

# Alibaba Cloud

## ApsaraDB for RDS Product Introduction

Document Version: 20220712

# Legal disclaimer

Alibaba Cloud reminds you to carefully read and fully understand the terms and conditions of this legal disclaimer before you read or use this document. If you have read or used this document, it shall be deemed as your total acceptance of this legal disclaimer.

1. You shall download and obtain this document from the Alibaba Cloud website or other Alibaba Cloud-authorized channels, and use this document for your own legal business activities only. The content of this document is considered confidential information of Alibaba Cloud. You shall strictly abide by the confidentiality obligations. No part of this document shall be disclosed or provided to any third party for use without the prior written consent of Alibaba Cloud.
2. No part of this document shall be excerpted, translated, reproduced, transmitted, or disseminated by any organization, company or individual in any form or by any means without the prior written consent of Alibaba Cloud.
3. The content of this document may be changed because of product version upgrade, adjustment, or other reasons. Alibaba Cloud reserves the right to modify the content of this document without notice and an updated version of this document will be released through Alibaba Cloud-authorized channels from time to time. You should pay attention to the version changes of this document as they occur and download and obtain the most up-to-date version of this document from Alibaba Cloud-authorized channels.
4. This document serves only as a reference guide for your use of Alibaba Cloud products and services. Alibaba Cloud provides this document based on the "status quo", "being defective", and "existing functions" of its products and services. Alibaba Cloud makes every effort to provide relevant operational guidance based on existing technologies. However, Alibaba Cloud hereby makes a clear statement that it in no way guarantees the accuracy, integrity, applicability, and reliability of the content of this document, either explicitly or implicitly. Alibaba Cloud shall not take legal responsibility for any errors or lost profits incurred by any organization, company, or individual arising from download, use, or trust in this document. Alibaba Cloud shall not, under any circumstances, take responsibility for any indirect, consequential, punitive, contingent, special, or punitive damages, including lost profits arising from the use or trust in this document (even if Alibaba Cloud has been notified of the possibility of such a loss).
5. By law, all the contents in Alibaba Cloud documents, including but not limited to pictures, architecture design, page layout, and text description, are intellectual property of Alibaba Cloud and/or its affiliates. This intellectual property includes, but is not limited to, trademark rights, patent rights, copyrights, and trade secrets. No part of this document shall be used, modified, reproduced, publicly transmitted, changed, disseminated, distributed, or published without the prior written consent of Alibaba Cloud and/or its affiliates. The names owned by Alibaba Cloud shall not be used, published, or reproduced for marketing, advertising, promotion, or other purposes without the prior written consent of Alibaba Cloud. The names owned by Alibaba Cloud include, but are not limited to, "Alibaba Cloud", "Aliyun", "HiChina", and other brands of Alibaba Cloud and/or its affiliates, which appear separately or in combination, as well as the auxiliary signs and patterns of the preceding brands, or anything similar to the company names, trade names, trademarks, product or service names, domain names, patterns, logos, marks, signs, or special descriptions that third parties identify as Alibaba Cloud and/or its affiliates.
6. Please directly contact Alibaba Cloud for any errors of this document.

# Document conventions

Style	Description	Example
 <b>Danger</b>	A danger notice indicates a situation that will cause major system changes, faults, physical injuries, and other adverse results.	 <b>Danger:</b> Resetting will result in the loss of user configuration data.
 <b>Warning</b>	A warning notice indicates a situation that may cause major system changes, faults, physical injuries, and other adverse results.	 <b>Warning:</b> Restarting will cause business interruption. About 10 minutes are required to restart an instance.
 <b>Notice</b>	A caution notice indicates warning information, supplementary instructions, and other content that the user must understand.	 <b>Notice:</b> If the weight is set to 0, the server no longer receives new requests.
 <b>Note</b>	A note indicates supplemental instructions, best practices, tips, and other content.	 <b>Note:</b> You can use Ctrl + A to select all files.
>	Closing angle brackets are used to indicate a multi-level menu cascade.	Click <b>Settings</b> > <b>Network</b> > <b>Set network type</b> .
<b>Bold</b>	Bold formatting is used for buttons, menus, page names, and other UI elements.	Click <b>OK</b> .
Courier font	Courier font is used for commands	Run the <code>cd /d C:/window</code> command to enter the Windows system folder.
<i>Italic</i>	Italic formatting is used for parameters and variables.	<code>bae log list --instanceid</code> <i>Instance_ID</i>
[] or [a b]	This format is used for an optional value, where only one item can be selected.	<code>ipconfig [-all -t]</code>
{ } or {a b}	This format is used for a required value, where only one item can be selected.	<code>switch {active stand}</code>

# Table of Contents

1.What is ApsaraDB RDS? .....	05
2.Functions and features .....	07
3.Why choose ApsaraDB for RDS .....	08
3.1. Customized database engines .....	08
3.2. Cost effective and easy to use .....	09
3.3. High performance .....	11
3.4. High availability and disaster tolerance .....	12
3.5. High security .....	13
3.6. Competitive advantages of ApsaraDB RDS instances over s... ..	14
4.How do I select the configuration of an ApsaraDB RDS instanc... ..	30
5.Product editions .....	35
5.1. Overview .....	35
5.2. RDS Basic Edition .....	38
5.3. High-availability Edition .....	41
5.4. Cluster Edition .....	43
5.5. Enterprise Edition .....	45
6.Storage types .....	47
7.Product specifications .....	50
7.1. ApsaraDB RDS instance families .....	50
7.2. Primary ApsaraDB RDS instance types .....	52
7.3. Read-only ApsaraDB RDS instance types .....	56
8.Limits .....	59
9.Common scenarios .....	62

# 1. What is ApsaraDB RDS?

ApsaraDB RDS is a stable, reliable, and scalable online database service that is built on top of the Apsara Distributed File System and high-performance SSDs of Alibaba Cloud. ApsaraDB RDS supports the MySQL, SQL Server, PostgreSQL, and MariaDB TX database engines. ApsaraDB RDS provides a portfolio of solutions for disaster recovery, backup, restoration, monitoring, and migration to facilitate database O&M.

## Learning path

For more information about the terms, basic operations, and advanced operations of ApsaraDB RDS, visit the [RDS Learning Path page](#).

## Features

ApsaraDB RDS supports a wide range of features, such as instance management, backup and restoration, log audit, and monitoring and alerting. You can use the instance management feature to create RDS instances and change the specifications of an existing RDS instance. For more information about the supported features, see the following topics:

- [Features of ApsaraDB RDS for MySQL instances](#)
- [Features of ApsaraDB RDS for PostgreSQL instances](#)
- [Features of ApsaraDB RDS for SQL Server instances](#)
- [Features of ApsaraDB RDS for MariaDB TX instances](#)

## Terms

Before you create an RDS instance, we recommend that you fully understand the following terms:

- 
- 
- 
- 

- database engine

ApsaraDB RDS supports the MySQL, SQL Server, PostgreSQL, and MariaDB TX database engines. For more information, see [Quick Start](#).

- network type

You can create an RDS instance in the classic network or in a virtual private cloud (VPC). A VPC is an isolated virtual network that is deployed on Alibaba Cloud. VPCs provide higher security than the classic network. We recommend that you create RDS instances in VPCs.

- edition

ApsaraDB RDS provides the Basic Edition, High-availability Edition, Cluster Edition, and Enterprise Edition. For more information, see [Overview of ApsaraDB RDS editions](#).

- instance family

ApsaraDB RDS provides the shared, general-purpose, and dedicated instance families. For more information, see [Instance families](#).

- storage type

ApsaraDB RDS supports local SSDs, standard SSDs, and enhanced SSDs (ESSDs). For more information, see [Storage types](#).

## Related services

- **Elastic Compute Service (ECS):** ECS provides high-performance cloud servers. If an ECS instance and an RDS instance reside in the same region, these instances can communicate over an internal network to ensure the optimal performance of the RDS instance. The use of ECS and ApsaraDB RDS is a typical service access architecture.
- **ApsaraDB for Redis:** ApsaraDB for Redis is an in-memory database service that persists data on disks. You can use ECS in combination with ApsaraDB RDS and ApsaraDB for Redis to process a large number of read requests within a short period of time.
- **ApsaraDB for MongoDB:** ApsaraDB for MongoDB is a stable, reliable, and scalable database service that is compatible with the MongoDB protocol. You can store structured data in ApsaraDB RDS and unstructured data in ApsaraDB for MongoDB to meet your varying business requirements.
- **MaxCompute:** MaxCompute, formerly known as ODPS, is a fully hosted data warehousing solution that can process terabytes or petabytes of data at high speeds. MaxCompute provides a complete suite of data import solutions and a variety of distributed computing models. You can use these solutions and models to import data from RDS instances into MaxCompute. Then, you can use MaxCompute to process large amounts of data.
- **Data Transmission Service (DTS):** DTS is used to migrate data from on-premises databases to RDS instances and migrate data between RDS instances for disaster recovery.
- **Object Storage Service (OSS):** OSS is a secure, cost-effective, and highly reliable cloud storage solution that allows you to store large amounts of data on the cloud.

## References

- For more information about the pricing of ApsaraDB RDS, see [Pricing, billable items, and billing methods](#).
- For more information about the various issues that you may encounter and how to troubleshoot these issues, see [FAQ](#) and [FAQ overview](#).
- You can use one of the following methods to create RDS instances and manage the created RDS instances, such as creating databases, creating accounts, and configuring networks:
  - ApsaraDB RDS console: The console provides an easy-to-use web-based GUI. For more information, log on to the [ApsaraDB RDS console](#).
  - CLI: All the operations that you can perform in the ApsaraDB RDS console are supported by the CLI. For more information, see [What is Alibaba Cloud CLI?](#)
  - SDK: All the operations that you can perform in the ApsaraDB RDS console are supported by the ApsaraDB RDS SDK. For more information, see [SDK reference](#).
  - API: All the operations that you can perform in the ApsaraDB RDS console are supported by the ApsaraDB RDS API. For more information, see [List of operations by function](#).
  - Quick start: This guide walks you through the procedure of creating an RDS instance to the procedure of connecting to the RDS instance. For more information, see [General workflow to use ApsaraDB RDS](#).

## 2.Functions and features

The features supported by an RDS for MySQL instance vary depending on the instance engine version, RDS edition, and storage type. This topic describes the features supported for each engine.

- [Features of ApsaraDB RDS for MySQL instances](#)
- [Features of ApsaraDB RDS for PostgreSQL instances](#)
- [Features of ApsaraDB RDS for SQL Server instances](#)
- [Features of ApsaraDB RDS for MariaDB TX instances](#)

# 3. Why choose ApsaraDB for RDS

## 3.1. Customized database engines

Alibaba Cloud customizes database engines based on the community editions of native MySQL and PostgreSQL to provide more advanced features.

### AliSQL

AliSQL is an independent MySQL branch that is developed by Alibaba Cloud. AliSQL provides all the features of the MySQL Community Edition. AliSQL also provides some similar features that you can find in the MySQL Enterprise Edition. These similar features include enterprise-grade backup and restoration, thread pool, and parallel query. In addition, AliSQL provides Oracle-compatible features, such as the Sequence engine. ApsaraDB RDS for MySQL with AliSQL provides all features of MySQL and a wide range of advanced features that are developed by Alibaba Cloud. These advanced features include enterprise-grade security, backup and restoration, monitoring, performance optimization, and read-only instances.

AliSQL provides a number of innovative features that are designed to improve functionality, performance, stability, and security, including:

- **Thread Pool**

This feature uses the Listener-Worker model to improve the connection performance of AliSQL. It optimizes the concurrency control for different types of operations based on their priorities. This allows ApsaraDB for RDS to ensure high performance when it processes a large number of concurrent requests.

- **Statement outline**

This feature uses optimizer and index hints to ensure the stability of ApsaraDB for RDS when SQL query plans change due to data update, index addition or deletion, or parameter adjustment.

- **Fast query cache**

The fast query cache is developed by Alibaba Cloud based on the native MySQL query cache. The fast query cache uses a new design and implementation mechanism to increase the query performance of ApsaraDB for RDS. The fast query cache also optimizes concurrency control, memory management, and caching.

- **Binlog in Redo**

This feature synchronously writes binary logs to the redo log file when a transaction is committed. This reduces operations on disks and improves database performance.

- **Faster DDL**

This feature is developed by the ApsaraDB for RDS team. It fixes defects in the cache maintenance logic that is used to manage data definition language (DDL) operations. It also provides the optimized buffer pool management mechanism to reduce competition for locks that are triggered by DDL operations. This feature ensures the DDL operation performance of ApsaraDB for RDS when it processes a regular number of requests.

For more information, see [Overview of AliSQL features](#).

### AliPG

Alibaba Cloud offers two PostgreSQL-compatible database services that run AliPG: ApsaraDB RDS and ApsaraDB for MyBase. AliPG is a unified database engine that is developed by Alibaba Cloud. Since the commercial rollout of AliPG in 2015, AliPG has been running stably for years and processed a large volume of workloads within Alibaba Group and for Alibaba Cloud customers. AliPG supports the following major PostgreSQL versions: 9.4, 10, 11, 12, 13 and 14.

AliPG has the following advantages over open source PostgreSQL:

- **Faster speed**
  - Image recognition and vector similarity-based searches are tens of thousands of times faster on AliPG than on open source PostgreSQL. For more information, see [Image recognition, similarity-based retrieval, and similarity-based audience spotting](#).
  - Marketing and user profiling in real time are thousands of times faster on AliPG than on open source PostgreSQL. For more information, see [Real-time precision marketing \(user selection\)](#).
  - The GIS-based Mod operator on AliPG processes mobile objects 50 times faster than the Mod operator on open source PostGIS. For more information, see [Overview](#).
- **Higher stability**

AliPG uses the Platform as a Service (PaaS) architecture. This architecture allows you to transform traditional software from license-based services to subscription-based services. You can manage a large amount of metadata, optimize connections, and efficiently isolate resources. In addition, each RDS instance supports tens of thousands of schemas.
- **Higher security**
  - AliPG is certified based on leading national and international security standards, which empowers enterprises to increase institutional security scores in the financing and listing phases.
  - AliPG provides the following security enhancements:
    - Encrypts sensitive data that contains passwords. The sensitive data includes dynamic views, shared memory, the dblink plug-in, historical commands, and audit logs.
    - Fixes the function-related bugs that are found in open source PostgreSQL.
    - Supports fully encrypted databases. For more information, see [Fully encrypted databases](#).
    - Supports the semi-synchronous mode. This mode allows you to specify one of the following protection levels for your RDS instance: maximum protection, maximum availability, and maximum performance. For more information, see [Set the protection level of an ApsaraDB RDS for PostgreSQL instance](#).
    - Supports the failover slot feature. This feature prevents primary/secondary switchovers from affecting the reliability of logical replication. For more information, see [Logical Replication Slot Failover](#).
- **Higher flexibility and controllability.** For more information, see [What is ApsaraDB for MyBase?](#)
  - AliPG grants you the permissions to manage the operating systems on hosts in dedicated clusters.
  - AliPG allows you to customize overcommit ratios in the development, test, and staging environments. For example, you can specify 128 cores for a host that provides only 64 cores. This way, you can exclusively occupy resources in the production environment to reduce the overall costs.

For more information about the features of AliPG, see [Functional modules of AliPG](#).

## 3.2. Cost effective and easy to use

It features cost-effectiveness, flexible billing, on-demand configuration changes, easy deployment, high compatibility, and simple operations and maintenance (O&M).

## Flexible billing

ApsaraDB RDS supports the subscription and pay-as-you-go billing methods. You can flexibly choose a billing method based on your business requirements to reduce costs.

- For short-term use, we recommend that you choose the pay-as-you-go billing method. A pay-as-you-go instance is charged per hour based on your actual resource usage. If you no longer need your pay-as-you-go instance, you can release it to reduce costs.
- For long-term use, we recommend that you choose the subscription billing method. You can receive larger discounts for longer subscription periods.

For more information about how to change the specifications of an RDS instance, see the following topics:

- [Change the specifications of an ApsaraDB RDS for MySQL instance](#)
- [变更配置](#)
- [Change the specifications of an ApsaraDB RDS for SQL Server instance](#)
- [Change the configuration of an RDS MariaDB instance](#)

For more information about the fees for specification changes, see [Billing methods](#).

## On-demand configuration changes

You can purchase an RDS instance with low specifications that can meet your business requirements. As the database workloads and data storage increase, you can upgrade the instance specifications. If your business scale becomes small again, you can downgrade the instance specifications to reduce costs.

For more information, see [Change the specifications of an ApsaraDB RDS instance](#) and [Specification change fees](#).

## Easy deployment

- You do not need to purchase database server hardware or software. This significantly reduces costs.
- You can create an RDS instance of required specifications within a few minutes in the [ApsaraDB RDS console](#) by calling an [API operation](#).

## High compatibility

- You can use ApsaraDB RDS databases in the same way as databases that run native engines. This relieves the need to acquire new knowledge.
- ApsaraDB RDS is compatible with existing programs and tools. You can use [Data Transmission Service \(DTS\)](#) to quickly migrate data to ApsaraDB RDS. You can also use common data import and export tools to migrate data. The data migration does not require much workforce.

## Easy O&M

- Alibaba Cloud is responsible for routine maintenance and management tasks of ApsaraDB RDS instances. This includes troubleshooting hardware and software issues and installing database patches.
- You can add, delete, restart, back up, and restore RDS instances in the ApsaraDB RDS console or by calling API operations.

## Get started with ApsaraDB RDS

- [Quick Start](#)
- [ApsaraDB RDS learning path](#)

## Related information

- [How do I select the configuration of an ApsaraDB RDS instance?](#)

# 3.3. High performance

ApsaraDB RDS provides high-performance database instances. These database instances support features such as parameter optimization and SQL optimization.

## Parameter optimization

All parameters that are used in ApsaraDB RDS have been tested and optimized over years of production practices that are conducted by a team of experienced database administrators (DBAs) from Alibaba Cloud. These DBAs have continued to optimize each ApsaraDB RDS instance throughout the lifecycle of the instance to ensure that the instance runs at its optimal configuration.

## SQL optimization

ApsaraDB RDS identifies SQL statements that are run at low speeds and provides recommendations that help you optimize your business code.

## High-end hardware

All server hardware that is used by ApsaraDB RDS has passed the tests of multiple concerned parties. This ensures that ApsaraDB RDS can deliver optimal performance and high stability.

## High-speed access

If an ApsaraDB RDS instance is used with an Elastic Compute Service (ECS) instance that resides in the same region as the RDS instance, these instances can communicate over an internal network to shorten response time and reduce Internet traffic consumption. For more information about ECS instances, see [What is ECS?](#)

## Performance overview

- [ApsaraDB RDS for MySQL performance overview](#)
- [ApsaraDB RDS for SQL Server performance overview](#)
- [ApsaraDB RDS for PostgreSQL performance overview](#)

## Get started with ApsaraDB RDS

- [Quick Start](#)
- [Learning Path](#)

## Related information

- [How do I select the configuration of an ApsaraDB RDS instance?](#)
- [Considerations for performance comparison between a user-created database and an ApsaraDB for RDS instance](#)

# 3.4. High availability and disaster tolerance

ApsaraDB for RDS supports multiple disaster tolerance plans to protect you from data loss.

## Backup and recovery

- RDS supports automatic and manual backups. You can set the automatic backup frequency or manually create backups at any time. For more information, see [Backup and recovery](#).
- RDS supports data recovery by time or backup set. You can restore data of any point in time within the log retention period to a new instance, verify the data, and then transfer the data to the original instance. For more information, see [Backup and recovery](#).

## Disaster tolerance

Series	Disaster tolerance
Basic Edition	<ul style="list-style-type: none"> <li>• Data backups are stored as multiple copies on OSS or distributed cloud disks to prevent data loss. This applies to all RDS series.</li> <li>• The Basic Edition consists of a single node without a slave node as hot backup. Therefore, if fault occurs, the restoration time is long. Choose Basic Edition if you do not require high availability.</li> </ul>
High-availability Edition	<p>The High-availability Edition adopts the high-availability architecture with one master node and one slave node. It is applicable to over 80% of scenarios. If the master node fails, a switchover occurs within seconds without affecting your applications. If the slave node fails, a new slave node is automatically generated to ensure high availability.</p> <ul style="list-style-type: none"> <li>• Single-zone instance: The master and slave nodes are in the same zone but on different physical servers. All cabinets, air conditioners, electricity, and networks in the zone are redundant to ensure high availability.</li> <li>• Multi-zone instance: The master and slave nodes are in different zones of an area, providing area-level disaster tolerance ability.</li> </ul> <div style="background-color: #e0f2f7; padding: 10px; margin-top: 10px;"> <p><b>Note</b></p> <ul style="list-style-type: none"> <li>• You can switch between single-zone instances and multi-zone instances. For more information, see the following topics:               <ul style="list-style-type: none"> <li>◦ <a href="#">Migrate an ApsaraDB RDS for MySQL instance across zones in the same region</a></li> <li>◦ <a href="#">Migrate an ApsaraDB RDS for PostgreSQL instance across zones in the same region</a></li> <li>◦ <a href="#">Migrate an ApsaraDB RDS for SQL Server instance across zones in the same region</a></li> </ul> </li> <li>• When the slave node malfunctions, RDS instantly backs up the master node. When the backup process is about to finish, a global lock is generated and the master node runs in the read-only status for 5 seconds or less.</li> </ul> </div>

Series	Disaster tolerance
Cluster Edition	<p>Based on the AlwaysOn technology, it provides one master node, one slave node, and up to seven read-only nodes that horizontally scale read capabilities. The slave and read-only nodes synchronize data from the master node. The Cluster Edition provides the same availability as the High-availability Edition. Besides, the read-only nodes can be deployed in zones different from those of the master and slave nodes.</p> <div style="background-color: #e6f2ff; padding: 10px;"> <p> <b>Note</b></p> <ul style="list-style-type: none"> <li>• Only RDS SQL Server 2017 provides the Cluster Edition. For more information, see <a href="#">Cluster Edition</a>.</li> <li>• For information about RDS MySQL read-only instances, see <a href="#">Overview of read-only ApsaraDB RDS for MySQL instances</a>.</li> <li>• For information about RDS PostgreSQL read-only instances, see <a href="#">Overview of read-only ApsaraDB RDS for PostgreSQL instances</a>.</li> </ul> </div>
Enterprise Edition	<ul style="list-style-type: none"> <li>• RDS MySQL 5.7 supports the Enterprise Edition.</li> <li>• In the Enterprise Edition, your DB system has one master instance and two slave instances. Data is replicated between the master and slave instances through multiple replicas to guarantee data consistency and finance-level reliability. The Enterprise Edition can be used by large-sized enterprises to build core production databases.</li> <li>• In the Enterprise Edition, the master and slave instances are located in three different zones in the same region.</li> </ul>

## Get started

- [Getting Started](#)
- [Learning path](#)

## Related information

- [How do I select the configuration of an ApsaraDB RDS instance?](#)
- [Build a high availability architecture](#)

# 3.5. High security

ApsaraDB for RDS provides a complete set of security measures to guarantee data security.

## DDoS protection

If DDoS attacks are detected, the security system of RDS enables traffic cleaning first. If traffic cleaning fails or the attacks reach the blackhole threshold, blackhole filtering is triggered. For more information, see [Attack protection](#).

 **Note** We recommend that you access RDS instances through the intranet to prevent DDoS attacks.

## Access control

- IP addresses can access your RDS instance only after you add them to the whitelists of the RDS instance. IP addresses that are not in the whitelists cannot access the RDS instance.
- Each account can only view and operate its own databases.

For more information, see [access control](#).

### System security

- RDS is protected by multiple firewall layers that block various network attacks to guarantee data security.
- Direct logon to the RDS server is not allowed. Only the ports required by certain database services are open.
- The RDS server cannot initiate an external connection. It can only accept access requests.

For more information, see [Network isolation](#).

### Professional security team

Alibaba Cloud security team is responsible for guaranteeing the security of RDS.

### Get started

- [Getting Started](#)
- [Learning path](#)

### Related information

- [How do I select the configuration of an ApsaraDB RDS instance?](#)

## 3.6. Competitive advantages of ApsaraDB RDS instances over self-managed databases

ApsaraDB RDS provides highly available, reliable, secure, and scalable cloud-hosted databases that are comparable to commercial databases in terms of performance. These cloud-hosted databases cost approximately two thirds lower than self-managed databases that are hosted on Elastic Compute Service (ECS) instances, and approximately nine tenths lower than self-managed databases that are deployed on third-party database servers.

### Comparison between ApsaraDB RDS instances and self-managed databases in terms of price

Item	ApsaraDB RDS instance	Self-managed database on ECS instance	Self-managed database on third-party database server
------	-----------------------	---------------------------------------	--

Item	ApsaraDB RDS instance	Self-managed database on ECS instance	Self-managed database on third-party database server
Hardware, spare parts, and accessories	<p>You are charged only for the RDS instances that you create. For example, an RDS instance that provides 2 cores, 4 GB of memory, and 100 GB of storage to deliver up to 6,800 IOPS costs USD 1,000 per year.</p>	<p>You must purchase at least two ECS instances to build a primary/secondary architecture. Two ECS instances that each provide 2 cores, 4 GB of memory, and 100 GB of storage to deliver up to 6,800 IOPS costs USD 900 per year.</p>	<ul style="list-style-type: none"> <li>• You must purchase at least two database servers. A database server that delivers up to 6,800 IOPS costs approximately USD 1,200.</li> <li>• You must purchase one internal switch that is used to connect to the frontend web server. A 1U non-hosted switch costs approximately USD 140.</li> <li>• You must purchase spare parts and accessories for future repairs and replacements. These spare parts and accessories cost at least 30% of the fee that you pay for hardware.</li> <li>• The fee for hardware is approximately USD 3,300 based on the following calculation: <math>(1200 \times 2 + 140) \times 130\% \approx 3300</math>.</li> </ul> <p>If the hardware retires in three years, the annual fee for spare parts and accessories is USD 1,100 based on the following calculation: <math>3300/3 = 1100</math>.</p>
Hosting in data centers	<p>The fees for hosting in data centers are charged to the cloud service provider. No fees are charged to you.</p>	<p>The fees for hosting in data centers are charged to the cloud service provider. No fees are charged to you.</p>	<p>Every 1U of rack space costs USD 400 per year. The annual fee that is required to host two 1U database servers and one 1U internal switch is USD 1,200 based on the following calculation: <math>400 \times 3 = 1200</math>.</p>

Item	ApsaraDB RDS instance	Self-managed database on ECS instance	Self-managed database on third-party database server
Bandwidth	<ul style="list-style-type: none"> <li>If an ECS instance and an RDS instance reside in the same region, these instances can communicate over an internal network. You are not charged for the internal network traffic that you consume.</li> <li>If an ECS instance and an RDS instance reside in different regions, these instances can communicate over the Internet. You are not charged for the Internet traffic that you consume.</li> </ul>	<ul style="list-style-type: none"> <li>ECS instances in the same region can communicate over an internal network. You are not charged for the internal network traffic that you consume.</li> <li>ECS instances in different regions can communicate over the Internet. You are charged for the Internet traffic that you consume. For more information, see <a href="#">Public bandwidth</a>.</li> </ul>	Your databases can communicate only over an internal network. You are not charged for Internet traffic because no Internet traffic is consumed.
Database O&M	The fees for database O&M are charged to the cloud service provider. No fees are charged to you.	The monthly salary of a junior database administrator (DBA) is USD 5,000 or more. If a database project accounts for 30% of the total workload that a DBA needs to complete, the annual fee that is required to maintain the database project is at least USD 18,000 based on the following calculation: $5000 \times 12 \times 30\% = 18000$ .	The monthly salary of a DBA is USD 5,000 or more. If a database project accounts for 30% of the total workload that a DBA needs to complete, the annual fee that is required to maintain the database project is at least USD 18,000 based on the following calculation: $5000 \times 12 \times 30\% = 18000$ .
Annual fee in total	USD 1,000	USD 18,900	USD 20,300

### Advantages of ApsaraDB RDS for MySQL instances over self-managed MySQL databases

Item	ApsaraDB RDS for MySQL instance	Self-managed MySQL database on ECS instance	Self-managed MySQL database on third-party database server
Cost-effectiveness	<ul style="list-style-type: none"> <li>Scalable resources are provided.</li> <li>AliSQL is an independent MySQL branch that is developed by Alibaba Cloud. AliSQL provides features that are similar to the features of MySQL Enterprise Edition to improve user experience. For more information, see <a href="#">Overview of AliSQL features</a>.</li> <li>A free quota for backup storage is provided. The free quota is up to twice the purchased storage capacity based on the instance configuration. For more information, see <a href="#">Backup storage pricing for an ApsaraDB RDS for MySQL instance</a>.</li> <li>Internet traffic is free of charge.</li> <li>User-provided domain names are supported free of charge.</li> <li>Updates to ApsaraDB RDS for MySQL are released by Alibaba Cloud to keep pace with the latest MySQL releases.</li> </ul>	<ul style="list-style-type: none"> <li>Scalable resources are provided.</li> <li>Open source MySQL is used. No optimization is provided.</li> <li>You are charged for the backup storage that you use.</li> <li>You are charged for the Internet traffic that you consume.</li> </ul>	<ul style="list-style-type: none"> <li>The initial investment cost is high.</li> <li>Open source MySQL is used. No optimization is provided.</li> <li>You must allocate independent backup resources. This requires high costs.</li> <li>You are charged for the Internet traffic that you consume and the domain names that you use. The domain names are charged at high prices.</li> </ul>

Item	ApsaraDB RDS for MySQL instance	Self-managed MySQL database on ECS instance	Self-managed MySQL database on third-party database server
Availability	<ul style="list-style-type: none"> <li>In RDS Basic Edition, your database system requires approximately 15 minutes to complete a failover.</li> <li>In RDS High-availability Edition or RDS Cluster Edition, your database system runs in a proprietary high-availability architecture of Alibaba Cloud. This architecture allows your database system to complete a failover within 30 seconds.</li> <li>You can create read-only RDS instances to balance loads in your database system. For more information, see <a href="#">Overview of read-only ApsaraDB RDS for MySQL instances</a>.</li> <li>Read/write splitting allows your database system to distribute read and write requests by using a unified read/write splitting endpoint. For more information, see <a href="#">Enable the proxy terminal feature for an ApsaraDB RDS for MySQL instance</a>.</li> <li>Analytic RDS instances that can be used to analyze data are in development.</li> </ul>	<ul style="list-style-type: none"> <li>In the basic edition, your databases require approximately 30 minutes to complete a failover.</li> <li>You must purchase additional software or hardware to build a high-availability architecture.</li> <li>You must configure or purchase additional software or hardware to build a load balancing architecture.</li> <li>If you want to analyze data, you must create analytic databases. The process of creating analytic databases is time-consuming and requires high costs.</li> </ul>	<ul style="list-style-type: none"> <li>Your databases are standalone. If a database server breaks down, repairs can take hours to weeks.</li> <li>You must purchase additional software or hardware to build a high-availability architecture.</li> <li>You must configure or purchase additional software or hardware to build a load balancing architecture.</li> <li>If you want to analyze data, you must create analytic databases. The process of creating analytic databases is time-consuming and requires high costs.</li> </ul>

Item	ApsaraDB RDS for MySQL instance	Self-managed MySQL database on ECS instance	Self-managed MySQL database on third-party database server
Reliability	<ul style="list-style-type: none"> <li>Automated replication of data between primary and secondary RDS instances, data backups, and log backups are supported to ensure high data reliability.</li> <li>RDS Enterprise Edition supports a recovery point objective (RPO) of 0 and a recovery time objective (RTO) of approximately 1 minute when this edition is used with MySQL 5.7 or MySQL 8.0.</li> </ul>	<ul style="list-style-type: none"> <li>Your databases are highly available only when they are deployed in an optimal high-availability architecture.</li> <li>To ensure an RPO of 0, you must purchase independent research and development (R&amp;D) services. This requires high costs.</li> </ul>	<ul style="list-style-type: none"> <li>Data reliability is moderate and varies based on the corruption probability of individual disks.</li> <li>To ensure an RPO of 0, you must purchase independent R&amp;D services. This requires high costs.</li> </ul>

Item	ApsaraDB RDS for MySQL instance	Self-managed MySQL database on ECS instance	Self-managed MySQL database on third-party database server
Usability	<ul style="list-style-type: none"> <li>An automated backup and restoration system is provided to support point in time recovery (PITR) and database-level backup and restoration. In addition, streaming backups are supported to minimize the impacts on performance. For more information, see <a href="#">Enable automatic backups for an ApsaraDB RDS for MySQL instance</a>.</li> <li>An automated monitoring and alerting system allows you to monitor all supported metrics at the instance and database levels and view monitoring information that is collected over a time range of a few seconds. If the value of a metric exceeds the specified threshold, ApsaraDB RDS sends you an alert by using Short Message Service (SMS), email, or DingTalk. In addition, a free quota for alert notifications over SMS is provided based on your purchase details. For more information, see <a href="#">Configure an alert rule for an ApsaraDB RDS for MySQL instance</a>.</li> <li>You can update the minor engine version of an RDS instance with a few clicks. For more information, see <a href="#">Update the minor engine version of an ApsaraDB RDS for MySQL instance</a>.</li> </ul>	<ul style="list-style-type: none"> <li>Automated backups are not supported. You must purchase or configure the streaming backup and PITR features. This requires high costs.</li> <li>You must purchase an independent monitoring system and configure it in the CloudMonitor console.</li> <li>Technical challenges are imposed on usability.</li> <li>Version updates require high costs.</li> </ul>	<ul style="list-style-type: none"> <li>Automated backups are not supported. You must purchase or configure the streaming backup and PITR features. This requires high costs.</li> <li>You must purchase or configure an independent monitoring system. This requires high costs.</li> <li>Remote data centers require high costs and are difficult to be built. As a result, geo-disaster recovery is difficult to be implemented.</li> <li>Version updates require high costs.</li> </ul>

Item	ApsaraDB RDS for MySQL instance	Self-managed MySQL database on ECS instance	Self-managed MySQL database on third-party database server
Performance	<ul style="list-style-type: none"> <li>RDS instances that are equipped with local SSDs provide high performance.</li> <li>RDS instances that are equipped with enhanced SSDs (ESSDs) provide higher performance than RDS instances that are equipped with local SSDs or standard SSDs.</li> <li>You can create read-only RDS instances to improve performance and balance loads.</li> <li>The SQL Explorer feature can meet most of your business requirements for monitoring and performance optimization. For more information, see <a href="#">Use the SQL Explorer feature on an ApsaraDB RDS for MySQL instance</a>.</li> </ul>	<ul style="list-style-type: none"> <li>If you choose local disks, data reliability is reduced. If you choose cloud disks, you must plan a disk architecture. This requires high costs.</li> <li>ECS-hosted self-managed databases that are equipped with ESSDs are inferior to RDS instances that are equipped with ESSDs in terms of performance.</li> <li>The cluster edition is difficult to be deployed and requires high consultancy costs and high maintenance costs.</li> <li>You must recruit experienced DBAs. This requires high costs.</li> </ul>	<ul style="list-style-type: none"> <li>Database servers are updated at lower speeds than cloud computing hardware. Therefore, self-managed databases on these servers are inferior to RDS instances.</li> <li>Computing-storage separation is difficult to be implemented and can require you to spend millions of US dollars on advanced storage media.</li> <li>The cluster edition is difficult to be deployed and requires high consultancy costs and high maintenance costs.</li> <li>You must recruit experienced DBAs. This requires high costs.</li> </ul>
Security	<ul style="list-style-type: none"> <li><a href="#">IP address whitelists</a>, <a href="#">security groups</a>, and <a href="#">virtual private clouds (VPCs)</a> can be used to control access to RDS instances.</li> <li><a href="#">Link encryption</a> and <a href="#">disk encryption</a> are provided to protect data. In addition, disk encryption supports Bring Your Own Keys (BYOKs) for various storage media.</li> <li>The <a href="#">SQL Explorer</a> feature is provided to audit the executed SQL statements.</li> </ul>	<ul style="list-style-type: none"> <li>IP address whitelists, security groups, and VPCs can be used to control access to ECS-hosted self-managed databases.</li> <li>Link encryption and disk encryption must be separately configured to protect data. This requires high consultancy costs due to difficulties in the rotation of BYOKs.</li> <li>SQL logs are difficult to be audited because they must be separately stored.</li> </ul>	<ul style="list-style-type: none"> <li>IP address whitelists and VPCs can be used to control access to self-managed databases on third-party servers. This requires high consultancy costs.</li> <li>Link encryption and disk encryption must be separately configured to protect data. This requires high consultancy costs due to difficulties in the rotation of BYOKs.</li> <li>SQL logs are difficult to be audited because they must be separately stored.</li> </ul>

## Advantages of ApsaraDB RDS for SQL Server instances over self-managed SQL Server databases

Item	ApsaraDB RDS for SQL Server instance	Self-managed SQL Server database on ECS instance	Self-managed SQL Server database on third-party database server
Cost-effectiveness	<ul style="list-style-type: none"> <li>Scalable resources are provided.</li> <li>SQL Server Web Edition is supported to increase cost-effectiveness.</li> <li>A free quota for backup storage is provided. The free quota is equal to half the purchased storage capacity. For more information, see <a href="#">Backup storage fees of an ApsaraDB RDS for SQL Server instance</a>.</li> <li>Internet traffic is free of charge.</li> </ul>	<ul style="list-style-type: none"> <li>Scalable resources are provided.</li> <li>SQL Server Web Edition is not supported.</li> <li>You are charged for the backup storage that you use.</li> <li>You are charged for the Internet traffic that you consume.</li> </ul>	<ul style="list-style-type: none"> <li>The initial investment cost is high.</li> <li>SQL Server Web Edition is not supported.</li> <li>You must allocate independent backup resources. This requires high costs.</li> <li>You are charged for the Internet traffic that you consume and the domain names that you use. The domain names are charged at high prices.</li> </ul>

Item	ApsaraDB RDS for SQL Server instance	Self-managed SQL Server database on ECS instance	Self-managed SQL Server database on third-party database server
Availability	<ul style="list-style-type: none"> <li>In RDS Basic Edition, your database system requires approximately 15 minutes to complete a failover.</li> <li>In RDS High-availability Edition or RDS Cluster Edition, your database system runs in a proprietary high-availability architecture of Alibaba Cloud. This architecture allows your database system to complete a failover within 30 seconds.</li> <li>In RDS Cluster Edition, you can create read-only RDS instances to balance loads in your database system. For more information, see <a href="#">Overview of read-only ApsaraDB RDS for SQL Server instances</a>.</li> <li>In RDS Cluster Edition, you can use read/write splitting to distribute read and write requests by using a unified read/write splitting endpoint. For more information, see <a href="#">Overview of read/write splitting</a>.</li> </ul>	<ul style="list-style-type: none"> <li>In the basic edition, your databases require approximately 30 minutes to complete a failover.</li> <li>You must purchase additional software or hardware to build a high-availability architecture.</li> <li>You must configure or purchase additional software or hardware to build a load balancing architecture.</li> </ul>	<ul style="list-style-type: none"> <li>Your databases are standalone. If a database server breaks down, repairs can take hours to weeks.</li> <li>You must purchase additional software or hardware to build a high-availability architecture.</li> <li>You must configure or purchase additional software or hardware to build a load balancing architecture.</li> </ul>
Reliability	<ul style="list-style-type: none"> <li>Automated replication of data between primary and secondary RDS instances, data backups, and log backups are supported to ensure high data reliability.</li> <li>RDS Cluster Edition delivers an RPO of 0.</li> </ul>	<ul style="list-style-type: none"> <li>Your databases are highly available only when they are deployed in an optimal high-availability architecture.</li> <li>To ensure an RPO of 0, you must purchase independent R&amp;D services. This requires high costs.</li> </ul>	<ul style="list-style-type: none"> <li>Data reliability is moderate and varies based on the corruption probability of individual disks.</li> <li>To ensure an RPO of 0, you must purchase independent R&amp;D services. This requires high costs.</li> </ul>

Item	ApsaraDB RDS for SQL Server instance	Self-managed SQL Server database on ECS instance	Self-managed SQL Server database on third-party database server
Usability	<ul style="list-style-type: none"> <li>An automated backup and restoration system is provided to support PITR and database-level backup and restoration. In addition, streaming backups are supported to minimize the impacts on performance. For more information, see <a href="#">Back up an ApsaraDB RDS for SQL Server instance</a>.</li> <li>An automated monitoring and alerting system allows you to monitor all supported metrics at the instance and database levels and view monitoring information that is collected over a time range of a few seconds. If the value of a metric exceeds the specified threshold, ApsaraDB RDS sends you an alert by using SMS, email, or DingTalk. In addition, a free quota for alert notifications over SMS is provided based on your purchase details. For more information, see <a href="#">Configure an alert rule for an ApsaraDB RDS for SQL Server instance</a>.</li> <li>Geo-disaster recovery is in development.</li> </ul>	<ul style="list-style-type: none"> <li>Automated backups are not supported. You must purchase or configure the streaming backup and PITR features. This requires high costs.</li> <li>You must purchase an independent monitoring system and configure it in the CloudMonitor console.</li> <li>Technical challenges are imposed on usability.</li> </ul>	<ul style="list-style-type: none"> <li>Automated backups are not supported. You must purchase or configure the streaming backup and PITR features. This requires high costs.</li> <li>You must purchase or configure an independent monitoring system. This requires high costs.</li> <li>Remote data centers require high costs and are difficult to be built. As a result, geo-disaster recovery is difficult to be implemented.</li> </ul>

Item	ApsaraDB RDS for SQL Server instance	Self-managed SQL Server database on ECS instance	Self-managed SQL Server database on third-party database server
Performance	<ul style="list-style-type: none"> <li>RDS instances that run SQL Server 2008 R2 with local SSDs provide high performance. RDS instances that run SQL Server 201x support next-generation compute-storage separation and can benefit from hardware dividends.</li> <li>RDS instances that are equipped with ESSDs provide higher performance than RDS instances that are equipped with local SSDs or standard SSDs.</li> <li>You can create read-only RDS instances to improve performance and balance loads.</li> </ul>	<ul style="list-style-type: none"> <li>If you choose local disks, data reliability is reduced. If you choose cloud disks, you must plan a disk architecture. This requires high costs.</li> <li>ECS-hosted self-managed databases that are equipped with ESSDs are inferior to RDS instances that are equipped with ESSDs in terms of performance.</li> <li>The cluster edition is difficult to be deployed and requires high consultancy costs and high maintenance costs.</li> <li>You must recruit experienced DBAs. This requires high costs.</li> </ul>	<ul style="list-style-type: none"> <li>Database servers are updated at lower speeds than cloud computing hardware. Therefore, self-managed databases on these servers are inferior to RDS instances.</li> <li>Computing-storage separation is difficult to be implemented and can require you to spend millions of US dollars on advanced storage media.</li> <li>The cluster edition is difficult to be deployed and requires high consultancy costs and high maintenance costs.</li> <li>You must recruit experienced DBAs. This requires high costs.</li> </ul>
Security	<ul style="list-style-type: none"> <li><b>IP address whitelists</b> and <b>VPCs</b> can be used to control access to RDS instances.</li> <li><b>Link encryption</b> and <b>disk encryption</b> are provided to protect data.</li> <li>Updates to ApsaraDB RDS for SQL Server are released by Alibaba Cloud to keep pace with the latest Microsoft releases.</li> </ul>	<ul style="list-style-type: none"> <li>IP address whitelists, security groups, and VPCs can be used to control access to ECS-hosted self-managed databases.</li> <li>Link encryption and disk encryption must be separately configured to protect data. This requires high consultancy costs.</li> <li>SQL logs are difficult to be audited because they must be separately stored.</li> </ul>	<ul style="list-style-type: none"> <li>IP address whitelists and VPCs can be used to control access to self-managed databases on third-party servers. This requires high consultancy costs.</li> <li>Link encryption and disk encryption must be separately configured to protect data. This requires high consultancy costs.</li> <li>SQL logs are difficult to be audited because they must be separately stored.</li> </ul>
Legal liability	<p>ApsaraDB RDS for SQL Server is provided with a valid license. No legal liabilities are imposed on you.</p>	<p>You must purchase a valid license.</p>	<p>You must purchase a valid license. Otherwise, legal liabilities may be imposed on you.</p>

## Advantages of ApsaraDB RDS for PostgreSQL instances over self-managed PostgreSQL databases

Item	ApsaraDB RDS for PostgreSQL instance	Self-managed PostgreSQL database on ECS instance	Self-managed PostgreSQL database on third-party database server
Cost-effectiveness	<ul style="list-style-type: none"> <li>Scalable resources are provided.</li> <li>AliPG is compatible with open source PostgreSQL. AliPG provides a number of proprietary features to improve user experience. For more information, see <a href="#">AliPG benefits</a>.</li> <li>A free quota for backup storage is provided. The free quota is up to twice the purchased storage capacity based on the instance configuration. For more information, see <a href="#">View the free quota for backup storage of an ApsaraDB RDS for PostgreSQL instance</a>.</li> <li>Internet traffic is free of charge.</li> <li>User-provided domain names are supported free of charge.</li> <li>Updates to ApsaraDB RDS for PostgreSQL are released by Alibaba Cloud to keep pace with the latest PostgreSQL releases.</li> </ul>	<ul style="list-style-type: none"> <li>Scalable resources are provided.</li> <li>Open source PostgreSQL is used. No optimization is provided.</li> <li>You are charged for the backup storage that you use.</li> <li>You are charged for the Internet traffic that you consume.</li> </ul>	<ul style="list-style-type: none"> <li>The initial investment cost is high.</li> <li>Open source PostgreSQL is used. No optimization is provided.</li> <li>You must allocate independent backup resources. This requires high costs.</li> <li>You are charged for the Internet traffic that you consume and the domain names that you use. The domain names are charged at high prices.</li> </ul>

Item	ApsaraDB RDS for PostgreSQL instance	Self-managed PostgreSQL database on ECS instance	Self-managed PostgreSQL database on third-party database server
Availability	<ul style="list-style-type: none"> <li>In RDS Basic Edition, your database system requires approximately 15 minutes to complete a failover.</li> <li>In RDS High-availability Edition, your database system runs in a proprietary high-availability architecture of Alibaba Cloud. This architecture allows your database system to complete a failover within 30 seconds.</li> <li>You can create read-only RDS instances to balance loads in your database system. For more information, see <a href="#">Overview of read-only ApsaraDB RDS for PostgreSQL instances</a>.</li> </ul>	<ul style="list-style-type: none"> <li>In the basic edition, your databases require approximately 30 minutes to complete a failover.</li> <li>You must purchase additional software or hardware to build a high-availability architecture.</li> <li>You must configure or purchase additional software or hardware to build a load balancing architecture.</li> </ul>	<ul style="list-style-type: none"> <li>Your databases are standalone. If a database server breaks down, repairs can take hours to weeks.</li> <li>You must purchase additional software or hardware to build a high-availability architecture.</li> <li>You must configure or purchase additional software or hardware to build a load balancing architecture.</li> </ul>
Reliability	<ul style="list-style-type: none"> <li>Automated replication of data between primary and secondary RDS instances, data backups, and log backups are supported to ensure high data reliability.</li> <li>RPO customization allows you to specify an RPO of 0.</li> </ul>	<ul style="list-style-type: none"> <li>Your databases are highly available only when they are deployed in an optimal high-availability architecture.</li> <li>To ensure an RPO of 0, you must purchase independent R&amp;D services. This requires high costs.</li> </ul>	<ul style="list-style-type: none"> <li>Data reliability is moderate and varies based on the corruption probability of individual disks.</li> <li>To ensure an RPO of 0, you must purchase independent R&amp;D services. This requires high costs.</li> </ul>

Item	ApsaraDB RDS for PostgreSQL instance	Self-managed PostgreSQL database on ECS instance	Self-managed PostgreSQL database on third-party database server
Usability	<ul style="list-style-type: none"> <li>An automated backup and restoration system is provided to support PITR and database-level backup and restoration. In addition, streaming backups are supported to minimize the impacts on performance. For more information, see <a href="#">Back up an ApsaraDB RDS for PostgreSQL instance.</a></li> <li>An automated monitoring and alerting system allows you to monitor all supported metrics at the instance and database levels and view monitoring information that is collected over a time range of a few seconds. If the value of a metric exceeds the specified threshold, ApsaraDB RDS sends an alert to you by using SMS, email, or DingTalk. In addition, a free quota for alert notifications over SMS is provided based on your purchase details. For more information, see <a href="#">Configure an alert rule for an ApsaraDB RDS for PostgreSQL instance.</a></li> </ul>	<ul style="list-style-type: none"> <li>Automated backups are not supported. You must purchase or configure the streaming backup and PITR features. This requires high costs.</li> <li>You must purchase an independent monitoring system and configure it in the CloudMonitor console.</li> </ul>	<ul style="list-style-type: none"> <li>Automated backups are not supported. You must purchase or configure the streaming backup and PITR features. This requires high costs.</li> <li>You must purchase or configure an independent monitoring system. This requires high costs.</li> </ul>

Item	ApsaraDB RDS for PostgreSQL instance	Self-managed PostgreSQL database on ECS instance	Self-managed PostgreSQL database on third-party database server
Performance	<ul style="list-style-type: none"> <li>RDS instances that are equipped with local SSDs provide high performance.</li> <li>RDS instances that are equipped with ESSDs provide higher performance than RDS instances that are equipped with local SSDs or standard SSDs.</li> <li>You can create read-only RDS instances to improve performance and balance loads.</li> </ul>	<ul style="list-style-type: none"> <li>If you choose local disks, data reliability is reduced. If you choose cloud disks, you must plan a disk architecture. This requires high costs.</li> <li>ECS-hosted self-managed databases that are equipped with ESSDs are inferior to RDS instances that are equipped with ESSDs in terms of performance.</li> <li>You must recruit experienced DBAs. This requires high costs.</li> </ul>	<ul style="list-style-type: none"> <li>Database servers are updated at lower speeds than cloud computing hardware. Therefore, self-managed databases on these servers are inferior to RDS instances.</li> <li>Computing-storage separation is difficult to be implemented and can require you to spend millions of US dollars on advanced storage media.</li> <li>You must recruit experienced DBAs. This requires high costs.</li> </ul>
Security	<ul style="list-style-type: none"> <li>IP address whitelists, security groups, and VPCs can be used to control access to RDS instances.</li> <li>Link encryption and disk encryption are provided to protect data.</li> </ul>	<ul style="list-style-type: none"> <li>IP address whitelists, security groups, and VPCs can be used to control access to ECS-hosted self-managed databases.</li> <li>Link encryption must be separately configured to protect data.</li> </ul>	<ul style="list-style-type: none"> <li>IP address whitelist and VPCs can be used to control access to self-managed databases on third-party servers. This requires high consultancy costs.</li> <li>Link encryption must be separately configured to protect data.</li> </ul>

## Get started with ApsaraDB RDS

- [Quick Start](#)
- [Learning Path](#)

# 4. How do I select the configuration of an ApsaraDB RDS instance?

Before you purchase an ApsaraDB RDS instance, we recommend that you understand the benefits of various configurations. This way, you can select a suitable configuration to meet your business requirements.

## Introduction to RDS editions, storage types, instance families, and storage engines

Before you create an RDS instance, you determine which configuration is the most cost-effective and stable for your business based on factors such as performance, prices, and loads. The RDS edition, storage type, and instance family that you select affect one another. For more information, see [Create an ApsaraDB RDS for MySQL instance](#).

 **Note** If you want to create an RDS instance that runs MySQL 8.0, you must select a storage engine as the default storage engine.

- RDS editions

ApsaraDB RDS provides the following four editions: Basic Edition, High-availability Edition, Cluster Edition, and Enterprise Edition.

- Storage types

ApsaraDB RDS provides three storage types: local SSDs, standard SSDs, and enhanced SSDs (ESSDs). All storage types meet the reliability, persistence, and read/write performance requirements that are specified in Alibaba Cloud service level agreement (SLA).

- Instance families

ApsaraDB RDS provides various instance families based on the number of cores, memory capacity, number of connections, and IOPS. Each instance family includes multiple instance types.

Instance family	Description	Scenarios
-----------------	-------------	-----------

Instance family	Description	Scenarios
Shared instance family	<ul style="list-style-type: none"> <li>◦ A shared RDS instance exclusively occupies the allocated memory and storage resources, but shares CPU resources with the other shared RDS instances that are deployed on the same physical host.</li> <li>◦ CPU resources are highly reused among the shared RDS instances that are deployed on the same physical host. The reuse of CPU resources helps maximize cost-effectiveness.</li> <li>◦ Shared RDS instances that are deployed on the same physical host may compete for resources.</li> </ul>	<ul style="list-style-type: none"> <li>◦ You pursue high cost-effectiveness to reduce costs.</li> <li>◦ You require high availability rather than high performance stability from your ApsaraDB RDS for SQL Server instance.</li> </ul>
General-purpose instance family	<ul style="list-style-type: none"> <li>◦ A general-purpose RDS instance exclusively occupies the allocated memory resources, but shares CPU and storage resources with the other general-purpose RDS instances that are deployed on the same physical host.</li> <li>◦ CPU resources are moderately reused among the general-purpose RDS instances that are deployed on the same physical host. The reuse of CPU resources helps increase cost-effectiveness.</li> <li>◦ The storage capacity of a general-purpose RDS instance is independent of the number of cores and the memory capacity. You can specify the storage capacity based on your business requirements.</li> </ul>	<p>You do not require high performance stability.</p>
Dedicated instance family	<ul style="list-style-type: none"> <li>◦ A dedicated RDS instance exclusively occupies the allocated CPU and memory resources. The performance of a dedicated RDS instance remains stable and is not affected by the other instances that are deployed on the same physical host.</li> <li>◦ Dedicated host instance types are the highest instance types in the dedicated instance family. A dedicated host RDS instance occupies all resources on the physical host on which the RDS instance is deployed.</li> </ul>	<p>You use databases as core systems in sectors such as finance, e-commerce, public affairs, and large-sized or medium-sized Internet services.</p>

● Storage engines

If you want to create an RDS instance that runs MySQL 8.0, you can select one of the following storage engines:

- InnoDB: the default storage engine provided by open source MySQL. The InnoDB storage engine that is used for ApsaraDB RDS is optimized by Alibaba Cloud.

- o X-Engine: the storage engine developed by Alibaba Cloud. X-Engine is compatible with InnoDB. X-Engine outperforms InnoDB in terms of disk space usage and cost-effectiveness. X-Engine is more suitable for scenarios such as data archiving than InnoDB. For more information, see [Introduction to X-Engine](#).

## Select configuration for an RDS instance

Perform the following steps to select a suitable configuration for an RDS instance:

### 1. Select an RDS edition.

We recommend that you select RDS High-availability Edition. If you select RDS High-availability Edition, your database system consists of a primary RDS instance and a secondary RDS instance to ensure high availability. RDS High-availability Edition is suitable for medium-sized enterprises and large-sized enterprises and for industries such as Internet, Internet of Things (IoT), online retail, logistics, and gaming.

For data security purposes, we recommend that you select RDS Enterprise Edition or RDS Cluster Edition. These editions are suitable for crucial databases in large-sized enterprises and for financial, securities, and insurance industries. RDS Enterprise Edition is available only when you select the MySQL engine. RDS Cluster Edition is available only when you select the SQL Server engine.

### 2. Select a storage type.

We recommend that you select a local SSD or an ESSD of a suitable performance level (PL) based on the IOPS and throughput requirements of your business. For more information about the differences between local SSDs, standard SSDs, and ESSDs, see [Functions and features](#).

The maximum IOPS of a standard SSD or ESSD varies based on the instance type and the storage capacity. The following table lists the formulas that you can use to calculate the maximum IOPS of an RDS instance that uses standard SSDs or ESSDs.

Storage type	ESSD			Standard SSD
	PL3	PL2	PL1	None
Formula (The storage capacity is measured in the unit of GB.)	$\min\{1800 + 50 \times \text{Storage capacity}, 1000000, \text{Maximum IOPS for the instance type}\}$	$\min\{1800 + 50 \times \text{Storage capacity}, 100000, \text{Maximum IOPS for the instance type}\}$	$\min\{1800 + 50 \times \text{Storage capacity}, 50000, \text{Maximum IOPS for the instance type}\}$	$\min\{1800 + 30 \times \text{Storage capacity}, 25000, \text{Maximum IOPS for the instance type}\}$

### 3. Select an instance type.

The specifications of an RDS instance type include the number of cores, memory capacity, maximum number of connections, and maximum IOPS. When you create an RDS instance, you can select one of the following instance type levels: entry level or enterprise level. Then, you can select an instance type based on your business requirements. The entry level provides the shared instance family and the general-purpose instance family. The enterprise level provides the dedicated instance family.

The screenshot shows the 'Instance Type' selection interface. It includes filters for CPU (Cores), Memory, Maximum Connections, IOPS Utilization (%), and Instance Type. There are two category tabs: 'Enterprise-level' (selected) and 'Entry-level'. Below the filters is a table with columns: Instance Family, Instance Type, CPU (Cores), Memory, Maximum Connections, IOPS Utilization (%), Purchased Instances, and Pricing. The table lists several 'Dedicated Instance' types with varying specifications. A note at the bottom of the table reads: 'Current Specifications: mysql.x2.large.2c (4 Cores/8GB/Dedicated Instance), Maximum Connections: 6000, IOPS: N/A'.

Instance Family	Instance Type	CPU (Cores)	Memory	Maximum Connections	IOPS Utilization (%)	Purchased Instances	Pricing
Dedicated Instance	mysql.x2.large.2c	4	8GB(Dedicated Instan...	6000	N/A		
Dedicated Instance	mysql.x2.medium.2c	2	4GB(Dedicated Instan...	4000	N/A		
Dedicated Instance	mysql.x2.xlarge.2c	8	16GB(Dedicated Insta...	8000	N/A		
Dedicated Instance	mysql.x2.3large.2c	12	24GB(Dedicated Insta...	12000	N/A		
Dedicated Instance	mysql.x2.2xlarge.2c	16	32GB(Dedicated Insta...	16000	N/A		
Dedicated Instance	mysql.x2.3xlarge.2c	24	48GB(Dedicated Insta...	24000	N/A		
Dedicated Instance	mysql.x2.4xlarge.2c	32	64GB(Dedicated Insta...	32000	N/A		
Dedicated Instance	mysql.x2.8xlarge.2c	64	128GB(Dedicated Inst...	63000	N/A		

**Note** If you select the standard SSD or ESSD storage type, the IOPS becomes N/A in the ApsaraDB RDS console. This is because ApsaraDB RDS calculates the IOPS based on the selected storage type. For more information, see [Select a storage type](#) in this section.

4. Select a storage engine.

If you want to create an RDS instance that runs MySQL, we recommend that you select X-Engine. X-Engine costs approximately 50% less than InnoDB but delivers comparable performance. For more information, see [Usage notes](#).

### Check and modify the configuration of an RDS instance

After you create and start to use an RDS instance, we recommend that you continue to monitor the performance of the RDS instance for a specific period of time. This way, you can check whether the configuration of the RDS instance is suitable.

For example, if the memory usage is high, we recommend that you log on to the RDS instance to troubleshoot the issue. If no exceptions occur, you can modify the configuration of the RDS instance. If exceptions occur, you can modify the allocation of memory on the RDS instance. For more information, see the following topics:

- [查看监控信息](#)
- [Configure an alert rule for an ApsaraDB RDS for MySQL instance](#)
- [Change the specifications of an ApsaraDB RDS for MySQL instance](#)

### Create an RDS instance

For more information about how to create an RDS instance, see the following topics:

- [Create an ApsaraDB RDS for MySQL instance](#)
- [Create an ApsaraDB RDS for SQL Server instance](#)
- [Create an ApsaraDB RDS for PostgreSQL instance](#)
- [Create an ApsaraDB RDS for MariaDB TX instance](#)

### References

- Test results of ApsaraDB RDS instances that run MySQL 8.0
- Test results of ApsaraDB RDS instances that run MySQL 5.7
- Test results of ApsaraDB RDS instances that run MySQL 5.6
- Test result of ApsaraDB RDS for PostgreSQL

# 5. Product editions

## 5.1. Overview

ApsaraDB RDS offers the following editions: Basic Edition, High-availability Edition, Cluster Edition, and Enterprise Edition. This topic describes how to view and change the edition of an ApsaraDB RDS instance and describes the scenarios of each edition.

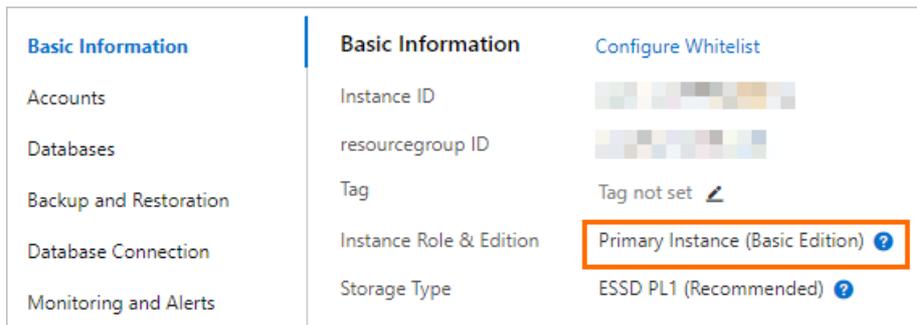
### Description of editions

Edition	Description	Scenario	Supported database
RDS Basic Edition	<ul style="list-style-type: none"> <li>Architecture: The database system consists of only a primary RDS instance. Computing is separated from storage.</li> <li>Read-only instance: Read-only instances are not supported.</li> </ul>	<ul style="list-style-type: none"> <li>Personal learning</li> <li>Microsites</li> <li>Development and testing environments for small and medium-sized enterprises</li> </ul>	<ul style="list-style-type: none"> <li>ApsaraDB RDS for MySQL</li> <li>ApsaraDB RDS for PostgreSQL</li> <li>ApsaraDB RDS for SQL Server</li> </ul>
High-availability Edition	<ul style="list-style-type: none"> <li>Architecture: The database system consists of a primary RDS instance and a secondary RDS instance. These RDS instances work in high availability mode. Dual-zone disaster recovery is supported. The secondary RDS instance cannot be directly accessed.</li> <li>Read-only instances: Read-only instances are supported only for RDS instances that run MySQL or PostgreSQL.</li> </ul>	<ul style="list-style-type: none"> <li>Production databases for large and medium-sized enterprises</li> <li>Databases that are used in industries such as the Internet, IoT, e-commerce, logistics, and gaming</li> </ul>	<ul style="list-style-type: none"> <li>ApsaraDB RDS for MySQL</li> <li>ApsaraDB RDS for PostgreSQL</li> <li>ApsaraDB RDS for SQL Server</li> <li>ApsaraDB RDS for MariaDB TX</li> </ul>
Cluster Edition	<ul style="list-style-type: none"> <li>Architecture: The database system consists of a primary RDS instance and a secondary RDS instance. These RDS instances work in high availability mode. The secondary RDS instance can be directly accessed.</li> <li>Read-only instances: Read-only instances are supported for RDS instances that run SQL Server.</li> </ul>	<ul style="list-style-type: none"> <li>Production databases for large and medium-sized enterprises</li> <li>Databases that are used in industries such as Internet-based new retail and automobile manufacturing, and databases that are used for Enterprise Resource Planning (ERP) systems</li> </ul>	<ul style="list-style-type: none"> <li>ApsaraDB RDS for SQL Server</li> </ul>

Edition	Description	Scenario	Supported database
Enterprise Edition	<ul style="list-style-type: none"> <li>Architecture: The database system consists of one primary RDS instance and two secondary RDS instances. Disaster recovery in three zones is supported. The secondary RDS instances cannot be directly accessed.</li> <li>Read-only instances: Read-only instances are supported for RDS instances that run MySQL.</li> </ul>	<ul style="list-style-type: none"> <li>Core databases in the finance, securities, and insurance industries that require high data security</li> <li>Core production databases for large enterprises</li> </ul>	<ul style="list-style-type: none"> <li>ApsaraDB RDS for MySQL</li> </ul>

### View the edition of an RDS instance

You can log on to the ApsaraDB RDS console, find the RDS instance, and then go to the **Basic Information** page to view the edition of the RDS instance.



### Change the edition of an RDS instance

Database engine	Edition change description
ApsaraDB RDS for MySQL	<p>If your RDS instance runs one of the following database versions and RDS editions, you can upgrade the RDS instance from RDS Basic Edition to RDS High-availability Edition. For more information, see <a href="#">Upgrade an ApsaraDB RDS for MySQL instance from Basic Edition to High-availability Edition</a>.</p> <ul style="list-style-type: none"> <li>MySQL 5.7 on RDS Basic Edition</li> <li>MySQL 8.0 on RDS Basic Edition</li> </ul>
	<p>If your RDS instance runs one of the following database versions and RDS editions, you can upgrade the RDS instance from RDS High-availability Edition to RDS Enterprise Edition:</p>

Database engine	Edition change description
ApsaraDB RDS for SQL Server	<p>If your RDS instance runs one of the following database versions and RDS editions, you can upgrade the RDS instance from RDS Basic Edition to RDS High-availability Edition. For more information, see <a href="#">Upgrade an ApsaraDB RDS for SQL Server instance from Basic Edition to High-availability Edition</a>.</p> <ul style="list-style-type: none"> <li>• SQL Server 2016 EE on RDS Basic Edition</li> <li>• SQL Server 2012 EE Basic on RDS Basic Edition</li> <li>• SQL Server 2016 Web on RDS Basic Edition</li> <li>• SQL Server 2012 Web on RDS Basic Edition</li> </ul>
	<p>If your RDS instance runs SQL Server 2008 R2 with local SSDs, you can upgrade the RDS instance from SQL Server 2008 R2 to SQL Server 2012 or SQL Server 2016. For more information, see <a href="#">Upgrade an ApsaraDB RDS for SQL Server instance with local SSDs from SQL Server 2008 R2 to SQL Server 2012 or SQL Server 2016</a>.</p>
ApsaraDB RDS for PostgreSQL	<p>If your RDS instance runs one of the following database versions and RDS editions, you can upgrade the RDS instance from RDS Basic Edition to RDS High-availability Edition. For more information, see <a href="#">Upgrade an ApsaraDB RDS for PostgreSQL instance from Basic Edition to High-availability Edition</a>.</p> <ul style="list-style-type: none"> <li>• PostgreSQL 14 on RDS Basic Edition</li> <li>• PostgreSQL 13 on RDS Basic Edition</li> <li>• PostgreSQL 12 on RDS Basic Edition</li> <li>• PostgreSQL 11 on RDS Basic edition</li> <li>• PostgreSQL 10 on RDS Basic edition</li> </ul>

**Note** You cannot change the edition of an RDS instance that does not meet the requirements in the preceding table. If you want to change the edition of the RDS instance, you must create an RDS instance that runs the specified RDS edition and then migrate the data of the original RDS instance to the new RDS instance. For more information, see the following topics:

- [Create an RDS instance](#)
- Data migration:
  - [Overview of data migration methods for ApsaraDB RDS for MySQL](#)
  - [Overview of data migration methods for ApsaraDB RDS for SQL Server](#)
  - [Overview of data migration methods for ApsaraDB RDS for PostgreSQL](#)

## Instance types supported by various editions

For more information about the instance types that are supported by various editions, see [ApsaraDB RDS instance families](#).

## Features supported by various editions

For more information about the features that are supported by various editions, see [Functions and features](#).

## Create an RDS instance

For more information about how to create an RDS instance, see the following topics:

- [Create an ApsaraDB RDS for MySQL instance](#)
- [Create an ApsaraDB RDS for SQL Server instance](#)
- [Create an ApsaraDB RDS for PostgreSQL instance](#)
- [Create an ApsaraDB RDS for MariaDB TX instance](#)

## 5.2. RDS Basic Edition

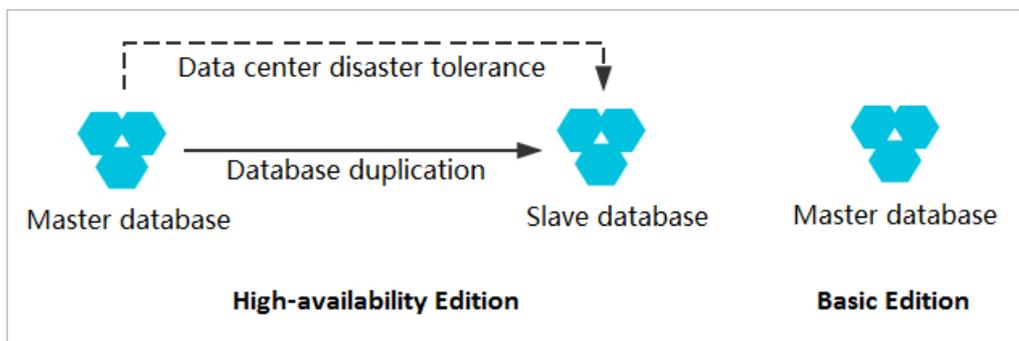
ApsaraDB RDS includes four editions: Basic, High-availability, Cluster, and Enterprise. This topic describes the Basic Edition.

In the Basic Edition, your database system consists of only one primary RDS instance, and computing is separated from storage. This edition is cost-effective.

**Note** The Basic Edition does not provide a secondary RDS instance as a hot standby for the primary RDS instance. If the primary RDS instance unexpectedly exits, your database service may be unavailable for a long period of time. If you change the specifications or upgrade the database engine version of the primary RDS instance, your database service may also be unavailable for a long period of time. If you require high service availability, we recommend that you do not select the Basic Edition. For example, you can select the High-availability Edition. Some primary RDS instances support the upgrade from the Basic Edition to the High-availability Edition. For more information, see [Upgrade an RDS instance to the High-availability Edition](#).

Basic Information		<a href="#">Configure Whitelist</a>	
Instance ID	pgm-██████████	Name	pgm-██████████
Zone <span>?</span>	China (Hangzhou) ZoneH	Instance Role & Edition <span>?</span>	<b>Primary Instance (Basic Edition)</b>
Network Type	VPC <a href="#">See Detail</a>	Storage Type <span>?</span>	Enhanced SSD (Recommended)

The following figure shows a comparison between the Basic Edition and the High-availability Edition.



### Benefits

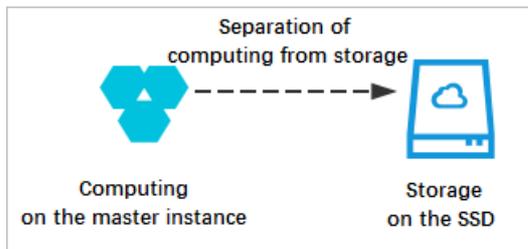
#### Performance

The primary RDS instance does not need to replicate data to a secondary RDS instance. Therefore, no extra performance overheads are caused. When the same instance configuration is used, the Basic Edition provides higher performance than the High-availability Edition and the Enterprise Edition.

## Reliability

- Computing is separated from storage. This prevents data losses in the event of failures on the compute nodes.

**Note** If you set the **Backup Frequency** parameter to **Every 30 Minutes**, you can restore data to a specific point in time that is within the last 30 minutes in the event of SSD damages or other unexpected faults. This applies when you are using the SQL Server database engine with the Basic Edition. For more information, see [Back up an ApsaraDB RDS for SQL Server instance](#).



- The ultra-large Apsara distributed storage system of Alibaba Cloud is used to store multiple data copies. This ensures the reliability of your database service.

## Cost-effectiveness

The Basic Edition reduces your overall costs by about 50% compared with the High-availability Edition.

## Features

The Basic Edition supports basic features, such as IP address whitelist, monitoring and alerting, and backup and restoration. The Basic Edition does not support the following features:

- [Primary/secondary switchover](#)
- [Cross-zone migration](#)
- [Log management](#)
- [Read-only instance](#)

**Note** If the primary RDS instance runs the PostgreSQL database engine, all the created read-only RDS instances run the Basic Edition. However, if the primary RDS instance runs the PostgreSQL database engine with the Basic edition, no read-only RDS instances can be created.

For more information about the features that are supported by the Basic Edition, see [Overview of ApsaraDB RDS editions](#).

## Scenarios

- Small-sized websites and applications

The Basic Edition is cost-effective and relieves the need for database operations and maintenance (O&M). You can focus only on your business development.

- Personal learning

If you are new to ApsaraDB RDS, you can use the Basic Edition for testing and learning.

- Research and development (R&D) and testing

The Basic Edition allows you to create and release RDS instances based on your business requirements. This significantly improves R&D and testing efficiency.

## Create an RDS instance

For more information about how to create an RDS instance that runs the Basic Edition, see the following topics:

- [Create an ApsaraDB RDS for MySQL instance](#)
- [Create an ApsaraDB RDS for SQL Server instance](#)
- [Create an ApsaraDB RDS for PostgreSQL instance](#)

## Get started with the Basic Edition

The Basic Edition is supported for MySQL, SQL Server, and PostgreSQL. For more information about how to create and connect to an RDS instance that runs the Basic Edition, see the following topics:

- [Create an ApsaraDB RDS for MySQL instance](#)
- [Create an ApsaraDB RDS for SQL Server instance](#)
- [Create an ApsaraDB RDS for PostgreSQL instance](#)

## Upgrade an RDS instance to the High-availability Edition

- If an RDS instance runs MySQL 5.7, you can upgrade its edition from Basic to High-availability by changing the instance specifications. For more information, see [Change the specifications of an ApsaraDB RDS for MySQL instance](#).
- If an RDS instance runs SQL Server, you can upgrade its edition from Basic to High-availability by using the ApsaraDB RDS console. For more information, see [Upgrade an ApsaraDB RDS for SQL Server instance from Basic Edition to High-availability Edition](#).

## FAQ

- Why does it require a long period of time to upgrade or change the specifications of my RDS instance that runs the Basic Edition?

In the Basic Edition, your database system consists of only one primary RDS instance. When you upgrade or change the specifications of the primary RDS instance, ApsaraDB RDS checks whether the physical host where the primary RDS instance resides can provide sufficient resources. If the physical server cannot provide sufficient resources, ApsaraDB RDS migrates the data of your database system to another suitable physical host and switches your database service over to the physical host. This process interrupts your database service. In extreme circumstances, your database service may be unavailable for more than 30 minutes. We recommend that you select the High-availability, Enterprise, or Cluster Edition. These editions are based on the high-availability architecture. This architecture allows you to replicate data from the secondary RDS instance during an upgrade or a specification change. This minimizes the downtime of your database system. For more information, see [High-availability Edition](#), [Enterprise Edition](#), and [Cluster Edition](#).

- Why does the Basic Edition provide only a small number of features? And which features are provided in the Basic Edition?

The Basic Edition provides only one primary RDS instance. Therefore, the features that are supported in the High-availability Edition, Cluster Edition, and Enterprise Edition are unavailable in the Basic Edition. The Basic Edition is suitable only in a small number of business scenarios. For more information about the features that are supported in the Basic Edition, see the following topics:

- [Features of ApsaraDB RDS for MySQL](#)
- [Features of ApsaraDB RDS for SQL Server](#)
- [Features of ApsaraDB RDS for PostgreSQL](#)

**Note** The Basic Edition is not supported for RDS MariaDB TX.

## 5.3. High-availability Edition

ApsaraDB RDS is available in four editions: Basic Edition, High-availability Edition, Cluster Edition, and Enterprise Edition. This topic describes High-availability Edition.

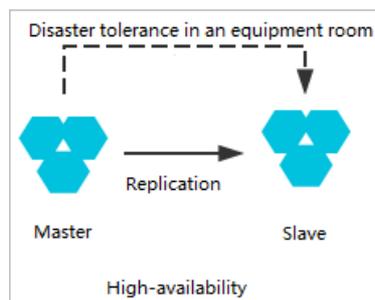
High-availability Edition is a widely used edition of ApsaraDB RDS. If you use this edition, your database system consists of a primary RDS instance and a secondary RDS instance. These instances work together in a high-availability architecture. High-availability Edition is suitable for more than 80% of business scenarios, such as Internet, IoT, online retail, logistics, and gaming.

Basic Information		Configure Whitelist   Migrate Across Zones	
Instance ID	rm-xxxxxx	Name	rm-xxxxxx
Zone	China (Hangzhou) ZoneH(Primary) + ZoneH(Secondary)	Instance Role & Edition	Primary Instance (High-availability Edition)
Network Type	VPC See Detail	Storage Type	Local SSD
Read and write separate	Details		

### Note

- The secondary RDS instance runs as a standby for the primary RDS instance and does not allow external access.
- In extreme circumstances, High-availability Edition may fail to prevent data loss. If you require a data security level of 100% and a recovery point objective (RPO) of 0, we recommend that you use Enterprise Edition. For more information, see [Enterprise Edition](#).

## Topology



## Benefits

- High availability

In High-availability Edition, data is replicated from the primary RDS instance to the secondary RDS instance in semi-synchronous mode. If the primary RDS instance is inaccessible, your database system fails over to the secondary RDS instance. For more information about data replication modes, see [Change the data replication mode of an ApsaraDB RDS for MySQL instance](#).

The primary RDS instance and the secondary RDS instance can reside in the same zone or in different zones of the same region.

**Note** If the secondary RDS instance is inaccessible, the primary RDS instance performs backups in real time. When a backup is near completion, a FLUSH TABLE WITH READ LOCK (FTWRL) statement is executed. This triggers a global lock that is held for up to 5 seconds. Before the global lock is released, you can only read data from the primary RDS instance.

- Comprehensive functionality

High-availability Edition provides a complete suite of features, such as automatic scaling, backup and restoration, performance optimization, read/write splitting, and SQL Explorer. The SQL Explorer feature allows you to store the logs of all executed SQL statements for up to five years. This way, you can trace database access behavior and ensure the security of important data.

## Limits

For performance purposes, you must deploy the primary RDS instance and the secondary RDS instance in the same region.

## Upgrade the RDS edition of an RDS instance to High-availability Edition

If you use Basic Edition, your database system consists of only a primary RDS instance. The primary RDS instance does not have a secondary RDS instance as a hot standby. If the primary RDS instance unexpectedly exits, your database service is unavailable for a long period of time. If you change the specifications or upgrade the database engine version of the primary RDS instance, your database service is also unavailable for a long period of time. Therefore, if you require high service availability, we recommend that you use High-availability Edition.

You can create an RDS instance that runs High-availability Edition. You can also upgrade the RDS edition of a created RDS instance from Basic Edition to High-availability Edition. The upgrade eliminates the need to migrate data and reclaim the original RDS instance.

**Note**

- If an RDS instance runs MySQL 5.7 or MySQL 8.0 on RDS Basic Edition, you can upgrade the RDS edition of the instance to High-availability Edition in the ApsaraDB RDS console. For more information, see [Upgrade an ApsaraDB RDS for MySQL instance from Basic Edition to High-availability Edition](#).
- If an RDS instance runs SQL Server on RDS Basic Edition, you can upgrade the RDS edition of the instance to High-availability Edition in the ApsaraDB RDS console. For more information, see [Upgrade an ApsaraDB RDS for SQL Server instance from Basic Edition to High-availability Edition](#).

## Create an RDS instance that runs High-availability Edition

For more information, see the following topics:

- [Create an ApsaraDB RDS for MySQL instance](#)
- [Create an ApsaraDB RDS for PostgreSQL instance](#)
- [Create an ApsaraDB RDS for SQL Server instance](#)
- [Create an ApsaraDB RDS for MariaDB TX instance](#)

## FAQ

- Can I access a secondary RDS instance?

No, you cannot access a secondary RDS instance. You can access only a primary RDS instance. A secondary RDS instance runs only as a standby and does not allow external access.

- Can I downgrade the RDS edition of my RDS instance from High-availability Edition to Basic Edition?

No, you cannot downgrade the RDS edition of your RDS instance from High-availability Edition to Basic Edition. You can create an RDS instance that runs Basic Edition, migrate the data of your original RDS instance to the new RDS instance, and then release your original RDS instance. For more information, see [Migrate data between RDS instances](#).

- If my RDS instance runs High-availability Edition, how do I change the data replication mode of the instance?

For more information, see [Change the data replication mode of an ApsaraDB RDS for MySQL instance](#).

- When I use High-availability Edition, does the data replication mode degrade to the asynchronous mode if the secondary RDS instance cannot process data as fast as the primary RDS instance?

Yes, when you use High-availability Edition, the data replication mode degrades to the asynchronous mode if the secondary RDS instance cannot process data as fast as the primary RDS instance. For more information, see [Data replication modes](#).

## 5.4. Cluster Edition

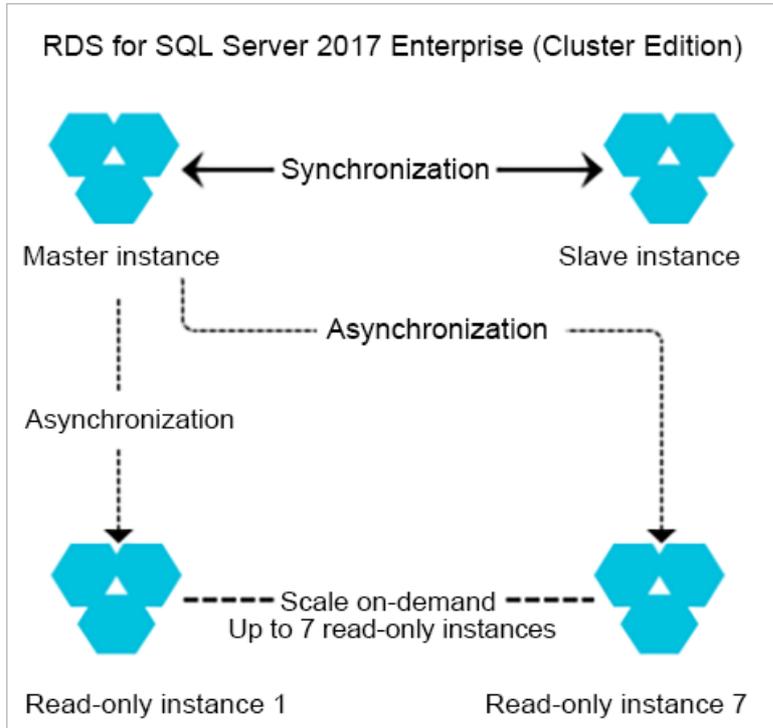
ApsaraDB RDS is available in four editions: Basic Edition, High-availability Edition, Cluster Edition, and Enterprise Edition. This topic describes Cluster Edition.

Cluster Edition is supported for SQL Server 2017 and SQL Server 2019. Cluster Edition is developed based on the native SQL Server technology AlwaysOn. In Cluster Edition, computing is separated from storage, and you can create read-only RDS instances to implement read/write splitting. After you create read-only RDS instances, you can apply for a read-only routing endpoint. By default, each read-only RDS instance is assigned an independent internal endpoint. The internal endpoint of a read-only RDS instance is used to connect only to that read-only RDS instance.

**Note** After you enable the read-only routing endpoint, you must add the read-only routing endpoint and the endpoint of the primary RDS instance to your application. This way, your database system can route write requests to the primary RDS instance and route read requests to the read-only routing endpoint.

<b>Basic Information</b>	<a href="#">Configure Whitelist</a>		
Instance ID	rm-██████████	Name	rm-██████████
Zone	China (Hangzhou) ZoneH(Primary) + ZoneI(Secondary)	Instance Role & Edition	<b>Primary Instance (Cluster Edition)</b>
Network Type	VPC <a href="#">See Detail</a>	Storage Type	Enhanced SSD (Recommended)
Advanced Feature:	Linked Server, Distributed Transaction	Character Set:	Chinese_PRC_CI_AS
Time Zone:	China Standard Time		

By default, if you use Cluster Edition, your database system consists of a primary RDS instance and a secondary RDS instance. These instances work together in a high-availability architecture. You can create up to seven read-only RDS instances for your database system based on your business requirements. The following figure shows the topology of a database system that runs Cluster Edition.



## Benefits

- Scalable read capability

You can create read-only RDS instances to linearly increase the read capability of your database system. The specifications of read-only RDS instances can differ from the specifications of the primary RDS instance. You can create read-only RDS instances that have higher specifications than the primary instance to attain a strong read capability.

**Note** No secondary RDS instance is provided as a standby for a read-only RDS instance to ensure high availability, you must create at least two read-only RDS instances.

- Flexible cost control

Read-only RDS instances can use general-purpose instance types, which are cost-effective. You can create general-purpose read-only RDS instances to offload read requests from the primary RDS instance. This helps reduce costs and optimize system configurations. Read-only RDS instances can have lower specifications than the primary RDS instance. You can create read-only RDS instances with low specifications to process read requests from background applications, such as intelligent analytics applications. This way, you can also reduce costs.

Cluster Edition supports the maximum performance mode. This mode is in development and will be available soon. In maximum performance mode, you can configure asynchronous replication between the primary RDS instance and the secondary RDS instance during peak hours to maximize the performance of your database system.

## Scenarios

- Use read-only RDS instances to offload read requests during peak hours.

For example, you can create read-only RDS instances that have high specifications to help new retail enterprises implement read/write splitting and traffic throttling and process read requests that grow several times during large-scale online promotional events, such as Double 11.

- Confine analytics tasks to read-only RDS instances.

An enterprise can create an independent read-only RDS instance that uses intelligent technologies to analyze data. This reduces the probability of blocking on the primary RDS instance, increases concurrency, and mitigates interruptions to crucial workloads to ensure service stability.

## Create an RDS instance that runs Cluster Edition

For more information about how to create an RDS instance that runs Cluster Edition, see [Create an ApsaraDB RDS for SQL Server instance](#).

# 5.5. Enterprise Edition

ApsaraDB RDS includes four editions: Basic, High-availability, Cluster, and Enterprise. This topic describes the Enterprise Edition.

The Enterprise Edition is suitable for enterprises. It allows your database system to consist of one primary RDS instance, one secondary RDS instance, and one logger RDS instance. Data is synchronously replicated from the primary RDS instance to the secondary RDS instance and the logger RDS instance. This ensures strong data consistency and finance-grade reliability.

Basic Information		Configure Whitelist	
Instance ID	rm-██████████	Name	rm-██████████
Zone	China (Hangzhou) ZoneH(Primary) + ZoneH(Secondary)+ZoneH(Secondary)	Instance Role & Edition	Primary Instance (Enterprise Edition)
Network Type	VPC See Detail	Storage Type	Local SSD
Read and write separate	Details		

The Enterprise Edition supports the following database engine versions and instance families:

- Database engine versions: MySQL 5.7 and MySQL 8.0
- Instance families: dedicated instance family and dedicated host instance family

## Limits

For performance purposes, you must deploy the three RDS instances of your database system in the same region.

## Benefits

- High reliability
  - The Enterprise Edition provides enterprise-grade reliability with a recovery point objective (RPO) of 0.
  - The three RDS instances of your database system can be deployed in three different data centers of the same city to support cross-zone disaster recovery.
- Comprehensive functionality

The Enterprise Edition supports all the features that are provided by ApsaraDB RDS. These features include automatic scaling, backup and restoration, performance optimization, read/write splitting, and SQL Explorer. The SQL Explorer feature is used to log all the SQL statements that are executed within up to five years. Based on the SQL logs, you can trace database access behavior. This ensures the security of important data.

For more information, see [Overview of ApsaraDB RDS editions](#).

#### Note

If you use MySQL 5.7 or MySQL 8.0 with the Enterprise Edition, a trial edition of the SQL Explorer feature is provided free of charge.

- **Strong consistency and high availability**

The following improvements are made to the database engines of ApsaraDB RDS to increase data consistency and service availability:

- Raft, a distributed consensus algorithm, is used to ensure the reliability and atomicity of switchovers among the RDS instances in your database system.
- Two data replicas and three log replicas are supported. In addition, transaction logs are synchronized from the primary RDS instance to the secondary RDS instance and logger RDS instance. A transaction is committed only after the related log is written into at least two of the three RDS instances in your database system.
- If you use MySQL 5.7 or MySQL 8.0, the Raft algorithm is used to control the commitment, rollback, and crash recovery of transactions. This ensures data consistency in your database system.
- The secondary RDS instance and the logger RDS instance replay only the transaction logs that have been written into a majority of the three RDS instances in your database system. In addition, parallel replication algorithms at various levels are used to increase replay efficiency. Therefore, you can reduce the recovery time objective (RTO) and ensure service availability. The supported levels are the database, table, logical clock, and WriteSet levels.

## Create an RDS instance

For more information about how to create an RDS instance that runs the Enterprise Edition, see [Create an ApsaraDB RDS for MySQL instance](#).

## FAQ

Is the Enterprise Edition supported for read-only RDS instances?

No, the Enterprise Edition is not supported for read-only RDS instances. You can create a read-only RDS instance for a primary RDS instance that runs the Enterprise Edition. However, the created read-only RDS instance is based on the high-availability architecture.

# 6.Storage types

ApsaraDB RDS supports the following storage types: local SSD, standard SSD, and enhanced SSD (ESSD). This topic describes the differences between the three storage types and purchase suggestions.

## Introduction

Storage type	Description
ESSD	<p>ESSDs are also a recommended type of storage medium. ESSDs are developed by Alibaba Cloud based on the next-generation distributed block storage architecture. ESSDs deliver ultra high storage performance. ESSDs are integrated with 25 Gigabit Ethernet and remote direct memory access (RDMA) technologies. ESSDs can help you reduce one-way latencies and process up to 1 million read and write requests at random per second. ESSDs are provided in three performance levels (PLs) as indicated on the ApsaraDB RDS buy page:</p> <ul style="list-style-type: none"><li>• ESSD PL1: This is the most basic PL of ESSDs.</li><li>• ESSD PL2: An ESSD of PL2 delivers IOPS and throughput that are approximately two times the IOPS and throughput delivered by an ESSD of PL1.</li><li>• ESSD PL3: An ESSD of PL3 delivers IOPS that is up to 20 times the IOPS delivered by an ESSD of PL1. An ESSD of PL3 also delivers throughput that is up to 11 times the throughput delivered by an ESSD of PL1. ESSDs of PL3 are suitable for business scenarios in which highly concurrent requests must be processed with high I/O performance and at low read and write latencies.</li></ul> <p>For more information about the performance of ESSDs, see <a href="#">ESSDs</a>.</p>
Local SSD	<p>Local SSDs reside on the same physical host as the database engine that is run by your RDS instance. You can store data in local SSDs to reduce I/O latencies.</p>
Standard SSD	<p>Standard SSDs are elastic block storage devices that are designed based on a distributed storage architecture. You can store data in standard SSDs to separate computing from storage.</p> <div style="background-color: #e6f2ff; padding: 10px;"><p> <b>Note</b> Standard SSDs are being phased out. We recommend that you use ESSDs. For more information, see <a href="#">[Notice] End of sale for the standard SSD storage type for specific database engines in ApsaraDB RDS</a>.</p></div>

For more information about the differences in performance among the preceding storage types, see [EBS performance](#). The performance comparison items include the **maximum capacity per disk**, **maximum IOPS**, and **maximum throughput**.

**Note** All of the preceding storage types meet the reliability, durability, and read and write performance requirements that are specified in the ApsaraDB RDS SLA.

- Local SSDs are suitable for **RDS High-availability Edition**, which provides one primary RDS instance and one secondary RDS instance. Local SSDs are also suitable for **RDS Enterprise Edition**, which provides one primary RDS instance, one secondary RDS instance, and one logger RDS instance. Both RDS editions support failovers. If the primary RDS instance is faulty, your database system can fail over to the secondary RDS instance within a few seconds.
- Standard SSDs and ESSDs both use a distributed storage architecture. This architecture supports multiple data copies, which are used to ensure data reliability. If you use **RDS Basic Edition**, the recovery from a fault requires a long period of time. If you use RDS High-availability Edition, RDS Cluster Edition, or RDS Enterprise Edition, your database system can fail over to the secondary RDS instance within a few seconds in the event of a fault.

### View the storage type of an RDS instance

Log on to the ApsaraDB RDS console and go to the **Basic Information** page of the RDS instance. In the Basic Information section of the page, view the storage type of the RDS instance.

<b>Basic Information</b>	<a href="#">Configure Whitelist</a>		
Instance ID	pgm-██████████	Name	pgm-██████████
Zone <span>?</span>	China (Hangzhou) ZoneH	Instance Role & Edition <span>?</span>	Primary Instance (Basic Edition)
Network Type	VPC <a href="#">See Detail</a>	Storage Type <span>?</span>	<b>Enhanced SSD (Recommended)</b>

### Comparison between storage types

Item	ESSD	Local SSD	Standard SSD
I/O performance	<p>★★★★★</p> <p>Delivers higher I/O performance than standard SSDs.</p>	<p>★★★★★</p> <p>Helps reduce I/O latencies and improve I/O performance.</p>	<p>★★★★</p> <p>Requires additional network I/O overheads, which decrease I/O performance.</p>
Configuration flexibility	<p>★★★★★</p> <p>Provides various configuration options and allows you to separately scale up the storage capacity. The storage capacity cannot be scaled down.</p>	<p>★★★★★</p> <p>Provides various configuration options and allows you to separately adjust the storage capacity. Some instance types provide a fixed amount of storage capacity when used with local SSDs.</p>	<p>★★★★★</p> <p>Provides various configuration options and allows you to separately scale up the storage capacity. The storage capacity cannot be scaled down.</p>

Item	ESSD	Local SSD	Standard SSD
Scalability	<p>★★★★★</p> <ul style="list-style-type: none"> <li>If your RDS instance runs MySQL, PostgreSQL, or MariaDB TX, you can upgrade the storage type of your RDS instance without the need to replicate data. You can scale up the storage capacity of your RDS instance within a few seconds.</li> <li>If your RDS instance runs SQL Server, you can scale up the storage capacity of your RDS instance within a few minutes.</li> </ul>	<p>★★★</p> <p>May require a few hours to copy data when you scale up the storage capacity of your RDS instance.</p>	<p>★★★★★</p> <ul style="list-style-type: none"> <li>If your RDS instance runs MySQL, PostgreSQL, or MariaDB TX, you can upgrade the storage type of your RDS instance without the need to replicate data. You can scale up the storage capacity of your RDS instance within a few seconds.</li> <li>If your RDS instance runs SQL Server, you can scale up the storage capacity of your RDS instance within a few minutes.</li> </ul>
Impact of scale up	<ul style="list-style-type: none"> <li>If your RDS instance runs MySQL, PostgreSQL, or MariaDB TX, no transient connections occur during the scale-up process.</li> <li>If your RDS instance runs SQL Server, transient connections occur during the scale-up process.</li> </ul>	<p>Transient connections occur during the scale-up process.</p>	<ul style="list-style-type: none"> <li>If your RDS instance runs MySQL, PostgreSQL, or MariaDB TX, no transient connections occur during the scale-up process.</li> <li>If your RDS instance runs SQL Server, transient connections occur during the scale-up process.</li> </ul>

## Product support

For more information about the storage types and the features that are supported by different database engines, see the following topics:

- [Features of ApsaraDB RDS for MySQL instances](#)
- [Features of ApsaraDB RDS for PostgreSQL instances](#)
- [Features of ApsaraDB RDS for SQL Server instances](#)
- [Features of ApsaraDB RDS for MariaDB TX instances](#)

## FAQ

[FAQ about storage capacity](#)

# 7. Product specifications

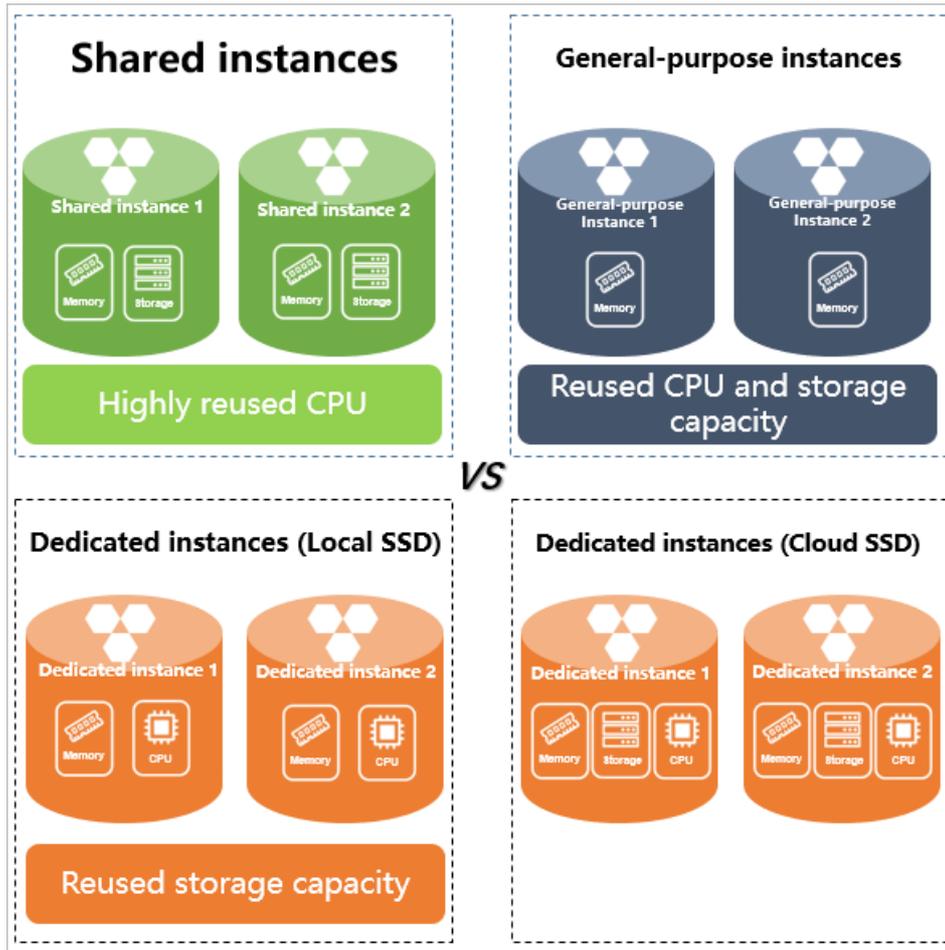
## 7.1. ApsaraDB RDS instance families

This topic describes the instance families of ApsaraDB RDS. ApsaraDB RDS supports the shared instance family, general-purpose instance family, and dedicated instance family.

### Instance families

Instance family	Description	Scenarios
Shared instance family	<ul style="list-style-type: none"> <li>A shared RDS instance exclusively occupies the allocated memory and storage resources, but shares CPU resources with the other shared RDS instances that are deployed on the same physical host.</li> <li>CPU resources are highly reused among the shared RDS instances that are deployed on the same physical host. The reuse of CPU resources helps maximize cost-effectiveness.</li> <li>Shared RDS instances that are deployed on the same physical host may compete for resources.</li> </ul>	<ul style="list-style-type: none"> <li>You pursue high cost-effectiveness to reduce costs.</li> <li>You require high availability rather than high performance stability from your ApsaraDB RDS for SQL Server instance.</li> </ul>
General-purpose instance family	<ul style="list-style-type: none"> <li>A general-purpose RDS instance exclusively occupies the allocated memory resources, but shares CPU and storage resources with the other general-purpose RDS instances that are deployed on the same physical host.</li> <li>CPU resources are moderately reused among the general-purpose RDS instances that are deployed on the same physical host. The reuse of CPU resources helps increase cost-effectiveness.</li> <li>The storage capacity of a general-purpose RDS instance is independent of the number of cores and the memory capacity. You can specify the storage capacity based on your business requirements.</li> </ul>	You do not require high performance stability.
Dedicated instance family	<ul style="list-style-type: none"> <li>A dedicated RDS instance exclusively occupies the allocated CPU and memory resources. The performance of a dedicated RDS instance remains stable and is not affected by the other instances that are deployed on the same physical host.</li> <li>Dedicated host instance types are the highest instance types in the dedicated instance family. A dedicated host RDS instance occupies all resources on the physical host on which the RDS instance is deployed.</li> </ul>	You use databases as core systems in sectors such as finance, e-commerce, public affairs, and large-sized or medium-sized Internet services.

Comparison among instance families



## Instance types

For more information about the supported instance types and their specifications, such as the number of cores, memory capacity, storage capacity, maximum number of connections, and IOPS, see [Primary ApsaraDB RDS instance types](#).

## Pricing

For more information about the prices of different instance types, visit the [ApsaraDB RDS buy page](#).

## Change of the instance family

You can change the instance type of your RDS instance between a dedicated instance type and a general-purpose instance type based on your business requirements.

**Note** You cannot change the instance type of your RDS instance from a shared instance type to an instance type that belongs to a different instance family. If you want to change the instance type of your RDS instance from a shared instance type to an instance type that belongs to a different instance family, you can create an RDS instance that uses the new instance type and then use Data Transmission Service (DTS) to migrate the data of your RDS instance to the new RDS instance. For more information, see [Data migration solutions](#).

For more information about how to change the instance type of your RDS instance to an instance type that belongs to a different instance family, see the following topics:

- [Change the specifications of an ApsaraDB RDS for MySQL instance](#)
- [Change the specifications of an ApsaraDB RDS for SQL Server instance](#)
- [Change the specifications of an ApsaraDB RDS for PostgreSQL instance](#)
- [Change the specifications of an ApsaraDB RDS for MariaDB TX instance](#)

## FAQ

A general-purpose RDS instance and a dedicated RDS instance are allocated the same number of cores and the same amount of memory. Why does the general-purpose RDS instance support a larger maximum number of connections and deliver higher IOPS than the dedicated RDS instance?

A dedicated RDS instance exclusively occupies the allocated CPU and memory resources, whereas a general-purpose RDS instance exclusively occupies only the allocated memory resources. Therefore, a general-purpose RDS instance delivers higher performance than a dedicated RDS instance due to flexible resource scheduling. However, a dedicated RDS instance provides higher performance stability than a general-purpose RDS instance. For more information, see the "[Instance families](#)" section of the topic.

## 7.2. Primary ApsaraDB RDS instance types

This topic provides an overview of primary ApsaraDB RDS instance types. This overview includes the most recent instance types, the earlier instance types, and the specifications for each instance type.

ApsaraDB RDS allows you to create read-only RDS instances, which are used to increase the read capability of your database system. For more information, see [Overview of read-only ApsaraDB RDS for MySQL instances](#) and [Read-only ApsaraDB RDS instance types](#).

When you purchase a primary RDS instance, you must select a primary instance type. For more information, see [Create an ApsaraDB RDS for MySQL instance](#).

### Primary instance types for different database engines

- [Primary ApsaraDB RDS for MySQL instance types](#)
- [Primary ApsaraDB RDS for SQL Server instance types](#)
- [Primary ApsaraDB RDS for PostgreSQL instance types](#)
- [Primary ApsaraDB RDS for MariaDB TX instance types](#)

### Maximum IOPS for standard SSDs and ESSDs

The maximum IOPS of an RDS instance that is equipped with local SSDs varies based on the instance type. The maximum IOPS of an RDS instance that is equipped with standard SSDs or enhanced SSDs (ESSDs) varies based on the instance type and the storage capacity. The following table lists the formulas that are used to calculate the maximum IOPS of an RDS instance equipped with standard SSDs or ESSDs.

 **Note** If the throughput of an RDS instance reaches the upper limit, the IOPS that the RDS instance can deliver is affected.

Storage type	ESSD			Standard SSD
PL	PL3	PL2	PL1	None
Formula (The storage capacity is measured in the unit of GB.)	$\min\{1800 + 50 \times \text{Storage capacity}, 1000000, \text{Maximum IOPS for the instance type}\}$	$\min\{1800 + 50 \times \text{Storage capacity}, 100000, \text{Maximum IOPS for the instance type}\}$	$\min\{1800 + 50 \times \text{Storage capacity}, 50000, \text{Maximum IOPS for the instance type}\}$	$\min\{1800 + 30 \times \text{Storage capacity}, 25000, \text{Maximum IOPS for the instance type}\}$

The  $\min\{1800 + 50 \times \text{Storage capacity}, 50000, \text{Maximum IOPS for the instance type}\}$  formula is used as an example to describe the IOPS values in the preceding table.

- **min:** specifies that the smallest IOPS among the three IOPS values in the formula is considered the maximum IOPS of the RDS instance.
- **1800 + 50 × Storage capacity:** the baseline IOPS that is supported by each ESSD of PL1.
- **50000:** the maximum IOPS that is supported by each ESSD of PL1. The maximum IOPS varies based on the storage type. For more information, see [ESSDs](#).
- **Maximum IOPS for the instance type:** the maximum IOPS that is supported by the instance type of the Elastic Compute Service (ECS) instance on which the RDS instance is deployed. For more information about the maximum IOPS for each instance type, see the specification tables that are provided in this topic.

The smallest IOPS among the three IOPS values in the applicable formula is considered the maximum IOPS of the RDS instance.

- In the following examples, an RDS instance that is equipped with ESSDs of PL1 is used. The instance type is `mysql.x2.large.2c`, the maximum IOPS for the instance type is 20,000, and the storage capacity is 20 GB. In this example, the baseline IOPS is 2,800 based on the following calculation:  $1800 + 50 \times 20 = 2800$ . The smallest IOPS among the three IOPS values in the applicable formula is 2,800. Therefore, the maximum IOPS of the RDS instance is 2,800.
- In the following examples, an RDS instance that is equipped with ESSDs of PL1 is used. The instance type is `mysql.x2.large.2c`, and the maximum IOPS for the instance type is 20,000. In this example, if the storage capacity of the RDS instance exceeds 6,000 GB, the baseline IOPS is 301,800. The smallest IOPS among the three IOPS values in the applicable formula is 20,000. Therefore, the maximum IOPS of the RDS instance is 20,000.

#### Note

- If the maximum I/O bandwidth of the RDS instance is reached, the RDS instance may fail to deliver the maximum IOPS.
- The baseline IOPS of an ECS cloud disk allows you to read and write 4 KB of data per second. The default IOPS that is supported by MySQL allows you to read and write 16 KB of data. Therefore, each read/write operation on MySQL consumes 4 IOPS.
- In the specification tables that are provided in this topic, if the maximum IOPS and maximum I/O bandwidth Mbit/s for an instance type are marked as None, ApsaraDB RDS allows multiple instances of the instance type to preempt resources. In this case, the IOPS is not limited. The maximum I/O bandwidth is measured in the unit of Mbit/s.

## Maximum throughput for standard SSDs and ESSDs

RDS instances that are equipped with standard SSDs or ESSDs are deployed on sixth-generation ECS instances. The maximum throughput of these RDS instances varies based on the instance type of the ECS instance on which these RDS instances are deployed. For more information, see [Storage I/O performance of the new generation of enterprise-level instance families](#).

**Note** If the IOPS of an RDS instance reaches the upper limit, the throughput that the RDS instance can deliver is affected.

Storage type	ESSD			Standard SSD
PL	PL3	PL2	PL1	None
Formula (The throughput is measured in the unit of Mbit/s.)	$\min\{120 + 0.5 \times \text{Storage capacity}, 4000, \text{Maximum I/O bandwidth for the instance type}\}$	$\min\{120 + 0.5 \times \text{Storage capacity}, 750, \text{Maximum I/O bandwidth for the instance type}\}$	$\min\{120 + 0.5 \times \text{Storage capacity}, 350, \text{Maximum I/O bandwidth for the instance type}\}$	$\min\{120 + 0.5 \times \text{Storage capacity}, 300, \text{Maximum I/O bandwidth for the instance type}\}$

The  $\min\{120 + 0.5 \times \text{Storage capacity}, 350, \text{Maximum I/O bandwidth for the instance type}\}$  formula is used as an example to describe the IOPS values in the preceding table.

- $120 + 0.5 \times \text{Storage capacity}$ : the baseline throughput that is supported by each ESSD of PL1.
- 350: the maximum throughput that is supported by each ESSD of PL1. For more information about standard SSDs and ESSDs of various PLs, see [ESSDs](#).
- Maximum I/O bandwidth for the instance type: the maximum I/O bandwidth that is supported by the instance type of the ECS instance on which the RDS instance is deployed. For more information about the maximum I/O bandwidth for each instance type, see the specification tables that are provided in this topic.

**Note** Only the maximum I/O bandwidths of ApsaraDB RDS for MySQL instances are provided in this topic.

The smallest throughput among the three throughput values in the applicable formula is considered the maximum throughput of the RDS instance.

- In the following examples, an RDS instance that is equipped with ESSDs of PL3 is used. The instance type is `mysql.x2.large.2c`, the maximum I/O bandwidth is 1,536 Mbit/s, and the storage capacity is 20 GB. In this example, the baseline throughput is 130 Mbit/s, which is the smallest throughput among the three throughput values in the formula. Therefore, the maximum throughput of the RDS instance is 130 Mbit/s.
- In the following examples, an RDS instance that is equipped with ESSDs of PL3 is used. The instance type is `mysql.x2.large.2c`, the maximum I/O bandwidth is 1,536 Mbit/s, and the storage capacity is 5,000 GB. In this example, the baseline throughput is 2,620 Mbit/s, which is higher than the maximum I/O bandwidth for the instance type. Therefore, the maximum throughput of the RDS instance is 1,536 Mbit/s.

## Maximum number of connections and maximum IOPS for different instance configurations

The maximum number of connections and maximum IOPS of an RDS instance vary based on the instance configuration. For more information, see the following table. An RDS instance may fail to deliver the maximum number of connections or maximum IOPS due to various reasons.

Instance configuration	Description	Maximum number of connections guaranteed	Maximum IOPS guaranteed
Dedicated RDS instance with standard SSDs or ESSDs	A dedicated RDS instance that is equipped with standard SSDs or ESSDs exclusively occupies the allocated CPU, memory, storage, and I/O resources.	Yes	Yes
Dedicated host RDS instance	A dedicated host RDS instance exclusively occupies the CPU, memory, storage, and I/O resources of the physical host on which the RDS instance is deployed.	Yes	Yes
Dedicated RDS instance with local SSDs	A dedicated RDS instance that is equipped with local SSDs exclusively occupies the allocated CPU and memory resources, but shares I/O resources with the other RDS instances that are deployed on the same physical host.	Yes	No
General-purpose RDS instance	A general-purpose RDS instance exclusively occupies the allocated memory resources, but shares CPU and I/O resources with the other RDS instances that are deployed on the same physical host.	Yes	No

 **Note** For more information, see [ApsaraDB RDS instance families](#).

## FAQ

- When the same number of cores and the same size of memory capacity are provided, why does an entry-level RDS instance support a larger maximum number of connections and deliver higher IOPS than an enterprise-level RDS instance?

An entry-level RDS instance belongs to the shared or general-purpose instance family, and an enterprise-level RDS instance belongs to the dedicated instance family. The shared and general-purpose instance families support the reuse of CPU resources. Therefore, an entry-level RDS instance supports a larger maximum number of connections and delivers higher IOPS than an enterprise-level RDS instance. The dedicated instance family supports the exclusive allocation of CPU and memory resources. Therefore, an enterprise-level RDS instance provides higher stability than an entry-level RDS instance. For more information, see [Instance families](#).

- How do I query the available resources that I can purchase?

You can call [DescribeAvailableResource](#) operation to query the available resources in a region.

- Why are the queries per second (QPS) and the transactions per second (TPS) not provided?

To obtain the QPS and TPS of an RDS instance, you must create objects on the RDS instance and perform tests. If the instance type remains unchanged, the QPS and TPS of an RDS instance vary based on the implementation method and the business system. For more information about how to perform tests and obtain the QPS and the TPS, see [Test guidelines](#).

## 7.3. Read-only ApsaraDB RDS instance types

This topic provides an overview of read-only ApsaraDB RDS instance types. This overview includes the most recent instance types and the specifications for each instance type.

ApsaraDB RDS allows you to create read-only RDS instances. These read-only RDS instances are used to increase the read capability of your database system. For more information about read-only RDS instances, see [Overview of read-only ApsaraDB RDS for MySQL instances](#).

For more information about primary ApsaraDB RDS instance types, see [Primary ApsaraDB RDS instance types](#).

### Read-only instance types for different database engines

- [Read-only ApsaraDB RDS for MySQL instance types](#)
- [Read-only ApsaraDB RDS for PostgreSQL instance types](#)
- [Read-only ApsaraDB RDS for SQL Server instance types](#)

### Maximum IOPS for standard SSDs and ESSDs

The maximum IOPS of an RDS instance that is equipped with local SSDs varies based on the instance type. The maximum IOPS of an RDS instance that is equipped with standard SSDs or enhanced SSDs (ESSDs) varies based on the instance type and the storage capacity. The following table lists the formulas that are used to calculate the maximum IOPS of an RDS instance equipped with standard SSDs or ESSDs.

 **Note** If the throughput of an RDS instance reaches the upper limit, the IOPS that the RDS instance can deliver is affected.

Storage type	ESSD			Standard SSD
PL	PL3	PL2	PL1	None
Formula (The storage capacity is measured in the unit of GB.)	$\min\{1800 + 50 \times \text{Storage capacity}, 1000000, \text{Maximum IOPS for the instance type}\}$	$\min\{1800 + 50 \times \text{Storage capacity}, 100000, \text{Maximum IOPS for the instance type}\}$	$\min\{1800 + 50 \times \text{Storage capacity}, 50000, \text{Maximum IOPS for the instance type}\}$	$\min\{1800 + 30 \times \text{Storage capacity}, 25000, \text{Maximum IOPS for the instance type}\}$

The  $\min\{1800 + 50 \times \text{Storage capacity}, 50000, \text{Maximum IOPS for the instance type}\}$  formula is used as an example to describe the IOPS values in the preceding table.

- min: specifies that the smallest IOPS among the three IOPS values in the formula is considered the maximum IOPS of the RDS instance.

- $1800 + 50 \times$  Storage capacity: the baseline IOPS that is supported by each ESSD of PL1.
- 50000: the maximum IOPS that is supported by each ESSD of PL1. The maximum IOPS varies based on the storage type. For more information, see [ESSDs](#).
- Maximum IOPS for the instance type: the maximum IOPS that is supported by the instance type of the Elastic Compute Service (ECS) instance on which the RDS instance is deployed. For more information about the maximum IOPS for each instance type, see the specification tables that are provided in this topic.

The smallest IOPS among the three IOPS values in the applicable formula is considered the maximum IOPS of the RDS instance.

- In the following examples, an RDS instance that is equipped with ESSDs of PL1 is used. The instance type is `mysql.x2.large.2c`, the maximum IOPS for the instance type is 20,000, and the storage capacity is 20 GB. In this example, the baseline IOPS is 2,800 based on the following calculation:  $1800 + 50 \times 20 = 2800$ . The smallest IOPS among the three IOPS values in the applicable formula is 2,800. Therefore, the maximum IOPS of the RDS instance is 2,800.
- In the following examples, an RDS instance that is equipped with ESSDs of PL1 is used. The instance type is `mysql.x2.large.2c`, and the maximum IOPS for the instance type is 20,000. In this example, if the storage capacity of the RDS instance exceeds 6,000 GB, the baseline IOPS is 301,800. The smallest IOPS among the three IOPS values in the applicable formula is 20,000. Therefore, the maximum IOPS of the RDS instance is 20,000.

#### Note

- If the maximum I/O bandwidth of the RDS instance is reached, the RDS instance may fail to deliver the maximum IOPS.
- The baseline IOPS of an ECS cloud disk allows you to read and write 4 KB of data per second. The default IOPS that is supported by MySQL allows you to read and write 16 KB of data. Therefore, each read/write operation on MySQL consumes 4 IOPS.
- In the specification tables that are provided in this topic, if the maximum IOPS and maximum I/O bandwidth Mbit/s for an instance type are marked as None, ApsaraDB RDS allows multiple instances of the instance type to preempt resources. In this case, the IOPS is not limited. The maximum I/O bandwidth is measured in the unit of Mbit/s.

## Pricing

For more information about the prices of read-only RDS instances, see the following file:

- For more information about the prices of pay-as-you-go read-only RDS instances, see the following files:
  - [Prices of pay-as-you-go read-only ApsaraDB RDS for MySQL instances](#)
  - [Prices of pay-as-you-go read-only ApsaraDB RDS for PostgreSQL instances](#)
  - [Prices of pay-as-you-go read-only ApsaraDB RDS for SQL Server instances](#)
- For more information about the prices of subscription read-only RDS instances, see the following files:
  - [Prices of subscription read-only ApsaraDB RDS for MySQL instances](#)
  - [Prices of subscription read-only ApsaraDB RDS for PostgreSQL instances](#)
  - [Prices of subscription read-only ApsaraDB RDS for SQL Server instances](#)

For more information about the prices of the storage capacity that you select for read-only RDS instances, visit the [ApsaraDB RDS buy page](#).

## 8.Limits

This topic describes the limits and usage notes of ApsaraDB RDS.

After you create an RDS instance, you do not need to perform basic database O&M operations, such as high availability configuration and security patching. However, you must take note of the items that are described in the following table.

Item	Description
Specification change	<p>When you change the specifications of your RDS instance, ApsaraDB RDS may migrate the data of your RDS instance to a new RDS instance. The incremental data that is generated in your RDS instance during the migration process continues to be synchronized to the new RDS instance. After the migration process is complete, ApsaraDB RDS switches your workloads over to the new RDS instance during the switching time that you specify. During the migration process, network interruptions or transient connections may occur. The actual situation varies based on the RDS edition that is used. If network interruptions or transient connections occur, you cannot perform most of the operations that are related to databases, accounts, and network settings.</p> <div style="background-color: #e6f2ff; padding: 10px; border: 1px solid #d9e1f2;"> <p> <b>Note</b></p> <ul style="list-style-type: none"> <li>• If your RDS instance runs the RDS Basic Edition, your RDS instance is not provided with a secondary RDS instance as a hot standby. When you change the specifications of your RDS instance, your database service is unavailable for 30 minutes or more. We recommend that you change the specifications of your RDS instance during off-peak hours to prevent interruptions to your workloads.</li> <li>• If your RDS instance does not run the RDS Basic Edition, a transient connection that lasts about 30 seconds may occur when you change the specifications of the instance. The transient connection does not interrupt your workloads. However, we still recommend that you change the specifications of your RDS instance during off-peak hours. Otherwise, make sure that your application is configured to automatically reconnect to your RDS instance.</li> <li>• In most cases, if your RDS instance is equipped with standard SSDs or enhanced SSDs (ESSDs) and does not run the RDS Basic Edition, no transient connections occur when you increase the storage capacity of the instance.</li> </ul> </div>

Item	Description
Version upgrade	<p>When you upgrade the major engine version or update the minor engine version of your RDS instance, network interruptions or transient connections may occur. The actual situation varies based on the RDS edition that is used. If network interruptions or transient connections occur, you cannot perform most of the operations that are related to databases, accounts, and network settings.</p> <div style="background-color: #e6f2ff; padding: 10px; border: 1px solid #d9e1f2;"> <p> <b>Note</b></p> <ul style="list-style-type: none"> <li>If your RDS instance runs the RDS Basic Edition, your RDS instance is not provided with a secondary RDS instance as a hot standby. When you upgrade the database engine version of your RDS instance, your database service is unavailable for 30 minutes or more. We recommend that you upgrade the database engine version of your RDS instance during off-peak hours to prevent interruptions to your workloads.</li> <li>If your RDS instance does not run the RDS Basic Edition, a transient connection that lasts about 30 seconds may occur when you upgrade the database engine version of the instance. The transient connection does not interrupt your workloads. However, we still recommend that you upgrade the database engine version of your RDS instance during off-peak hours. Otherwise, make sure that your application is configured to automatically reconnect to your RDS instance.</li> </ul> </div>
Failover	<p>In the RDS High-availability Edition or the RDS Enterprise Edition, your RDS instance is provided with a secondary RDS instance as a hot standby. If your RDS instance unexpectedly exits, your database system can fail over to the secondary RDS instance within 30 seconds. During the failover process, a transient connection that lasts about 30 seconds occur. We recommend that you configure your application to automatically reconnect to your database system. This allows you to prevent interruptions to your workloads.</p>
Network change	<p>When you migrate your RDS instance between the classic network and a virtual private cloud (VPC), the server on which your application runs is disconnected from your RDS instance. In addition, the IP addresses of your RDS instance change. After the migration process is complete, we recommend that you immediately update the endpoint configuration on your application.</p>
Data restoration	<p>Before you restore the data of your RDS instance, we recommend that you back up the important data on your RDS instance to prevent data loss. We also recommend that you restore the data of your RDS instance by using a temporary RDS instance or a cloned RDS instance. You must first create a temporary RDS instance or a cloned RDS instance. Then, you can restore the data of your original RDS instance to the temporary RDS instance or the cloned RDS instance. After you verify the data on the temporary RDS instance or the cloned RDS instance, you can migrate the data back to your original RDS instance.</p>

Item	Description
Storage capacity	<p>If the storage capacity of your RDS instance is exhausted, ApsaraDB RDS locks the instance. In this case, you can only read data from the instance. We recommend that you check the storage usage on a regular basis.</p> <div style="background-color: #e0f2f7; padding: 10px; border: 1px solid #ccc;"> <p> <b>Note</b> If the storage usage is abnormally high, see <a href="#">What do I do if my ApsaraDB RDS for MySQL instance is locked because its storage capacity is exhausted?</a></p> </div>
Performance optimization	<ul style="list-style-type: none"> <li>• You must check whether the number of cores, memory capacity, IOPS, storage capacity, and maximum number of connections for your RDS instance are sufficient. If the specifications are insufficient, you must optimize or upgrade your RDS instance based on your business requirements.</li> <li>• You must check whether your RDS instance runs as expected. For example, you can check whether a large number of SQL statements are executed at low speeds, whether SQL statements need to be optimized, and whether specific indexes are unnecessary or missing. If an issue is identified, you must resolve the issue to optimize the performance of your RDS instance.</li> </ul>

## Limits on database engines

- [Limits of ApsaraDB RDS for MySQL](#)
- [Limits of ApsaraDB RDS for PostgreSQL](#)
- [Limits of ApsaraDB RDS for SQL Server](#)
- [Limits of ApsaraDB RDS for MariaDB TX](#)

# 9. Common scenarios

ApsaraDB RDS can be used with other Alibaba Cloud services to meet your business requirements in various scenarios.

- Use ApsaraDB RDS with self-managed database instances for geo-disaster recovery
- Use ApsaraDB RDS with heterogeneous databases for diversified data storage
- Use read/write splitting to increase the processing capability of an ApsaraDB RDS instance
- Use ApsaraDB RDS with MaxCompute for data computing at scale