – iam:roles:createRole • Adding system role **Security Administrator**: 1. Select a user group to which the user belongs. 2. Click **Authorize** in the **Operation** column. 3. Add the **Security Administrator** role.

11 Constraints

To improve instance stability and security, RDS has certain constraints in place.

Constraints on Usage

- Only the InnoDB storage engine is supported. Transparent Data Encryption (TDE) is not supported.
- DDL statements cannot be executed during full backup.
- DML operations cannot be performed on tables in system databases such as **mysql**, **information_schema**, and **performance_schema**.
- Operations that require the **SUPER** or ***_ADMIN** permissions are not supported.

Specifications

Table 11-1 Specifications

Item	Constraints	Description
Storage space	Cloud SSD: 40 GB to 4,000 GB	-
Connections	A maximum of 100,000 for 512 GB of memory	The default maximum number of connections varies depending on the memory size.
IOPS	Cloud SSD: a maximum of 50,000	The input/output operations per second (IOPS) supported depends on the I/O performance of Elastic Volume Service (EVS) disks. For details, see the description about ultra-high I/O in **Disk Types and Performance** of *Elastic Volume Service Service Overview*.

Quotas

Table 11-2 Quotas

Item	Constraints	Description
Read replica	A maximum of five read replicas can be created for a DB instance.	For more information, see **Introduction to Read Replicas**.
Tags	A maximum of 20 tags can be added for a DB instance.	For more information, see **Managing Tags**.
Free backup space	RDS for MariaDB provides free backup space of the same size as your purchased storage space.	After you pay for the storage space of your DB instance, you will get a backup space of the same size for free. For more information, see **How Is RDS Backup Data Billed?**
Retention period of automated backups	The default value is 7 days. The value ranges from 1 to 732 days.	For more information, see **Configuring a Same-Region Backup Policy**.
Log retention period	• Error log details: 30 days • Slow query log details: 30 days	For more information, see **Log Management**.

Naming

Table 11-3 Naming

Item	Constraints
Instance name	• 4 to 64 characters long • Must start with a letter. Only letters (case sensitive), digits, hyphens (-), and underscores (_) are allowed.
Database name	• 1 to 64 characters long • Only letters, digits, hyphens (-), and underscores (_) are allowed. The total number of hyphens (-) cannot exceed 10.
Account name	• 1 to 32 characters long • Only letters, digits, hyphens (-), and underscores (_) are allowed.

Item	Constraints
Backup name	• 4 to 64 characters long • Must start with a letter. Only letters (case sensitive), digits, hyphens (-), and underscores (_) are allowed.
Parameter template name	• 1 to 64 characters long • Only letters (case sensitive), digits, hyphens (-), underscores (_), and periods (.) are allowed.

Security

Table 11-4 Security

Item	Constraints
Root permissions	Only the administrator account **root** is provided on the instance creation page. For details about the supported permissions, see **Table 11-6**. **NOTE** Running **revoke**, **drop user**, or **rename user** on **root** may cause service interruption. Exercise caution when running any of these statements.
Root password	• 8 to 32 characters long • Must contain at least three types of the following characters: uppercase letters, lowercase letters, digits, and special characters (~!@$#%^*-_=+?,()&). For more information, see **Resetting the Administrator Password to Restore Root Access**.
Database port	1024 to 65535 (excluding 12017 and 33071, which are occupied by the RDS system) For more information, see **Changing a Database Port**.
VPC	The VPC where a DB instance is located cannot be changed after the instance is created.
Security group	• By default, you can create a maximum of 100 security groups in your cloud account. • By default, you can add up to 50 security group rules to a security group. For more information, see **Configuring a Security Group Rule**. • One RDS DB instance can be associated with multiple security groups, and one security group can be associated with multiple RDS DB instances.

Item	Constraints
System account	To provide O&M services, the system automatically creates system accounts when you create RDS for MariaDB instances. These system accounts are unavailable to you. • **mariadb.sys**: used to create views. • **rdsAdmin**: a management account, used to query and modify instance information, rectify faults, migrate data, and restore data. • **rdsRepl**: a replication account, used to synchronize data from the primary instance to the standby instance or read replicas. • **rdsBackup**: a backup account, used for backend backup. • **rdsMetric**: a metric monitoring account used by watchdog to collect database status data. • **rdsProxy**: a database proxy account, used for authentication when the database is connected through the read/write splitting address. This account is automatically created when you enable read/write splitting.
Instance parameter	To ensure the optimal performance of RDS, you can modify parameters in the parameter template you created as needed.

Instance Operations

Table 11-5 Instance operations

Item	Description
Instance deployment	ECSs where DB instances are deployed are not directly visible to you. You can only access the DB instances through IP addresses and database ports.
Data synchronization	You can synchronize data from self-managed MariaDB databases or MariaDB databases built on other clouds to RDS for MariaDB, or from one RDS for MariaDB instance to another RDS for MariaDB instance. The common data synchronization tool is Data Replication Service (DRS). For details, see **From MariaDB to MariaDB**. DRS is easy to use and can complete a synchronization task in minutes. DRS facilitates data transfer between databases, helping you reduce DBA labor costs and hardware costs.

Item	Description
High CPU usage	If the CPU usage is high or close to 100%, data read/write and database access will become slow, and an error will be reported during data deletion.
Full storage	There is not enough storage available for a DB instance and the instance becomes read-only, so applications cannot write any data to the instance. For details, see **What Should I Do If an RDS DB Instance Is Abnormal Due to Full Storage Space?**
Number of tables	RDS for MariaDB supports a maximum of 500,000 tables. If there are more than 500,000 tables, database backup or a minor version upgrade may fail.
Rebooting a DB instance	DB instances cannot be rebooted through commands. They must be rebooted through the RDS console. For details, see **Rebooting DB Instances or Read Replicas**.
Viewing backups	You can download automated and manual backups for local storage. To download a backup, you can use OBS Browser+, the current browser, or the download URL. For more information, see **Downloading a Full Backup File**.
Log management	• RDS for MariaDB logging is enabled by default and cannot be disabled. • Binary logging is enabled for RDS for MariaDB by default and uses row-based logging. • Read replicas do not provide binlogs.
Recycle bin	RDS for MariaDB allows you to move deleted pay-per-use DB instances to the recycle bin. You can rebuild a DB instance that was deleted up to 7 days ago from the recycle bin.

Root Permissions

Table 11-6 Root permissions

Permission	Level	Description	Supported
Select	Table	Query permissions	Yes
Insert	Table	Insert permissions	
Update	Table	Update permissions	
Delete	Table	Delete permissions	
Create	Database, table, or index	Permissions of creating databases, tables, or indexes	

Permission	Level	Description	Supported
Drop	Database or table	Permissions of deleting databases or tables	
Reload	Server management	Permissions of running the following commands: flush-hosts, flush-logs, flush-privileges, flush-status, flush-tables, flush-threads, refresh, and reload	
Process	Server management	Permissions of viewing processes	
Grant	Database, table, or stored program	Permissions of granting access control	
References	Database or table	Foreign key operation permissions	
Index	Table	Index permissions	
Alter	Table	Permissions of altering tables, such as adding fields or indexes	
Show_db	Server management	Permissions of viewing database connections	
Create_tmp_table	Server management	Permissions of creating temporary tables	
Lock_tables	Server management	Permissions of locking tables	
Execute	Stored procedure	Permissions of executing storage procedures	
Repl_slave	Server management	Replication permissions	
Repl_client	Server management	Replication permissions	

Permission	Level	Description	Supported
Create_view	View	Permissions of creating views	
Show_view	View	Permissions of viewing views	
Create_routine	Stored procedure	Permissions of creating stored procedures	
Alter_routine	Stored procedure	Permissions of altering stored procedures	
Create_user	Server management	Permissions of creating users	
Event	Database	Event triggers	
Trigger	Database	Triggers	
Super	Server management	Permissions of killing threads	No **NOTE** For details, see **Why Does the Root User of My RDS Instance Not Have the Super Permissions?**
File	File on the server	Permissions of accessing files on database server nodes	No
Shutdown	Server management	Permissions of shutting down databases	
Create_tablespace	Server management	Permissions of creating tablespaces	

12 Related Services

The following figure shows the relationship between RDS for MariaDB and other services.

Figure 12-1 Relationships between RDS for MariaDB and other services

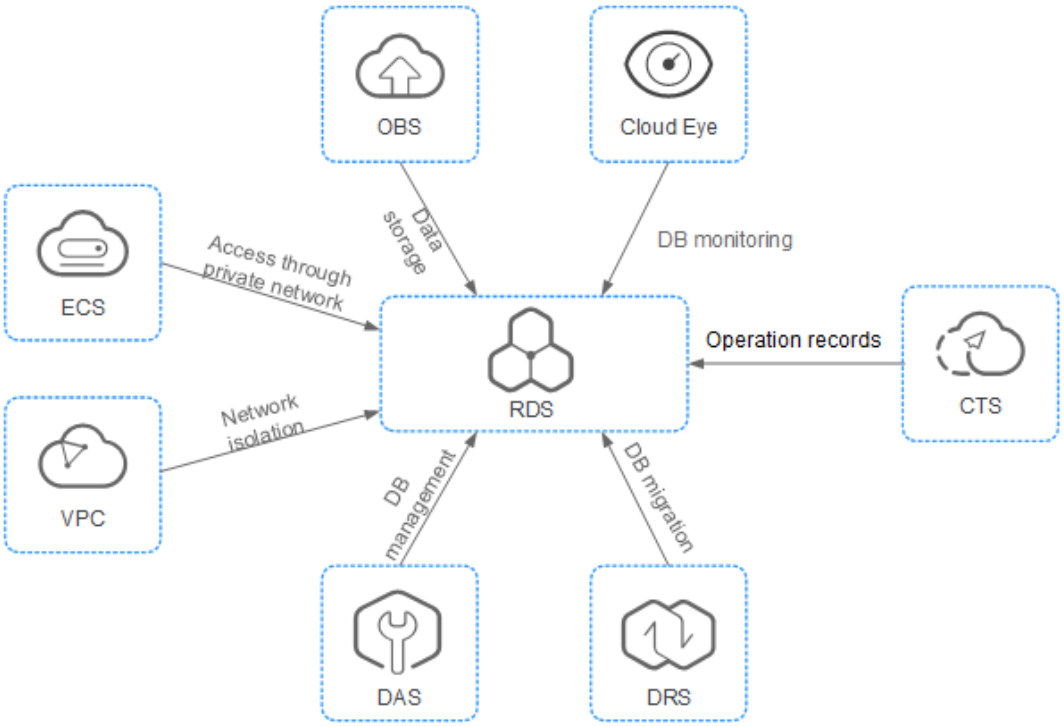


Table 12-1 Related services

Service Name	Description
Elastic Cloud Server (ECS)	Enables you to access RDS DB instances through an internal network. You can then access applications faster and you do not need to pay for public network traffic.
Virtual Private Cloud (VPC)	Isolates your networks and controls access to your RDS DB instances.

Service Name	Description
Object Storage Service (OBS)	Stores automated and manual backups of your RDS DB instances.
Cloud Eye	Monitors RDS resources in real time and reports alarms and warnings promptly.
Cloud Trace Service (CTS)	Records operations on cloud service resources for query, audit, and backtrack.
Data Replication Service (DRS)	Smoothly migrates databases to the cloud.
Data Admin Service (DAS)	Provides a visualized GUI interface for you to connect to and manage cloud databases.

13 Basic Concepts

DB Instances

The smallest management unit of RDS is DB instance. A DB instance is an isolated database environment on the cloud. An instance ID uniquely identifies a DB instance. A DB instance can contain multiple user-created databases and can be accessed using tools and applications. Each database name is unique.

A default administrator account is provided when you purchase a DB instance. You can use this account to create databases and database users and assign permissions to them. For details about the **root** permissions, see **Table 11-6**. You can set the administrator password when or after purchasing a DB instance. If you forget the administrator password, you can reset it.

You can create and manage DB instances running MariaDB on the console. For details about DB instance types, specifications, engines, versions, and statuses, see **DB Instance Description**.

DB Instance Types

There are two types of RDS DB instances: single-node instances and primary/standby instances. Instance specifications vary depending on the instance type.

For details, see **Product Series**.

DB Instance Classes

The DB instance class determines the compute (vCPUs) and memory capacity (memory size) of a DB instance. For details, see **DB Instance Classes**.

Automated Backups

When you create a DB instance, an automated backup policy is enabled by default, but after the DB instance is created, you can modify the policy if needed. RDS for MariaDB will automatically create backups for DB instances based on your settings.

Manual Backups

Manual backups are user-initiated full backups of DB instances. They are retained until you delete them manually.

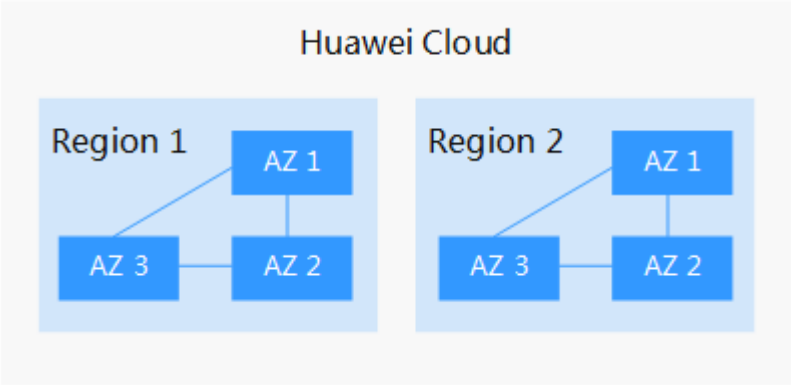
Regions and AZs

A region and availability zone (AZ) identify the location of a data center. You can create resources in a specific region and AZ.

- Regions are defined by their geographical location and network latency. Public services, such as Elastic Cloud Server (ECS), Elastic Volume Service (EVS), Object Storage Service (OBS), Virtual Private Cloud (VPC), Elastic IP (EIP), and Image Management Service (IMS), can all be shared within a given region. Regions are classified as universal regions and dedicated regions. A universal region provides cloud services for all users. A dedicated region provides services of only a specific type or only for specific users.
- An AZ contains one or multiple physical data centers. Each AZ has its own independent cooling, fire extinguishing, moisture-proofing, and electrical facilities. Within an AZ, compute, network, storage, and other resources are logically divided into multiple clusters. AZs within a region are interconnected using high-speed optical fibers so you can build cross-AZ high-availability systems.

Figure 13-1 shows the relationship between regions and AZs.

Figure 13-1 Regions and AZs



Huawei Cloud provides services in many regions around the world. You can select a region and AZ as needed. For more information, see **Global Products and Services**.

Projects

Projects are used to group and isolate OpenStack resources (compute, storage, and network resources). A project can be a department or a project team. Multiple projects can be created for a single account.

